Anderson Goddard Ltd

Independent Energy Specialists, SAP, SBEM, EPC's, U-Value & Condensation Risk, 2D & 3D Thermal Modelling

Site	Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH	Assessor	Daniel Goddard
Client	John Southworth Builders	Accreditation	CP52-0001
Date	27/10/2026	Tel	01925 733942
Ref	Amberley Drive-AG-79841-L21-Rev D	Web	www.andersongoddard.com
Drawing ref	18073-PJA-00-XX-DR-A-1001-P	email	Info@andersongoddard.com

	Fabric Buildups, U-Values, Construction details, Air Permeability		Thermal Mass	Kappa
Ground Floor	150mm Kingspan TF70 or similar λ 0.022	0.11 W/m²K	Suspended	75
Wall (main)	100mm Brick, 60mm low e cavity, foil faced BM, 140mm insulation λ0.034, 25mm low e service void, foil faced VCL, Plaster board	0.19 W/m²K	Timber	9
Party walls	Filled and sealed cavity	0.00 W/m²K	Block	45
Roof Cold (PIJ)	500mm mineral wool λ 0.044, 150 between 350 above Joists	0.09 W/m²K	Timber, plaster board	9
Windows	Double glazed, BFRC g-Value => 0.30 (Window)	1.20 W/m²K		
Patio Doors	Double glazed, BFRC g-Value => 0.30 (Window)	1.20 W/m²K		
Doors		1.00 W/m²K		
Air permeability	Test required to all plots to achieve 4m³ (50Pa)		Air test results for each plot	
Lintels				
Thermal Bridging	TO BE CONFIRMED		Photograph required for each junction	

Manufactures data sheets and BBA certificates to be provided for insulation to all areas, bricks & blocks, Timber Frame or other construction methodology / BRFC, BSI or CERTASS data to be provided for Windows and Doors

	Heating, Domestic Hot Water (DHW), Controls, Ventilation, Lighting, Renewable Technologies and Energy saving Technologies etc.	Evidence required, (geolocation photographs to show Location, date and time)
Heating	Vaillant aroTHERM Plus 5kW	Photograph to show identification label(s), including make/model and serial N°
Emitter	Radiators	
Controls	Programmer, Room thermostats and TRV's	Data Sheet / Photograph of heating controls
Heating Flow Temperature	<45°C	Heating Commissioning sheets or designs showing heating flow temperature
Domestic Hot Water (DHW)	210L Cylinder (1.50kw/24hr)	Photograph of primary pipework continuity of insulation if appliable
Mixer Showers	Flow rate =< 8 Litres /min	Photograph of each shower
Electric Showers	none	Evidence of flow rate settings for each shower
Ventilation	Vent Axia Lo-Carbon NBR C 100, DMEV	Photograph of Ventilation system, ductwork and insulation around ductwork
Secondary heating	None	Photograph of secondary heating if appliable
Gas/Electric meter	Smart Meters. Electric meter with export capability	Data sheet / Photograph of Electric/Gas Meter
Photovoltaic	None	Photograph of Photovoltaic installation, MCS certificate etc
Photovoltaic Battery	None	Photograph of Photovoltaic installation, MCS certificate etc
Appendix G (FGHRS / WWHRS)	None	Data sheet / Photograph if appliable
Appendix Q (other Tech)	None	Data sheet / Photograph if appliable
LE lights	Based on LED light bulb or light fitting, Power - 8watt Efficacy - 80 Lumens per circuit watt	Manufactures datasheet for each light fitting & lighting schedule
Overheating	Not Assessed, needs to be assessed for compliance to Approved Document Part 0, simplified assessment or TM59 Dynamic assessment	

Property details					AD.L Volume 1 2021													Block Compliance						M & E		System 1					System 2				
Plot N°	House Type	Front Orient	Side	Det	GIFA	DER	TER	DER / TER %	DER =< TER	DPER	TPER	DPER / TPER %	TPER =< TPER	DFEE	TFEE	DFEE / TFEE %	DFEE =< TFEE	SAP Rating	Band	DER x TFA	TER x TFA	DPER x TFA	TPER x TFA	DFEE x TFA	TFEE x TFA	Heating	DHW	Orient	Pitch	No Panels	Panel size (Watts	PV Kw Peak (Kw)	Orient	Pitch	No Panels	Panel size (Watts	PV Kw Peak (Kw)
1	3B5P	SW	NW	Semi	95.14	3.80	11.13	65.85%	PASS	39.74	58.09	31.58%	PASS	38.63	39.28	1.65%	PASS	84	B	361.53	1058.91	3780.86	5526.68	3675.26	3737.10	aroTherm Plus	210										
2	3B5P	SW	SE	Semi	95.14	3.80	11.13	65.85%	PASS	39.74	58.09	31.58%	PASS	38.63	39.28	1.65%	PASS	84	B	361.53	1058.91	3780.86	5526.68	3675.26	3737.10	aroTherm Plus	210										
3	3B5P	SW	NW	Semi	95.14	3.80	11.13	65.85%	PASS	39.74	58.09	31.58%	PASS	38.63	39.28	1.65%	PASS	84	B	361.53	1058.91	3780.86	5526.68	3675.26	3737.10	aroTherm Plus	210										
4	3B5P	SW	SE	Semi	95.14	3.80	11.13	65.85%	PASS	39.74	58.09	31.58%	PASS	38.63	39.28	1.65%	PASS	84	B	361.53	1058.91	3780.86	5526.68	3675.26	3737.10	aroTherm Plus	210										
5	2B4P	West	North	Semi	87.46	3.95	11.67	66.15%	PASS	41.25	60.90	32.26%	PASS	40.01	40.64	1.55%	PASS	83	B	345.47	1020.66	3607.73	5326.31	3499.27	3554.37	aroTherm Plus	210										
6	2B4P	West	South	Semi	87.46	3.95	11.67	66.15%	PASS	41.25	60.90	32.26%	PASS	40.01	40.64	1.55%	PASS	83	B	345.47	1020.66	3607.73	5326.31	3499.27	3554.37	aroTherm Plus	210										
7	2B4P	West	North	Semi	87.46	3.95	11.67	66.15%	PASS	41.25	60.90	32.26%	PASS	40.01	40.64	1.55%	PASS	83	B	345.47	1020.66	3607.73	5326.31	3499.27	3554.37	aroTherm Plus	210										
8	2B4P	West	South	Semi	87.46	3.95	11.67	66.15%	PASS	41.25	60.90	32.26%	PASS	40.01	40.64	1.55%	PASS	83	B	345.47	1020.66	3607.73	5326.31	3499.27	3554.37	aroTherm Plus	210										

Rev	Date	Description
B	22/06/2026	Removed UFH.
C	19/10/2026	Updated ASHP to Vaillant unit and switched the controls to PRT. PV has been removed and DMEV has been added.
D	27/10/2026	Changed external wall spec to timber frame, Will require updated PSI values when supplier has been chosen.

Please confirm fabric build ups, U-Values, g-Values, construction details and air permeability values used in preparation of the design stage assessment are correct, please also review and confirm the assumptions made in relation to Heating, DHW, Ventilation, Lighting, shower flow rates, renewable technologies etc used in preparation of the design stage SAP assessment are correct. The results and outcomes shown in this summary sheet are provided for information only and do not qualify as a design specification, the fabric and mechanical specification items will need to be verified and confirmed by design specialists. Datasheets for all fabric and mechanical specification items shown in the summary sheet will need to be provided once Architectural details and Mechancial, Electrical, Plumbing (MEP) designs have been completed. Once the specification has been confirmed please ensure that we are notified of any changes to the design to ensure that compliance is still achieved and that you are not building at risk.

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Tue 27 Oct 2026 09:27:01

Project Information			
Assessed By	Daniel Goddard	Building Type	House, Semi-detached
OCDEA Registration	EES/030945	Assessment Date	2026-10-27

Dwelling Details			
Assessment Type	As designed	Total Floor Area	95 m^2
Site Reference	79841-01	Plot Reference	001
Address	Plot 1 Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH		

Client Details	
Name	-
Company	John Southworth
Address	Unit 10, Ravensfield Industrial Estate, Charles Street, DUKINFIELD, SK16 4SD

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.13 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	3.8 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*58.09 kWh_{PE}/m^2*	
Dwelling primary energy	39.74 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*39.3 kWh/m^2*	
Dwelling fabric energy efficiency	38.6 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.19	Walls (1) (0.19)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.11	GF (0.11)	OK
Roofs	*0.16*	0.09	Roof (1) (0.09)	OK
Windows, doors, and roof windows	*1.6*	1.18	Front (1.2)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	96.97	0.19
Party wall: Party Wall (1)	33.41	0 **(!)**
Ground floor: GF, GF	47.57	0.11
Exposed roof: Roof (1)	47.56999969482422	0.09 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
Front, Window	5.76	South West	1.0	1.2
Rear, Window	5.24	North East	1.0	1.2
Door, Door	2.15	South West	N/A	1 **(!)**
Rear, Glazed Doors	5.71	North East	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.046	To Be Confirmed
External wall	E3: Sill	Calculated by person with suitable	0.047	To Be

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
		expertise		Confirmed
External wall	E4: Jamb	Calculated by person with suitable expertise	0.053	To Be Confirmed
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.068	To Be Confirmed
External wall	E10: Eaves (insulation at ceiling level)	Calculated by person with suitable expertise	0.091	To Be Confirmed
External wall	E12: Gable (insulation at ceiling level)	Calculated by person with suitable expertise	0.075	To Be Confirmed
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.046	To Be Confirmed
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.054	To Be Confirmed
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.116	To Be Confirmed
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.046	To Be Confirmed
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.054	To Be Confirmed

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4 m^3/hm^2, Design value	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	285.6%
Emitter type	Radiators
Flow temperature	45°C
System type	
Manufacturer	Vaillant Group UK Ltd
Model	aroTHERM plus VWL 55/8.1 A 230V
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	198 litres
Declared heat loss	1.5 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer, room thermostat and TRVs	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	80 lm/W	**OK**
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.18 W/(l/s)	**OK**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model	Lo-Carbon NBR dMEV C 100, 498095	
Commissioning		

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Tue 27 Oct 2026 09:27:01

Project Information			
Assessed By	Daniel Goddard	Building Type	House, Semi-detached
OCDEA Registration	EES/030945	Assessment Date	2026-10-27

Dwelling Details			
Assessment Type	As designed	Total Floor Area	95 m^2
Site Reference	79841-02	Plot Reference	001
Address	Plot 2 Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH		

Client Details	
Name	-
Company	John Southworth
Address	Unit 10, Ravensfield Industrial Estate, Charles Street, DUKINFIELD, SK16 4SD

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.13 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	3.8 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*58.09 kWh_{PE}/m^2*	
Dwelling primary energy	39.74 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*39.3 kWh/m^2*	
Dwelling fabric energy efficiency	38.6 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.19	Walls (1) (0.19)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.11	GF (0.11)	OK
Roofs	*0.16*	0.09	Roof (1) (0.09)	OK
Windows, doors, and roof windows	*1.6*	1.18	Front (1.2)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	96.97	0.19
Party wall: Party Wall (1)	33.41	0 **(!)**
Ground floor: GF, GF	47.57	0.11
Exposed roof: Roof (1)	47.56999969482422	0.09 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
Front, Window	5.76	South West	1.0	1.2
Rear, Window	5.24	North East	1.0	1.2
Door, Door	2.15	South West	N/A	1 **(!)**
Rear, Glazed Doors	5.71	North East	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.046	To Be Confirmed
External wall	E3: Sill	Calculated by person with suitable	0.047	To Be

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
		expertise		Confirmed
External wall	E4: Jamb	Calculated by person with suitable expertise	0.053	To Be Confirmed
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.068	To Be Confirmed
External wall	E10: Eaves (insulation at ceiling level)	Calculated by person with suitable expertise	0.091	To Be Confirmed
External wall	E12: Gable (insulation at ceiling level)	Calculated by person with suitable expertise	0.075	To Be Confirmed
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.046	To Be Confirmed
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.054	To Be Confirmed
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.116	To Be Confirmed
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.046	To Be Confirmed
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.054	To Be Confirmed

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4 m^3/hm^2, Design value	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	285.6%
Emitter type	Radiators
Flow temperature	45°C
System type	
Manufacturer	Vaillant Group UK Ltd
Model	aroTHERM plus VWL 55/8.1 A 230V
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	198 litres
Declared heat loss	1.5 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer, room thermostat and TRVs	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	80 lm/W	**OK**
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.18 W/(l/s)	**OK**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model	Lo-Carbon NBR dMEV C 100, 498095	
Commissioning		

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Tue 27 Oct 2026 09:27:02

Project Information			
Assessed By	Daniel Goddard	Building Type	House, Semi-detached
OCDEA Registration	EES/030945	Assessment Date	2026-10-27

Dwelling Details			
Assessment Type	As designed	Total Floor Area	95 m^2
Site Reference	79841-03	Plot Reference	001
Address	Plot 3 Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH		

Client Details	
Name	-
Company	John Southworth
Address	Unit 10, Ravensfield Industrial Estate, Charles Street, DUKINFIELD, SK16 4SD

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.13 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	3.8 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*58.09 kWh_{PE}/m^2*	
Dwelling primary energy	39.74 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*39.3 kWh/m^2*	
Dwelling fabric energy efficiency	38.6 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.19	Walls (1) (0.19)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.11	GF (0.11)	OK
Roofs	*0.16*	0.09	Roof (1) (0.09)	OK
Windows, doors, and roof windows	*1.6*	1.18	Front (1.2)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	96.97	0.19
Party wall: Party Wall (1)	33.41	0 **(!)**
Ground floor: GF, GF	47.57	0.11
Exposed roof: Roof (1)	47.56999969482422	0.09 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
Front, Window	5.76	South West	1.0	1.2
Rear, Window	5.24	North East	1.0	1.2
Door, Door	2.15	South West	N/A	1 **(!)**
Rear, Glazed Doors	5.71	North East	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.046	To Be Confirmed
External wall	E3: Sill	Calculated by person with suitable	0.047	To Be

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
		expertise		Confirmed
External wall	E4: Jamb	Calculated by person with suitable expertise	0.053	To Be Confirmed
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.068	To Be Confirmed
External wall	E10: Eaves (insulation at ceiling level)	Calculated by person with suitable expertise	0.091	To Be Confirmed
External wall	E12: Gable (insulation at ceiling level)	Calculated by person with suitable expertise	0.075	To Be Confirmed
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.046	To Be Confirmed
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.054	To Be Confirmed
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.116	To Be Confirmed
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.046	To Be Confirmed
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.054	To Be Confirmed

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4 m^3/hm^2, Design value	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	285.6%
Emitter type	Radiators
Flow temperature	45°C
System type	
Manufacturer	Vaillant Group UK Ltd
Model	aroTHERM plus VWL 55/8.1 A 230V
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	198 litres
Declared heat loss	1.5 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer, room thermostat and TRVs	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	80 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.18 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model	Lo-Carbon NBR dMEV C 100, 498095	
Commissioning		

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Tue 27 Oct 2026 09:27:02

Project Information			
Assessed By	Daniel Goddard	Building Type	House, Semi-detached
OCDEA Registration	EES/030945	Assessment Date	2026-10-27

Dwelling Details			
Assessment Type	As designed	Total Floor Area	95 m^2
Site Reference	79841-04	Plot Reference	001
Address	Plot 4 Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH		

Client Details	
Name	-
Company	John Southworth
Address	Unit 10, Ravensfield Industrial Estate, Charles Street, DUKINFIELD, SK16 4SD

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.13 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	3.8 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*58.09 kWh_{PE}/m^2*	
Dwelling primary energy	39.74 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*39.3 kWh/m^2*	
Dwelling fabric energy efficiency	38.6 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.19	Walls (1) (0.19)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.11	GF (0.11)	OK
Roofs	*0.16*	0.09	Roof (1) (0.09)	OK
Windows, doors, and roof windows	*1.6*	1.18	Front (1.2)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	96.97	0.19
Party wall: Party Wall (1)	33.41	0 **(!)**
Ground floor: GF, GF	47.57	0.11
Exposed roof: Roof (1)	47.56999969482422	0.09 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
Front, Window	5.76	South West	1.0	1.2
Rear, Window	5.24	North East	1.0	1.2
Door, Door	2.15	South West	N/A	1 **(!)**
Rear, Glazed Doors	5.71	North East	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.046	To Be Confirmed
External wall	E3: Sill	Calculated by person with suitable	0.047	To Be

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
		expertise		Confirmed
External wall	E4: Jamb	Calculated by person with suitable expertise	0.053	To Be Confirmed
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.068	To Be Confirmed
External wall	E10: Eaves (insulation at ceiling level)	Calculated by person with suitable expertise	0.091	To Be Confirmed
External wall	E12: Gable (insulation at ceiling level)	Calculated by person with suitable expertise	0.075	To Be Confirmed
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.046	To Be Confirmed
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.054	To Be Confirmed
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.116	To Be Confirmed
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.046	To Be Confirmed
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.054	To Be Confirmed

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4 m^3/hm^2, Design value	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	285.6%
Emitter type	Radiators
Flow temperature	45°C
System type	
Manufacturer	Vaillant Group UK Ltd
Model	aroTHERM plus VWL 55/8.1 A 230V
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	198 litres
Declared heat loss	1.5 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer, room thermostat and TRVs	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	80 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.18 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model	Lo-Carbon NBR dMEV C 100, 498095	
Commissioning		

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Tue 27 Oct 2026 09:27:02

Project Information			
Assessed By	Daniel Goddard	Building Type	House, Semi-detached
OCDEA Registration	EES/030945	Assessment Date	2026-10-27

Dwelling Details			
Assessment Type	As designed	Total Floor Area	87 m^2
Site Reference	79841-05	Plot Reference	001
Address	Plot 5 Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH		

Client Details	
Name	-
Company	John Southworth
Address	Unit 10, Ravensfield Industrial Estate, Charles Street, DUKINFIELD, SK16 4SD

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.67 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	3.95 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*60.9 kWh_{PE}/m^2*	
Dwelling primary energy	41.25 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*40.6 kWh/m^2*	
Dwelling fabric energy efficiency	40.0 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.19	Walls (1) (0.19)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.11	GF (0.11)	OK
Roofs	*0.16*	0.09	Roof (1) (0.09)	OK
Windows, doors, and roof windows	*1.6*	1.18	Front (1.2)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	89.53	0.19
Party wall: Party Wall (1)	32.23	0 **(!)**
Ground floor: GF, GF	43.73	0.11
Exposed roof: Roof (1)	43.72999954223633	0.09 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
Front, Window	8.49	West	1.0	1.2
Rear, Window	3	East	1.0	1.2
Door, Door	2.15	West	N/A	1 **(!)**
Rear, Glazed Doors	7.6	East	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.046	To Be Confirmed
External wall	E3: Sill	Calculated by person with suitable	0.047	To Be

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
		expertise		Confirmed
External wall	E4: Jamb	Calculated by person with suitable expertise	0.053	To Be Confirmed
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.068	To Be Confirmed
External wall	E10: Eaves (insulation at ceiling level)	Calculated by person with suitable expertise	0.091	To Be Confirmed
External wall	E12: Gable (insulation at ceiling level)	Calculated by person with suitable expertise	0.075	To Be Confirmed
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.046	To Be Confirmed
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.054	To Be Confirmed
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.116	To Be Confirmed
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.046	To Be Confirmed
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.054	To Be Confirmed

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4 m^3/hm^2, Design value	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	286.3%
Emitter type	Radiators
Flow temperature	45°C
System type	
Manufacturer	Vaillant Group UK Ltd
Model	aroTHERM plus VWL 55/8.1 A 230V
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	198 litres
Declared heat loss	1.5 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer, room thermostat and TRVs	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	80 lm/W	**OK**
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.18 W/(l/s)	**OK**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model	Lo-Carbon NBR dMEV C 100, 498095	
Commissioning		

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Tue 27 Oct 2026 09:27:03

Project Information			
Assessed By	Daniel Goddard	Building Type	House, Semi-detached
OCDEA Registration	EES/030945	Assessment Date	2026-10-27

Dwelling Details			
Assessment Type	As designed	Total Floor Area	87 m^2
Site Reference	79841-06	Plot Reference	001
Address	Plot 6 Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH		

Client Details	
Name	-
Company	John Southworth
Address	Unit 10, Ravensfield Industrial Estate, Charles Street, DUKINFIELD, SK16 4SD

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.67 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	3.95 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*60.9 kWh_{PE}/m^2*	
Dwelling primary energy	41.25 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*40.6 kWh/m^2*	
Dwelling fabric energy efficiency	40.0 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.19	Walls (1) (0.19)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.11	GF (0.11)	OK
Roofs	*0.16*	0.09	Roof (1) (0.09)	OK
Windows, doors, and roof windows	*1.6*	1.18	Front (1.2)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	89.53	0.19
Party wall: Party Wall (1)	32.23	0 **(!)**
Ground floor: GF, GF	43.73	0.11
Exposed roof: Roof (1)	43.72999954223633	0.09 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
Front, Window	8.49	West	1.0	1.2
Rear, Window	3	East	1.0	1.2
Door, Door	2.15	West	N/A	1 **(!)**
Rear, Glazed Doors	7.6	East	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.046	To Be Confirmed
External wall	E3: Sill	Calculated by person with suitable	0.047	To Be

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
		expertise		Confirmed
External wall	E4: Jamb	Calculated by person with suitable expertise	0.053	To Be Confirmed
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.068	To Be Confirmed
External wall	E10: Eaves (insulation at ceiling level)	Calculated by person with suitable expertise	0.091	To Be Confirmed
External wall	E12: Gable (insulation at ceiling level)	Calculated by person with suitable expertise	0.075	To Be Confirmed
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.046	To Be Confirmed
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.054	To Be Confirmed
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.116	To Be Confirmed
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.046	To Be Confirmed
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.054	To Be Confirmed

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4 m^3/hm^2, Design value	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	286.3%
Emitter type	Radiators
Flow temperature	45°C
System type	
Manufacturer	Vaillant Group UK Ltd
Model	aroTHERM plus VWL 55/8.1 A 230V
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	198 litres
Declared heat loss	1.5 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer, room thermostat and TRVs	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	80 lm/W	**OK**
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.18 W/(l/s)	**OK**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model	Lo-Carbon NBR dMEV C 100, 498095	
Commissioning		

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Tue 27 Oct 2026 09:27:03

Project Information			
Assessed By	Daniel Goddard	Building Type	House, Semi-detached
OCDEA Registration	EES/030945	Assessment Date	2026-10-27

Dwelling Details			
Assessment Type	As designed	Total Floor Area	87 m^2
Site Reference	79841-07	Plot Reference	001
Address	Plot 7 Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH		

Client Details	
Name	-
Company	John Southworth
Address	Unit 10, Ravensfield Industrial Estate, Charles Street, DUKINFIELD, SK16 4SD

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.67 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	3.95 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*60.9 kWh_{PE}/m^2*	
Dwelling primary energy	41.25 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*40.6 kWh/m^2*	
Dwelling fabric energy efficiency	40.0 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.19	Walls (1) (0.19)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.11	GF (0.11)	OK
Roofs	*0.16*	0.09	Roof (1) (0.09)	OK
Windows, doors, and roof windows	*1.6*	1.18	Front (1.2)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	89.53	0.19
Party wall: Party Wall (1)	32.23	0 **(!)**
Ground floor: GF, GF	43.73	0.11
Exposed roof: Roof (1)	43.72999954223633	0.09 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
Front, Window	8.49	West	1.0	1.2
Rear, Window	3	East	1.0	1.2
Door, Door	2.15	West	N/A	1 **(!)**
Rear, Glazed Doors	7.6	East	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.046	To Be Confirmed
External wall	E3: Sill	Calculated by person with suitable	0.047	To Be

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
		expertise		Confirmed
External wall	E4: Jamb	Calculated by person with suitable expertise	0.053	To Be Confirmed
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.068	To Be Confirmed
External wall	E10: Eaves (insulation at ceiling level)	Calculated by person with suitable expertise	0.091	To Be Confirmed
External wall	E12: Gable (insulation at ceiling level)	Calculated by person with suitable expertise	0.075	To Be Confirmed
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.046	To Be Confirmed
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.054	To Be Confirmed
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.116	To Be Confirmed
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.046	To Be Confirmed
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.054	To Be Confirmed

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4 m^3/hm^2, Design value	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	286.3%
Emitter type	Radiators
Flow temperature	45°C
System type	
Manufacturer	Vaillant Group UK Ltd
Model	aroTHERM plus VWL 55/8.1 A 230V
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	198 litres
Declared heat loss	1.5 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer, room thermostat and TRVs	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	80 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.18 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model	Lo-Carbon NBR dMEV C 100, 498095	
Commissioning		

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Tue 27 Oct 2026 09:27:04

Project Information			
Assessed By	Daniel Goddard	Building Type	House, Semi-detached
OCDEA Registration	EES/030945	Assessment Date	2026-10-27

Dwelling Details			
Assessment Type	As designed	Total Floor Area	87 m^2
Site Reference	79841-08	Plot Reference	001
Address	Plot 8 Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH		

Client Details	
Name	-
Company	John Southworth
Address	Unit 10, Ravensfield Industrial Estate, Charles Street, DUKINFIELD, SK16 4SD

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.67 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	3.95 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*60.9 kWh_{PE}/m^2*	
Dwelling primary energy	41.25 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*40.6 kWh/m^2*	
Dwelling fabric energy efficiency	40.0 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.19	Walls (1) (0.19)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.11	GF (0.11)	OK
Roofs	*0.16*	0.09	Roof (1) (0.09)	OK
Windows, doors, and roof windows	*1.6*	1.18	Front (1.2)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	89.53	0.19
Party wall: Party Wall (1)	32.23	0 **(!)**
Ground floor: GF, GF	43.73	0.11
Exposed roof: Roof (1)	43.72999954223633	0.09 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
Front, Window	8.49	West	1.0	1.2
Rear, Window	3	East	1.0	1.2
Door, Door	2.15	West	N/A	1 **(!)**
Rear, Glazed Doors	7.6	East	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.046	To Be Confirmed
External wall	E3: Sill	Calculated by person with suitable	0.047	To Be

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
		expertise		Confirmed
External wall	E4: Jamb	Calculated by person with suitable expertise	0.053	To Be Confirmed
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.068	To Be Confirmed
External wall	E10: Eaves (insulation at ceiling level)	Calculated by person with suitable expertise	0.091	To Be Confirmed
External wall	E12: Gable (insulation at ceiling level)	Calculated by person with suitable expertise	0.075	To Be Confirmed
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.046	To Be Confirmed
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.054	To Be Confirmed
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.116	To Be Confirmed
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.046	To Be Confirmed
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.054	To Be Confirmed

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4 m^3/hm^2, Design value	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	286.3%
Emitter type	Radiators
Flow temperature	45°C
System type	
Manufacturer	Vaillant Group UK Ltd
Model	aroTHERM plus VWL 55/8.1 A 230V
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	198 litres
Declared heat loss	1.5 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer, room thermostat and TRVs	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	80 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.18 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model	Lo-Carbon NBR dMEV C 100, 498095	
Commissioning		

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Plot Reference	79841-01	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	3B5P (Semi)
Plot Address	Plot 1, Amberley Drive, Wythenshawe , MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	84 B	**DER**	3.80	**TER**	11.13
Environmental	97 A	**% DER < TER**			65.86
CO_2 Emissions (t/year)	0.33	**DFEE**	38.63	**TFEE**	39.28
Compliance Check	See BREL	**% DFEE < TFEE**			1.65
% DPER < TPER	31.59	**DPER**	39.74	**TPER**	58.09

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700 (1b)	x	2.5500 (2b)	=	121.3035	(1b) - (3b)
First floor	47.5700 (1c)	x	2.8300 (2c)	=	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	255.9266	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1172	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3172	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2696	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3438	0.3370	0.3303	0.2966	0.2899	0.2562	0.2562	0.2494	0.2696	0.2899	0.3033	0.3168	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

Effective ac	0.5938	0.5870	0.5803	0.5466	0.5399	0.5062	0.5062	0.5000	0.5196	0.5399	0.5533	0.5668	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.0000	1.1450	12.5954			(27)
Glazed Doors			5.7100	1.1450	6.5382			(27)
GF			47.5700	0.1100	5.2327	75.0000	3567.7500	(28a)
Main	115.8314	18.8600	96.9714	0.1900	18.4246	9.0000	872.7426	(29a)
PIJ	47.5700		47.5700	0.0900	4.2813	9.0000	428.1300	(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.2222			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000	20.0000	668.2000	(32)
Timber			93.9800			9.0000	845.8200	(32c)
Timber			21.9300			9.0000	197.3700	(32c)
FF			47.5700			18.0000	856.2600	(32d)
GF			47.5700			9.0000	428.1300	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7864.4026 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 82.6614 (35)
List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	12.2600	0.0460	0.5640	
E3 Sill	12.2600	0.0470	0.5762	
E4 Jamb	37.2000	0.0530	1.9716	
E5 Ground floor (normal)	21.5300	0.0680	1.4640	
E10 Eaves (insulation at ceiling level)	15.3200	0.0910	1.3941	
E12 Gable (insulation at ceiling level)	6.2100	0.0750	0.4657	
E16 Corner (normal)	10.7600	0.0460	0.4950	
E18 Party wall between dwellings	10.7600	0.0540	0.5810	
P1 Party wall - Ground floor	6.2100	0.1160	0.7204	
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.0460	0.2857	
E6 Intermediate floor within a dwelling	21.5300	0.0540	1.1626	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.6803 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 58.9025 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.1489	49.5795	49.0102	46.1637	45.5944	42.7478	42.7478	42.2279	43.8864	45.5944	46.7330	47.8716	(38)
Heat transfer coeff	109.0513	108.4820	107.9127	105.0662	104.4968	101.6503	101.6503	101.1304	102.7889	104.4968	105.6355	106.7741	(39)
Average = Sum(39)m / 12 =												104.9279	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1462	1.1402	1.1343	1.1043	1.0983	1.0684	1.0684	1.0630	1.0804	1.0983	1.1103	1.1223	(40)
HLP (average)												1.1029	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6898 (42)
Hot water usage for mixer showers

69.3181	68.2763	66.7584	63.8540	61.7106	59.3203	57.9617	59.4682	61.1196	63.6860	66.6528	69.0525	(42a)

Hot water usage for baths

29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)

Hot water usage for other uses

42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)

Average daily hot water use (litres/day) 130.0024 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	141.4261	138.4062	134.7285	129.1362	124.5949	119.7126	117.8364	121.4982	125.3600	130.4856	136.1640	141.0593	(44)
Energy conte	223.9843	197.0885	207.0727	176.7810	167.7287	147.2007	142.5129	150.4401	154.5815	177.0677	193.9906	220.8648	(45)
Energy content (annual)										Total = Sum(45)m =		2159.3135	
Distribution loss (46)m = 0.15 x (45)m	33.5976	29.5633	31.0609	26.5172	25.1593	22.0801	21.3769	22.5660	23.1872	26.5602	29.0986	33.1297	(46)

Water storage loss (or HIU loss):
Store volume 198.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.5000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.8100 (55)
Total storage loss

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)

If cylinder contains dedicated solar storage

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(64)
									Total per year (kWh/year) = Sum(64)m =		2728.8595	(64)
12Total per year (kWh/year)											2729	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

113.1727	100.4849	107.5496	96.2293	94.4677	86.3938	86.0835	88.7193	88.8479	97.5729	101.9515	112.1355	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	128.3915	142.1477	128.3915	132.6712	128.3915	132.6712	128.3915	128.3915	132.6712	128.3915	132.6712	128.3915	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	248.2231	250.7989	244.3080	230.4897	213.0465	196.6524	185.7002	183.1244	189.6153	203.4336	220.8767	237.2708	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	(71)
Water heating gains (Table 5)	152.1139	149.5311	144.5559	133.6518	126.9727	119.9914	115.7036	119.2463	123.3999	131.1464	141.5993	150.7197	(72)
Total internal gains	592.0747	605.8239	580.6016	560.1589	531.7570	512.6613	493.1415	494.1084	509.0326	526.3177	558.4935	579.7283	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

Northeast			5.2400		11.2829		0.3000		0.0000		0.7700		13.6573 (75)
Southwest			5.7600		36.7938		0.3000		0.0000		0.7700		48.9564 (79)
Northeast			5.7100		11.2829		0.3000		0.0000		0.7700		14.8823 (75)
Solar gains	77.4960	141.4841	218.7646	313.2651	389.4060	403.5350	381.9991	322.6040	251.0817	163.1592	94.5487	65.2034	(83)
Total gains	669.5707	747.3080	799.3662	873.4241	921.1630	916.1963	875.1406	816.7124	760.1144	689.4770	653.0422	644.9316	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.0324	20.1375	20.2437	20.7922	20.9055	21.4909	21.4909	21.6014	21.2528	20.9055	20.6801	20.4596	
alpha	2.3355	2.3425	2.3496	2.3861	2.3937	2.4327	2.4327	2.4401	2.4169	2.3937	2.3787	2.3640	
util living area	0.9366	0.9168	0.8872	0.8224	0.7240	0.5806	0.4568	0.4970	0.6825	0.8436	0.9136	0.9411	(86)
Living	18.1386	18.4504	18.9401	19.6529	20.2554	20.7069	20.8827	20.8533	20.5315	19.7666	18.8815	18.1290	
Non living	17.3599	17.6687	18.1515	18.8553	19.4221	19.8353	19.9692	19.9552	19.6898	18.9792	18.1128	17.3629	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.5362	18.4504	18.9401	19.6529	20.2554	20.7069	20.8827	20.8533	20.5315	19.7666	18.8815	18.5306	(87)
Th 2	19.9633	19.9681	19.9730	19.9973	20.0022	20.0267	20.0267	20.0312	20.0169	20.0022	19.9924	19.9827	(88)
util rest of house	0.9286	0.9064	0.8724	0.7982	0.6839	0.5175	0.3714	0.4120	0.6252	0.8173	0.9011	0.9336	(89)
MIT 2	18.6315	17.6687	18.1515	18.8553	19.4221	19.8353	19.9692	19.9552	19.6898	18.9792	18.1128	17.7293	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	18.8320	17.8420	18.3263	19.0321	19.6068	20.0285	20.1717	20.1542	19.8764	19.1537	18.2832	17.9070	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8320	17.8420	18.3263	19.0321	19.6068	20.0285	20.1717	20.1542	19.8764	19.1537	18.2832	17.9070	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9182	0.8785	0.8427	0.7707	0.6661	0.5177	0.3848	0.4235	0.6160	0.7903	0.8738	0.9139	(94)
Useful gains	614.7754	656.4768	673.6300	673.1595	613.5941	474.2825	336.7945	345.9045	468.2536	544.8730	570.6176	589.4234	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1584.7391	1403.9725	1276.2062	1064.5413	826.2405	551.8096	363.0626	379.6677	593.7502	893.8365	1181.3436	1463.5487	(97)
Space heating kWh	721.6530	502.3171	448.3167	281.7949	158.2089	0.0000	0.0000	0.0000	0.0000	259.6288	439.7228	650.3492	(98a)
Space heating requirement - total per year (kWh/year)												3461.9915	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	721.6530	502.3171	448.3167	281.7949	158.2089	0.0000	0.0000	0.0000	0.0000	259.6288	439.7228	650.3492	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3461.9915	
Space heating per m2											(98c) / (4) =	36.3884	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												285.6431	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	721.6530	502.3171	448.3167	281.7949	158.2089	0.0000	0.0000	0.0000	0.0000	259.6288	439.7228	650.3492	(98)
Space heating efficiency (main heating system 1)	285.6431	285.6431	285.6431	285.6431	285.6431	0.0000	0.0000	0.0000	0.0000	285.6431	285.6431	285.6431	(210)
Space heating fuel (main heating system)	252.6415	175.8548	156.9500	98.6528	55.3869	0.0000	0.0000	0.0000	0.0000	90.8927	153.9414	227.6790	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	95.5956	84.5123	89.6597	78.4799	75.8502	68.0973	66.9996	69.7820	70.6879	79.1282	84.5203	94.5007	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.7468	4.2874	4.7468	4.5936	4.7468	4.5936	4.7468	4.7468	4.5936	4.7468	4.5936	4.7468	(231)
Lighting	26.9272	21.6020	19.4502	14.2500	11.0071	8.9929	10.0411	13.0518	16.9530	22.2432	25.1236	27.6755	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	1211.9992	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	284.9050	
Water heating fuel used	957.8138	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)		
mechanical ventilation fans (SFP = 0.1790)	55.8892	(230a)
Total electricity for the above, kWh/year	55.8892	(231)
Electricity for lighting (calculated in Appendix L)	217.3176	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2443.0198	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1211.9992	0.1547	187.4674	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	957.8138	0.1410	135.0326	(264)
Space and water heating			322.5000	(265)
Pumps, fans and electric keep-hot	55.8892	0.1387	7.7525	(267)
Energy for lighting	217.3176	0.1443	31.3656	(268)
Total CO2, kg/year			361.6181	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.8000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1211.9992	1.5726	1906.0057	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	957.8138	1.5213	1457.1193	(278)
Space and water heating			3363.1249	(279)
Pumps, fans and electric keep-hot	55.8892	1.5128	84.5493	(281)
Energy for lighting	217.3176	1.5338	333.3289	(282)
Total Primary energy kWh/year			3781.0031	(286)
Dwelling Primary energy Rate (DPER)			39.7400	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700	(1b) x	2.5500	(2b) =	121.3035	(1b) - (3b)
First floor	47.5700	(1c) x	2.8300	(2c) =	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 95.1400						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		255.9266	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 = 0.0000	(6a)
Number of open flues	0 * 20 = 0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000	(6d)
Number of flues attached to other heater	0 * 35 = 0.0000	(6e)
Number of blocked chimneys	0 * 20 = 0.0000	(6f)
Number of intermittent extract fans	3 * 10 = 30.0000	(7a)
Number of passive vents	0 * 10 = 0.0000	(7b)
Number of flueless gas fires	0 * 40 = 0.0000	(7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1172	(8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3672	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3121	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)

Adj infilt rate													
	0.3980	0.3902	0.3824	0.3434	0.3355	0.2965	0.2965	0.2887	0.3121	0.3355	0.3512	0.3668	(22b)
Effective ac	0.5792	0.5761	0.5731	0.5589	0.5563	0.5440	0.5440	0.5417	0.5487	0.5563	0.5617	0.5673	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type			16.7100	1.1450	19.1336			(27)
GF			47.5700	0.1300	6.1841			(28a)
Main	115.8314	18.8600	96.9714	0.1800	17.4549			(29a)
PIJ	47.5700		47.5700	0.1100	5.2327			(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.1552			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	82.6614 (35)
List of Thermal Bridges	

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.2600	0.0500	0.6130
E3 Sill	12.2600	0.0500	0.6130
E4 Jamb	37.2000	0.0500	1.8600
E5 Ground floor (normal)	21.5300	0.1600	3.4448
E10 Eaves (insulation at ceiling level)	15.3200	0.0600	0.9192
E12 Gable (insulation at ceiling level)	6.2100	0.0600	0.3726
E16 Corner (normal)	10.7600	0.0900	0.9684
E18 Party wall between dwellings	10.7600	0.0600	0.6456
P1 Party wall - Ground floor	6.2100	0.0800	0.4968
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.1200	0.7452
E6 Intermediate floor within a dwelling	21.5300	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.6786	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	60.8338	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.9161	48.6564	48.4019	47.2062	46.9824	45.9410	45.9410	45.7482	46.3422	46.9824	47.4350	47.9081	(38)
Heat transfer coeff	109.7500	109.4903	109.2357	108.0400	107.8163	106.7749	106.7749	106.5820	107.1760	107.8163	108.2688	108.7420	(39)
Average = Sum(39)m / 12 =												108.0389	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1536	1.1508	1.1482	1.1356	1.1332	1.1223	1.1223	1.1203	1.1265	1.1332	1.1380	1.1430	(40)
HLP (average)												1.1356	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6898	(42)
Hot water usage for mixer showers													
	69.3181	68.2763	66.7584	63.8540	61.7106	59.3203	57.9617	59.4682	61.1196	63.6860	66.6528	69.0525	(42a)
Hot water usage for baths													
	29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)
Hot water usage for other uses													
	42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)
Average daily hot water use (litres/day)												130.0024	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	141.4261	138.4062	134.7285	129.1362	124.5949	119.7126	117.8364	121.4982	125.3600	130.4856	136.1640	141.0593	(44)
Energy conte	223.9843	197.0885	207.0727	176.7810	167.7287	147.2007	142.5129	150.4401	154.5815	177.0677	193.9906	220.8648	(45)
Energy content (annual)										Total = Sum(45)m =		2159.3135	
Distribution loss (46)m = 0.15 x (45)m													
	33.5976	29.5633	31.0609	26.5172	25.1593	22.0801	21.3769	22.5660	23.1872	26.5602	29.0986	33.1297	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6426	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8870	(55)
Total storage loss													
	27.4979	24.8369	27.4979	26.6109	27.4979	26.6109	27.4979	27.4979	26.6109	27.4979	26.6109	27.4979	(56)
If cylinder contains dedicated solar storage													
	27.4979	24.8369	27.4979	26.6109	27.4979	26.6109	27.4979	27.4979	26.6109	27.4979	26.6109	27.4979	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	274.7447	242.9366	257.8330	225.9039	218.4890	196.3236	193.2732	201.2004	203.7044	227.8281	243.1135	271.6251	(62)
WWHRS	-31.6893	-28.0263	-29.3475	-24.3009	-22.6476	-19.3797	-18.1654	-19.3170	-20.0510	-23.6379	-26.7789	-31.1025	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	243.0553	214.9103	228.4855	201.6030	195.8415	176.9439	175.1079	181.8834	183.6534	204.1902	216.3347	240.5226	(64)
										Total per year (kWh/year) = Sum(64)m =		2462.5316	(64)
12Total per year (kWh/year)												2463	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	115.0831	102.2104	109.4599	98.0780	96.3781	88.2426	87.9938	90.6296	90.6967	99.4833	103.8002	114.0458	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	128.3915	142.1477	128.3915	132.6712	128.3915	132.6712	128.3915	128.3915	132.6712	128.3915	132.6712	128.3915	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													

	248.2231	250.7989	244.3080	230.4897	213.0465	196.6524	185.7002	183.1244	189.6153	203.4336	220.8767	237.2708 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901 (71)
Water heating gains (Table 5)												
	154.6815	152.0988	147.1236	136.2195	129.5404	122.5591	118.2712	121.8140	125.9676	133.7141	144.1670	153.2874 (72)
Total internal gains												
	597.6424	611.3916	586.1693	565.7266	537.3247	515.2290	495.7092	496.6761	511.6003	531.8854	564.0611	585.2959 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.9500	11.2829	0.6300	0.7000	0.7700	37.7579	(75)
Southwest	5.7600	36.7938	0.6300	0.7000	0.7700	64.7693	(79)

Solar gains	102.5273	187.1835	289.4255	414.4498	515.1842	533.8768	505.3848	426.8051	332.1811	215.8597	125.0880	86.2641	(83)
Total gains	700.1696	798.5751	875.5948	980.1764	1052.5089	1049.1058	1001.0940	923.4812	843.7815	747.7451	689.1491	671.5600	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.9048	19.9521	19.9986	20.2199	20.2618	20.4595	20.4595	20.4965	20.3829	20.2618	20.1771	20.0894	
alpha	2.3270	2.3301	2.3332	2.3480	2.3508	2.3640	2.3640	2.3664	2.3589	2.3508	2.3451	2.3393	
util living area													
	0.9314	0.9069	0.8698	0.7943	0.6844	0.5434	0.4241	0.4677	0.6547	0.8270	0.9063	0.9369	(86)
MIT	18.1785	18.5155	19.0308	19.7277	20.3199	20.7260	20.8906	20.8588	20.5483	19.7886	18.8835	18.1262	(87)
Th 2	19.9573	19.9595	19.9617	19.9719	19.9738	19.9827	19.9827	19.9843	19.9792	19.9738	19.9699	19.9659	(88)
util rest of house													
	0.9228	0.8954	0.8533	0.7675	0.6417	0.4790	0.3394	0.3820	0.5948	0.7984	0.8929	0.9290	(89)
MIT 2	16.6692	17.0931	17.7389	18.6012	19.3042	19.7586	19.9161	19.8935	19.5819	18.6954	17.5696	16.6081	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	17.0038	17.4084	18.0252	18.8509	19.5293	19.9731	20.1321	20.1075	19.7961	18.9378	17.8608	16.9446	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.0038	17.4084	18.0252	18.8509	19.5293	19.9731	20.1321	20.1075	19.7961	18.9378	17.8608	16.9446	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8885	0.8578	0.8141	0.7330	0.6211	0.4784	0.3525	0.3931	0.5828	0.7631	0.8559	0.8961	(94)
Useful gains	622.1005	685.0011	712.8020	718.4703	653.7264	501.8644	352.8490	362.9780	491.7948	570.5944	589.8307	601.7860	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1394.2402	1369.5514	1258.9669	1075.0984	844.1304	573.7081	377.1447	395.1511	610.4905	898.9463	1165.0629	1385.8749	(97)
Space heating kWh													
	574.4719	460.0178	406.3466	256.7722	141.6606	0.0000	0.0000	0.0000	0.0000	244.2938	414.1671	583.3622	(98a)
Space heating requirement - total per year (kWh/year)												3081.0922	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	574.4719	460.0178	406.3466	256.7722	141.6606	0.0000	0.0000	0.0000	0.0000	244.2938	414.1671	583.3622	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3081.0922	
Space heating per m2											(98c) / (4) =	32.3848	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	574.4719	460.0178	406.3466	256.7722	141.6606	0.0000	0.0000	0.0000	0.0000	244.2938	414.1671	583.3622	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	622.3964	498.3942	440.2456	278.1931	153.4784	0.0000	0.0000	0.0000	0.0000	264.6736	448.7184	632.0284	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	243.0553	214.9103	228.4855	201.6030	195.8415	176.9439	175.1079	181.8834	183.6534	204.1902	216.3347	240.5226	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.9191	85.7216	85.3360	84.6033	83.3456	79.8000	79.8000	79.8000	79.8000	84.4630	85.4917	85.9694	(217)
Fuel for water heating, kWh/month													
	282.8887	250.7073	267.7479	238.2920	234.9753	221.7342	219.4334	227.9240	230.1421	241.7511	253.0475	279.7769	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	26.6772	21.4014	19.2696	14.1178	10.9050	8.9094	9.9479	12.9306	16.7956	22.0367	24.8904	27.4187	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-43.7273	-61.2512	-87.4769	-97.6894	-104.7589	-97.5416	-96.2965	-91.1670	-82.0635	-69.6860	-47.9165	-37.8482	(233a)

Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-25.9245	-54.3936	-107.8641	-161.6637	-213.4533	-214.3907	-211.9042	-179.5910	-131.8391	-77.7180	-34.5868	-20.5145 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3338.1281	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2948.4206	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	215.3004	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2351.2664	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4236.5827	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3338.1281	0.2100	701.0069	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2948.4206	0.2100	619.1683	(264)
Space and water heating			1320.1752	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	215.3004	0.1443	31.0745	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-917.4229	0.1347	-123.6078	
PV Unit electricity exported	-1433.8435	0.1260	-180.5987	
Total			-304.2065	(269)
Total CO2, kg/year			1058.9725	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.1300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3338.1281	1.1300	3772.0847	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2948.4206	1.1300	3331.7153	(278)
Space and water heating			7103.8001	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	215.3004	1.5338	330.2349	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-917.4229	1.4980	-1374.2639	
PV Unit electricity exported	-1433.8435	0.4623	-662.9248	
Total			-2037.1887	(283)
Total Primary energy kWh/year			5526.9471	(286)
Target Primary Energy Rate (TPER)			58.0900	(287)

Full SAP Calculation Printout

Plot Reference	79841-01	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	3B5P (Semi)
Plot Address	Plot 1, Amberley Drive, Wythenshawe , MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	84 B	**DER**	3.80	**TER**	11.13
Environmental	97 A	**% DER < TER**			65.86
CO_2 Emissions (t/year)	0.33	**DFEE**	38.63	**TFEE**	39.28
Compliance Check	See BREL	**% DFEE < TFEE**			1.65
% DPER < TPER	31.59	**DPER**	39.74	**TPER**	58.09

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700 (1b)	x	2.5500 (2b)	=	121.3035	(1b) - (3b)
First floor	47.5700 (1c)	x	2.8300 (2c)	=	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	255.9266	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1172	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3172	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2696	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3438	0.3370	0.3303	0.2966	0.2899	0.2562	0.2562	0.2494	0.2696	0.2899	0.3033	0.3168	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5591	0.5568	0.5546	0.5440	0.5420	0.5328	0.5328	0.5311	0.5364	0.5420	0.5460	0.5502	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.0000	1.1450	12.5954			(27)
Glazed Doors			5.7100	1.1450	6.5382			(27)
GF			47.5700	0.1100	5.2327	75.0000	3567.7500	(28a)
Main	115.8314	18.8600	96.9714	0.1900	18.4246	9.0000	872.7426	(29a)
PIJ	47.5700		47.5700	0.0900	4.2813	9.0000	428.1300	(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.2222			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000	20.0000	668.2000	(32)
Timber			93.9800			9.0000	845.8200	(32c)
Timber			21.9300			9.0000	197.3700	(32c)
FF			47.5700			18.0000	856.2600	(32d)
GF			47.5700			9.0000	428.1300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	7864.4026 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		82.6614 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	12.2600	0.0460	0.5640	
E3 Sill	12.2600	0.0470	0.5762	
E4 Jamb	37.2000	0.0530	1.9716	
E5 Ground floor (normal)	21.5300	0.0680	1.4640	
E10 Eaves (insulation at ceiling level)	15.3200	0.0910	1.3941	
E12 Gable (insulation at ceiling level)	6.2100	0.0750	0.4657	
E16 Corner (normal)	10.7600	0.0460	0.4950	
E18 Party wall between dwellings	10.7600	0.0540	0.5810	
P1 Party wall - Ground floor	6.2100	0.1160	0.7204	
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.0460	0.2857	
E6 Intermediate floor within a dwelling	21.5300	0.0540	1.1626	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			9.6803	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	58.9025	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.2188	47.0250	46.8351	45.9428	45.7758	44.9987	44.9987	44.8548	45.2981	45.7758	46.1136	46.4666	(38)
Heat transfer coeff	106.1213	105.9275	105.7375	104.8453	104.6783	103.9012	103.9012	103.7573	104.2005	104.6783	105.0160	105.3691	(39)
Average = Sum(39)m / 12 =												104.8445	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1154	1.1134	1.1114	1.1020	1.1003	1.0921	1.0921	1.0906	1.0952	1.1003	1.1038	1.1075	(40)
HLP (average)												1.1020	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6898 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)
Hot water usage for other uses	42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)
Average daily hot water use (litres/day)												66.0935	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	72.1080	70.1298	67.9701	65.2822	62.8843	60.3923	59.8747	62.0299	64.2404	66.7996	69.5112	72.0068	(44)
Energy conte	114.2015	99.8639	104.4676	89.3681	84.6544	74.2594	72.4132	76.8060	79.2149	90.6464	99.0315	112.7453	(45)
Energy content (annual)										Total = Sum(45)m =		1097.6720	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	97.0712	84.8843	88.7974	75.9629	71.9562	63.1205	61.5512	65.2851	67.3326	77.0494	84.1768	95.8335	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	97.0712	84.8843	88.7974	75.9629	71.9562	63.1205	61.5512	65.2851	67.3326	77.0494	84.1768	95.8335	(64)
										Total per year (kWh/year) = Sum(64)m =		933.0212	(64)
12Total per year (kWh/year)												933	(64)
Electric shower(s)	55.5122	49.4618	54.0104	51.5415	52.5087	50.0882	51.7578	52.5087	51.5415	54.0104	52.9948	55.5122	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		631.4482	(64a)
Heat gains from water heating, kWh/month	38.1459	33.5865	35.7020	31.8761	31.1162	28.3022	28.3272	29.4484	29.7185	32.7650	34.2929	37.8364	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	128.3915	142.1477	128.3915	132.6712	128.3915	132.6712	128.3915	128.3915	132.6712	128.3915	132.6712	128.3915	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	248.2231	250.7989	244.3080	230.4897	213.0465	196.6524	185.7002	183.1244	189.6153	203.4336	220.8767	237.2708	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	(71)
Water heating gains (Table 5)	51.2713	49.9800	47.9865	44.2724	41.8229	39.3086	38.0743	39.5812	41.2757	44.0389	47.6290	50.8554	(72)
Total internal gains	491.2321	506.2728	484.0322	470.7795	446.6071	431.9784	415.5122	414.4434	426.9085	439.2103	464.5232	479.8640	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.2400	11.2829	0.3000	0.0000	0.7700	13.6573	(75)
Southwest	5.7600	36.7938	0.3000	0.0000	0.7700	48.9564	(79)
Northeast	5.7100	11.2829	0.3000	0.0000	0.7700	14.8823	(75)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	77.4960	141.4841	218.7646	313.2651	389.4060	403.5350	381.9991	322.6040	251.0817	163.1592	94.5487	65.2034	(83)

Total gains	568.7282	647.7569	702.7968	784.0446	836.0132	835.5135	797.5113	737.0474	677.9902	602.3695	559.0719	545.0673	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.5855	20.6231	20.6602	20.8360	20.8692	21.0253	21.0253	21.0545	20.9649	20.8692	20.8021	20.7324	
alpha	2.3724	2.3749	2.3773	2.3891	2.3913	2.4017	2.4017	2.4036	2.3977	2.3913	2.3868	2.3822	
util living area	0.9532	0.9353	0.9087	0.8496	0.7567	0.6220	0.4976	0.5436	0.7261	0.8747	0.9350	0.9574	(86)
MIT	18.0164	18.3309	18.8268	19.5309	20.1682	20.6445	20.8522	20.8122	20.4458	19.6293	18.7171	17.9628	(87)
Th 2	19.9883	19.9899	19.9915	19.9992	20.0006	20.0073	20.0073	20.0085	20.0047	20.0006	19.9977	19.9947	(88)
util rest of house	0.9471	0.9269	0.8962	0.8278	0.7186	0.5578	0.4064	0.4535	0.6707	0.8521	0.9252	0.9518	(89)
MIT 2	17.2567	17.5674	18.0562	18.7444	19.3464	19.7728	19.9342	19.9101	19.6123	18.8519	17.9579	17.2078	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	17.4251	17.7366	18.2270	18.9187	19.5286	19.9661	20.1377	20.1101	19.7970	19.0243	18.1262	17.3752	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.4251	17.7366	18.2270	18.9187	19.5286	19.9661	20.1377	20.1101	19.7970	19.0243	18.1262	17.3752	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9257	0.9020	0.8683	0.7995	0.6981	0.5549	0.4192	0.4635	0.6575	0.8244	0.9006	0.9316	(94)
Useful gains	526.4754	584.2673	610.2529	626.8489	583.5811	463.6020	334.3474	341.6049	445.7919	496.5917	503.4925	507.7860	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1392.8536	1359.7515	1239.9842	1050.4170	819.4813	557.5393	367.5683	384.9514	593.6340	881.8364	1157.9236	1388.2559	(97)
Space heating kWh	644.5854	521.1254	468.5201	304.9690	175.5097	0.0000	0.0000	0.0000	0.0000	286.6221	471.1904	655.0696	(98a)
Space heating requirement - total per year (kWh/year)												3527.5917	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	644.5854	521.1254	468.5201	304.9690	175.5097	0.0000	0.0000	0.0000	0.0000	286.6221	471.1904	655.0696	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3527.5917	
Space heating per m2											(98c) / (4) =	37.0779	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	976.6712	768.8688	788.5553	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6860	0.7526	0.7171	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	669.9562	578.6296	565.4383	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	923.3410	881.4929	813.3722	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	182.4370	225.3303	184.4628	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	45.6093	56.3326	46.1157	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												148.0575	(107)
Energy for space heating												37.0779	(99)
Energy for space cooling												1.5562	(108)
Total												38.6341	(109)
Fabric Energy Efficiency (DFEE)												38.6	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700	(1b) x	2.5500	(2b) =	121.3035	(1b) - (3b)
First floor	47.5700	(1c) x	2.8300	(2c) =	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		255.9266	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)

Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1172 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3672 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3121 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3980	0.3902	0.3824	0.3434	0.3355	0.2965	0.2965	0.2887	0.3121	0.3355	0.3512	0.3668	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0.0000 (23c)

Effective ac	0.5792	0.5761	0.5731	0.5589	0.5563	0.5440	0.5440	0.5417	0.5487	0.5563	0.5617	0.5673	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type			16.7100	1.1450	19.1336			(27)
GF			47.5700	0.1300	6.1841			(28a)
Main	115.8314	18.8600	96.9714	0.1800	17.4549			(29a)
PIJ	47.5700		47.5700	0.1100	5.2327			(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.1552			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	82.6614 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.2600	0.0500	0.6130
E3 Sill	12.2600	0.0500	0.6130
E4 Jamb	37.2000	0.0500	1.8600
E5 Ground floor (normal)	21.5300	0.1600	3.4448
E10 Eaves (insulation at ceiling level)	15.3200	0.0600	0.9192
E12 Gable (insulation at ceiling level)	6.2100	0.0600	0.3726
E16 Corner (normal)	10.7600	0.0900	0.9684
E18 Party wall between dwellings	10.7600	0.0600	0.6456
P1 Party wall - Ground floor	6.2100	0.0800	0.4968
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.1200	0.7452
E6 Intermediate floor within a dwelling	21.5300	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.6786 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	60.8338 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.9161	48.6564	48.4019	47.2062	46.9824	45.9410	45.9410	45.7482	46.3422	46.9824	47.4350	47.9081	(38)
Heat transfer coeff	109.7500	109.4903	109.2357	108.0400	107.8163	106.7749	106.7749	106.5820	107.1760	107.8163	108.2688	108.7420	(39)
Average = Sum(39)m / 12 =												108.0389	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1536	1.1508	1.1482	1.1356	1.1332	1.1223	1.1223	1.1203	1.1265	1.1332	1.1380	1.1430	(40)
HLP (average)												1.1356	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6898 (42)

Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)

Hot water usage for other uses

42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)

Average daily hot water use (litres/day)	66.0935 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	72.1080	70.1298	67.9701	65.2822	62.8843	60.3923	59.8747	62.0299	64.2404	66.7996	69.5112	72.0068	(44)
Energy conte	114.2015	99.8639	104.4676	89.3681	84.6544	74.2594	72.4132	76.8060	79.2149	90.6464	99.0315	112.7453	(45)
Energy content (annual)										Total = Sum(45)m =		1097.6720	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	97.0712	84.8843	88.7974	75.9629	71.9562	63.1205	61.5512	65.2851	67.3326	77.0494	84.1768	95.8335	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	97.0712	84.8843	88.7974	75.9629	71.9562	63.1205	61.5512	65.2851	67.3326	77.0494	84.1768	95.8335	(64)
										Total per year (kWh/year) = Sum(64)m =		933.0212	(64)
12Total per year (kWh/year)												933	(64)

Electric shower(s)

	55.5122	49.4618	54.0104	51.5415	52.5087	50.0882	51.7578	52.5087	51.5415	54.0104	52.9948	55.5122 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												631.4482 (64a)
Heat gains from water heating, kWh/month												
	38.1459	33.5865	35.7020	31.8761	31.1162	28.3022	28.3272	29.4484	29.7185	32.7650	34.2929	37.8364 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	128.3915	142.1477	128.3915	132.6712	128.3915	132.6712	128.3915	128.3915	132.6712	128.3915	132.6712	128.3915	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.2231	250.7989	244.3080	230.4897	213.0465	196.6524	185.7002	183.1244	189.6153	203.4336	220.8767	237.2708	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	(71)
Water heating gains (Table 5)													
	51.2713	49.9800	47.9865	44.2724	41.8229	39.3086	38.0743	39.5812	41.2757	44.0389	47.6290	50.8554	(72)
Total internal gains													
	491.2321	506.2728	484.0322	470.7795	446.6071	431.9784	415.5122	414.4434	426.9085	439.2103	464.5232	479.8640	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.9500	11.2829	0.6300	0.7000	0.7700	37.7579	(75)
Southwest	5.7600	36.7938	0.6300	0.7000	0.7700	64.7693	(79)

Solar gains	102.5273	187.1835	289.4255	414.4498	515.1842	533.8768	505.3848	426.8051	332.1811	215.8597	125.0880	86.2641	(83)
Total gains	593.7594	693.4563	773.4578	885.2293	961.7913	965.8553	920.8970	841.2485	759.0896	655.0699	589.6112	566.1280	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.9048	19.9521	19.9986	20.2199	20.2618	20.4595	20.4595	20.4965	20.3829	20.2618	20.1771	20.0894	
alpha	2.3270	2.3301	2.3332	2.3480	2.3508	2.3640	2.3640	2.3664	2.3589	2.3508	2.3451	2.3393	
util living area													
	0.9497	0.9278	0.8942	0.8227	0.7160	0.5747	0.4534	0.5019	0.6931	0.8592	0.9294	0.9546	(86)
MIT	17.9677	18.3221	18.8633	19.6066	20.2437	20.6897	20.8734	20.8352	20.4846	19.6550	18.6993	17.9131	(87)
Th 2	19.9573	19.9595	19.9617	19.9719	19.9738	19.9827	19.9827	19.9843	19.9792	19.9738	19.9699	19.9659	(88)
util rest of house													
	0.9431	0.9184	0.8800	0.7981	0.6747	0.5095	0.3650	0.4129	0.6346	0.8343	0.9187	0.9486	(89)
MIT 2	17.1891	17.5387	18.0703	18.7935	19.3883	19.7828	19.9220	19.9005	19.6209	18.8559	17.9222	17.1407	(90)
Living area fraction									fLA = Living area / (4) =			0.2217	(91)
MIT	17.3617	17.7124	18.2461	18.9737	19.5779	19.9838	20.1329	20.1077	19.8123	19.0330	18.0944	17.3120	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.3617	17.7124	18.2461	18.9737	19.5779	19.9838	20.1329	20.1077	19.8123	19.0330	18.0944	17.3120	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9204	0.8917	0.8504	0.7698	0.6569	0.5096	0.3788	0.4245	0.6238	0.8060	0.8926	0.9272	(94)
Useful gains	546.5122	618.3632	657.7375	681.4821	631.7763	492.1761	348.8078	357.1278	473.5438	527.9803	526.2865	524.9062	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1433.5247	1402.8286	1283.0935	1088.3651	849.3649	574.8578	377.2228	395.1734	612.2266	909.2163	1190.3561	1425.8196	(97)
Space heating kWh													
	659.9373	527.1608	465.2648	292.9557	161.8860	0.0000	0.0000	0.0000	0.0000	283.6395	478.1301	670.2795	(98a)
Space heating requirement - total per year (kWh/year)												3539.2538	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	659.9373	527.1608	465.2648	292.9557	161.8860	0.0000	0.0000	0.0000	0.0000	283.6395	478.1301	670.2795	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3539.2538	
Space heating per m2											(98c) / (4) =	37.2005	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1003.6836	790.1339	810.0232	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7267	0.7879	0.7516	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	729.3467	622.5318	608.8108	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1075.6886	1025.7100	935.1657	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	249.3662	299.9646	242.8080	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	62.3415	74.9911	60.7020	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												198.0347	(107)

Energy for space heating	37.2005 (99)
Energy for space cooling	2.0815 (108)
Total	39.2820 (109)
Fabric Energy Efficiency (TFEE)	39.3 (109)

Full SAP Calculation Printout

Plot Reference	79841-01	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	3B5P (Semi)
Plot Address	Plot 1, Amberley Drive, Wythenshawe , MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	84 B	**DER**	3.80	**TER**	11.13
Environmental	97 A	**% DER < TER**			65.86
CO_2 Emissions (t/year)	0.33	**DFEE**	38.63	**TFEE**	39.28
Compliance Check	See BREL	**% DFEE < TFEE**			1.65
% DPER < TPER	31.59	**DPER**	39.74	**TPER**	58.09

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700 (1b)	x	2.5500 (2b)	=	121.3035	(1b) - (3b)
First floor	47.5700 (1c)	x	2.8300 (2c)	=	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	255.9266	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1172	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3172	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2696	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3438	0.3370	0.3303	0.2966	0.2899	0.2562	0.2562	0.2494	0.2696	0.2899	0.3033	0.3168	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

Effective ac	0.5938	0.5870	0.5803	0.5466	0.5399	0.5062	0.5062	0.5000	0.5196	0.5399	0.5533	0.5668	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.0000	1.1450	12.5954			(27)
Glazed Doors			5.7100	1.1450	6.5382			(27)
GF			47.5700	0.1100	5.2327	75.0000	3567.7500	(28a)
Main	115.8314	18.8600	96.9714	0.1900	18.4246	9.0000	872.7426	(29a)
PIJ	47.5700		47.5700	0.0900	4.2813	9.0000	428.1300	(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.2222			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000	20.0000	668.2000	(32)
Timber			93.9800			9.0000	845.8200	(32c)
Timber			21.9300			9.0000	197.3700	(32c)
FF			47.5700			18.0000	856.2600	(32d)
GF			47.5700			9.0000	428.1300	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7864.4026 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 82.6614 (35)
List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	12.2600	0.0460	0.5640	
E3 Sill	12.2600	0.0470	0.5762	
E4 Jamb	37.2000	0.0530	1.9716	
E5 Ground floor (normal)	21.5300	0.0680	1.4640	
E10 Eaves (insulation at ceiling level)	15.3200	0.0910	1.3941	
E12 Gable (insulation at ceiling level)	6.2100	0.0750	0.4657	
E16 Corner (normal)	10.7600	0.0460	0.4950	
E18 Party wall between dwellings	10.7600	0.0540	0.5810	
P1 Party wall - Ground floor	6.2100	0.1160	0.7204	
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.0460	0.2857	
E6 Intermediate floor within a dwelling	21.5300	0.0540	1.1626	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.6803 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 58.9025 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.1489	49.5795	49.0102	46.1637	45.5944	42.7478	42.7478	42.2279	43.8864	45.5944	46.7330	47.8716	(38)
Heat transfer coeff	109.0513	108.4820	107.9127	105.0662	104.4968	101.6503	101.6503	101.1304	102.7889	104.4968	105.6355	106.7741	(39)
Average = Sum(39)m / 12 =												104.9279	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1462	1.1402	1.1343	1.1043	1.0983	1.0684	1.0684	1.0630	1.0804	1.0983	1.1103	1.1223	(40)
HLP (average)												1.1029	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6898 (42)
Hot water usage for mixer showers

69.3181	68.2763	66.7584	63.8540	61.7106	59.3203	57.9617	59.4682	61.1196	63.6860	66.6528	69.0525	(42a)

Hot water usage for baths

29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)

Hot water usage for other uses

42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)

Average daily hot water use (litres/day) 130.0024 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	141.4261	138.4062	134.7285	129.1362	124.5949	119.7126	117.8364	121.4982	125.3600	130.4856	136.1640	141.0593	(44)
Energy conte	223.9843	197.0885	207.0727	176.7810	167.7287	147.2007	142.5129	150.4401	154.5815	177.0677	193.9906	220.8648	(45)
Energy content (annual)										Total = Sum(45)m =		2159.3135	
Distribution loss (46)m = 0.15 x (45)m	33.5976	29.5633	31.0609	26.5172	25.1593	22.0801	21.3769	22.5660	23.1872	26.5602	29.0986	33.1297	(46)

Water storage loss (or HIU loss):
Store volume 198.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.5000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.8100 (55)
Total storage loss

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)

If cylinder contains dedicated solar storage

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(64)
									Total per year (kWh/year) = Sum(64)m =		2728.8595	(64)
12Total per year (kWh/year)											2729	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

113.1727	100.4849	107.5496	96.2293	94.4677	86.3938	86.0835	88.7193	88.8479	97.5729	101.9515	112.1355	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	128.3915	142.1477	128.3915	132.6712	128.3915	132.6712	128.3915	128.3915	132.6712	128.3915	132.6712	128.3915	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	248.2231	250.7989	244.3080	230.4897	213.0465	196.6524	185.7002	183.1244	189.6153	203.4336	220.8767	237.2708	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	(71)
Water heating gains (Table 5)	152.1139	149.5311	144.5559	133.6518	126.9727	119.9914	115.7036	119.2463	123.3999	131.1464	141.5993	150.7197	(72)
Total internal gains	592.0747	605.8239	580.6016	560.1589	531.7570	512.6613	493.1415	494.1084	509.0326	526.3177	558.4935	579.7283	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

Northeast			5.2400		11.2829		0.3000		0.0000		0.7700		13.6573 (75)
Southwest			5.7600		36.7938		0.3000		0.0000		0.7700		48.9564 (79)
Northeast			5.7100		11.2829		0.3000		0.0000		0.7700		14.8823 (75)
Solar gains	77.4960	141.4841	218.7646	313.2651	389.4060	403.5350	381.9991	322.6040	251.0817	163.1592	94.5487	65.2034	(83)
Total gains	669.5707	747.3080	799.3662	873.4241	921.1630	916.1963	875.1406	816.7124	760.1144	689.4770	653.0422	644.9316	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.0324	20.1375	20.2437	20.7922	20.9055	21.4909	21.4909	21.6014	21.2528	20.9055	20.6801	20.4596	
alpha	2.3355	2.3425	2.3496	2.3861	2.3937	2.4327	2.4327	2.4401	2.4169	2.3937	2.3787	2.3640	
util living area	0.9366	0.9168	0.8872	0.8224	0.7240	0.5806	0.4568	0.4970	0.6825	0.8436	0.9136	0.9411	(86)
Living	18.1386	18.4504	18.9401	19.6529	20.2554	20.7069	20.8827	20.8533	20.5315	19.7666	18.8815	18.1290	
Non living	17.3599	17.6687	18.1515	18.8553	19.4221	19.8353	19.9692	19.9552	19.6898	18.9792	18.1128	17.3629	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.5362	18.4504	18.9401	19.6529	20.2554	20.7069	20.8827	20.8533	20.5315	19.7666	18.8815	18.5306	(87)
Th 2	19.9633	19.9681	19.9730	19.9973	20.0022	20.0267	20.0267	20.0312	20.0169	20.0022	19.9924	19.9827	(88)
util rest of house	0.9286	0.9064	0.8724	0.7982	0.6839	0.5175	0.3714	0.4120	0.6252	0.8173	0.9011	0.9336	(89)
MIT 2	18.6315	17.6687	18.1515	18.8553	19.4221	19.8353	19.9692	19.9552	19.6898	18.9792	18.1128	17.7293	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	18.8320	17.8420	18.3263	19.0321	19.6068	20.0285	20.1717	20.1542	19.8764	19.1537	18.2832	17.9070	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8320	17.8420	18.3263	19.0321	19.6068	20.0285	20.1717	20.1542	19.8764	19.1537	18.2832	17.9070	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9182	0.8785	0.8427	0.7707	0.6661	0.5177	0.3848	0.4235	0.6160	0.7903	0.8738	0.9139	(94)
Useful gains	614.7754	656.4768	673.6300	673.1595	613.5941	474.2825	336.7945	345.9045	468.2536	544.8730	570.6176	589.4234	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1584.7391	1403.9725	1276.2062	1064.5413	826.2405	551.8096	363.0626	379.6677	593.7502	893.8365	1181.3436	1463.5487	(97)
Space heating kWh	721.6530	502.3171	448.3167	281.7949	158.2089	0.0000	0.0000	0.0000	0.0000	259.6288	439.7228	650.3492	(98a)
Space heating requirement - total per year (kWh/year)												3461.9915	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	721.6530	502.3171	448.3167	281.7949	158.2089	0.0000	0.0000	0.0000	0.0000	259.6288	439.7228	650.3492	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3461.9915	
Space heating per m2											(98c) / (4) =	36.3884	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												285.6431	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	721.6530	502.3171	448.3167	281.7949	158.2089	0.0000	0.0000	0.0000	0.0000	259.6288	439.7228	650.3492	(98)
Space heating efficiency (main heating system 1)	285.6431	285.6431	285.6431	285.6431	285.6431	0.0000	0.0000	0.0000	0.0000	285.6431	285.6431	285.6431	(210)
Space heating fuel (main heating system)	252.6415	175.8548	156.9500	98.6528	55.3869	0.0000	0.0000	0.0000	0.0000	90.8927	153.9414	227.6790	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	95.5956	84.5123	89.6597	78.4799	75.8502	68.0973	66.9996	69.7820	70.6879	79.1282	84.5203	94.5007	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.7468	4.2874	4.7468	4.5936	4.7468	4.5936	4.7468	4.7468	4.5936	4.7468	4.5936	4.7468	(231)
Lighting	26.9272	21.6020	19.4502	14.2500	11.0071	8.9929	10.0411	13.0518	16.9530	22.2432	25.1236	27.6755	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	1211.9992	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	284.9050	
Water heating fuel used	957.8138	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)		
mechanical ventilation fans (SFP = 0.1790)	55.8892	(230a)
Total electricity for the above, kWh/year	55.8892	(231)
Electricity for lighting (calculated in Appendix L)	217.3176	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2443.0198	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1211.9992	0.1547	187.4674	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	957.8138	0.1410	135.0326	(264)
Space and water heating			322.5000	(265)
Pumps, fans and electric keep-hot	55.8892	0.1387	7.7525	(267)
Energy for lighting	217.3176	0.1443	31.3656	(268)
Total CO2, kg/year			361.6181	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.8000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1211.9992	1.5726	1906.0057	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	957.8138	1.5213	1457.1193	(278)
Space and water heating			3363.1249	(279)
Pumps, fans and electric keep-hot	55.8892	1.5128	84.5493	(281)
Energy for lighting	217.3176	1.5338	333.3289	(282)
Total Primary energy kWh/year			3781.0031	(286)
Dwelling Primary energy Rate (DPER)			39.7400	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700	(1b) x	2.5500	(2b) =	121.3035	(1b) - (3b)
First floor	47.5700	(1c) x	2.8300	(2c) =	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 95.1400						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		255.9266	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 = 0.0000	(6a)
Number of open flues	0 * 20 = 0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000	(6d)
Number of flues attached to other heater	0 * 35 = 0.0000	(6e)
Number of blocked chimneys	0 * 20 = 0.0000	(6f)
Number of intermittent extract fans	3 * 10 = 30.0000	(7a)
Number of passive vents	0 * 10 = 0.0000	(7b)
Number of flueless gas fires	0 * 40 = 0.0000	(7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1172	(8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3672	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3121	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)

Adj infilt rate													
	0.3980	0.3902	0.3824	0.3434	0.3355	0.2965	0.2965	0.2887	0.3121	0.3355	0.3512	0.3668	(22b)
Effective ac	0.5792	0.5761	0.5731	0.5589	0.5563	0.5440	0.5440	0.5417	0.5487	0.5563	0.5617	0.5673	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type			16.7100	1.1450	19.1336			(27)
GF			47.5700	0.1300	6.1841			(28a)
Main	115.8314	18.8600	96.9714	0.1800	17.4549			(29a)
PIJ	47.5700		47.5700	0.1100	5.2327			(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.1552			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	82.6614 (35)
List of Thermal Bridges	

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.2600	0.0500	0.6130
E3 Sill	12.2600	0.0500	0.6130
E4 Jamb	37.2000	0.0500	1.8600
E5 Ground floor (normal)	21.5300	0.1600	3.4448
E10 Eaves (insulation at ceiling level)	15.3200	0.0600	0.9192
E12 Gable (insulation at ceiling level)	6.2100	0.0600	0.3726
E16 Corner (normal)	10.7600	0.0900	0.9684
E18 Party wall between dwellings	10.7600	0.0600	0.6456
P1 Party wall - Ground floor	6.2100	0.0800	0.4968
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.1200	0.7452
E6 Intermediate floor within a dwelling	21.5300	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.6786	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	60.8338	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.9161	48.6564	48.4019	47.2062	46.9824	45.9410	45.9410	45.7482	46.3422	46.9824	47.4350	47.9081	(38)
Heat transfer coeff	109.7500	109.4903	109.2357	108.0400	107.8163	106.7749	106.7749	106.5820	107.1760	107.8163	108.2688	108.7420	(39)
Average = Sum(39)m / 12 =												108.0389	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1536	1.1508	1.1482	1.1356	1.1332	1.1223	1.1223	1.1203	1.1265	1.1332	1.1380	1.1430	(40)
HLP (average)												1.1356	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6898	(42)
Hot water usage for mixer showers													
	69.3181	68.2763	66.7584	63.8540	61.7106	59.3203	57.9617	59.4682	61.1196	63.6860	66.6528	69.0525	(42a)
Hot water usage for baths													
	29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)
Hot water usage for other uses													
	42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)
Average daily hot water use (litres/day)												130.0024	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	141.4261	138.4062	134.7285	129.1362	124.5949	119.7126	117.8364	121.4982	125.3600	130.4856	136.1640	141.0593	(44)
Energy conte	223.9843	197.0885	207.0727	176.7810	167.7287	147.2007	142.5129	150.4401	154.5815	177.0677	193.9906	220.8648	(45)
Energy content (annual)										Total = Sum(45)m =		2159.3135	
Distribution loss (46)m = 0.15 x (45)m													
	33.5976	29.5633	31.0609	26.5172	25.1593	22.0801	21.3769	22.5660	23.1872	26.5602	29.0986	33.1297	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6426	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8870	(55)
Total storage loss													
	27.4979	24.8369	27.4979	26.6109	27.4979	26.6109	27.4979	27.4979	26.6109	27.4979	26.6109	27.4979	(56)
If cylinder contains dedicated solar storage													
	27.4979	24.8369	27.4979	26.6109	27.4979	26.6109	27.4979	27.4979	26.6109	27.4979	26.6109	27.4979	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	274.7447	242.9366	257.8330	225.9039	218.4890	196.3236	193.2732	201.2004	203.7044	227.8281	243.1135	271.6251	(62)
WWHRS	-31.6893	-28.0263	-29.3475	-24.3009	-22.6476	-19.3797	-18.1654	-19.3170	-20.0510	-23.6379	-26.7789	-31.1025	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	243.0553	214.9103	228.4855	201.6030	195.8415	176.9439	175.1079	181.8834	183.6534	204.1902	216.3347	240.5226	(64)
										Total per year (kWh/year) = Sum(64)m =		2462.5316	(64)
12Total per year (kWh/year)												2463	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	115.0831	102.2104	109.4599	98.0780	96.3781	88.2426	87.9938	90.6296	90.6967	99.4833	103.8002	114.0458	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	128.3915	142.1477	128.3915	132.6712	128.3915	132.6712	128.3915	128.3915	132.6712	128.3915	132.6712	128.3915	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													

	248.2231	250.7989	244.3080	230.4897	213.0465	196.6524	185.7002	183.1244	189.6153	203.4336	220.8767	237.2708 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901 (71)
Water heating gains (Table 5)												
	154.6815	152.0988	147.1236	136.2195	129.5404	122.5591	118.2712	121.8140	125.9676	133.7141	144.1670	153.2874 (72)
Total internal gains												
	597.6424	611.3916	586.1693	565.7266	537.3247	515.2290	495.7092	496.6761	511.6003	531.8854	564.0611	585.2959 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.9500	11.2829	0.6300	0.7000	0.7700	37.7579	(75)
Southwest	5.7600	36.7938	0.6300	0.7000	0.7700	64.7693	(79)

Solar gains	102.5273	187.1835	289.4255	414.4498	515.1842	533.8768	505.3848	426.8051	332.1811	215.8597	125.0880	86.2641	(83)
Total gains	700.1696	798.5751	875.5948	980.1764	1052.5089	1049.1058	1001.0940	923.4812	843.7815	747.7451	689.1491	671.5600	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.9048	19.9521	19.9986	20.2199	20.2618	20.4595	20.4595	20.4965	20.3829	20.2618	20.1771	20.0894	
alpha	2.3270	2.3301	2.3332	2.3480	2.3508	2.3640	2.3640	2.3664	2.3589	2.3508	2.3451	2.3393	
util living area													
	0.9314	0.9069	0.8698	0.7943	0.6844	0.5434	0.4241	0.4677	0.6547	0.8270	0.9063	0.9369	(86)
MIT	18.1785	18.5155	19.0308	19.7277	20.3199	20.7260	20.8906	20.8588	20.5483	19.7886	18.8835	18.1262	(87)
Th 2	19.9573	19.9595	19.9617	19.9719	19.9738	19.9827	19.9827	19.9843	19.9792	19.9738	19.9699	19.9659	(88)
util rest of house													
	0.9228	0.8954	0.8533	0.7675	0.6417	0.4790	0.3394	0.3820	0.5948	0.7984	0.8929	0.9290	(89)
MIT 2	16.6692	17.0931	17.7389	18.6012	19.3042	19.7586	19.9161	19.8935	19.5819	18.6954	17.5696	16.6081	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	17.0038	17.4084	18.0252	18.8509	19.5293	19.9731	20.1321	20.1075	19.7961	18.9378	17.8608	16.9446	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.0038	17.4084	18.0252	18.8509	19.5293	19.9731	20.1321	20.1075	19.7961	18.9378	17.8608	16.9446	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8885	0.8578	0.8141	0.7330	0.6211	0.4784	0.3525	0.3931	0.5828	0.7631	0.8559	0.8961	(94)
Useful gains	622.1005	685.0011	712.8020	718.4703	653.7264	501.8644	352.8490	362.9780	491.7948	570.5944	589.8307	601.7860	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1394.2402	1369.5514	1258.9669	1075.0984	844.1304	573.7081	377.1447	395.1511	610.4905	898.9463	1165.0629	1385.8749	(97)
Space heating kWh													
	574.4719	460.0178	406.3466	256.7722	141.6606	0.0000	0.0000	0.0000	0.0000	244.2938	414.1671	583.3622	(98a)
Space heating requirement - total per year (kWh/year)												3081.0922	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	574.4719	460.0178	406.3466	256.7722	141.6606	0.0000	0.0000	0.0000	0.0000	244.2938	414.1671	583.3622	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3081.0922	
Space heating per m2											(98c) / (4) =	32.3848	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	574.4719	460.0178	406.3466	256.7722	141.6606	0.0000	0.0000	0.0000	0.0000	244.2938	414.1671	583.3622	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	622.3964	498.3942	440.2456	278.1931	153.4784	0.0000	0.0000	0.0000	0.0000	264.6736	448.7184	632.0284	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	243.0553	214.9103	228.4855	201.6030	195.8415	176.9439	175.1079	181.8834	183.6534	204.1902	216.3347	240.5226	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.9191	85.7216	85.3360	84.6033	83.3456	79.8000	79.8000	79.8000	79.8000	84.4630	85.4917	85.9694	(217)
Fuel for water heating, kWh/month													
	282.8887	250.7073	267.7479	238.2920	234.9753	221.7342	219.4334	227.9240	230.1421	241.7511	253.0475	279.7769	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	26.6772	21.4014	19.2696	14.1178	10.9050	8.9094	9.9479	12.9306	16.7956	22.0367	24.8904	27.4187	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-43.7273	-61.2512	-87.4769	-97.6894	-104.7589	-97.5416	-96.2965	-91.1670	-82.0635	-69.6860	-47.9165	-37.8482	(233a)

Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-25.9245	-54.3936	-107.8641	-161.6637	-213.4533	-214.3907	-211.9042	-179.5910	-131.8391	-77.7180	-34.5868	-20.5145 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3338.1281	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2948.4206	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	215.3004	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2351.2664	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4236.5827	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3338.1281	0.2100	701.0069	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2948.4206	0.2100	619.1683	(264)
Space and water heating			1320.1752	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	215.3004	0.1443	31.0745	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-917.4229	0.1347	-123.6078	
PV Unit electricity exported	-1433.8435	0.1260	-180.5987	
Total			-304.2065	(269)
Total CO2, kg/year			1058.9725	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.1300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3338.1281	1.1300	3772.0847	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2948.4206	1.1300	3331.7153	(278)
Space and water heating			7103.8001	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	215.3004	1.5338	330.2349	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-917.4229	1.4980	-1374.2639	
PV Unit electricity exported	-1433.8435	0.4623	-662.9248	
Total			-2037.1887	(283)
Total Primary energy kWh/year			5526.9471	(286)
Target Primary Energy Rate (TPER)			58.0900	(287)

Full SAP Calculation Printout

Plot Reference	79841-01	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	3B5P (Semi)
Plot Address	Plot 1, Amberley Drive, Wythenshawe , MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	84 B	**DER**	3.80	**TER**	11.13
Environmental	97 A	**% DER < TER**			65.86
CO_2 Emissions (t/year)	0.33	**DFEE**	38.63	**TFEE**	39.28
Compliance Check	See BREL	**% DFEE < TFEE**			1.65
% DPER < TPER	31.59	**DPER**	39.74	**TPER**	58.09

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700 (1b)	x	2.5500 (2b)	=	121.3035	(1b) - (3b)
First floor	47.5700 (1c)	x	2.8300 (2c)	=	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	255.9266	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1172	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3172	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2696	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3438	0.3370	0.3303	0.2966	0.2899	0.2562	0.2562	0.2494	0.2696	0.2899	0.3033	0.3168	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

Effective ac	0.5938	0.5870	0.5803	0.5466	0.5399	0.5062	0.5062	0.5000	0.5196	0.5399	0.5533	0.5668	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.0000	1.1450	12.5954			(27)
Glazed Doors			5.7100	1.1450	6.5382			(27)
GF			47.5700	0.1100	5.2327	75.0000	3567.7500	(28a)
Main	115.8314	18.8600	96.9714	0.1900	18.4246	9.0000	872.7426	(29a)
PIJ	47.5700		47.5700	0.0900	4.2813	9.0000	428.1300	(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.2222			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000	20.0000	668.2000	(32)
Timber			93.9800			9.0000	845.8200	(32c)
Timber			21.9300			9.0000	197.3700	(32c)
FF			47.5700			18.0000	856.2600	(32d)
GF			47.5700			9.0000	428.1300	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7864.4026 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 82.6614 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.2600	0.0460	0.5640
E3 Sill	12.2600	0.0470	0.5762
E4 Jamb	37.2000	0.0530	1.9716
E5 Ground floor (normal)	21.5300	0.0680	1.4640
E10 Eaves (insulation at ceiling level)	15.3200	0.0910	1.3941
E12 Gable (insulation at ceiling level)	6.2100	0.0750	0.4657
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	6.2100	0.1160	0.7204
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.0460	0.2857
E6 Intermediate floor within a dwelling	21.5300	0.0540	1.1626

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.6803 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 58.9025 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.1489	49.5795	49.0102	46.1637	45.5944	42.7478	42.7478	42.2279	43.8864	45.5944	46.7330	47.8716	(38)
Heat transfer coeff	109.0513	108.4820	107.9127	105.0662	104.4968	101.6503	101.6503	101.1304	102.7889	104.4968	105.6355	106.7741	(39)
Average = Sum(39)m / 12 =												104.9279	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1462	1.1402	1.1343	1.1043	1.0983	1.0684	1.0684	1.0630	1.0804	1.0983	1.1103	1.1223	(40)
HLP (average)												1.1029	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6898 (42)
Hot water usage for mixer showers

69.3181	68.2763	66.7584	63.8540	61.7106	59.3203	57.9617	59.4682	61.1196	63.6860	66.6528	69.0525	(42a)

Hot water usage for baths

29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)

Hot water usage for other uses

42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)

Average daily hot water use (litres/day) 130.0024 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	141.4261	138.4062	134.7285	129.1362	124.5949	119.7126	117.8364	121.4982	125.3600	130.4856	136.1640	141.0593	(44)
Energy conte	223.9843	197.0885	207.0727	176.7810	167.7287	147.2007	142.5129	150.4401	154.5815	177.0677	193.9906	220.8648	(45)
Energy content (annual)										Total = Sum(45)m =		2159.3135	
Distribution loss (46)m = 0.15 x (45)m	33.5976	29.5633	31.0609	26.5172	25.1593	22.0801	21.3769	22.5660	23.1872	26.5602	29.0986	33.1297	(46)

Water storage loss (or HIU loss):
Store volume 198.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.5000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.8100 (55)
Total storage loss

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)

If cylinder contains dedicated solar storage

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(64)
										Total per year (kWh/year) = Sum(64)m =		2728.8595	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

113.1727	100.4849	107.5496	96.2293	94.4677	86.3938	86.0835	88.7193	88.8479	97.5729	101.9515	112.1355	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.7636	27.3239	22.2213	16.8230	12.5754	10.6166	11.4717	14.9113	20.0139	25.4123	29.6599	31.6186	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	370.4822	374.3267	364.6388	344.0144	317.9799	293.5111	277.1644	273.3200	283.0079	303.6322	329.6668	354.1356	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	(71)
Water heating gains (Table 5)	152.1139	149.5311	144.5559	133.6518	126.9727	119.9914	115.7036	119.2463	123.3999	131.1464	141.5993	150.7197	(72)
Total internal gains	660.9829	658.8050	639.0393	602.1125	565.1513	531.7425	511.9630	515.1009	534.0450	567.8142	608.5492	644.0971	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.2400	11.2829	0.3000	0.0000	0.7700	13.6573	(75)

Southwest			5.7600		36.7938		0.3000		0.0000		0.7700		48.9564 (79)
Northeast			5.7100		11.2829		0.3000		0.0000		0.7700		14.8823 (75)
Solar gains	77.4960	141.4841	218.7646	313.2651	389.4060	403.5350	381.9991	322.6040	251.0817	163.1592	94.5487	65.2034	(83)
Total gains	738.4790	800.2891	857.8039	915.3776	954.5573	935.2775	893.9621	837.7049	785.1267	730.9734	703.0979	709.3005	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.0324	20.1375	20.2437	20.7922	20.9055	21.4909	21.4909	21.6014	21.2528	20.9055	20.6801	20.4596	
alpha	2.3355	2.3425	2.3496	2.3861	2.3937	2.4327	2.4327	2.4401	2.4169	2.3937	2.3787	2.3640	
util living area	0.9240	0.9060	0.8730	0.8095	0.7116	0.5727	0.4492	0.4876	0.6706	0.8287	0.9014	0.9295	(86)
Living	18.2710	18.5463	19.0357	19.7082	20.2857	20.7160	20.8871	20.8595	20.5506	19.8255	18.9718	18.2556	
Non living	17.4886	17.7612	18.2422	18.9059	19.4477	19.8417	19.9715	19.9587	19.7045	19.0326	18.1993	17.4863	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.6039	18.5463	19.0357	19.7082	20.2857	20.7160	20.8871	20.8595	20.5506	19.8255	18.9718	18.6395	(87)
Th 2	19.9633	19.9681	19.9730	19.9973	20.0022	20.0267	20.0267	20.0312	20.0169	20.0022	19.9924	19.9827	(88)
util rest of house	0.9147	0.8945	0.8569	0.7843	0.6709	0.5098	0.3646	0.4034	0.6129	0.8009	0.8876	0.9208	(89)
MIT 2	18.6973	17.7612	18.2422	18.9059	19.4477	19.8417	19.9715	19.9587	19.7045	19.0326	18.1993	17.8355	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	18.8983	17.9353	18.4181	19.0837	19.6334	20.0355	20.1744	20.1584	19.8921	19.2084	18.3705	18.0137	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8983	17.9353	18.4181	19.0837	19.6334	20.0355	20.1744	20.1584	19.8921	19.2084	18.3705	18.0137	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9034	0.8655	0.8268	0.7574	0.6542	0.5104	0.3782	0.4151	0.6047	0.7744	0.8593	0.8995	(94)
Useful gains	667.1350	692.6899	709.2373	693.3322	624.4582	477.3398	338.0626	347.7645	474.7788	566.0790	604.1585	637.9921	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1591.9656	1414.0915	1286.1111	1069.9632	829.0197	552.5224	363.3436	380.0839	595.3595	899.5481	1190.5652	1474.9447	(97)
Space heating kWh	688.0740	484.7819	429.1941	271.1743	152.1938	0.0000	0.0000	0.0000	0.0000	248.1010	422.2128	622.6927	(98a)
Space heating requirement - total per year (kWh/year)												3318.4246	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	688.0740	484.7819	429.1941	271.1743	152.1938	0.0000	0.0000	0.0000	0.0000	248.1010	422.2128	622.6927	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3318.4246	
Space heating per m2											(98c) / (4) =	34.8794	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												285.6431	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement	688.0740	484.7819	429.1941	271.1743	152.1938	0.0000	0.0000	0.0000	0.0000	248.1010	422.2128	622.6927	(98)
Space heating efficiency (main heating system 1)	285.6431	285.6431	285.6431	285.6431	285.6431	0.0000	0.0000	0.0000	0.0000	285.6431	285.6431	285.6431	(210)
Space heating fuel (main heating system)	240.8859	169.7160	150.2554	94.9347	53.2811	0.0000	0.0000	0.0000	0.0000	86.8570	147.8113	217.9968	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	95.5956	84.5123	89.6597	78.4799	75.8502	68.0973	66.9996	69.7820	70.6879	79.1282	84.5203	94.5007	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.7468	4.2874	4.7468	4.5936	4.7468	4.5936	4.7468	4.7468	4.5936	4.7468	4.5936	4.7468	(231)
Lighting	26.9272	21.6020	19.4502	14.2500	11.0071	8.9929	10.0411	13.0518	16.9530	22.2432	25.1236	27.6755	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1161.7383	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	284.9050	
Water heating fuel used	957.8138	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)		
mechanical ventilation fans (SFP = 0.1790)	55.8892	(230a)
Total electricity for the above, kWh/year	55.8892	(231)
Electricity for lighting (calculated in Appendix L)	217.3176	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2392.7589	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1161.7383	16.4900	191.5706	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	957.8138	16.4900	157.9435	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	55.8892	16.4900	9.2161	(249)
Energy for lighting	217.3176	16.4900	35.8357	(250)
Additional standing charges			0.0000	(251)
Total energy cost			394.5659	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0136	(257)
SAP value		83.5698	
SAP rating (Section 12)		84	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1161.7383	0.1547	179.6824	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	957.8138	0.1410	135.0326	(264)
Space and water heating			314.7150	(265)
Pumps, fans and electric keep-hot	55.8892	0.1387	7.7525	(267)
Energy for lighting	217.3176	0.1443	31.3656	(268)
Total CO2, kg/year			353.8331	(272)
CO2 emissions per m2			3.7200	(273)
EI value			96.6167	
EI rating			97	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700	(1b) x	2.5500	(2b) =	121.3035	(1b) - (3b)
First floor	47.5700	(1c) x	2.8300	(2c) =	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		255.9266	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1172 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.3172 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2696 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.5000	4.4000	4.4000	4.0000	4.1000	3.5000	3.4000	3.4000	3.5000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1250	1.1000	1.1000	1.0000	1.0250	0.8750	0.8500	0.8500	0.8750	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.3033	0.2966	0.2966	0.2696	0.2764	0.2359	0.2292	0.2292	0.2359	0.2629	0.2629	0.2696	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5533	0.5466	0.5466	0.5196	0.5264	0.5000	0.5000	0.5000	0.5000	0.5129	0.5129	0.5196	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.0000	1.1450	12.5954			(27)
Glazed Doors			5.7100	1.1450	6.5382			(27)
GF			47.5700	0.1100	5.2327	75.0000	3567.7500	(28a)
Main	115.8314	18.8600	96.9714	0.1900	18.4246	9.0000	872.7426	(29a)
PIJ	47.5700		47.5700	0.0900	4.2813	9.0000	428.1300	(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.2222			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000	20.0000	668.2000	(32)
Timber			93.9800			9.0000	845.8200	(32c)
Timber			21.9300			9.0000	197.3700	(32c)
FF			47.5700			18.0000	856.2600	(32d)
GF			47.5700			9.0000	428.1300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 7864.4026 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	82.6614 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.2600	0.0460	0.5640
E3 Sill	12.2600	0.0470	0.5762
E4 Jamb	37.2000	0.0530	1.9716
E5 Ground floor (normal)	21.5300	0.0680	1.4640
E10 Eaves (insulation at ceiling level)	15.3200	0.0910	1.3941
E12 Gable (insulation at ceiling level)	6.2100	0.0750	0.4657
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	6.2100	0.1160	0.7204
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.0460	0.2857
E6 Intermediate floor within a dwelling	21.5300	0.0540	1.1626

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.6803 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	58.9025 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.7330	46.1637	46.1637	43.8864	44.4557	42.2279	42.2279	42.2279	42.2279	43.3171	43.3171	43.8864	(38)
Heat transfer coeff	105.6355	105.0662	105.0662	102.7889	103.3582	101.1304	101.1304	101.1304	101.1304	102.2196	102.2196	102.7889	(39)
Average = Sum(39)m / 12 =												102.8054	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1103	1.1043	1.1043	1.0804	1.0864	1.0630	1.0630	1.0630	1.0630	1.0744	1.0744	1.0804	(40)
HLP (average)												1.0806	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6898 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
69.3181	68.2763	66.7584	63.8540	61.7106	59.3203	57.9617	59.4682	61.1196	63.6860	66.6528	69.0525	(42a)

Hot water usage for baths

29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)

Hot water usage for other uses

42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)

Average daily hot water use (litres/day)	130.0024 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	141.4261	138.4062	134.7285	129.1362	124.5949	119.7126	117.8364	121.4982	125.3600	130.4856	136.1640	141.0593	(44)
Energy conte	223.9843	197.0885	207.0727	176.7810	167.7287	147.2007	142.5129	150.4401	154.5815	177.0677	193.9906	220.8648	(45)
Energy content (annual)										Total = Sum(45)m =		2159.3135	
Distribution loss (46)m = 0.15 x (45)m	33.5976	29.5633	31.0609	26.5172	25.1593	22.0801	21.3769	22.5660	23.1872	26.5602	29.0986	33.1297	(46)

Water storage loss (or HIU loss):	
Store volume	198.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.5000 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.8100 (55)

Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)

PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(64)
											Total per year (kWh/year) = Sum(64)m =	2728.8595	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	(64a)
Heat gains from water heating, kWh/month													
	113.1727	100.4849	107.5496	96.2293	94.4677	86.3938	86.0835	88.7193	88.8479	97.5729	101.9515	112.1355	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	30.7636	27.3239	22.2213	16.8230	12.5754	10.6166	11.4717	14.9113	20.0139	25.4123	29.6599	31.6186	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	370.4822	374.3267	364.6388	344.0144	317.9799	293.5111	277.1644	273.3200	283.0079	303.6322	329.6668	354.1356	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	(71)
Water heating gains (Table 5)													
	152.1139	149.5311	144.5559	133.6518	126.9727	119.9914	115.7036	119.2463	123.3999	131.1464	141.5993	150.7197	(72)
Total internal gains													
	660.9829	658.8050	639.0393	602.1125	565.1513	531.7425	511.9630	515.1009	534.0450	567.8142	608.5492	644.0971	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.2400	9.9768	0.3000	0.0000	0.7700	12.0763	(75)
Southwest	5.7600	32.4665	0.3000	0.0000	0.7700	43.1986	(79)
Northeast	5.7100	9.9768	0.3000	0.0000	0.7700	13.1595	(75)

Solar gains	68.4345	128.1917	209.4359	304.7615	367.0320	391.4022	361.7471	301.9532	246.5183	158.0045	88.6690	61.9867	(83)
Total gains	729.4174	786.9967	848.4751	906.8740	932.1833	923.1446	873.7100	817.0541	780.5633	725.8187	697.2182	706.0838	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.6801	20.7922	20.7922	21.2528	21.1358	21.6014	21.6014	21.6014	21.6014	21.3712	21.3712	21.2528	
alpha	2.3787	2.3861	2.3861	2.4169	2.4091	2.4401	2.4401	2.4401	2.4401	2.4247	2.4247	2.4169	
util living area													
	0.9182	0.8992	0.8620	0.7888	0.6768	0.5250	0.4134	0.4546	0.6463	0.8113	0.8926	0.9235	(86)
Living	18.5201	18.7824	19.2497	19.9027	20.4431	20.7978	20.9177	20.8930	20.6214	19.9822	19.1828	18.5086	
Non living	17.7531	18.0124	18.4669	19.1048	19.5977	19.9104	19.9956	19.9818	19.7760	19.1949	18.4250	17.7576	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.7314	18.7824	19.2497	19.9027	20.4431	20.7978	20.9177	20.8930	20.6214	19.9822	19.1828	18.8571	(87)
Th 2	19.9924	19.9973	19.9973	20.0169	20.0120	20.0312	20.0312	20.0312	20.0312	20.0218	20.0218	20.0169	(88)
util rest of house													
	0.9080	0.8867	0.8442	0.7604	0.6296	0.4545	0.3228	0.3631	0.5846	0.7802	0.8774	0.9141	(89)
MIT 2	18.8469	18.0124	18.4669	19.1048	19.5977	19.9104	19.9956	19.9818	19.7760	19.1949	18.4250	18.0736	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	19.0429	18.1831	18.6404	19.2816	19.7851	20.1071	20.2000	20.1838	19.9634	19.3694	18.5930	18.2473	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0429	18.1831	18.6404	19.2816	19.7851	20.1071	20.2000	20.1838	19.9634	19.3694	18.5930	18.2473	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8967	0.8581	0.8150	0.7359	0.6176	0.4604	0.3394	0.3784	0.5799	0.7558	0.8496	0.8927	(94)
Useful gains	654.0588	675.3372	691.5218	667.3790	575.7410	424.9959	296.5230	309.1414	452.6128	548.5783	592.3479	630.3348	(95)
Ext temp.	5.0000	5.6000	7.2000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.2000	7.7000	4.8000	(96)
Heat loss rate W													
	1483.4318	1322.0540	1202.0000	984.8867	732.3009	476.0312	313.5081	332.0882	552.5144	835.0712	1113.4747	1382.2329	(97)
Space heating kWh													
	617.0535	434.5937	379.7958	228.6056	116.4806	0.0000	0.0000	0.0000	0.0000	213.1507	375.2113	559.4122	(98a)
Space heating requirement - total per year (kWh/year)												2924.3033	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	617.0535	434.5937	379.7958	228.6056	116.4806	0.0000	0.0000	0.0000	0.0000	213.1507	375.2113	559.4122	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2924.3033	
Space heating per m2											(98c) / (4) =	30.7368	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	286.1613	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	617.0535	434.5937	379.7958	228.6056	116.4806	0.0000	0.0000	0.0000	0.0000	213.1507	375.2113	559.4122	(98)
Space heating efficiency (main heating system 1)	286.1613	286.1613	286.1613	286.1613	286.1613	0.0000	0.0000	0.0000	0.0000	286.1613	286.1613	286.1613	(210)
Space heating fuel (main heating system)	215.6314	151.8702	132.7209	79.8870	40.7045	0.0000	0.0000	0.0000	0.0000	74.4862	131.1188	195.4884	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	95.5956	84.5123	89.6597	78.4799	75.8502	68.0973	66.9996	69.7820	70.6879	79.1282	84.5203	94.5007	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.7468	4.2874	4.7468	4.5936	4.7468	4.5936	4.7468	4.7468	4.5936	4.7468	4.5936	4.7468	(231)
Lighting	26.9272	21.6020	19.4502	14.2500	11.0071	8.9929	10.0411	13.0518	16.9530	22.2432	25.1236	27.6755	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1021.9074	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	284.9050	
Water heating fuel used	957.8138	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)		
mechanical ventilation fans (SFP = 0.1790)	55.8892	(230a)
Total electricity for the above, kWh/year	55.8892	(231)
Electricity for lighting (calculated in Appendix L)	217.3176	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2252.9280	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1021.9074	26.0000	265.6959	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	957.8138	26.0000	249.0316	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	55.8892	26.0000	14.5312	(249)
Energy for lighting	217.3176	26.0000	56.5026	(250)
Additional standing charges			0.0000	(251)
Total energy cost			585.7613	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1021.9074	0.1549	158.3440	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	957.8138	0.1410	135.0326	(264)
Space and water heating			293.3766	(265)
Pumps, fans and electric keep-hot	55.8892	0.1387	7.7525	(267)
Energy for lighting	217.3176	0.1443	31.3656	(268)
Total CO2, kg/year			332.4947	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1021.9074	1.5736	1608.1055	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	957.8138	1.5213	1457.1193	(278)
Space and water heating			3065.2248	(279)
Pumps, fans and electric keep-hot	55.8892	1.5128	84.5493	(281)
Energy for lighting	217.3176	1.5338	333.3289	(282)

Total Primary energy kWh/year 3483.1030 (286)

SAP 10 EPC IMPROVEMENTS

001

Current energy efficiency rating: B 84
Current environmental impact rating: A 97

N	Solar water heating		Recommended
U	Solar photovoltaic panels		Recommended
V2	Wind turbine		Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.4	-£ 49	-23 kg (7.0%)
U Solar photovoltaic panels	+ 7.9	-£ 262	-212 kg (68.5%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£49	0.25 kg/m²	B 85	A 97
Solar photovoltaic panels	£262	2.23 kg/m²	A 93	A 99
Total Savings	£311	2.47 kg/m²		

Potential energy efficiency rating: A 93
Potential environmental impact rating: A 99

Fuel prices for cost data on this page from database revision number 599 TEST (30 Sep 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, West Pennines (England)):

	Current	Potential	Saving
Electricity	£586	£537	£49
Space heating	£280	£304	-£24
Water heating	£249	£176	£73
Lighting	£57	£57	£0
Generated (PV)	-£0	-£262	£262
Total cost of fuels	£586	£275	£311
Total cost of uses	£586	£275	£311
Delivered energy	24 kWh/m²	4 kWh/m²	19 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.1 tonnes	0.2 tonnes
CO2 emissions per m²	3 kg/m²	1 kg/m²	2 kg/m²
Primary energy	37 kWh/m²	17 kWh/m²	20 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700	(1b) x	2.5500	(2b) =	121.3035	(1b) - (3b)
First floor	47.5700	(1c) x	2.8300	(2c) =	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		255.9266	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1172	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3172	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2696	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)

Adj infilt rate

	0.3438	0.3370	0.3303	0.2966	0.2899	0.2562	0.2562	0.2494	0.2696	0.2899	0.3033	0.3168 (22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

Effective ac	0.5938	0.5870	0.5803	0.5466	0.5399	0.5062	0.5062	0.5000	0.5196	0.5399	0.5533	0.5668 (25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.0000	1.1450	12.5954			(27)
Glazed Doors			5.7100	1.1450	6.5382			(27)
GF			47.5700	0.1100	5.2327	75.0000	3567.7500	(28a)
Main	115.8314	18.8600	96.9714	0.1900	18.4246	9.0000	872.7426	(29a)
PIJ	47.5700		47.5700	0.0900	4.2813	9.0000	428.1300	(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.2222			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000	20.0000	668.2000	(32)
Timber			93.9800			9.0000	845.8200	(32c)
Timber			21.9300			9.0000	197.3700	(32c)
FF			47.5700			18.0000	856.2600	(32d)
GF			47.5700			9.0000	428.1300	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7864.4026 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 82.6614 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.2600	0.0460	0.5640
E3 Sill	12.2600	0.0470	0.5762
E4 Jamb	37.2000	0.0530	1.9716
E5 Ground floor (normal)	21.5300	0.0680	1.4640
E10 Eaves (insulation at ceiling level)	15.3200	0.0910	1.3941
E12 Gable (insulation at ceiling level)	6.2100	0.0750	0.4657
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	6.2100	0.1160	0.7204
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.0460	0.2857
E6 Intermediate floor within a dwelling	21.5300	0.0540	1.1626

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.6803 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 58.9025 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.1489	49.5795	49.0102	46.1637	45.5944	42.7478	42.7478	42.2279	43.8864	45.5944	46.7330	47.8716	(38)
Heat transfer coeff	109.0513	108.4820	107.9127	105.0662	104.4968	101.6503	101.6503	101.1304	102.7889	104.4968	105.6355	106.7741	(39)
Average = Sum(39)m / 12 =												104.9279	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1462	1.1402	1.1343	1.1043	1.0983	1.0684	1.0684	1.0630	1.0804	1.0983	1.1103	1.1223	(40)
HLP (average)												1.1029	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6898 (42)

Hot water usage for mixer showers

69.3181	68.2763	66.7584	63.8540	61.7106	59.3203	57.9617	59.4682	61.1196	63.6860	66.6528	69.0525	(42a)

Hot water usage for baths

29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)

Hot water usage for other uses

42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)

Average daily hot water use (litres/day) 130.0024 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	141.4261	138.4062	134.7285	129.1362	124.5949	119.7126	117.8364	121.4982	125.3600	130.4856	136.1640	141.0593	(44)
Energy conte	223.9843	197.0885	207.0727	176.7810	167.7287	147.2007	142.5129	150.4401	154.5815	177.0677	193.9906	220.8648	(45)
Energy content (annual)										Total = Sum(45)m =		2159.3135	
Distribution loss (46)m = 0.15 x (45)m	33.5976	29.5633	31.0609	26.5172	25.1593	22.0801	21.3769	22.5660	23.1872	26.5602	29.0986	33.1297	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage	15.5986	14.0891	15.5986	15.0955	15.5986	15.0955	15.5986	15.5986	15.0955	15.5986	15.0955	15.5986	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	262.8454	232.1888	244.5380	207.6349	193.7954	172.2014	168.3470	177.2047	186.7860	214.5330	231.5981	259.7258	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
If combined cylinder, total volume of cylinder												198.0000	(H13)
Effective solar volume												111.9000	(H14)
Reference volume												225.0000	(H15)

Storage tank correction coefficient												1.1908	(H16)
Heat delivered to hot water												652.0514	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												652.0514	
Solar input	-0.0000	-19.9133	-62.1742	-83.6265	-107.4087	-98.8285	-98.0326	-86.6188	-61.4012	-32.9585	-1.0890	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	262.8454	212.2755	182.3638	124.0084	86.3867	73.3729	70.3143	90.5859	125.3849	181.5745	230.5090	259.7258	(64)
									Total per year (kWh/year) = Sum(64)m =			1899.3470	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
							Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =					0.0000	(64a)
Heat gains from water heating, kWh/month													
	105.5636	93.6122	98.8239	83.4628	76.6232	68.9448	68.0528	71.4330	77.1620	88.8472	94.5878	104.5264	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	30.7636	27.3239	22.2213	16.8230	12.5754	10.6166	11.4717	14.9113	20.0139	25.4123	29.6599	31.6186	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	370.4822	374.3267	364.6388	344.0144	317.9799	293.5111	277.1644	273.3200	283.0079	303.6322	329.6668	354.1356	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	(71)
Water heating gains (Table 5)													
	141.8866	139.3038	132.8278	115.9205	102.9881	95.7567	91.4688	96.0121	107.1694	119.4183	131.3720	140.4924	(72)
Total internal gains													
	650.7556	648.5777	627.3112	584.3812	541.1667	507.5077	487.7282	491.8667	517.8145	556.0861	598.3219	633.8698	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.2400	11.2829	0.3000	0.0000	0.7700	13.6573	(75)
Southwest	5.7600	36.7938	0.3000	0.0000	0.7700	48.9564	(79)
Northeast	5.7100	11.2829	0.3000	0.0000	0.7700	14.8823	(75)

Solar gains	77.4960	141.4841	218.7646	313.2651	389.4060	403.5350	381.9991	322.6040	251.0817	163.1592	94.5487	65.2034	(83)
Total gains	728.2517	790.0618	846.0758	897.6463	930.5727	911.0427	869.7273	814.4707	768.8963	719.2454	692.8707	699.0732	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.0324	20.1375	20.2437	20.7922	20.9055	21.4909	21.4909	21.6014	21.2528	20.9055	20.6801	20.4596	
alpha	2.3355	2.3425	2.3496	2.3861	2.3937	2.4327	2.4327	2.4401	2.4169	2.3937	2.3787	2.3640	
util living area													
	0.9260	0.9081	0.8759	0.8149	0.7205	0.5828	0.4591	0.4981	0.6783	0.8329	0.9039	0.9313	(86)
Living	18.2517	18.5281	19.0168	19.6851	20.2641	20.7044	20.8814	20.8526	20.5383	19.8092	18.9536	18.2358	
Non living	17.4699	17.7436	18.2243	18.8848	19.4295	19.8335	19.9685	19.9548	19.6951	19.0178	18.1819	17.4670	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.5941	18.5281	19.0168	19.6851	20.2641	20.7044	20.8814	20.8526	20.5383	19.8092	18.9536	18.6225	(87)
Th 2	19.9633	19.9681	19.9730	19.9973	20.0022	20.0267	20.0267	20.0312	20.0169	20.0022	19.9924	19.9827	(88)
util rest of house													
	0.9168	0.8968	0.8600	0.7901	0.6802	0.5197	0.3734	0.4130	0.6208	0.8055	0.8904	0.9229	(89)
MIT 2	18.6878	17.7436	18.2243	18.8848	19.4295	19.8335	19.9685	19.9548	19.6951	19.0178	18.1819	17.8189	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	18.8887	17.9175	18.4000	19.0622	19.6145	20.0266	20.1709	20.1538	19.8820	19.1932	18.3530	17.9970	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8887	17.9175	18.4000	19.0622	19.6145	20.0266	20.1709	20.1538	19.8820	19.1932	18.3530	17.9970	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9056	0.8680	0.8300	0.7630	0.6627	0.5197	0.3868	0.4244	0.6120	0.7789	0.8622	0.9018	(94)
Useful gains	659.5153	685.8089	702.2323	684.9189	616.7090	473.4353	336.4173	345.6993	470.5826	560.1999	597.4258	630.4165	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1590.9131	1412.1682	1284.1640	1067.7050	827.0390	551.6116	362.9789	379.6217	594.3257	897.9674	1188.7140	1473.1650	(97)
Space heating kWh													
	692.9599	488.1135	432.9572	275.6060	156.4855	0.0000	0.0000	0.0000	0.0000	251.2990	425.7275	627.0049	(98a)
Space heating requirement - total per year (kWh/year)												3350.1535	
Solar heating kWh													
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	692.9599	488.1135	432.9572	275.6060	156.4855	0.0000	0.0000	0.0000	0.0000	251.2990	425.7275	627.0049	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3350.1535	
Space heating per m2											(98c) / (4) =	35.2129	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)

Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												285.6431	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	692.9599	488.1135	432.9572	275.6060	156.4855	0.0000	0.0000	0.0000	0.0000	251.2990	425.7275	627.0049	(98)
Space heating efficiency (main heating system 1)													
	285.6431	285.6431	285.6431	285.6431	285.6431	0.0000	0.0000	0.0000	0.0000	285.6431	285.6431	285.6431	(210)
Space heating fuel (main heating system)													
	242.5965	170.8823	151.5728	96.4861	54.7836	0.0000	0.0000	0.0000	0.0000	87.9766	149.0418	219.5064	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	262.8454	212.2755	182.3638	124.0084	86.3867	73.3729	70.3143	90.5859	125.3849	181.5745	230.5090	259.7258	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month													
	92.2572	74.5075	64.0086	43.5262	30.3212	25.7535	24.6799	31.7951	44.0094	63.7316	80.9073	91.1622	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5413	10.4244	11.5413	11.1690	11.5413	11.1690	11.5413	11.5413	11.1690	11.5413	11.1690	11.5413	(231)
Lighting	26.9272	21.6020	19.4502	14.2500	11.0071	8.9929	10.0411	13.0518	16.9530	22.2432	25.1236	27.6755	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-38.0992	-56.3669	-84.4848	-96.8839	-103.3352	-90.3781	-89.0958	-83.8778	-74.2858	-64.5119	-42.3440	-32.4195	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-11.9873	-27.2131	-57.8614	-93.8882	-132.3476	-141.3356	-139.5557	-115.8962	-82.1773	-42.3340	-17.0658	-9.4943	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1172.8462	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												284.9050	
Water heating fuel used												666.6598	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)													
mechanical ventilation fans (SFP = 0.1790)												55.8892	(230a)
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												135.8892	(231)
Electricity for lighting (calculated in Appendix L)												217.3176	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1727.2394	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												465.4733	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1172.8462	16.4900	193.4023	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	666.6598	16.4900	109.9322	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	55.8892	16.4900	9.2161	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	217.3176	16.4900	35.8357	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-856.0828	16.4900	-141.1681	
PV Unit electricity exported	-871.1566	5.5900	-48.6977	
Total			-189.8657	(252)
Total energy cost			171.7126	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4411	(257)
SAP value		92.8497	
SAP rating (Section 12)		93	(258)
SAP band		A	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	

Space heating - main system 1	1172.8462	0.1546	181.3537	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	666.6598	0.1462	97.4831	(264)
Space and water heating			278.8368	(265)
Pumps, fans and electric keep-hot	135.8892	0.1387	18.8495	(267)
Energy for lighting	217.3176	0.1443	31.3656	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-856.0828	0.1347	-115.2938	
PV Unit electricity exported	-871.1566	0.1232	-107.3186	
Total			-222.6124	(269)
Total CO2, kg/year			106.4395	(272)
CO2 emissions per m2			1.1200	(273)
EI value			98.9822	
EI rating			99	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700 (1b)	x	2.5500 (2b)	=	121.3035	(1b) - (3b)
First floor	47.5700 (1c)	x	2.8300 (2c)	=	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		255.9266	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1172	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3172	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2696	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.5000	4.4000	4.4000	4.0000	4.1000	3.5000	3.4000	3.4000	3.5000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1250	1.1000	1.1000	1.0000	1.0250	0.8750	0.8500	0.8500	0.8750	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.3033	0.2966	0.2966	0.2696	0.2764	0.2359	0.2292	0.2292	0.2359	0.2629	0.2629	0.2696	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
Effective ac	0.5533	0.5466	0.5466	0.5196	0.5264	0.5000	0.5000	0.5000	0.5000	0.5129	0.5129	0.5196	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.0000	1.1450	12.5954			(27)
Glazed Doors			5.7100	1.1450	6.5382			(27)
GF			47.5700	0.1100	5.2327	75.0000	3567.7500	(28a)
Main	115.8314	18.8600	96.9714	0.1900	18.4246	9.0000	872.7426	(29a)
PIJ	47.5700		47.5700	0.0900	4.2813	9.0000	428.1300	(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.2222			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000	20.0000	668.2000	(32)
Timber			93.9800			9.0000	845.8200	(32c)
Timber			21.9300			9.0000	197.3700	(32c)
FF			47.5700			18.0000	856.2600	(32d)
GF			47.5700			9.0000	428.1300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	7864.4026 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		82.6614 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.2600	0.0460	0.5640
E3 Sill	12.2600	0.0470	0.5762
E4 Jamb	37.2000	0.0530	1.9716

E5 Ground floor (normal)	21.5300	0.0680	1.4640	
E10 Eaves (insulation at ceiling level)	15.3200	0.0910	1.3941	
E12 Gable (insulation at ceiling level)	6.2100	0.0750	0.4657	
E16 Corner (normal)	10.7600	0.0460	0.4950	
E18 Party wall between dwellings	10.7600	0.0540	0.5810	
P1 Party wall - Ground floor	6.2100	0.1160	0.7204	
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.0460	0.2857	
E6 Intermediate floor within a dwelling	21.5300	0.0540	1.1626	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				9.6803 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	58.9025 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.7330	46.1637	46.1637	43.8864	44.4557	42.2279	42.2279	42.2279	42.2279	43.3171	43.3171	43.8864	(38)
Heat transfer coeff	105.6355	105.0662	105.0662	102.7889	103.3582	101.1304	101.1304	101.1304	101.1304	102.2196	102.2196	102.7889	(39)
Average = Sum(39)m / 12 =												102.8054	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1103	1.1043	1.1043	1.0804	1.0864	1.0630	1.0630	1.0630	1.0630	1.0744	1.0744	1.0804	(40)
HLP (average)												1.0806	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6898	(42)
Hot water usage for mixer showers	69.3181	68.2763	66.7584	63.8540	61.7106	59.3203	57.9617	59.4682	61.1196	63.6860	66.6528	69.0525	(42a)
Hot water usage for baths	29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)
Hot water usage for other uses	42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)
Average daily hot water use (litres/day)												130.0024	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	141.4261	138.4062	134.7285	129.1362	124.5949	119.7126	117.8364	121.4982	125.3600	130.4856	136.1640	141.0593	(44)
Energy conte	223.9843	197.0885	207.0727	176.7810	167.7287	147.2007	142.5129	150.4401	154.5815	177.0677	193.9906	220.8648	(45)
Energy content (annual)										Total = Sum(45)m =		2159.3135	
Distribution loss (46)m = 0.15 x (45)m	33.5976	29.5633	31.0609	26.5172	25.1593	22.0801	21.3769	22.5660	23.1872	26.5602	29.0986	33.1297	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage	15.5986	14.0891	15.5986	15.0955	15.5986	15.0955	15.5986	15.5986	15.0955	15.5986	15.0955	15.5986	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	262.8454	232.1888	244.5380	207.6349	193.7954	172.2014	168.3470	177.2047	186.7860	214.5330	231.5981	259.7258	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
If combined cylinder, total volume of cylinder												198.0000	(H13)
Effective solar volume												111.9000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.1908	(H16)
Heat delivered to hot water												618.9847	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												618.9847	
Solar input	-0.0000	-15.4923	-59.0081	-81.5881	-101.6969	-96.4015	-92.8449	-80.4442	-60.1659	-31.3427	-0.0000	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	262.8454	216.6965	185.5299	126.0468	92.0985	75.7999	75.5021	96.7604	126.6201	183.1903	231.5981	259.7258	(64)
									Total per year (kWh/year) = Sum(64)m =			1932.4138	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	105.5636	93.6122	98.8239	83.4628	76.6232	68.9448	68.0528	71.4330	77.1620	88.8472	94.5878	104.5264	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.7636	27.3239	22.2213	16.8230	12.5754	10.6166	11.4717	14.9113	20.0139	25.4123	29.6599	31.6186	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	370.4822	374.3267	364.6388	344.0144	317.9799	293.5111	277.1644	273.3200	283.0079	303.6322	329.6668	354.1356	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	(71)
Water heating gains (Table 5)	141.8866	139.3038	132.8278	115.9205	102.9881	95.7567	91.4688	96.0121	107.1694	119.4183	131.3720	140.4924	(72)
Total internal gains	650.7556	648.5777	627.3112	584.3812	541.1667	507.5077	487.7282	491.8667	517.8145	556.0861	598.3219	633.8698	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.2400	9.9768	0.3000	0.0000	0.7700	12.0763	(75)
Southwest	5.7600	32.4665	0.3000	0.0000	0.7700	43.1986	(79)
Northeast	5.7100	9.9768	0.3000	0.0000	0.7700	13.1595	(75)

Solar gains	68.4345	128.1917	209.4359	304.7615	367.0320	391.4022	361.7471	301.9532	246.5183	158.0045	88.6690	61.9867	(83)
Total gains	719.1901	776.7694	836.7471	889.1427	908.1987	898.9099	849.4753	793.8199	764.3328	714.0906	686.9909	695.8565	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.6801	20.7922	20.7922	21.2528	21.1358	21.6014	21.6014	21.6014	21.6014	21.3712	21.3712	21.2528	
alpha	2.3787	2.3861	2.3861	2.4169	2.4091	2.4401	2.4401	2.4401	2.4401	2.4247	2.4247	2.4169	
util living area	0.9203	0.9015	0.8651	0.7947	0.6863	0.5352	0.4231	0.4650	0.6542	0.8159	0.8954	0.9256	(86)
Living	18.5009	18.7644	19.2314	19.8812	20.4244	20.7889	20.9133	20.8874	20.6103	19.9668	19.1650	18.4889	
Non living	17.7345	17.9950	18.4497	19.0854	19.5825	19.9046	19.9936	19.9789	19.7678	19.1811	18.4080	17.7385	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.7216	18.7644	19.2314	19.8812	20.4244	20.7889	20.9133	20.8874	20.6103	19.9668	19.1650	18.8401	(87)
Th 2	19.9924	19.9973	19.9973	20.0169	20.0120	20.0312	20.0312	20.0312	20.0312	20.0218	20.0218	20.0169	(88)
util rest of house	0.9103	0.8892	0.8476	0.7667	0.6394	0.4641	0.3311	0.3723	0.5927	0.7852	0.8805	0.9164	(89)
MIT 2	18.8374	17.9950	18.4497	19.0854	19.5825	19.9046	19.9936	19.9789	19.7678	19.1811	18.4080	18.0572	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	19.0334	18.1656	18.6230	19.2618	19.7691	20.1006	20.1975	20.1803	19.9546	19.3553	18.5758	18.2308	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0334	18.1656	18.6230	19.2618	19.7691	20.1006	20.1975	20.1803	19.9546	19.3553	18.5758	18.2308	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8991	0.8608	0.8184	0.7419	0.6267	0.4696	0.3477	0.3875	0.5873	0.7605	0.8528	0.8952	(94)
Useful gains	646.6185	668.6364	684.8036	659.6225	569.1298	422.0954	295.3349	307.5664	448.9051	543.0922	585.8426	622.9395	(95)
Ext temp.	5.0000	5.6000	7.2000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.2000	7.7000	4.8000	(96)
Heat loss rate W	1482.4222	1320.2176	1200.1677	982.8514	730.6544	475.3719	313.2473	331.7390	551.6221	833.6267	1111.7232	1380.5331	(97)
Space heating kWh	621.8380	437.8626	383.4309	232.7248	120.1743	0.0000	0.0000	0.0000	0.0000	216.1576	378.6340	563.6496	(98a)
Space heating requirement - total per year (kWh/year)												2954.4718	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	621.8380	437.8626	383.4309	232.7248	120.1743	0.0000	0.0000	0.0000	0.0000	216.1576	378.6340	563.6496	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2954.4718	
Space heating per m2											(98c) / (4) =	31.0539	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	286.1613 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	621.8380	437.8626	383.4309	232.7248	120.1743	0.0000	0.0000	0.0000	0.0000	216.1576	378.6340	563.6496	(98)
Space heating efficiency (main heating system 1)	286.1613	286.1613	286.1613	286.1613	286.1613	0.0000	0.0000	0.0000	0.0000	286.1613	286.1613	286.1613	(210)
Space heating fuel (main heating system)	217.3033	153.0125	133.9912	81.3265	41.9953	0.0000	0.0000	0.0000	0.0000	75.5370	132.3149	196.9692	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	262.8454	216.6965	185.5299	126.0468	92.0985	75.7999	75.5021	96.7604	126.6201	183.1903	231.5981	259.7258	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	92.2572	76.0592	65.1199	44.2417	32.3260	26.6053	26.5008	33.9624	44.4429	64.2987	81.2896	91.1622	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5413	10.4244	11.5413	11.1690	11.5413	11.1690	11.5413	11.5413	11.1690	11.5413	11.1690	11.5413	(231)
Lighting	26.9272	21.6020	19.4502	14.2500	11.0071	8.9929	10.0411	13.0518	16.9530	22.2432	25.1236	27.6755	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-34.0473	-51.7688	-81.1382	-94.0147	-98.5583	-89.0565	-86.8343	-81.0552	-73.4727	-62.5386	-39.9377	-30.8844	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)

Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-10.1922	-23.9644	-55.1146	-91.5066	-123.4807	-135.5875	-129.5950	-105.8499	-80.1049	-40.9300	-15.7876	-8.9717 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	1032.4499 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	284.9050
Water heating fuel used	678.2660 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)	
mechanical ventilation fans (SFP = 0.1790)	55.8892 (230a)
pump for solar water heating	80.0000 (230g)
Total electricity for the above, kWh/year	135.8892 (231)
Electricity for lighting (calculated in Appendix L)	217.3176 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1644.3918 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	419.5309 (238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1032.4499	26.0000	268.4370	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	678.2660	26.0000	176.3492	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	55.8892	26.0000	14.5312	(249)
Pump for solar water heating	80.0000	26.0000	20.8000	(249)
Energy for lighting	217.3176	26.0000	56.5026	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-823.3066	26.0000	-214.0597	
PV Unit electricity exported	-821.0852	5.8100	-47.7050	
Total			-261.7648	(252)
Total energy cost			274.8551	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1032.4499	0.1549	159.9347	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	678.2660	0.1460	99.0032	(264)
Space and water heating			258.9379	(265)
Pumps, fans and electric keep-hot	135.8892	0.1387	18.8495	(267)
Energy for lighting	217.3176	0.1443	31.3656	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-823.3066	0.1344	-110.6379	
PV Unit electricity exported	-821.0852	0.1232	-101.1600	
Total			-211.7979	(269)
Total CO2, kg/year			97.3552	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1032.4499	1.5735	1624.5364	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	678.2660	1.5399	1044.4947	(278)
Space and water heating			2669.0311	(279)
Pumps, fans and electric keep-hot	135.8892	1.5128	205.5733	(281)
Energy for lighting	217.3176	1.5338	333.3289	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-823.3066	1.4967	-1232.2140	
PV Unit electricity exported	-821.0852	0.4521	-371.2400	
Total			-1603.4540	(283)
Total Primary energy kWh/year			1604.4793	(286)

Full SAP Calculation Printout

Plot Reference	79841-02	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	3B5P (Semi)
Plot Address	Plot 2, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	84 B	**DER**	3.80	**TER**	11.13
Environmental	97 A	**% DER < TER**			65.86
CO_2 Emissions (t/year)	0.33	**DFEE**	38.63	**TFEE**	39.28
Compliance Check	See BREL	**% DFEE < TFEE**			1.65
% DPER < TPER	31.59	**DPER**	39.74	**TPER**	58.09

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700 (1b)	x	2.5500 (2b)	=	121.3035	(1b) - (3b)
First floor	47.5700 (1c)	x	2.8300 (2c)	=	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	255.9266	(5)

---

2. Ventilation rate

---

			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		3 * 10 =	30.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		30.0000 / (5) =	0.1172	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			4.0000	(17)
Infiltration rate			0.3172	(18)
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.2696	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3438	0.3370	0.3303	0.2966	0.2899	0.2562	0.2562	0.2494	0.2696	0.2899	0.3033	0.3168	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5938	0.5870	0.5803	0.5466	0.5399	0.5062	0.5062	0.5000	0.5196	0.5399	0.5533	0.5668	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.0000	1.1450	12.5954			(27)
Glazed Doors			5.7100	1.1450	6.5382			(27)
GF			47.5700	0.1100	5.2327	75.0000	3567.7500	(28a)
Main	115.8314	18.8600	96.9714	0.1900	18.4246	9.0000	872.7426	(29a)
PIJ	47.5700		47.5700	0.0900	4.2813	9.0000	428.1300	(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.2222			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000	20.0000	668.2000	(32)
Timber			93.9800			9.0000	845.8200	(32c)
Timber			21.9300			9.0000	197.3700	(32c)
FF			47.5700			18.0000	856.2600	(32d)
GF			47.5700			9.0000	428.1300	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7864.4026 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 82.6614 (35)
List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	12.2600	0.0460	0.5640	
E3 Sill	12.2600	0.0470	0.5762	
E4 Jamb	37.2000	0.0530	1.9716	
E5 Ground floor (normal)	21.5300	0.0680	1.4640	
E10 Eaves (insulation at ceiling level)	15.3200	0.0910	1.3941	
E12 Gable (insulation at ceiling level)	6.2100	0.0750	0.4657	
E16 Corner (normal)	10.7600	0.0460	0.4950	
E18 Party wall between dwellings	10.7600	0.0540	0.5810	
P1 Party wall - Ground floor	6.2100	0.1160	0.7204	
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.0460	0.2857	
E6 Intermediate floor within a dwelling	21.5300	0.0540	1.1626	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.6803 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 58.9025 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.1489	49.5795	49.0102	46.1637	45.5944	42.7478	42.7478	42.2279	43.8864	45.5944	46.7330	47.8716	(38)
Heat transfer coeff	109.0513	108.4820	107.9127	105.0662	104.4968	101.6503	101.6503	101.1304	102.7889	104.4968	105.6355	106.7741	(39)
Average = Sum(39)m / 12 =												104.9279	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1462	1.1402	1.1343	1.1043	1.0983	1.0684	1.0684	1.0630	1.0804	1.0983	1.1103	1.1223	(40)
HLP (average)												1.1029	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6898 (42)
Hot water usage for mixer showers

69.3181	68.2763	66.7584	63.8540	61.7106	59.3203	57.9617	59.4682	61.1196	63.6860	66.6528	69.0525	(42a)

Hot water usage for baths

29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)

Hot water usage for other uses

42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)

Average daily hot water use (litres/day) 130.0024 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	141.4261	138.4062	134.7285	129.1362	124.5949	119.7126	117.8364	121.4982	125.3600	130.4856	136.1640	141.0593	(44)
Energy conte	223.9843	197.0885	207.0727	176.7810	167.7287	147.2007	142.5129	150.4401	154.5815	177.0677	193.9906	220.8648	(45)
Energy content (annual)										Total = Sum(45)m =		2159.3135	
Distribution loss (46)m = 0.15 x (45)m	33.5976	29.5633	31.0609	26.5172	25.1593	22.0801	21.3769	22.5660	23.1872	26.5602	29.0986	33.1297	(46)

Water storage loss (or HIU loss):
Store volume 198.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.5000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.8100 (55)
Total storage loss

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)

If cylinder contains dedicated solar storage

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(64)
									Total per year (kWh/year) = Sum(64)m =		2728.8595	(64)
12Total per year (kWh/year)											2729	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

113.1727	100.4849	107.5496	96.2293	94.4677	86.3938	86.0835	88.7193	88.8479	97.5729	101.9515	112.1355	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	128.3915	142.1477	128.3915	132.6712	128.3915	132.6712	128.3915	128.3915	132.6712	128.3915	132.6712	128.3915	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	248.2231	250.7989	244.3080	230.4897	213.0465	196.6524	185.7002	183.1244	189.6153	203.4336	220.8767	237.2708	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	(71)
Water heating gains (Table 5)	152.1139	149.5311	144.5559	133.6518	126.9727	119.9914	115.7036	119.2463	123.3999	131.1464	141.5993	150.7197	(72)
Total internal gains	592.0747	605.8239	580.6016	560.1589	531.7570	512.6613	493.1415	494.1084	509.0326	526.3177	558.4935	579.7283	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

Northeast			5.2400		11.2829		0.3000		0.0000		0.7700		13.6573 (75)
Southwest			5.7600		36.7938		0.3000		0.0000		0.7700		48.9564 (79)
Northeast			5.7100		11.2829		0.3000		0.0000		0.7700		14.8823 (75)
Solar gains	77.4960	141.4841	218.7646	313.2651	389.4060	403.5350	381.9991	322.6040	251.0817	163.1592	94.5487	65.2034	(83)
Total gains	669.5707	747.3080	799.3662	873.4241	921.1630	916.1963	875.1406	816.7124	760.1144	689.4770	653.0422	644.9316	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.0324	20.1375	20.2437	20.7922	20.9055	21.4909	21.4909	21.6014	21.2528	20.9055	20.6801	20.4596	
alpha	2.3355	2.3425	2.3496	2.3861	2.3937	2.4327	2.4327	2.4401	2.4169	2.3937	2.3787	2.3640	
util living area	0.9366	0.9168	0.8872	0.8224	0.7240	0.5806	0.4568	0.4970	0.6825	0.8436	0.9136	0.9411	(86)
Living	18.1386	18.4504	18.9401	19.6529	20.2554	20.7069	20.8827	20.8533	20.5315	19.7666	18.8815	18.1290	
Non living	17.3599	17.6687	18.1515	18.8553	19.4221	19.8353	19.9692	19.9552	19.6898	18.9792	18.1128	17.3629	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.5362	18.4504	18.9401	19.6529	20.2554	20.7069	20.8827	20.8533	20.5315	19.7666	18.8815	18.5306	(87)
Th 2	19.9633	19.9681	19.9730	19.9973	20.0022	20.0267	20.0267	20.0312	20.0169	20.0022	19.9924	19.9827	(88)
util rest of house	0.9286	0.9064	0.8724	0.7982	0.6839	0.5175	0.3714	0.4120	0.6252	0.8173	0.9011	0.9336	(89)
MIT 2	18.6315	17.6687	18.1515	18.8553	19.4221	19.8353	19.9692	19.9552	19.6898	18.9792	18.1128	17.7293	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	18.8320	17.8420	18.3263	19.0321	19.6068	20.0285	20.1717	20.1542	19.8764	19.1537	18.2832	17.9070	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8320	17.8420	18.3263	19.0321	19.6068	20.0285	20.1717	20.1542	19.8764	19.1537	18.2832	17.9070	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9182	0.8785	0.8427	0.7707	0.6661	0.5177	0.3848	0.4235	0.6160	0.7903	0.8738	0.9139	(94)
Useful gains	614.7754	656.4768	673.6300	673.1595	613.5941	474.2825	336.7945	345.9045	468.2536	544.8730	570.6176	589.4234	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1584.7391	1403.9725	1276.2062	1064.5413	826.2405	551.8096	363.0626	379.6677	593.7502	893.8365	1181.3436	1463.5487	(97)
Space heating kWh	721.6530	502.3171	448.3167	281.7949	158.2089	0.0000	0.0000	0.0000	0.0000	259.6288	439.7228	650.3492	(98a)
Space heating requirement - total per year (kWh/year)												3461.9915	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	721.6530	502.3171	448.3167	281.7949	158.2089	0.0000	0.0000	0.0000	0.0000	259.6288	439.7228	650.3492	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3461.9915	
Space heating per m2											(98c) / (4) =	36.3884	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												285.6431	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	721.6530	502.3171	448.3167	281.7949	158.2089	0.0000	0.0000	0.0000	0.0000	259.6288	439.7228	650.3492	(98)
Space heating efficiency (main heating system 1)	285.6431	285.6431	285.6431	285.6431	285.6431	0.0000	0.0000	0.0000	0.0000	285.6431	285.6431	285.6431	(210)
Space heating fuel (main heating system)	252.6415	175.8548	156.9500	98.6528	55.3869	0.0000	0.0000	0.0000	0.0000	90.8927	153.9414	227.6790	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	95.5956	84.5123	89.6597	78.4799	75.8502	68.0973	66.9996	69.7820	70.6879	79.1282	84.5203	94.5007	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.7468	4.2874	4.7468	4.5936	4.7468	4.5936	4.7468	4.7468	4.5936	4.7468	4.5936	4.7468	(231)
Lighting	26.9272	21.6020	19.4502	14.2500	11.0071	8.9929	10.0411	13.0518	16.9530	22.2432	25.1236	27.6755	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	1211.9992	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	284.9050	
Water heating fuel used	957.8138	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)		
mechanical ventilation fans (SFP = 0.1790)	55.8892	(230a)
Total electricity for the above, kWh/year	55.8892	(231)
Electricity for lighting (calculated in Appendix L)	217.3176	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2443.0198	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1211.9992	0.1547	187.4674	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	957.8138	0.1410	135.0326	(264)
Space and water heating			322.5000	(265)
Pumps, fans and electric keep-hot	55.8892	0.1387	7.7525	(267)
Energy for lighting	217.3176	0.1443	31.3656	(268)
Total CO2, kg/year			361.6181	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.8000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1211.9992	1.5726	1906.0057	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	957.8138	1.5213	1457.1193	(278)
Space and water heating			3363.1249	(279)
Pumps, fans and electric keep-hot	55.8892	1.5128	84.5493	(281)
Energy for lighting	217.3176	1.5338	333.3289	(282)
Total Primary energy kWh/year			3781.0031	(286)
Dwelling Primary energy Rate (DPER)			39.7400	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700	(1b) x	2.5500	(2b) =	121.3035	(1b) - (3b)
First floor	47.5700	(1c) x	2.8300	(2c) =	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 95.1400						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		255.9266	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 = 0.0000	(6a)
Number of open flues	0 * 20 = 0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000	(6d)
Number of flues attached to other heater	0 * 35 = 0.0000	(6e)
Number of blocked chimneys	0 * 20 = 0.0000	(6f)
Number of intermittent extract fans	3 * 10 = 30.0000	(7a)
Number of passive vents	0 * 10 = 0.0000	(7b)
Number of flueless gas fires	0 * 40 = 0.0000	(7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1172	(8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3672	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3121	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)

Adj infilt rate													
	0.3980	0.3902	0.3824	0.3434	0.3355	0.2965	0.2965	0.2887	0.3121	0.3355	0.3512	0.3668	(22b)
Effective ac	0.5792	0.5761	0.5731	0.5589	0.5563	0.5440	0.5440	0.5417	0.5487	0.5563	0.5617	0.5673	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type			16.7100	1.1450	19.1336			(27)
GF			47.5700	0.1300	6.1841			(28a)
Main	115.8314	18.8600	96.9714	0.1800	17.4549			(29a)
PIJ	47.5700		47.5700	0.1100	5.2327			(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.1552			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	82.6614 (35)
List of Thermal Bridges	

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.2600	0.0500	0.6130
E3 Sill	12.2600	0.0500	0.6130
E4 Jamb	37.2000	0.0500	1.8600
E5 Ground floor (normal)	21.5300	0.1600	3.4448
E10 Eaves (insulation at ceiling level)	15.3200	0.0600	0.9192
E12 Gable (insulation at ceiling level)	6.2100	0.0600	0.3726
E16 Corner (normal)	10.7600	0.0900	0.9684
E18 Party wall between dwellings	10.7600	0.0600	0.6456
P1 Party wall - Ground floor	6.2100	0.0800	0.4968
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.1200	0.7452
E6 Intermediate floor within a dwelling	21.5300	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.6786	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	60.8338	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.9161	48.6564	48.4019	47.2062	46.9824	45.9410	45.9410	45.7482	46.3422	46.9824	47.4350	47.9081	(38)
Heat transfer coeff	109.7500	109.4903	109.2357	108.0400	107.8163	106.7749	106.7749	106.5820	107.1760	107.8163	108.2688	108.7420	(39)
Average = Sum(39)m / 12 =												108.0389	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1536	1.1508	1.1482	1.1356	1.1332	1.1223	1.1223	1.1203	1.1265	1.1332	1.1380	1.1430	(40)
HLP (average)												1.1356	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6898	(42)
Hot water usage for mixer showers													
	69.3181	68.2763	66.7584	63.8540	61.7106	59.3203	57.9617	59.4682	61.1196	63.6860	66.6528	69.0525	(42a)
Hot water usage for baths													
	29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)
Hot water usage for other uses													
	42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)
Average daily hot water use (litres/day)												130.0024	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	141.4261	138.4062	134.7285	129.1362	124.5949	119.7126	117.8364	121.4982	125.3600	130.4856	136.1640	141.0593	(44)
Energy conte	223.9843	197.0885	207.0727	176.7810	167.7287	147.2007	142.5129	150.4401	154.5815	177.0677	193.9906	220.8648	(45)
Energy content (annual)										Total = Sum(45)m =		2159.3135	
Distribution loss (46)m = 0.15 x (45)m													
	33.5976	29.5633	31.0609	26.5172	25.1593	22.0801	21.3769	22.5660	23.1872	26.5602	29.0986	33.1297	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6426	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8870	(55)
Total storage loss													
	27.4979	24.8369	27.4979	26.6109	27.4979	26.6109	27.4979	27.4979	26.6109	27.4979	26.6109	27.4979	(56)
If cylinder contains dedicated solar storage													
	27.4979	24.8369	27.4979	26.6109	27.4979	26.6109	27.4979	27.4979	26.6109	27.4979	26.6109	27.4979	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	274.7447	242.9366	257.8330	225.9039	218.4890	196.3236	193.2732	201.2004	203.7044	227.8281	243.1135	271.6251	(62)
WWHRS	-31.6893	-28.0263	-29.3475	-24.3009	-22.6476	-19.3797	-18.1654	-19.3170	-20.0510	-23.6379	-26.7789	-31.1025	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	243.0553	214.9103	228.4855	201.6030	195.8415	176.9439	175.1079	181.8834	183.6534	204.1902	216.3347	240.5226	(64)
										Total per year (kWh/year) = Sum(64)m =		2462.5316	(64)
12Total per year (kWh/year)												2463	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	115.0831	102.2104	109.4599	98.0780	96.3781	88.2426	87.9938	90.6296	90.6967	99.4833	103.8002	114.0458	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	128.3915	142.1477	128.3915	132.6712	128.3915	132.6712	128.3915	128.3915	132.6712	128.3915	132.6712	128.3915	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													

	248.2231	250.7989	244.3080	230.4897	213.0465	196.6524	185.7002	183.1244	189.6153	203.4336	220.8767	237.2708 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901 (71)
Water heating gains (Table 5)												
	154.6815	152.0988	147.1236	136.2195	129.5404	122.5591	118.2712	121.8140	125.9676	133.7141	144.1670	153.2874 (72)
Total internal gains												
	597.6424	611.3916	586.1693	565.7266	537.3247	515.2290	495.7092	496.6761	511.6003	531.8854	564.0611	585.2959 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.9500	11.2829	0.6300	0.7000	0.7700	37.7579	(75)
Southwest	5.7600	36.7938	0.6300	0.7000	0.7700	64.7693	(79)

Solar gains	102.5273	187.1835	289.4255	414.4498	515.1842	533.8768	505.3848	426.8051	332.1811	215.8597	125.0880	86.2641	(83)
Total gains	700.1696	798.5751	875.5948	980.1764	1052.5089	1049.1058	1001.0940	923.4812	843.7815	747.7451	689.1491	671.5600	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.9048	19.9521	19.9986	20.2199	20.2618	20.4595	20.4595	20.4965	20.3829	20.2618	20.1771	20.0894	
alpha	2.3270	2.3301	2.3332	2.3480	2.3508	2.3640	2.3640	2.3664	2.3589	2.3508	2.3451	2.3393	
util living area													
	0.9314	0.9069	0.8698	0.7943	0.6844	0.5434	0.4241	0.4677	0.6547	0.8270	0.9063	0.9369	(86)
MIT	18.1785	18.5155	19.0308	19.7277	20.3199	20.7260	20.8906	20.8588	20.5483	19.7886	18.8835	18.1262	(87)
Th 2	19.9573	19.9595	19.9617	19.9719	19.9738	19.9827	19.9827	19.9843	19.9792	19.9738	19.9699	19.9659	(88)
util rest of house													
	0.9228	0.8954	0.8533	0.7675	0.6417	0.4790	0.3394	0.3820	0.5948	0.7984	0.8929	0.9290	(89)
MIT 2	16.6692	17.0931	17.7389	18.6012	19.3042	19.7586	19.9161	19.8935	19.5819	18.6954	17.5696	16.6081	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	17.0038	17.4084	18.0252	18.8509	19.5293	19.9731	20.1321	20.1075	19.7961	18.9378	17.8608	16.9446	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.0038	17.4084	18.0252	18.8509	19.5293	19.9731	20.1321	20.1075	19.7961	18.9378	17.8608	16.9446	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8885	0.8578	0.8141	0.7330	0.6211	0.4784	0.3525	0.3931	0.5828	0.7631	0.8559	0.8961	(94)
Useful gains	622.1005	685.0011	712.8020	718.4703	653.7264	501.8644	352.8490	362.9780	491.7948	570.5944	589.8307	601.7860	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1394.2402	1369.5514	1258.9669	1075.0984	844.1304	573.7081	377.1447	395.1511	610.4905	898.9463	1165.0629	1385.8749	(97)
Space heating kWh													
	574.4719	460.0178	406.3466	256.7722	141.6606	0.0000	0.0000	0.0000	0.0000	244.2938	414.1671	583.3622	(98a)
Space heating requirement - total per year (kWh/year)												3081.0922	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	574.4719	460.0178	406.3466	256.7722	141.6606	0.0000	0.0000	0.0000	0.0000	244.2938	414.1671	583.3622	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3081.0922	
Space heating per m2											(98c) / (4) =	32.3848	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	574.4719	460.0178	406.3466	256.7722	141.6606	0.0000	0.0000	0.0000	0.0000	244.2938	414.1671	583.3622	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	622.3964	498.3942	440.2456	278.1931	153.4784	0.0000	0.0000	0.0000	0.0000	264.6736	448.7184	632.0284	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	243.0553	214.9103	228.4855	201.6030	195.8415	176.9439	175.1079	181.8834	183.6534	204.1902	216.3347	240.5226	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.9191	85.7216	85.3360	84.6033	83.3456	79.8000	79.8000	79.8000	79.8000	84.4630	85.4917	85.9694	(217)
Fuel for water heating, kWh/month													
	282.8887	250.7073	267.7479	238.2920	234.9753	221.7342	219.4334	227.9240	230.1421	241.7511	253.0475	279.7769	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	26.6772	21.4014	19.2696	14.1178	10.9050	8.9094	9.9479	12.9306	16.7956	22.0367	24.8904	27.4187	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-43.7273	-61.2512	-87.4769	-97.6894	-104.7589	-97.5416	-96.2965	-91.1670	-82.0635	-69.6860	-47.9165	-37.8482	(233a)

Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-25.9245	-54.3936	-107.8641	-161.6637	-213.4533	-214.3907	-211.9042	-179.5910	-131.8391	-77.7180	-34.5868	-20.5145 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3338.1281	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2948.4206	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	215.3004	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2351.2664	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4236.5827	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3338.1281	0.2100	701.0069	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2948.4206	0.2100	619.1683	(264)
Space and water heating			1320.1752	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	215.3004	0.1443	31.0745	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-917.4229	0.1347	-123.6078	
PV Unit electricity exported	-1433.8435	0.1260	-180.5987	
Total			-304.2065	(269)
Total CO2, kg/year			1058.9725	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.1300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3338.1281	1.1300	3772.0847	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2948.4206	1.1300	3331.7153	(278)
Space and water heating			7103.8001	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	215.3004	1.5338	330.2349	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-917.4229	1.4980	-1374.2639	
PV Unit electricity exported	-1433.8435	0.4623	-662.9248	
Total			-2037.1887	(283)
Total Primary energy kWh/year			5526.9471	(286)
Target Primary Energy Rate (TPER)			58.0900	(287)

Full SAP Calculation Printout

Plot Reference	79841-02	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	3B5P (Semi)
Plot Address	Plot 2, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	84 B	**DER**	3.80	**TER**	11.13
Environmental	97 A	**% DER < TER**			65.86
CO_2 Emissions (t/year)	0.33	**DFEE**	38.63	**TFEE**	39.28
Compliance Check	See BREL	**% DFEE < TFEE**			1.65
% DPER < TPER	31.59	**DPER**	39.74	**TPER**	58.09

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700 (1b)	x	2.5500 (2b)	=	121.3035	(1b) - (3b)
First floor	47.5700 (1c)	x	2.8300 (2c)	=	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	255.9266	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1172	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3172	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2696	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3438	0.3370	0.3303	0.2966	0.2899	0.2562	0.2562	0.2494	0.2696	0.2899	0.3033	0.3168	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5591	0.5568	0.5546	0.5440	0.5420	0.5328	0.5328	0.5311	0.5364	0.5420	0.5460	0.5502	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.0000	1.1450	12.5954			(27)
Glazed Doors			5.7100	1.1450	6.5382			(27)
GF			47.5700	0.1100	5.2327	75.0000	3567.7500	(28a)
Main	115.8314	18.8600	96.9714	0.1900	18.4246	9.0000	872.7426	(29a)
PIJ	47.5700		47.5700	0.0900	4.2813	9.0000	428.1300	(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.2222			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000	20.0000	668.2000	(32)
Timber			93.9800			9.0000	845.8200	(32c)
Timber			21.9300			9.0000	197.3700	(32c)
FF			47.5700			18.0000	856.2600	(32d)
GF			47.5700			9.0000	428.1300	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		7864.4026	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							82.6614	(35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	12.2600	0.0460	0.5640	
E3 Sill	12.2600	0.0470	0.5762	
E4 Jamb	37.2000	0.0530	1.9716	
E5 Ground floor (normal)	21.5300	0.0680	1.4640	
E10 Eaves (insulation at ceiling level)	15.3200	0.0910	1.3941	
E12 Gable (insulation at ceiling level)	6.2100	0.0750	0.4657	
E16 Corner (normal)	10.7600	0.0460	0.4950	
E18 Party wall between dwellings	10.7600	0.0540	0.5810	
P1 Party wall - Ground floor	6.2100	0.1160	0.7204	
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.0460	0.2857	
E6 Intermediate floor within a dwelling	21.5300	0.0540	1.1626	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			9.6803	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	58.9025	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.2188	47.0250	46.8351	45.9428	45.7758	44.9987	44.9987	44.8548	45.2981	45.7758	46.1136	46.4666	(38)
Heat transfer coeff	106.1213	105.9275	105.7375	104.8453	104.6783	103.9012	103.9012	103.7573	104.2005	104.6783	105.0160	105.3691	(39)
Average = Sum(39)m / 12 =												104.8445	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1154	1.1134	1.1114	1.1020	1.1003	1.0921	1.0921	1.0906	1.0952	1.1003	1.1038	1.1075	(40)
HLP (average)												1.1020	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6898 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)
Hot water usage for other uses	42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)
Average daily hot water use (litres/day)												66.0935	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	72.1080	70.1298	67.9701	65.2822	62.8843	60.3923	59.8747	62.0299	64.2404	66.7996	69.5112	72.0068	(44)
Energy conte	114.2015	99.8639	104.4676	89.3681	84.6544	74.2594	72.4132	76.8060	79.2149	90.6464	99.0315	112.7453	(45)
Energy content (annual)										Total = Sum(45)m =		1097.6720	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	97.0712	84.8843	88.7974	75.9629	71.9562	63.1205	61.5512	65.2851	67.3326	77.0494	84.1768	95.8335	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	97.0712	84.8843	88.7974	75.9629	71.9562	63.1205	61.5512	65.2851	67.3326	77.0494	84.1768	95.8335	(64)
										Total per year (kWh/year) = Sum(64)m =		933.0212	(64)
12Total per year (kWh/year)												933	(64)
Electric shower(s)	55.5122	49.4618	54.0104	51.5415	52.5087	50.0882	51.7578	52.5087	51.5415	54.0104	52.9948	55.5122	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		631.4482	(64a)
Heat gains from water heating, kWh/month	38.1459	33.5865	35.7020	31.8761	31.1162	28.3022	28.3272	29.4484	29.7185	32.7650	34.2929	37.8364	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	128.3915	142.1477	128.3915	132.6712	128.3915	132.6712	128.3915	128.3915	132.6712	128.3915	132.6712	128.3915	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	248.2231	250.7989	244.3080	230.4897	213.0465	196.6524	185.7002	183.1244	189.6153	203.4336	220.8767	237.2708	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	(71)
Water heating gains (Table 5)	51.2713	49.9800	47.9865	44.2724	41.8229	39.3086	38.0743	39.5812	41.2757	44.0389	47.6290	50.8554	(72)
Total internal gains	491.2321	506.2728	484.0322	470.7795	446.6071	431.9784	415.5122	414.4434	426.9085	439.2103	464.5232	479.8640	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.2400	11.2829	0.3000	0.0000	0.7700	13.6573	(75)
Southwest	5.7600	36.7938	0.3000	0.0000	0.7700	48.9564	(79)
Northeast	5.7100	11.2829	0.3000	0.0000	0.7700	14.8823	(75)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	77.4960	141.4841	218.7646	313.2651	389.4060	403.5350	381.9991	322.6040	251.0817	163.1592	94.5487	65.2034	(83)

Total gains	568.7282	647.7569	702.7968	784.0446	836.0132	835.5135	797.5113	737.0474	677.9902	602.3695	559.0719	545.0673	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.5855	20.6231	20.6602	20.8360	20.8692	21.0253	21.0253	21.0545	20.9649	20.8692	20.8021	20.7324	
alpha	2.3724	2.3749	2.3773	2.3891	2.3913	2.4017	2.4017	2.4036	2.3977	2.3913	2.3868	2.3822	
util living area	0.9532	0.9353	0.9087	0.8496	0.7567	0.6220	0.4976	0.5436	0.7261	0.8747	0.9350	0.9574	(86)
MIT	18.0164	18.3309	18.8268	19.5309	20.1682	20.6445	20.8522	20.8122	20.4458	19.6293	18.7171	17.9628	(87)
Th 2	19.9883	19.9899	19.9915	19.9992	20.0006	20.0073	20.0073	20.0085	20.0047	20.0006	19.9977	19.9947	(88)
util rest of house	0.9471	0.9269	0.8962	0.8278	0.7186	0.5578	0.4064	0.4535	0.6707	0.8521	0.9252	0.9518	(89)
MIT 2	17.2567	17.5674	18.0562	18.7444	19.3464	19.7728	19.9342	19.9101	19.6123	18.8519	17.9579	17.2078	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	17.4251	17.7366	18.2270	18.9187	19.5286	19.9661	20.1377	20.1101	19.7970	19.0243	18.1262	17.3752	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.4251	17.7366	18.2270	18.9187	19.5286	19.9661	20.1377	20.1101	19.7970	19.0243	18.1262	17.3752	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9257	0.9020	0.8683	0.7995	0.6981	0.5549	0.4192	0.4635	0.6575	0.8244	0.9006	0.9316	(94)
Useful gains	526.4754	584.2673	610.2529	626.8489	583.5811	463.6020	334.3474	341.6049	445.7919	496.5917	503.4925	507.7860	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1392.8536	1359.7515	1239.9842	1050.4170	819.4813	557.5393	367.5683	384.9514	593.6340	881.8364	1157.9236	1388.2559	(97)
Space heating kWh	644.5854	521.1254	468.5201	304.9690	175.5097	0.0000	0.0000	0.0000	0.0000	286.6221	471.1904	655.0696	(98a)
Space heating requirement - total per year (kWh/year)												3527.5917	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	644.5854	521.1254	468.5201	304.9690	175.5097	0.0000	0.0000	0.0000	0.0000	286.6221	471.1904	655.0696	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3527.5917	
Space heating per m2											(98c) / (4) =	37.0779	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	976.6712	768.8688	788.5553	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6860	0.7526	0.7171	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	669.9562	578.6296	565.4383	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	923.3410	881.4929	813.3722	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	182.4370	225.3303	184.4628	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	45.6093	56.3326	46.1157	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												148.0575	(107)
Energy for space heating												37.0779	(99)
Energy for space cooling												1.5562	(108)
Total												38.6341	(109)
Fabric Energy Efficiency (DFEE)												38.6	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700	(1b) x	2.5500	(2b) =	121.3035	(1b) - (3b)
First floor	47.5700	(1c) x	2.8300	(2c) =	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		255.9266	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)

Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1172 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3672 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3121 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3980	0.3902	0.3824	0.3434	0.3355	0.2965	0.2965	0.2887	0.3121	0.3355	0.3512	0.3668	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0.0000 (23c)

Effective ac	0.5792	0.5761	0.5731	0.5589	0.5563	0.5440	0.5440	0.5417	0.5487	0.5563	0.5617	0.5673	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type			16.7100	1.1450	19.1336			(27)
GF			47.5700	0.1300	6.1841			(28a)
Main	115.8314	18.8600	96.9714	0.1800	17.4549			(29a)
PIJ	47.5700		47.5700	0.1100	5.2327			(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.1552			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	82.6614 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.2600	0.0500	0.6130
E3 Sill	12.2600	0.0500	0.6130
E4 Jamb	37.2000	0.0500	1.8600
E5 Ground floor (normal)	21.5300	0.1600	3.4448
E10 Eaves (insulation at ceiling level)	15.3200	0.0600	0.9192
E12 Gable (insulation at ceiling level)	6.2100	0.0600	0.3726
E16 Corner (normal)	10.7600	0.0900	0.9684
E18 Party wall between dwellings	10.7600	0.0600	0.6456
P1 Party wall - Ground floor	6.2100	0.0800	0.4968
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.1200	0.7452
E6 Intermediate floor within a dwelling	21.5300	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.6786 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	60.8338 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.9161	48.6564	48.4019	47.2062	46.9824	45.9410	45.9410	45.7482	46.3422	46.9824	47.4350	47.9081	(38)
Heat transfer coeff	109.7500	109.4903	109.2357	108.0400	107.8163	106.7749	106.7749	106.5820	107.1760	107.8163	108.2688	108.7420	(39)
Average = Sum(39)m / 12 =												108.0389	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1536	1.1508	1.1482	1.1356	1.1332	1.1223	1.1223	1.1203	1.1265	1.1332	1.1380	1.1430	(40)
HLP (average)												1.1356	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6898 (42)

Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)

Hot water usage for other uses

42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)

Average daily hot water use (litres/day)	66.0935 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	72.1080	70.1298	67.9701	65.2822	62.8843	60.3923	59.8747	62.0299	64.2404	66.7996	69.5112	72.0068	(44)
Energy conte	114.2015	99.8639	104.4676	89.3681	84.6544	74.2594	72.4132	76.8060	79.2149	90.6464	99.0315	112.7453	(45)
Energy content (annual)										Total = Sum(45)m =		1097.6720	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	97.0712	84.8843	88.7974	75.9629	71.9562	63.1205	61.5512	65.2851	67.3326	77.0494	84.1768	95.8335	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	97.0712	84.8843	88.7974	75.9629	71.9562	63.1205	61.5512	65.2851	67.3326	77.0494	84.1768	95.8335	(64)
										Total per year (kWh/year) = Sum(64)m =		933.0212	(64)
12Total per year (kWh/year)												933	(64)

Electric shower(s)

	55.5122	49.4618	54.0104	51.5415	52.5087	50.0882	51.7578	52.5087	51.5415	54.0104	52.9948	55.5122 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												631.4482 (64a)
Heat gains from water heating, kWh/month												
	38.1459	33.5865	35.7020	31.8761	31.1162	28.3022	28.3272	29.4484	29.7185	32.7650	34.2929	37.8364 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	128.3915	142.1477	128.3915	132.6712	128.3915	132.6712	128.3915	128.3915	132.6712	128.3915	132.6712	128.3915	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.2231	250.7989	244.3080	230.4897	213.0465	196.6524	185.7002	183.1244	189.6153	203.4336	220.8767	237.2708	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	(71)
Water heating gains (Table 5)													
	51.2713	49.9800	47.9865	44.2724	41.8229	39.3086	38.0743	39.5812	41.2757	44.0389	47.6290	50.8554	(72)
Total internal gains													
	491.2321	506.2728	484.0322	470.7795	446.6071	431.9784	415.5122	414.4434	426.9085	439.2103	464.5232	479.8640	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.9500	11.2829	0.6300	0.7000	0.7700	37.7579	(75)
Southwest	5.7600	36.7938	0.6300	0.7000	0.7700	64.7693	(79)

Solar gains	102.5273	187.1835	289.4255	414.4498	515.1842	533.8768	505.3848	426.8051	332.1811	215.8597	125.0880	86.2641	(83)
Total gains	593.7594	693.4563	773.4578	885.2293	961.7913	965.8553	920.8970	841.2485	759.0896	655.0699	589.6112	566.1280	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.9048	19.9521	19.9986	20.2199	20.2618	20.4595	20.4595	20.4965	20.3829	20.2618	20.1771	20.0894	
alpha	2.3270	2.3301	2.3332	2.3480	2.3508	2.3640	2.3640	2.3664	2.3589	2.3508	2.3451	2.3393	
util living area													
	0.9497	0.9278	0.8942	0.8227	0.7160	0.5747	0.4534	0.5019	0.6931	0.8592	0.9294	0.9546	(86)
MIT	17.9677	18.3221	18.8633	19.6066	20.2437	20.6897	20.8734	20.8352	20.4846	19.6550	18.6993	17.9131	(87)
Th 2	19.9573	19.9595	19.9617	19.9719	19.9738	19.9827	19.9827	19.9843	19.9792	19.9738	19.9699	19.9659	(88)
util rest of house													
	0.9431	0.9184	0.8800	0.7981	0.6747	0.5095	0.3650	0.4129	0.6346	0.8343	0.9187	0.9486	(89)
MIT 2	17.1891	17.5387	18.0703	18.7935	19.3883	19.7828	19.9220	19.9005	19.6209	18.8559	17.9222	17.1407	(90)
Living area fraction									fLA = Living area / (4) =			0.2217	(91)
MIT	17.3617	17.7124	18.2461	18.9737	19.5779	19.9838	20.1329	20.1077	19.8123	19.0330	18.0944	17.3120	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.3617	17.7124	18.2461	18.9737	19.5779	19.9838	20.1329	20.1077	19.8123	19.0330	18.0944	17.3120	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9204	0.8917	0.8504	0.7698	0.6569	0.5096	0.3788	0.4245	0.6238	0.8060	0.8926	0.9272	(94)
Useful gains	546.5122	618.3632	657.7375	681.4821	631.7763	492.1761	348.8078	357.1278	473.5438	527.9803	526.2865	524.9062	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1433.5247	1402.8286	1283.0935	1088.3651	849.3649	574.8578	377.2228	395.1734	612.2266	909.2163	1190.3561	1425.8196	(97)
Space heating kWh													
	659.9373	527.1608	465.2648	292.9557	161.8860	0.0000	0.0000	0.0000	0.0000	283.6395	478.1301	670.2795	(98a)
Space heating requirement - total per year (kWh/year)												3539.2538	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	659.9373	527.1608	465.2648	292.9557	161.8860	0.0000	0.0000	0.0000	0.0000	283.6395	478.1301	670.2795	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3539.2538	
Space heating per m2											(98c) / (4) =	37.2005	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1003.6836	790.1339	810.0232	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7267	0.7879	0.7516	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	729.3467	622.5318	608.8108	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1075.6886	1025.7100	935.1657	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	249.3662	299.9646	242.8080	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	62.3415	74.9911	60.7020	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												198.0347	(107)

Energy for space heating	37.2005 (99)
Energy for space cooling	2.0815 (108)
Total	39.2820 (109)
Fabric Energy Efficiency (TFEE)	39.3 (109)

Full SAP Calculation Printout

Plot Reference	79841-02	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	3B5P (Semi)
Plot Address	Plot 2, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	84 B	**DER**	3.80	**TER**	11.13
Environmental	97 A	**% DER < TER**			65.86
CO_2 Emissions (t/year)	0.33	**DFEE**	38.63	**TFEE**	39.28
Compliance Check	See BREL	**% DFEE < TFEE**			1.65
% DPER < TPER	31.59	**DPER**	39.74	**TPER**	58.09

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700 (1b)	x	2.5500 (2b)	=	121.3035	(1b) - (3b)
First floor	47.5700 (1c)	x	2.8300 (2c)	=	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	255.9266	(5)

---

2. Ventilation rate

---

			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		3 * 10 =	30.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		30.0000 / (5) =	0.1172	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			4.0000	(17)
Infiltration rate			0.3172	(18)
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.2696	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3438	0.3370	0.3303	0.2966	0.2899	0.2562	0.2562	0.2494	0.2696	0.2899	0.3033	0.3168	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5938	0.5870	0.5803	0.5466	0.5399	0.5062	0.5062	0.5000	0.5196	0.5399	0.5533	0.5668	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.0000	1.1450	12.5954			(27)
Glazed Doors			5.7100	1.1450	6.5382			(27)
GF			47.5700	0.1100	5.2327	75.0000	3567.7500	(28a)
Main	115.8314	18.8600	96.9714	0.1900	18.4246	9.0000	872.7426	(29a)
PIJ	47.5700		47.5700	0.0900	4.2813	9.0000	428.1300	(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.2222			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000	20.0000	668.2000	(32)
Timber			93.9800			9.0000	845.8200	(32c)
Timber			21.9300			9.0000	197.3700	(32c)
FF			47.5700			18.0000	856.2600	(32d)
GF			47.5700			9.0000	428.1300	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7864.4026 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 82.6614 (35)
List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	12.2600	0.0460	0.5640	
E3 Sill	12.2600	0.0470	0.5762	
E4 Jamb	37.2000	0.0530	1.9716	
E5 Ground floor (normal)	21.5300	0.0680	1.4640	
E10 Eaves (insulation at ceiling level)	15.3200	0.0910	1.3941	
E12 Gable (insulation at ceiling level)	6.2100	0.0750	0.4657	
E16 Corner (normal)	10.7600	0.0460	0.4950	
E18 Party wall between dwellings	10.7600	0.0540	0.5810	
P1 Party wall - Ground floor	6.2100	0.1160	0.7204	
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.0460	0.2857	
E6 Intermediate floor within a dwelling	21.5300	0.0540	1.1626	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.6803 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 58.9025 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.1489	49.5795	49.0102	46.1637	45.5944	42.7478	42.7478	42.2279	43.8864	45.5944	46.7330	47.8716	(38)
Heat transfer coeff	109.0513	108.4820	107.9127	105.0662	104.4968	101.6503	101.6503	101.1304	102.7889	104.4968	105.6355	106.7741	(39)
Average = Sum(39)m / 12 =												104.9279	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1462	1.1402	1.1343	1.1043	1.0983	1.0684	1.0684	1.0630	1.0804	1.0983	1.1103	1.1223	(40)
HLP (average)												1.1029	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6898 (42)
Hot water usage for mixer showers

69.3181	68.2763	66.7584	63.8540	61.7106	59.3203	57.9617	59.4682	61.1196	63.6860	66.6528	69.0525	(42a)

Hot water usage for baths

29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)

Hot water usage for other uses

42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)

Average daily hot water use (litres/day) 130.0024 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	141.4261	138.4062	134.7285	129.1362	124.5949	119.7126	117.8364	121.4982	125.3600	130.4856	136.1640	141.0593	(44)
Energy conte	223.9843	197.0885	207.0727	176.7810	167.7287	147.2007	142.5129	150.4401	154.5815	177.0677	193.9906	220.8648	(45)
Energy content (annual)										Total = Sum(45)m =		2159.3135	
Distribution loss (46)m = 0.15 x (45)m	33.5976	29.5633	31.0609	26.5172	25.1593	22.0801	21.3769	22.5660	23.1872	26.5602	29.0986	33.1297	(46)

Water storage loss (or HIU loss):
Store volume 198.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.5000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.8100 (55)
Total storage loss

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)

If cylinder contains dedicated solar storage

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(64)
									Total per year (kWh/year) = Sum(64)m =		2728.8595	(64)
12Total per year (kWh/year)											2729	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

113.1727	100.4849	107.5496	96.2293	94.4677	86.3938	86.0835	88.7193	88.8479	97.5729	101.9515	112.1355	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	128.3915	142.1477	128.3915	132.6712	128.3915	132.6712	128.3915	128.3915	132.6712	128.3915	132.6712	128.3915	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	248.2231	250.7989	244.3080	230.4897	213.0465	196.6524	185.7002	183.1244	189.6153	203.4336	220.8767	237.2708	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	(71)
Water heating gains (Table 5)	152.1139	149.5311	144.5559	133.6518	126.9727	119.9914	115.7036	119.2463	123.3999	131.1464	141.5993	150.7197	(72)
Total internal gains	592.0747	605.8239	580.6016	560.1589	531.7570	512.6613	493.1415	494.1084	509.0326	526.3177	558.4935	579.7283	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

Northeast			5.2400		11.2829		0.3000		0.0000		0.7700		13.6573 (75)
Southwest			5.7600		36.7938		0.3000		0.0000		0.7700		48.9564 (79)
Northeast			5.7100		11.2829		0.3000		0.0000		0.7700		14.8823 (75)
Solar gains	77.4960	141.4841	218.7646	313.2651	389.4060	403.5350	381.9991	322.6040	251.0817	163.1592	94.5487	65.2034	(83)
Total gains	669.5707	747.3080	799.3662	873.4241	921.1630	916.1963	875.1406	816.7124	760.1144	689.4770	653.0422	644.9316	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.0324	20.1375	20.2437	20.7922	20.9055	21.4909	21.4909	21.6014	21.2528	20.9055	20.6801	20.4596	
alpha	2.3355	2.3425	2.3496	2.3861	2.3937	2.4327	2.4327	2.4401	2.4169	2.3937	2.3787	2.3640	
util living area	0.9366	0.9168	0.8872	0.8224	0.7240	0.5806	0.4568	0.4970	0.6825	0.8436	0.9136	0.9411	(86)
Living	18.1386	18.4504	18.9401	19.6529	20.2554	20.7069	20.8827	20.8533	20.5315	19.7666	18.8815	18.1290	
Non living	17.3599	17.6687	18.1515	18.8553	19.4221	19.8353	19.9692	19.9552	19.6898	18.9792	18.1128	17.3629	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.5362	18.4504	18.9401	19.6529	20.2554	20.7069	20.8827	20.8533	20.5315	19.7666	18.8815	18.5306	(87)
Th 2	19.9633	19.9681	19.9730	19.9973	20.0022	20.0267	20.0267	20.0312	20.0169	20.0022	19.9924	19.9827	(88)
util rest of house	0.9286	0.9064	0.8724	0.7982	0.6839	0.5175	0.3714	0.4120	0.6252	0.8173	0.9011	0.9336	(89)
MIT 2	18.6315	17.6687	18.1515	18.8553	19.4221	19.8353	19.9692	19.9552	19.6898	18.9792	18.1128	17.7293	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	18.8320	17.8420	18.3263	19.0321	19.6068	20.0285	20.1717	20.1542	19.8764	19.1537	18.2832	17.9070	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8320	17.8420	18.3263	19.0321	19.6068	20.0285	20.1717	20.1542	19.8764	19.1537	18.2832	17.9070	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9182	0.8785	0.8427	0.7707	0.6661	0.5177	0.3848	0.4235	0.6160	0.7903	0.8738	0.9139	(94)
Useful gains	614.7754	656.4768	673.6300	673.1595	613.5941	474.2825	336.7945	345.9045	468.2536	544.8730	570.6176	589.4234	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1584.7391	1403.9725	1276.2062	1064.5413	826.2405	551.8096	363.0626	379.6677	593.7502	893.8365	1181.3436	1463.5487	(97)
Space heating kWh	721.6530	502.3171	448.3167	281.7949	158.2089	0.0000	0.0000	0.0000	0.0000	259.6288	439.7228	650.3492	(98a)
Space heating requirement - total per year (kWh/year)												3461.9915	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	721.6530	502.3171	448.3167	281.7949	158.2089	0.0000	0.0000	0.0000	0.0000	259.6288	439.7228	650.3492	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3461.9915	
Space heating per m2											(98c) / (4) =	36.3884	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												285.6431	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	721.6530	502.3171	448.3167	281.7949	158.2089	0.0000	0.0000	0.0000	0.0000	259.6288	439.7228	650.3492	(98)
Space heating efficiency (main heating system 1)	285.6431	285.6431	285.6431	285.6431	285.6431	0.0000	0.0000	0.0000	0.0000	285.6431	285.6431	285.6431	(210)
Space heating fuel (main heating system)	252.6415	175.8548	156.9500	98.6528	55.3869	0.0000	0.0000	0.0000	0.0000	90.8927	153.9414	227.6790	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	95.5956	84.5123	89.6597	78.4799	75.8502	68.0973	66.9996	69.7820	70.6879	79.1282	84.5203	94.5007	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.7468	4.2874	4.7468	4.5936	4.7468	4.5936	4.7468	4.7468	4.5936	4.7468	4.5936	4.7468	(231)
Lighting	26.9272	21.6020	19.4502	14.2500	11.0071	8.9929	10.0411	13.0518	16.9530	22.2432	25.1236	27.6755	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	1211.9992	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	284.9050	
Water heating fuel used	957.8138	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)		
mechanical ventilation fans (SFP = 0.1790)	55.8892	(230a)
Total electricity for the above, kWh/year	55.8892	(231)
Electricity for lighting (calculated in Appendix L)	217.3176	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2443.0198	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1211.9992	0.1547	187.4674	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	957.8138	0.1410	135.0326	(264)
Space and water heating			322.5000	(265)
Pumps, fans and electric keep-hot	55.8892	0.1387	7.7525	(267)
Energy for lighting	217.3176	0.1443	31.3656	(268)
Total CO2, kg/year			361.6181	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.8000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1211.9992	1.5726	1906.0057	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	957.8138	1.5213	1457.1193	(278)
Space and water heating			3363.1249	(279)
Pumps, fans and electric keep-hot	55.8892	1.5128	84.5493	(281)
Energy for lighting	217.3176	1.5338	333.3289	(282)
Total Primary energy kWh/year			3781.0031	(286)
Dwelling Primary energy Rate (DPER)			39.7400	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700	(1b) x	2.5500	(2b) =	121.3035	(1b) - (3b)
First floor	47.5700	(1c) x	2.8300	(2c) =	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 95.1400						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		255.9266	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 = 0.0000	(6a)
Number of open flues	0 * 20 = 0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000	(6d)
Number of flues attached to other heater	0 * 35 = 0.0000	(6e)
Number of blocked chimneys	0 * 20 = 0.0000	(6f)
Number of intermittent extract fans	3 * 10 = 30.0000	(7a)
Number of passive vents	0 * 10 = 0.0000	(7b)
Number of flueless gas fires	0 * 40 = 0.0000	(7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1172	(8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3672	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3121	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)

Adj infilt rate													
	0.3980	0.3902	0.3824	0.3434	0.3355	0.2965	0.2965	0.2887	0.3121	0.3355	0.3512	0.3668	(22b)
Effective ac	0.5792	0.5761	0.5731	0.5589	0.5563	0.5440	0.5440	0.5417	0.5487	0.5563	0.5617	0.5673	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type			16.7100	1.1450	19.1336			(27)
GF			47.5700	0.1300	6.1841			(28a)
Main	115.8314	18.8600	96.9714	0.1800	17.4549			(29a)
PIJ	47.5700		47.5700	0.1100	5.2327			(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.1552			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	82.6614 (35)
List of Thermal Bridges	

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.2600	0.0500	0.6130
E3 Sill	12.2600	0.0500	0.6130
E4 Jamb	37.2000	0.0500	1.8600
E5 Ground floor (normal)	21.5300	0.1600	3.4448
E10 Eaves (insulation at ceiling level)	15.3200	0.0600	0.9192
E12 Gable (insulation at ceiling level)	6.2100	0.0600	0.3726
E16 Corner (normal)	10.7600	0.0900	0.9684
E18 Party wall between dwellings	10.7600	0.0600	0.6456
P1 Party wall - Ground floor	6.2100	0.0800	0.4968
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.1200	0.7452
E6 Intermediate floor within a dwelling	21.5300	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.6786	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	60.8338	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.9161	48.6564	48.4019	47.2062	46.9824	45.9410	45.9410	45.7482	46.3422	46.9824	47.4350	47.9081	(38)
Heat transfer coeff	109.7500	109.4903	109.2357	108.0400	107.8163	106.7749	106.7749	106.5820	107.1760	107.8163	108.2688	108.7420	(39)
Average = Sum(39)m / 12 =												108.0389	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1536	1.1508	1.1482	1.1356	1.1332	1.1223	1.1223	1.1203	1.1265	1.1332	1.1380	1.1430	(40)
HLP (average)												1.1356	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6898	(42)
Hot water usage for mixer showers													
	69.3181	68.2763	66.7584	63.8540	61.7106	59.3203	57.9617	59.4682	61.1196	63.6860	66.6528	69.0525	(42a)
Hot water usage for baths													
	29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)
Hot water usage for other uses													
	42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)
Average daily hot water use (litres/day)												130.0024	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	141.4261	138.4062	134.7285	129.1362	124.5949	119.7126	117.8364	121.4982	125.3600	130.4856	136.1640	141.0593	(44)
Energy conte	223.9843	197.0885	207.0727	176.7810	167.7287	147.2007	142.5129	150.4401	154.5815	177.0677	193.9906	220.8648	(45)
Energy content (annual)										Total = Sum(45)m =		2159.3135	
Distribution loss (46)m = 0.15 x (45)m													
	33.5976	29.5633	31.0609	26.5172	25.1593	22.0801	21.3769	22.5660	23.1872	26.5602	29.0986	33.1297	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6426	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8870	(55)
Total storage loss													
	27.4979	24.8369	27.4979	26.6109	27.4979	26.6109	27.4979	27.4979	26.6109	27.4979	26.6109	27.4979	(56)
If cylinder contains dedicated solar storage													
	27.4979	24.8369	27.4979	26.6109	27.4979	26.6109	27.4979	27.4979	26.6109	27.4979	26.6109	27.4979	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	274.7447	242.9366	257.8330	225.9039	218.4890	196.3236	193.2732	201.2004	203.7044	227.8281	243.1135	271.6251	(62)
WWHRS	-31.6893	-28.0263	-29.3475	-24.3009	-22.6476	-19.3797	-18.1654	-19.3170	-20.0510	-23.6379	-26.7789	-31.1025	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	243.0553	214.9103	228.4855	201.6030	195.8415	176.9439	175.1079	181.8834	183.6534	204.1902	216.3347	240.5226	(64)
										Total per year (kWh/year) = Sum(64)m =		2462.5316	(64)
12Total per year (kWh/year)												2463	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	115.0831	102.2104	109.4599	98.0780	96.3781	88.2426	87.9938	90.6296	90.6967	99.4833	103.8002	114.0458	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	128.3915	142.1477	128.3915	132.6712	128.3915	132.6712	128.3915	128.3915	132.6712	128.3915	132.6712	128.3915	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													

	248.2231	250.7989	244.3080	230.4897	213.0465	196.6524	185.7002	183.1244	189.6153	203.4336	220.8767	237.2708 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901 (71)
Water heating gains (Table 5)												
	154.6815	152.0988	147.1236	136.2195	129.5404	122.5591	118.2712	121.8140	125.9676	133.7141	144.1670	153.2874 (72)
Total internal gains												
	597.6424	611.3916	586.1693	565.7266	537.3247	515.2290	495.7092	496.6761	511.6003	531.8854	564.0611	585.2959 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.9500	11.2829	0.6300	0.7000	0.7700	37.7579	(75)
Southwest	5.7600	36.7938	0.6300	0.7000	0.7700	64.7693	(79)

Solar gains	102.5273	187.1835	289.4255	414.4498	515.1842	533.8768	505.3848	426.8051	332.1811	215.8597	125.0880	86.2641	(83)
Total gains	700.1696	798.5751	875.5948	980.1764	1052.5089	1049.1058	1001.0940	923.4812	843.7815	747.7451	689.1491	671.5600	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.9048	19.9521	19.9986	20.2199	20.2618	20.4595	20.4595	20.4965	20.3829	20.2618	20.1771	20.0894	
alpha	2.3270	2.3301	2.3332	2.3480	2.3508	2.3640	2.3640	2.3664	2.3589	2.3508	2.3451	2.3393	
util living area													
	0.9314	0.9069	0.8698	0.7943	0.6844	0.5434	0.4241	0.4677	0.6547	0.8270	0.9063	0.9369	(86)
MIT	18.1785	18.5155	19.0308	19.7277	20.3199	20.7260	20.8906	20.8588	20.5483	19.7886	18.8835	18.1262	(87)
Th 2	19.9573	19.9595	19.9617	19.9719	19.9738	19.9827	19.9827	19.9843	19.9792	19.9738	19.9699	19.9659	(88)
util rest of house													
	0.9228	0.8954	0.8533	0.7675	0.6417	0.4790	0.3394	0.3820	0.5948	0.7984	0.8929	0.9290	(89)
MIT 2	16.6692	17.0931	17.7389	18.6012	19.3042	19.7586	19.9161	19.8935	19.5819	18.6954	17.5696	16.6081	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	17.0038	17.4084	18.0252	18.8509	19.5293	19.9731	20.1321	20.1075	19.7961	18.9378	17.8608	16.9446	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.0038	17.4084	18.0252	18.8509	19.5293	19.9731	20.1321	20.1075	19.7961	18.9378	17.8608	16.9446	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8885	0.8578	0.8141	0.7330	0.6211	0.4784	0.3525	0.3931	0.5828	0.7631	0.8559	0.8961	(94)
Useful gains	622.1005	685.0011	712.8020	718.4703	653.7264	501.8644	352.8490	362.9780	491.7948	570.5944	589.8307	601.7860	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1394.2402	1369.5514	1258.9669	1075.0984	844.1304	573.7081	377.1447	395.1511	610.4905	898.9463	1165.0629	1385.8749	(97)
Space heating kWh													
	574.4719	460.0178	406.3466	256.7722	141.6606	0.0000	0.0000	0.0000	0.0000	244.2938	414.1671	583.3622	(98a)
Space heating requirement - total per year (kWh/year)												3081.0922	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	574.4719	460.0178	406.3466	256.7722	141.6606	0.0000	0.0000	0.0000	0.0000	244.2938	414.1671	583.3622	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3081.0922	
Space heating per m2											(98c) / (4) =	32.3848	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	574.4719	460.0178	406.3466	256.7722	141.6606	0.0000	0.0000	0.0000	0.0000	244.2938	414.1671	583.3622	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	622.3964	498.3942	440.2456	278.1931	153.4784	0.0000	0.0000	0.0000	0.0000	264.6736	448.7184	632.0284	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	243.0553	214.9103	228.4855	201.6030	195.8415	176.9439	175.1079	181.8834	183.6534	204.1902	216.3347	240.5226	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.9191	85.7216	85.3360	84.6033	83.3456	79.8000	79.8000	79.8000	79.8000	84.4630	85.4917	85.9694	(217)
Fuel for water heating, kWh/month													
	282.8887	250.7073	267.7479	238.2920	234.9753	221.7342	219.4334	227.9240	230.1421	241.7511	253.0475	279.7769	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	26.6772	21.4014	19.2696	14.1178	10.9050	8.9094	9.9479	12.9306	16.7956	22.0367	24.8904	27.4187	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-43.7273	-61.2512	-87.4769	-97.6894	-104.7589	-97.5416	-96.2965	-91.1670	-82.0635	-69.6860	-47.9165	-37.8482	(233a)

Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-25.9245	-54.3936	-107.8641	-161.6637	-213.4533	-214.3907	-211.9042	-179.5910	-131.8391	-77.7180	-34.5868	-20.5145 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3338.1281	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2948.4206	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	215.3004	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2351.2664	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4236.5827	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3338.1281	0.2100	701.0069	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2948.4206	0.2100	619.1683	(264)
Space and water heating			1320.1752	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	215.3004	0.1443	31.0745	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-917.4229	0.1347	-123.6078	
PV Unit electricity exported	-1433.8435	0.1260	-180.5987	
Total			-304.2065	(269)
Total CO2, kg/year			1058.9725	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.1300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3338.1281	1.1300	3772.0847	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2948.4206	1.1300	3331.7153	(278)
Space and water heating			7103.8001	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	215.3004	1.5338	330.2349	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-917.4229	1.4980	-1374.2639	
PV Unit electricity exported	-1433.8435	0.4623	-662.9248	
Total			-2037.1887	(283)
Total Primary energy kWh/year			5526.9471	(286)
Target Primary Energy Rate (TPER)			58.0900	(287)

Full SAP Calculation Printout

Plot Reference	79841-02	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	3B5P (Semi)
Plot Address	Plot 2, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	84 B	**DER**	3.80	**TER**	11.13
Environmental	97 A	**% DER < TER**			65.86
CO_2 Emissions (t/year)	0.33	**DFEE**	38.63	**TFEE**	39.28
Compliance Check	See BREL	**% DFEE < TFEE**			1.65
% DPER < TPER	31.59	**DPER**	39.74	**TPER**	58.09

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700 (1b)	x	2.5500 (2b)	=	121.3035	(1b) - (3b)
First floor	47.5700 (1c)	x	2.8300 (2c)	=	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	255.9266	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1172	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3172	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2696	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3438	0.3370	0.3303	0.2966	0.2899	0.2562	0.2562	0.2494	0.2696	0.2899	0.3033	0.3168	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

Effective ac	0.5938	0.5870	0.5803	0.5466	0.5399	0.5062	0.5062	0.5000	0.5196	0.5399	0.5533	0.5668	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.0000	1.1450	12.5954			(27)
Glazed Doors			5.7100	1.1450	6.5382			(27)
GF			47.5700	0.1100	5.2327	75.0000	3567.7500	(28a)
Main	115.8314	18.8600	96.9714	0.1900	18.4246	9.0000	872.7426	(29a)
PIJ	47.5700		47.5700	0.0900	4.2813	9.0000	428.1300	(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.2222			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000	20.0000	668.2000	(32)
Timber			93.9800			9.0000	845.8200	(32c)
Timber			21.9300			9.0000	197.3700	(32c)
FF			47.5700			18.0000	856.2600	(32d)
GF			47.5700			9.0000	428.1300	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7864.4026 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 82.6614 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.2600	0.0460	0.5640
E3 Sill	12.2600	0.0470	0.5762
E4 Jamb	37.2000	0.0530	1.9716
E5 Ground floor (normal)	21.5300	0.0680	1.4640
E10 Eaves (insulation at ceiling level)	15.3200	0.0910	1.3941
E12 Gable (insulation at ceiling level)	6.2100	0.0750	0.4657
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	6.2100	0.1160	0.7204
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.0460	0.2857
E6 Intermediate floor within a dwelling	21.5300	0.0540	1.1626

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.6803 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 58.9025 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.1489	49.5795	49.0102	46.1637	45.5944	42.7478	42.7478	42.2279	43.8864	45.5944	46.7330	47.8716	(38)
Heat transfer coeff	109.0513	108.4820	107.9127	105.0662	104.4968	101.6503	101.6503	101.1304	102.7889	104.4968	105.6355	106.7741	(39)
Average = Sum(39)m / 12 =												104.9279	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1462	1.1402	1.1343	1.1043	1.0983	1.0684	1.0684	1.0630	1.0804	1.0983	1.1103	1.1223	(40)
HLP (average)												1.1029	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6898 (42)
Hot water usage for mixer showers

69.3181	68.2763	66.7584	63.8540	61.7106	59.3203	57.9617	59.4682	61.1196	63.6860	66.6528	69.0525	(42a)

Hot water usage for baths

29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)

Hot water usage for other uses

42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)

Average daily hot water use (litres/day) 130.0024 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	141.4261	138.4062	134.7285	129.1362	124.5949	119.7126	117.8364	121.4982	125.3600	130.4856	136.1640	141.0593	(44)
Energy conte	223.9843	197.0885	207.0727	176.7810	167.7287	147.2007	142.5129	150.4401	154.5815	177.0677	193.9906	220.8648	(45)
Energy content (annual)										Total = Sum(45)m =		2159.3135	
Distribution loss (46)m = 0.15 x (45)m	33.5976	29.5633	31.0609	26.5172	25.1593	22.0801	21.3769	22.5660	23.1872	26.5602	29.0986	33.1297	(46)

Water storage loss (or HIU loss):
Store volume 198.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.5000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.8100 (55)
Total storage loss

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)

If cylinder contains dedicated solar storage

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(64)
										Total per year (kWh/year) = Sum(64)m =		2728.8595	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

113.1727	100.4849	107.5496	96.2293	94.4677	86.3938	86.0835	88.7193	88.8479	97.5729	101.9515	112.1355	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.7636	27.3239	22.2213	16.8230	12.5754	10.6166	11.4717	14.9113	20.0139	25.4123	29.6599	31.6186	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	370.4822	374.3267	364.6388	344.0144	317.9799	293.5111	277.1644	273.3200	283.0079	303.6322	329.6668	354.1356	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	(71)
Water heating gains (Table 5)	152.1139	149.5311	144.5559	133.6518	126.9727	119.9914	115.7036	119.2463	123.3999	131.1464	141.5993	150.7197	(72)
Total internal gains	660.9829	658.8050	639.0393	602.1125	565.1513	531.7425	511.9630	515.1009	534.0450	567.8142	608.5492	644.0971	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.2400	11.2829	0.3000	0.0000	0.7700	13.6573	(75)

Southwest			5.7600		36.7938		0.3000		0.0000		0.7700		48.9564 (79)
Northeast			5.7100		11.2829		0.3000		0.0000		0.7700		14.8823 (75)
Solar gains	77.4960	141.4841	218.7646	313.2651	389.4060	403.5350	381.9991	322.6040	251.0817	163.1592	94.5487	65.2034	(83)
Total gains	738.4790	800.2891	857.8039	915.3776	954.5573	935.2775	893.9621	837.7049	785.1267	730.9734	703.0979	709.3005	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.0324	20.1375	20.2437	20.7922	20.9055	21.4909	21.4909	21.6014	21.2528	20.9055	20.6801	20.4596	
alpha	2.3355	2.3425	2.3496	2.3861	2.3937	2.4327	2.4327	2.4401	2.4169	2.3937	2.3787	2.3640	
util living area	0.9240	0.9060	0.8730	0.8095	0.7116	0.5727	0.4492	0.4876	0.6706	0.8287	0.9014	0.9295	(86)
Living	18.2710	18.5463	19.0357	19.7082	20.2857	20.7160	20.8871	20.8595	20.5506	19.8255	18.9718	18.2556	
Non living	17.4886	17.7612	18.2422	18.9059	19.4477	19.8417	19.9715	19.9587	19.7045	19.0326	18.1993	17.4863	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.6039	18.5463	19.0357	19.7082	20.2857	20.7160	20.8871	20.8595	20.5506	19.8255	18.9718	18.6395	(87)
Th 2	19.9633	19.9681	19.9730	19.9973	20.0022	20.0267	20.0267	20.0312	20.0169	20.0022	19.9924	19.9827	(88)
util rest of house	0.9147	0.8945	0.8569	0.7843	0.6709	0.5098	0.3646	0.4034	0.6129	0.8009	0.8876	0.9208	(89)
MIT 2	18.6973	17.7612	18.2422	18.9059	19.4477	19.8417	19.9715	19.9587	19.7045	19.0326	18.1993	17.8355	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	18.8983	17.9353	18.4181	19.0837	19.6334	20.0355	20.1744	20.1584	19.8921	19.2084	18.3705	18.0137	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8983	17.9353	18.4181	19.0837	19.6334	20.0355	20.1744	20.1584	19.8921	19.2084	18.3705	18.0137	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9034	0.8655	0.8268	0.7574	0.6542	0.5104	0.3782	0.4151	0.6047	0.7744	0.8593	0.8995	(94)
Useful gains	667.1350	692.6899	709.2373	693.3322	624.4582	477.3398	338.0626	347.7645	474.7788	566.0790	604.1585	637.9921	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1591.9656	1414.0915	1286.1111	1069.9632	829.0197	552.5224	363.3436	380.0839	595.3595	899.5481	1190.5652	1474.9447	(97)
Space heating kWh	688.0740	484.7819	429.1941	271.1743	152.1938	0.0000	0.0000	0.0000	0.0000	248.1010	422.2128	622.6927	(98a)
Space heating requirement - total per year (kWh/year)												3318.4246	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	688.0740	484.7819	429.1941	271.1743	152.1938	0.0000	0.0000	0.0000	0.0000	248.1010	422.2128	622.6927	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3318.4246	
Space heating per m2											(98c) / (4) =	34.8794	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												285.6431	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement	688.0740	484.7819	429.1941	271.1743	152.1938	0.0000	0.0000	0.0000	0.0000	248.1010	422.2128	622.6927	(98)
Space heating efficiency (main heating system 1)	285.6431	285.6431	285.6431	285.6431	285.6431	0.0000	0.0000	0.0000	0.0000	285.6431	285.6431	285.6431	(210)
Space heating fuel (main heating system)	240.8859	169.7160	150.2554	94.9347	53.2811	0.0000	0.0000	0.0000	0.0000	86.8570	147.8113	217.9968	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	95.5956	84.5123	89.6597	78.4799	75.8502	68.0973	66.9996	69.7820	70.6879	79.1282	84.5203	94.5007	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.7468	4.2874	4.7468	4.5936	4.7468	4.5936	4.7468	4.7468	4.5936	4.7468	4.5936	4.7468	(231)
Lighting	26.9272	21.6020	19.4502	14.2500	11.0071	8.9929	10.0411	13.0518	16.9530	22.2432	25.1236	27.6755	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1161.7383	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	284.9050	
Water heating fuel used	957.8138	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)		
mechanical ventilation fans (SFP = 0.1790)	55.8892	(230a)
Total electricity for the above, kWh/year	55.8892	(231)
Electricity for lighting (calculated in Appendix L)	217.3176	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2392.7589	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1161.7383	16.4900	191.5706	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	957.8138	16.4900	157.9435	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	55.8892	16.4900	9.2161	(249)
Energy for lighting	217.3176	16.4900	35.8357	(250)
Additional standing charges			0.0000	(251)
Total energy cost			394.5659	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0136	(257)
SAP value		83.5698	
SAP rating (Section 12)		84	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1161.7383	0.1547	179.6824	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	957.8138	0.1410	135.0326	(264)
Space and water heating			314.7150	(265)
Pumps, fans and electric keep-hot	55.8892	0.1387	7.7525	(267)
Energy for lighting	217.3176	0.1443	31.3656	(268)
Total CO2, kg/year			353.8331	(272)
CO2 emissions per m2			3.7200	(273)
EI value			96.6167	
EI rating			97	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700	(1b) x	2.5500	(2b) =	121.3035	(1b) - (3b)
First floor	47.5700	(1c) x	2.8300	(2c) =	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		255.9266	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1172 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.3172 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2696 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.5000	4.4000	4.4000	4.0000	4.1000	3.5000	3.4000	3.4000	3.5000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1250	1.1000	1.1000	1.0000	1.0250	0.8750	0.8500	0.8500	0.8750	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.3033	0.2966	0.2966	0.2696	0.2764	0.2359	0.2292	0.2292	0.2359	0.2629	0.2629	0.2696	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5533	0.5466	0.5466	0.5196	0.5264	0.5000	0.5000	0.5000	0.5000	0.5129	0.5129	0.5196	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.0000	1.1450	12.5954			(27)
Glazed Doors			5.7100	1.1450	6.5382			(27)
GF			47.5700	0.1100	5.2327	75.0000	3567.7500	(28a)
Main	115.8314	18.8600	96.9714	0.1900	18.4246	9.0000	872.7426	(29a)
PIJ	47.5700		47.5700	0.0900	4.2813	9.0000	428.1300	(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.2222			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000	20.0000	668.2000	(32)
Timber			93.9800			9.0000	845.8200	(32c)
Timber			21.9300			9.0000	197.3700	(32c)
FF			47.5700			18.0000	856.2600	(32d)
GF			47.5700			9.0000	428.1300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 7864.4026 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	82.6614 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.2600	0.0460	0.5640
E3 Sill	12.2600	0.0470	0.5762
E4 Jamb	37.2000	0.0530	1.9716
E5 Ground floor (normal)	21.5300	0.0680	1.4640
E10 Eaves (insulation at ceiling level)	15.3200	0.0910	1.3941
E12 Gable (insulation at ceiling level)	6.2100	0.0750	0.4657
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	6.2100	0.1160	0.7204
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.0460	0.2857
E6 Intermediate floor within a dwelling	21.5300	0.0540	1.1626

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.6803 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	58.9025 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.7330	46.1637	46.1637	43.8864	44.4557	42.2279	42.2279	42.2279	42.2279	43.3171	43.3171	43.8864	(38)
Heat transfer coeff	105.6355	105.0662	105.0662	102.7889	103.3582	101.1304	101.1304	101.1304	101.1304	102.2196	102.2196	102.7889	(39)
Average = Sum(39)m / 12 =												102.8054	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1103	1.1043	1.1043	1.0804	1.0864	1.0630	1.0630	1.0630	1.0630	1.0744	1.0744	1.0804	(40)
HLP (average)												1.0806	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6898 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
69.3181	68.2763	66.7584	63.8540	61.7106	59.3203	57.9617	59.4682	61.1196	63.6860	66.6528	69.0525	(42a)

Hot water usage for baths

29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)

Hot water usage for other uses

42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)

Average daily hot water use (litres/day)	130.0024 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	141.4261	138.4062	134.7285	129.1362	124.5949	119.7126	117.8364	121.4982	125.3600	130.4856	136.1640	141.0593	(44)
Energy conte	223.9843	197.0885	207.0727	176.7810	167.7287	147.2007	142.5129	150.4401	154.5815	177.0677	193.9906	220.8648	(45)
Energy content (annual)										Total = Sum(45)m =		2159.3135	
Distribution loss (46)m = 0.15 x (45)m	33.5976	29.5633	31.0609	26.5172	25.1593	22.0801	21.3769	22.5660	23.1872	26.5602	29.0986	33.1297	(46)

Water storage loss (or HIU loss):	
Store volume	198.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.5000 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.8100 (55)

Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)

PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(64)
											Total per year (kWh/year) = Sum(64)m =	2728.8595	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	(64a)
Heat gains from water heating, kWh/month													
	113.1727	100.4849	107.5496	96.2293	94.4677	86.3938	86.0835	88.7193	88.8479	97.5729	101.9515	112.1355	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	30.7636	27.3239	22.2213	16.8230	12.5754	10.6166	11.4717	14.9113	20.0139	25.4123	29.6599	31.6186	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	370.4822	374.3267	364.6388	344.0144	317.9799	293.5111	277.1644	273.3200	283.0079	303.6322	329.6668	354.1356	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	(71)
Water heating gains (Table 5)													
	152.1139	149.5311	144.5559	133.6518	126.9727	119.9914	115.7036	119.2463	123.3999	131.1464	141.5993	150.7197	(72)
Total internal gains													
	660.9829	658.8050	639.0393	602.1125	565.1513	531.7425	511.9630	515.1009	534.0450	567.8142	608.5492	644.0971	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.2400	9.9768	0.3000	0.0000	0.7700	12.0763	(75)
Southwest	5.7600	32.4665	0.3000	0.0000	0.7700	43.1986	(79)
Northeast	5.7100	9.9768	0.3000	0.0000	0.7700	13.1595	(75)

Solar gains	68.4345	128.1917	209.4359	304.7615	367.0320	391.4022	361.7471	301.9532	246.5183	158.0045	88.6690	61.9867	(83)
Total gains	729.4174	786.9967	848.4751	906.8740	932.1833	923.1446	873.7100	817.0541	780.5633	725.8187	697.2182	706.0838	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.6801	20.7922	20.7922	21.2528	21.1358	21.6014	21.6014	21.6014	21.6014	21.3712	21.3712	21.2528	
alpha	2.3787	2.3861	2.3861	2.4169	2.4091	2.4401	2.4401	2.4401	2.4401	2.4247	2.4247	2.4169	
util living area													
	0.9182	0.8992	0.8620	0.7888	0.6768	0.5250	0.4134	0.4546	0.6463	0.8113	0.8926	0.9235	(86)
Living	18.5201	18.7824	19.2497	19.9027	20.4431	20.7978	20.9177	20.8930	20.6214	19.9822	19.1828	18.5086	
Non living	17.7531	18.0124	18.4669	19.1048	19.5977	19.9104	19.9956	19.9818	19.7760	19.1949	18.4250	17.7576	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.7314	18.7824	19.2497	19.9027	20.4431	20.7978	20.9177	20.8930	20.6214	19.9822	19.1828	18.8571	(87)
Th 2	19.9924	19.9973	19.9973	20.0169	20.0120	20.0312	20.0312	20.0312	20.0312	20.0218	20.0218	20.0169	(88)
util rest of house													
	0.9080	0.8867	0.8442	0.7604	0.6296	0.4545	0.3228	0.3631	0.5846	0.7802	0.8774	0.9141	(89)
MIT 2	18.8469	18.0124	18.4669	19.1048	19.5977	19.9104	19.9956	19.9818	19.7760	19.1949	18.4250	18.0736	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	19.0429	18.1831	18.6404	19.2816	19.7851	20.1071	20.2000	20.1838	19.9634	19.3694	18.5930	18.2473	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0429	18.1831	18.6404	19.2816	19.7851	20.1071	20.2000	20.1838	19.9634	19.3694	18.5930	18.2473	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8967	0.8581	0.8150	0.7359	0.6176	0.4604	0.3394	0.3784	0.5799	0.7558	0.8496	0.8927	(94)
Useful gains	654.0588	675.3372	691.5218	667.3790	575.7410	424.9959	296.5230	309.1414	452.6128	548.5783	592.3479	630.3348	(95)
Ext temp.	5.0000	5.6000	7.2000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.2000	7.7000	4.8000	(96)
Heat loss rate W													
	1483.4318	1322.0540	1202.0000	984.8867	732.3009	476.0312	313.5081	332.0882	552.5144	835.0712	1113.4747	1382.2329	(97)
Space heating kWh													
	617.0535	434.5937	379.7958	228.6056	116.4806	0.0000	0.0000	0.0000	0.0000	213.1507	375.2113	559.4122	(98a)
Space heating requirement - total per year (kWh/year)												2924.3033	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	617.0535	434.5937	379.7958	228.6056	116.4806	0.0000	0.0000	0.0000	0.0000	213.1507	375.2113	559.4122	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2924.3033	
Space heating per m2											(98c) / (4) =	30.7368	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	286.1613	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	617.0535	434.5937	379.7958	228.6056	116.4806	0.0000	0.0000	0.0000	0.0000	213.1507	375.2113	559.4122	(98)
Space heating efficiency (main heating system 1)	286.1613	286.1613	286.1613	286.1613	286.1613	0.0000	0.0000	0.0000	0.0000	286.1613	286.1613	286.1613	(210)
Space heating fuel (main heating system)	215.6314	151.8702	132.7209	79.8870	40.7045	0.0000	0.0000	0.0000	0.0000	74.4862	131.1188	195.4884	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	95.5956	84.5123	89.6597	78.4799	75.8502	68.0973	66.9996	69.7820	70.6879	79.1282	84.5203	94.5007	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.7468	4.2874	4.7468	4.5936	4.7468	4.5936	4.7468	4.7468	4.5936	4.7468	4.5936	4.7468	(231)
Lighting	26.9272	21.6020	19.4502	14.2500	11.0071	8.9929	10.0411	13.0518	16.9530	22.2432	25.1236	27.6755	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1021.9074	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	284.9050	
Water heating fuel used	957.8138	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)		
mechanical ventilation fans (SFP = 0.1790)	55.8892	(230a)
Total electricity for the above, kWh/year	55.8892	(231)
Electricity for lighting (calculated in Appendix L)	217.3176	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2252.9280	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1021.9074	26.0000	265.6959	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	957.8138	26.0000	249.0316	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	55.8892	26.0000	14.5312	(249)
Energy for lighting	217.3176	26.0000	56.5026	(250)
Additional standing charges			0.0000	(251)
Total energy cost			585.7613	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1021.9074	0.1549	158.3440	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	957.8138	0.1410	135.0326	(264)
Space and water heating			293.3766	(265)
Pumps, fans and electric keep-hot	55.8892	0.1387	7.7525	(267)
Energy for lighting	217.3176	0.1443	31.3656	(268)
Total CO2, kg/year			332.4947	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1021.9074	1.5736	1608.1055	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	957.8138	1.5213	1457.1193	(278)
Space and water heating			3065.2248	(279)
Pumps, fans and electric keep-hot	55.8892	1.5128	84.5493	(281)
Energy for lighting	217.3176	1.5338	333.3289	(282)

Total Primary energy kWh/year 3483.1030 (286)

SAP 10 EPC IMPROVEMENTS

001

Current energy efficiency rating: B 84
Current environmental impact rating: A 97

N	Solar water heating		Recommended
U	Solar photovoltaic panels		Recommended
V2	Wind turbine		Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.4	-£ 49	-23 kg (7.0%)
U Solar photovoltaic panels	+ 7.9	-£ 262	-212 kg (68.5%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£49	0.25 kg/m²	B 85	A 97
Solar photovoltaic panels	£262	2.23 kg/m²	A 93	A 99
Total Savings	£311	2.47 kg/m²		

Potential energy efficiency rating: A 93
Potential environmental impact rating: A 99

Fuel prices for cost data on this page from database revision number 599 TEST (30 Sep 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, West Pennines (England)):

	Current	Potential	Saving
Electricity	£586	£537	£49
Space heating	£280	£304	-£24
Water heating	£249	£176	£73
Lighting	£57	£57	£0
Generated (PV)	-£0	-£262	£262
Total cost of fuels	£586	£275	£311
Total cost of uses	£586	£275	£311
Delivered energy	24 kWh/m²	4 kWh/m²	19 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.1 tonnes	0.2 tonnes
CO2 emissions per m²	3 kg/m²	1 kg/m²	2 kg/m²
Primary energy	37 kWh/m²	17 kWh/m²	20 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700	(1b) x	2.5500	(2b) =	121.3035	(1b) - (3b)
First floor	47.5700	(1c) x	2.8300	(2c) =	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		255.9266	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1172	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3172	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2696	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)

Adj infilt rate

	0.3438	0.3370	0.3303	0.2966	0.2899	0.2562	0.2562	0.2494	0.2696	0.2899	0.3033	0.3168 (22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

Effective ac	0.5938	0.5870	0.5803	0.5466	0.5399	0.5062	0.5062	0.5000	0.5196	0.5399	0.5533	0.5668 (25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.0000	1.1450	12.5954			(27)
Glazed Doors			5.7100	1.1450	6.5382			(27)
GF			47.5700	0.1100	5.2327	75.0000	3567.7500	(28a)
Main	115.8314	18.8600	96.9714	0.1900	18.4246	9.0000	872.7426	(29a)
PIJ	47.5700		47.5700	0.0900	4.2813	9.0000	428.1300	(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.2222			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000	20.0000	668.2000	(32)
Timber			93.9800			9.0000	845.8200	(32c)
Timber			21.9300			9.0000	197.3700	(32c)
FF			47.5700			18.0000	856.2600	(32d)
GF			47.5700			9.0000	428.1300	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7864.4026 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 82.6614 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.2600	0.0460	0.5640
E3 Sill	12.2600	0.0470	0.5762
E4 Jamb	37.2000	0.0530	1.9716
E5 Ground floor (normal)	21.5300	0.0680	1.4640
E10 Eaves (insulation at ceiling level)	15.3200	0.0910	1.3941
E12 Gable (insulation at ceiling level)	6.2100	0.0750	0.4657
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	6.2100	0.1160	0.7204
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.0460	0.2857
E6 Intermediate floor within a dwelling	21.5300	0.0540	1.1626

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.6803 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 58.9025 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.1489	49.5795	49.0102	46.1637	45.5944	42.7478	42.7478	42.2279	43.8864	45.5944	46.7330	47.8716	(38)
Heat transfer coeff	109.0513	108.4820	107.9127	105.0662	104.4968	101.6503	101.6503	101.1304	102.7889	104.4968	105.6355	106.7741	(39)
Average = Sum(39)m / 12 =												104.9279	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1462	1.1402	1.1343	1.1043	1.0983	1.0684	1.0684	1.0630	1.0804	1.0983	1.1103	1.1223	(40)
HLP (average)												1.1029	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6898 (42)

Hot water usage for mixer showers

69.3181	68.2763	66.7584	63.8540	61.7106	59.3203	57.9617	59.4682	61.1196	63.6860	66.6528	69.0525	(42a)

Hot water usage for baths

29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)

Hot water usage for other uses

42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)

Average daily hot water use (litres/day) 130.0024 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	141.4261	138.4062	134.7285	129.1362	124.5949	119.7126	117.8364	121.4982	125.3600	130.4856	136.1640	141.0593	(44)
Energy conte	223.9843	197.0885	207.0727	176.7810	167.7287	147.2007	142.5129	150.4401	154.5815	177.0677	193.9906	220.8648	(45)
Energy content (annual)										Total = Sum(45)m =		2159.3135	
Distribution loss (46)m = 0.15 x (45)m	33.5976	29.5633	31.0609	26.5172	25.1593	22.0801	21.3769	22.5660	23.1872	26.5602	29.0986	33.1297	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage	15.5986	14.0891	15.5986	15.0955	15.5986	15.0955	15.5986	15.5986	15.0955	15.5986	15.0955	15.5986	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	262.8454	232.1888	244.5380	207.6349	193.7954	172.2014	168.3470	177.2047	186.7860	214.5330	231.5981	259.7258	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
If combined cylinder, total volume of cylinder												198.0000	(H13)
Effective solar volume												111.9000	(H14)
Reference volume												225.0000	(H15)

Storage tank correction coefficient												1.1908	(H16)
Heat delivered to hot water												652.0514	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												652.0514	
Solar input	-0.0000	-19.9133	-62.1742	-83.6265	-107.4087	-98.8285	-98.0326	-86.6188	-61.4012	-32.9585	-1.0890	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	262.8454	212.2755	182.3638	124.0084	86.3867	73.3729	70.3143	90.5859	125.3849	181.5745	230.5090	259.7258	(64)
									Total per year (kWh/year) = Sum(64)m =			1899.3470	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
							Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =					0.0000	(64a)
Heat gains from water heating, kWh/month													
	105.5636	93.6122	98.8239	83.4628	76.6232	68.9448	68.0528	71.4330	77.1620	88.8472	94.5878	104.5264	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	30.7636	27.3239	22.2213	16.8230	12.5754	10.6166	11.4717	14.9113	20.0139	25.4123	29.6599	31.6186	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	370.4822	374.3267	364.6388	344.0144	317.9799	293.5111	277.1644	273.3200	283.0079	303.6322	329.6668	354.1356	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	(71)
Water heating gains (Table 5)													
	141.8866	139.3038	132.8278	115.9205	102.9881	95.7567	91.4688	96.0121	107.1694	119.4183	131.3720	140.4924	(72)
Total internal gains													
	650.7556	648.5777	627.3112	584.3812	541.1667	507.5077	487.7282	491.8667	517.8145	556.0861	598.3219	633.8698	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.2400	11.2829	0.3000	0.0000	0.7700	13.6573	(75)
Southwest	5.7600	36.7938	0.3000	0.0000	0.7700	48.9564	(79)
Northeast	5.7100	11.2829	0.3000	0.0000	0.7700	14.8823	(75)

Solar gains	77.4960	141.4841	218.7646	313.2651	389.4060	403.5350	381.9991	322.6040	251.0817	163.1592	94.5487	65.2034	(83)
Total gains	728.2517	790.0618	846.0758	897.6463	930.5727	911.0427	869.7273	814.4707	768.8963	719.2454	692.8707	699.0732	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.0324	20.1375	20.2437	20.7922	20.9055	21.4909	21.4909	21.6014	21.2528	20.9055	20.6801	20.4596	
alpha	2.3355	2.3425	2.3496	2.3861	2.3937	2.4327	2.4327	2.4401	2.4169	2.3937	2.3787	2.3640	
util living area													
	0.9260	0.9081	0.8759	0.8149	0.7205	0.5828	0.4591	0.4981	0.6783	0.8329	0.9039	0.9313	(86)
Living	18.2517	18.5281	19.0168	19.6851	20.2641	20.7044	20.8814	20.8526	20.5383	19.8092	18.9536	18.2358	
Non living	17.4699	17.7436	18.2243	18.8848	19.4295	19.8335	19.9685	19.9548	19.6951	19.0178	18.1819	17.4670	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.5941	18.5281	19.0168	19.6851	20.2641	20.7044	20.8814	20.8526	20.5383	19.8092	18.9536	18.6225	(87)
Th 2	19.9633	19.9681	19.9730	19.9973	20.0022	20.0267	20.0267	20.0312	20.0169	20.0022	19.9924	19.9827	(88)
util rest of house													
	0.9168	0.8968	0.8600	0.7901	0.6802	0.5197	0.3734	0.4130	0.6208	0.8055	0.8904	0.9229	(89)
MIT 2	18.6878	17.7436	18.2243	18.8848	19.4295	19.8335	19.9685	19.9548	19.6951	19.0178	18.1819	17.8189	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	18.8887	17.9175	18.4000	19.0622	19.6145	20.0266	20.1709	20.1538	19.8820	19.1932	18.3530	17.9970	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8887	17.9175	18.4000	19.0622	19.6145	20.0266	20.1709	20.1538	19.8820	19.1932	18.3530	17.9970	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9056	0.8680	0.8300	0.7630	0.6627	0.5197	0.3868	0.4244	0.6120	0.7789	0.8622	0.9018	(94)
Useful gains	659.5153	685.8089	702.2323	684.9189	616.7090	473.4353	336.4173	345.6993	470.5826	560.1999	597.4258	630.4165	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1590.9131	1412.1682	1284.1640	1067.7050	827.0390	551.6116	362.9789	379.6217	594.3257	897.9674	1188.7140	1473.1650	(97)
Space heating kWh													
	692.9599	488.1135	432.9572	275.6060	156.4855	0.0000	0.0000	0.0000	0.0000	251.2990	425.7275	627.0049	(98a)
Space heating requirement - total per year (kWh/year)												3350.1535	
Solar heating kWh													
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	692.9599	488.1135	432.9572	275.6060	156.4855	0.0000	0.0000	0.0000	0.0000	251.2990	425.7275	627.0049	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3350.1535	
Space heating per m2											(98c) / (4) =	35.2129	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)

Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												285.6431	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	692.9599	488.1135	432.9572	275.6060	156.4855	0.0000	0.0000	0.0000	0.0000	251.2990	425.7275	627.0049	(98)
Space heating efficiency (main heating system 1)													
	285.6431	285.6431	285.6431	285.6431	285.6431	0.0000	0.0000	0.0000	0.0000	285.6431	285.6431	285.6431	(210)
Space heating fuel (main heating system)													
	242.5965	170.8823	151.5728	96.4861	54.7836	0.0000	0.0000	0.0000	0.0000	87.9766	149.0418	219.5064	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	262.8454	212.2755	182.3638	124.0084	86.3867	73.3729	70.3143	90.5859	125.3849	181.5745	230.5090	259.7258	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month													
	92.2572	74.5075	64.0086	43.5262	30.3212	25.7535	24.6799	31.7951	44.0094	63.7316	80.9073	91.1622	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5413	10.4244	11.5413	11.1690	11.5413	11.1690	11.5413	11.5413	11.1690	11.5413	11.1690	11.5413	(231)
Lighting	26.9272	21.6020	19.4502	14.2500	11.0071	8.9929	10.0411	13.0518	16.9530	22.2432	25.1236	27.6755	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-38.0992	-56.3669	-84.4848	-96.8839	-103.3352	-90.3781	-89.0958	-83.8778	-74.2858	-64.5119	-42.3440	-32.4195	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-11.9873	-27.2131	-57.8614	-93.8882	-132.3476	-141.3356	-139.5557	-115.8962	-82.1773	-42.3340	-17.0658	-9.4943	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1172.8462	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												284.9050	
Water heating fuel used												666.6598	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)													
mechanical ventilation fans (SFP = 0.1790)												55.8892	(230a)
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												135.8892	(231)
Electricity for lighting (calculated in Appendix L)												217.3176	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1727.2394	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												465.4733	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1172.8462	16.4900	193.4023	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	666.6598	16.4900	109.9322	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	55.8892	16.4900	9.2161	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	217.3176	16.4900	35.8357	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-856.0828	16.4900	-141.1681	
PV Unit electricity exported	-871.1566	5.5900	-48.6977	
Total			-189.8657	(252)
Total energy cost			171.7126	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4411	(257)
SAP value		92.8497	
SAP rating (Section 12)		93	(258)
SAP band		A	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	

Space heating - main system 1	1172.8462	0.1546	181.3537	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	666.6598	0.1462	97.4831	(264)
Space and water heating			278.8368	(265)
Pumps, fans and electric keep-hot	135.8892	0.1387	18.8495	(267)
Energy for lighting	217.3176	0.1443	31.3656	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-856.0828	0.1347	-115.2938	
PV Unit electricity exported	-871.1566	0.1232	-107.3186	
Total			-222.6124	(269)
Total CO2, kg/year			106.4395	(272)
CO2 emissions per m2			1.1200	(273)
EI value			98.9822	
EI rating			99	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700 (1b)	x	2.5500 (2b)	=	121.3035	(1b) - (3b)
First floor	47.5700 (1c)	x	2.8300 (2c)	=	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		255.9266	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1172	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3172	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2696	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.5000	4.4000	4.4000	4.0000	4.1000	3.5000	3.4000	3.4000	3.5000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1250	1.1000	1.1000	1.0000	1.0250	0.8750	0.8500	0.8500	0.8750	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.3033	0.2966	0.2966	0.2696	0.2764	0.2359	0.2292	0.2292	0.2359	0.2629	0.2629	0.2696	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
Effective ac	0.5533	0.5466	0.5466	0.5196	0.5264	0.5000	0.5000	0.5000	0.5000	0.5129	0.5129	0.5196	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.0000	1.1450	12.5954			(27)
Glazed Doors			5.7100	1.1450	6.5382			(27)
GF			47.5700	0.1100	5.2327	75.0000	3567.7500	(28a)
Main	115.8314	18.8600	96.9714	0.1900	18.4246	9.0000	872.7426	(29a)
PIJ	47.5700		47.5700	0.0900	4.2813	9.0000	428.1300	(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.2222			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000	20.0000	668.2000	(32)
Timber			93.9800			9.0000	845.8200	(32c)
Timber			21.9300			9.0000	197.3700	(32c)
FF			47.5700			18.0000	856.2600	(32d)
GF			47.5700			9.0000	428.1300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	7864.4026 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		82.6614 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.2600	0.0460	0.5640
E3 Sill	12.2600	0.0470	0.5762
E4 Jamb	37.2000	0.0530	1.9716

E5 Ground floor (normal)	21.5300	0.0680	1.4640	
E10 Eaves (insulation at ceiling level)	15.3200	0.0910	1.3941	
E12 Gable (insulation at ceiling level)	6.2100	0.0750	0.4657	
E16 Corner (normal)	10.7600	0.0460	0.4950	
E18 Party wall between dwellings	10.7600	0.0540	0.5810	
P1 Party wall - Ground floor	6.2100	0.1160	0.7204	
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.0460	0.2857	
E6 Intermediate floor within a dwelling	21.5300	0.0540	1.1626	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				9.6803 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	58.9025 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.7330	46.1637	46.1637	43.8864	44.4557	42.2279	42.2279	42.2279	42.2279	43.3171	43.3171	43.8864	(38)
Heat transfer coeff	105.6355	105.0662	105.0662	102.7889	103.3582	101.1304	101.1304	101.1304	101.1304	102.2196	102.2196	102.7889	(39)
Average = Sum(39)m / 12 =												102.8054	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1103	1.1043	1.1043	1.0804	1.0864	1.0630	1.0630	1.0630	1.0630	1.0744	1.0744	1.0804	(40)
HLP (average)												1.0806	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6898	(42)
Hot water usage for mixer showers	69.3181	68.2763	66.7584	63.8540	61.7106	59.3203	57.9617	59.4682	61.1196	63.6860	66.6528	69.0525	(42a)
Hot water usage for baths	29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)
Hot water usage for other uses	42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)
Average daily hot water use (litres/day)												130.0024	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	141.4261	138.4062	134.7285	129.1362	124.5949	119.7126	117.8364	121.4982	125.3600	130.4856	136.1640	141.0593	(44)
Energy conte	223.9843	197.0885	207.0727	176.7810	167.7287	147.2007	142.5129	150.4401	154.5815	177.0677	193.9906	220.8648	(45)
Energy content (annual)										Total = Sum(45)m =		2159.3135	
Distribution loss (46)m = 0.15 x (45)m	33.5976	29.5633	31.0609	26.5172	25.1593	22.0801	21.3769	22.5660	23.1872	26.5602	29.0986	33.1297	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage	15.5986	14.0891	15.5986	15.0955	15.5986	15.0955	15.5986	15.5986	15.0955	15.5986	15.0955	15.5986	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	262.8454	232.1888	244.5380	207.6349	193.7954	172.2014	168.3470	177.2047	186.7860	214.5330	231.5981	259.7258	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
If combined cylinder, total volume of cylinder												198.0000	(H13)
Effective solar volume												111.9000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.1908	(H16)
Heat delivered to hot water												618.9847	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												618.9847	
Solar input	-0.0000	-15.4923	-59.0081	-81.5881	-101.6969	-96.4015	-92.8449	-80.4442	-60.1659	-31.3427	-0.0000	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	262.8454	216.6965	185.5299	126.0468	92.0985	75.7999	75.5021	96.7604	126.6201	183.1903	231.5981	259.7258	(64)
									Total per year (kWh/year) = Sum(64)m =			1932.4138	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	105.5636	93.6122	98.8239	83.4628	76.6232	68.9448	68.0528	71.4330	77.1620	88.8472	94.5878	104.5264	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.7636	27.3239	22.2213	16.8230	12.5754	10.6166	11.4717	14.9113	20.0139	25.4123	29.6599	31.6186	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	370.4822	374.3267	364.6388	344.0144	317.9799	293.5111	277.1644	273.3200	283.0079	303.6322	329.6668	354.1356	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	(71)
Water heating gains (Table 5)	141.8866	139.3038	132.8278	115.9205	102.9881	95.7567	91.4688	96.0121	107.1694	119.4183	131.3720	140.4924	(72)
Total internal gains	650.7556	648.5777	627.3112	584.3812	541.1667	507.5077	487.7282	491.8667	517.8145	556.0861	598.3219	633.8698	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.2400	9.9768	0.3000	0.0000	0.7700	12.0763	(75)
Southwest	5.7600	32.4665	0.3000	0.0000	0.7700	43.1986	(79)
Northeast	5.7100	9.9768	0.3000	0.0000	0.7700	13.1595	(75)

Solar gains	68.4345	128.1917	209.4359	304.7615	367.0320	391.4022	361.7471	301.9532	246.5183	158.0045	88.6690	61.9867	(83)
Total gains	719.1901	776.7694	836.7471	889.1427	908.1987	898.9099	849.4753	793.8199	764.3328	714.0906	686.9909	695.8565	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.6801	20.7922	20.7922	21.2528	21.1358	21.6014	21.6014	21.6014	21.6014	21.3712	21.3712	21.2528	
alpha	2.3787	2.3861	2.3861	2.4169	2.4091	2.4401	2.4401	2.4401	2.4401	2.4247	2.4247	2.4169	
util living area	0.9203	0.9015	0.8651	0.7947	0.6863	0.5352	0.4231	0.4650	0.6542	0.8159	0.8954	0.9256	(86)
Living	18.5009	18.7644	19.2314	19.8812	20.4244	20.7889	20.9133	20.8874	20.6103	19.9668	19.1650	18.4889	
Non living	17.7345	17.9950	18.4497	19.0854	19.5825	19.9046	19.9936	19.9789	19.7678	19.1811	18.4080	17.7385	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.7216	18.7644	19.2314	19.8812	20.4244	20.7889	20.9133	20.8874	20.6103	19.9668	19.1650	18.8401	(87)
Th 2	19.9924	19.9973	19.9973	20.0169	20.0120	20.0312	20.0312	20.0312	20.0312	20.0218	20.0218	20.0169	(88)
util rest of house	0.9103	0.8892	0.8476	0.7667	0.6394	0.4641	0.3311	0.3723	0.5927	0.7852	0.8805	0.9164	(89)
MIT 2	18.8374	17.9950	18.4497	19.0854	19.5825	19.9046	19.9936	19.9789	19.7678	19.1811	18.4080	18.0572	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	19.0334	18.1656	18.6230	19.2618	19.7691	20.1006	20.1975	20.1803	19.9546	19.3553	18.5758	18.2308	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0334	18.1656	18.6230	19.2618	19.7691	20.1006	20.1975	20.1803	19.9546	19.3553	18.5758	18.2308	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8991	0.8608	0.8184	0.7419	0.6267	0.4696	0.3477	0.3875	0.5873	0.7605	0.8528	0.8952	(94)
Useful gains	646.6185	668.6364	684.8036	659.6225	569.1298	422.0954	295.3349	307.5664	448.9051	543.0922	585.8426	622.9395	(95)
Ext temp.	5.0000	5.6000	7.2000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.2000	7.7000	4.8000	(96)
Heat loss rate W	1482.4222	1320.2176	1200.1677	982.8514	730.6544	475.3719	313.2473	331.7390	551.6221	833.6267	1111.7232	1380.5331	(97)
Space heating kWh	621.8380	437.8626	383.4309	232.7248	120.1743	0.0000	0.0000	0.0000	0.0000	216.1576	378.6340	563.6496	(98a)
Space heating requirement - total per year (kWh/year)												2954.4718	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	621.8380	437.8626	383.4309	232.7248	120.1743	0.0000	0.0000	0.0000	0.0000	216.1576	378.6340	563.6496	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2954.4718	
Space heating per m2											(98c) / (4) =	31.0539	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	286.1613 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	621.8380	437.8626	383.4309	232.7248	120.1743	0.0000	0.0000	0.0000	0.0000	216.1576	378.6340	563.6496	(98)
Space heating efficiency (main heating system 1)	286.1613	286.1613	286.1613	286.1613	286.1613	0.0000	0.0000	0.0000	0.0000	286.1613	286.1613	286.1613	(210)
Space heating fuel (main heating system)	217.3033	153.0125	133.9912	81.3265	41.9953	0.0000	0.0000	0.0000	0.0000	75.5370	132.3149	196.9692	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	262.8454	216.6965	185.5299	126.0468	92.0985	75.7999	75.5021	96.7604	126.6201	183.1903	231.5981	259.7258	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	92.2572	76.0592	65.1199	44.2417	32.3260	26.6053	26.5008	33.9624	44.4429	64.2987	81.2896	91.1622	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5413	10.4244	11.5413	11.1690	11.5413	11.1690	11.5413	11.5413	11.1690	11.5413	11.1690	11.5413	(231)
Lighting	26.9272	21.6020	19.4502	14.2500	11.0071	8.9929	10.0411	13.0518	16.9530	22.2432	25.1236	27.6755	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-34.0473	-51.7688	-81.1382	-94.0147	-98.5583	-89.0565	-86.8343	-81.0552	-73.4727	-62.5386	-39.9377	-30.8844	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)

Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-10.1922	-23.9644	-55.1146	-91.5066	-123.4807	-135.5875	-129.5950	-105.8499	-80.1049	-40.9300	-15.7876	-8.9717 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	1032.4499 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	284.9050
Water heating fuel used	678.2660 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)	
mechanical ventilation fans (SFP = 0.1790)	55.8892 (230a)
pump for solar water heating	80.0000 (230g)
Total electricity for the above, kWh/year	135.8892 (231)
Electricity for lighting (calculated in Appendix L)	217.3176 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1644.3918 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	419.5309 (238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1032.4499	26.0000	268.4370	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	678.2660	26.0000	176.3492	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	55.8892	26.0000	14.5312	(249)
Pump for solar water heating	80.0000	26.0000	20.8000	(249)
Energy for lighting	217.3176	26.0000	56.5026	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-823.3066	26.0000	-214.0597	
PV Unit electricity exported	-821.0852	5.8100	-47.7050	
Total			-261.7648	(252)
Total energy cost			274.8551	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1032.4499	0.1549	159.9347	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	678.2660	0.1460	99.0032	(264)
Space and water heating			258.9379	(265)
Pumps, fans and electric keep-hot	135.8892	0.1387	18.8495	(267)
Energy for lighting	217.3176	0.1443	31.3656	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-823.3066	0.1344	-110.6379	
PV Unit electricity exported	-821.0852	0.1232	-101.1600	
Total			-211.7979	(269)
Total CO2, kg/year			97.3552	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1032.4499	1.5735	1624.5364	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	678.2660	1.5399	1044.4947	(278)
Space and water heating			2669.0311	(279)
Pumps, fans and electric keep-hot	135.8892	1.5128	205.5733	(281)
Energy for lighting	217.3176	1.5338	333.3289	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-823.3066	1.4967	-1232.2140	
PV Unit electricity exported	-821.0852	0.4521	-371.2400	
Total			-1603.4540	(283)
Total Primary energy kWh/year			1604.4793	(286)

Full SAP Calculation Printout

Plot Reference	79841-03	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	3B5P (Semi)
Plot Address	Plot 3, Amberley Drive, Wythenshawe , MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	84 B	**DER**	3.80	**TER**	11.13
Environmental	97 A	**% DER < TER**			65.86
CO_2 Emissions (t/year)	0.33	**DFEE**	38.63	**TFEE**	39.28
Compliance Check	See BREL	**% DFEE < TFEE**			1.65
% DPER < TPER	31.59	**DPER**	39.74	**TPER**	58.09

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700 (1b)	x	2.5500 (2b)	=	121.3035	(1b) - (3b)
First floor	47.5700 (1c)	x	2.8300 (2c)	=	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	255.9266	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1172	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3172	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2696	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3438	0.3370	0.3303	0.2966	0.2899	0.2562	0.2562	0.2494	0.2696	0.2899	0.3033	0.3168	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

Effective ac	0.5938	0.5870	0.5803	0.5466	0.5399	0.5062	0.5062	0.5000	0.5196	0.5399	0.5533	0.5668	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.0000	1.1450	12.5954			(27)
Glazed Doors			5.7100	1.1450	6.5382			(27)
GF			47.5700	0.1100	5.2327	75.0000	3567.7500	(28a)
Main	115.8314	18.8600	96.9714	0.1900	18.4246	9.0000	872.7426	(29a)
PIJ	47.5700		47.5700	0.0900	4.2813	9.0000	428.1300	(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.2222			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000	20.0000	668.2000	(32)
Timber			93.9800			9.0000	845.8200	(32c)
Timber			21.9300			9.0000	197.3700	(32c)
FF			47.5700			18.0000	856.2600	(32d)
GF			47.5700			9.0000	428.1300	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7864.4026 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 82.6614 (35)
List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	12.2600	0.0460	0.5640	
E3 Sill	12.2600	0.0470	0.5762	
E4 Jamb	37.2000	0.0530	1.9716	
E5 Ground floor (normal)	21.5300	0.0680	1.4640	
E10 Eaves (insulation at ceiling level)	15.3200	0.0910	1.3941	
E12 Gable (insulation at ceiling level)	6.2100	0.0750	0.4657	
E16 Corner (normal)	10.7600	0.0460	0.4950	
E18 Party wall between dwellings	10.7600	0.0540	0.5810	
P1 Party wall - Ground floor	6.2100	0.1160	0.7204	
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.0460	0.2857	
E6 Intermediate floor within a dwelling	21.5300	0.0540	1.1626	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.6803 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 58.9025 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.1489	49.5795	49.0102	46.1637	45.5944	42.7478	42.7478	42.2279	43.8864	45.5944	46.7330	47.8716	(38)
Heat transfer coeff	109.0513	108.4820	107.9127	105.0662	104.4968	101.6503	101.6503	101.1304	102.7889	104.4968	105.6355	106.7741	(39)
Average = Sum(39)m / 12 =												104.9279	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1462	1.1402	1.1343	1.1043	1.0983	1.0684	1.0684	1.0630	1.0804	1.0983	1.1103	1.1223	(40)
HLP (average)												1.1029	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6898 (42)
Hot water usage for mixer showers

69.3181	68.2763	66.7584	63.8540	61.7106	59.3203	57.9617	59.4682	61.1196	63.6860	66.6528	69.0525	(42a)

Hot water usage for baths

29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)

Hot water usage for other uses

42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)

Average daily hot water use (litres/day) 130.0024 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	141.4261	138.4062	134.7285	129.1362	124.5949	119.7126	117.8364	121.4982	125.3600	130.4856	136.1640	141.0593	(44)
Energy conte	223.9843	197.0885	207.0727	176.7810	167.7287	147.2007	142.5129	150.4401	154.5815	177.0677	193.9906	220.8648	(45)
Energy content (annual)										Total = Sum(45)m =		2159.3135	
Distribution loss (46)m = 0.15 x (45)m	33.5976	29.5633	31.0609	26.5172	25.1593	22.0801	21.3769	22.5660	23.1872	26.5602	29.0986	33.1297	(46)

Water storage loss (or HIU loss):
Store volume 198.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.5000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.8100 (55)
Total storage loss

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)

If cylinder contains dedicated solar storage

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(64)
									Total per year (kWh/year) = Sum(64)m =		2728.8595	(64)
12Total per year (kWh/year)											2729	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

113.1727	100.4849	107.5496	96.2293	94.4677	86.3938	86.0835	88.7193	88.8479	97.5729	101.9515	112.1355	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	128.3915	142.1477	128.3915	132.6712	128.3915	132.6712	128.3915	128.3915	132.6712	128.3915	132.6712	128.3915	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	248.2231	250.7989	244.3080	230.4897	213.0465	196.6524	185.7002	183.1244	189.6153	203.4336	220.8767	237.2708	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	(71)
Water heating gains (Table 5)	152.1139	149.5311	144.5559	133.6518	126.9727	119.9914	115.7036	119.2463	123.3999	131.1464	141.5993	150.7197	(72)
Total internal gains	592.0747	605.8239	580.6016	560.1589	531.7570	512.6613	493.1415	494.1084	509.0326	526.3177	558.4935	579.7283	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

Northeast			5.2400		11.2829		0.3000		0.0000		0.7700		13.6573 (75)
Southwest			5.7600		36.7938		0.3000		0.0000		0.7700		48.9564 (79)
Northeast			5.7100		11.2829		0.3000		0.0000		0.7700		14.8823 (75)
Solar gains	77.4960	141.4841	218.7646	313.2651	389.4060	403.5350	381.9991	322.6040	251.0817	163.1592	94.5487	65.2034	(83)
Total gains	669.5707	747.3080	799.3662	873.4241	921.1630	916.1963	875.1406	816.7124	760.1144	689.4770	653.0422	644.9316	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.0324	20.1375	20.2437	20.7922	20.9055	21.4909	21.4909	21.6014	21.2528	20.9055	20.6801	20.4596	
alpha	2.3355	2.3425	2.3496	2.3861	2.3937	2.4327	2.4327	2.4401	2.4169	2.3937	2.3787	2.3640	
util living area	0.9366	0.9168	0.8872	0.8224	0.7240	0.5806	0.4568	0.4970	0.6825	0.8436	0.9136	0.9411	(86)
Living	18.1386	18.4504	18.9401	19.6529	20.2554	20.7069	20.8827	20.8533	20.5315	19.7666	18.8815	18.1290	
Non living	17.3599	17.6687	18.1515	18.8553	19.4221	19.8353	19.9692	19.9552	19.6898	18.9792	18.1128	17.3629	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.5362	18.4504	18.9401	19.6529	20.2554	20.7069	20.8827	20.8533	20.5315	19.7666	18.8815	18.5306	(87)
Th 2	19.9633	19.9681	19.9730	19.9973	20.0022	20.0267	20.0267	20.0312	20.0169	20.0022	19.9924	19.9827	(88)
util rest of house	0.9286	0.9064	0.8724	0.7982	0.6839	0.5175	0.3714	0.4120	0.6252	0.8173	0.9011	0.9336	(89)
MIT 2	18.6315	17.6687	18.1515	18.8553	19.4221	19.8353	19.9692	19.9552	19.6898	18.9792	18.1128	17.7293	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	18.8320	17.8420	18.3263	19.0321	19.6068	20.0285	20.1717	20.1542	19.8764	19.1537	18.2832	17.9070	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8320	17.8420	18.3263	19.0321	19.6068	20.0285	20.1717	20.1542	19.8764	19.1537	18.2832	17.9070	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9182	0.8785	0.8427	0.7707	0.6661	0.5177	0.3848	0.4235	0.6160	0.7903	0.8738	0.9139	(94)
Useful gains	614.7754	656.4768	673.6300	673.1595	613.5941	474.2825	336.7945	345.9045	468.2536	544.8730	570.6176	589.4234	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1584.7391	1403.9725	1276.2062	1064.5413	826.2405	551.8096	363.0626	379.6677	593.7502	893.8365	1181.3436	1463.5487	(97)
Space heating kWh	721.6530	502.3171	448.3167	281.7949	158.2089	0.0000	0.0000	0.0000	0.0000	259.6288	439.7228	650.3492	(98a)
Space heating requirement - total per year (kWh/year)												3461.9915	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	721.6530	502.3171	448.3167	281.7949	158.2089	0.0000	0.0000	0.0000	0.0000	259.6288	439.7228	650.3492	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3461.9915	
Space heating per m2											(98c) / (4) =	36.3884	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												285.6431	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	721.6530	502.3171	448.3167	281.7949	158.2089	0.0000	0.0000	0.0000	0.0000	259.6288	439.7228	650.3492	(98)
Space heating efficiency (main heating system 1)	285.6431	285.6431	285.6431	285.6431	285.6431	0.0000	0.0000	0.0000	0.0000	285.6431	285.6431	285.6431	(210)
Space heating fuel (main heating system)	252.6415	175.8548	156.9500	98.6528	55.3869	0.0000	0.0000	0.0000	0.0000	90.8927	153.9414	227.6790	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	95.5956	84.5123	89.6597	78.4799	75.8502	68.0973	66.9996	69.7820	70.6879	79.1282	84.5203	94.5007	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.7468	4.2874	4.7468	4.5936	4.7468	4.5936	4.7468	4.7468	4.5936	4.7468	4.5936	4.7468	(231)
Lighting	26.9272	21.6020	19.4502	14.2500	11.0071	8.9929	10.0411	13.0518	16.9530	22.2432	25.1236	27.6755	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	1211.9992	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	284.9050	
Water heating fuel used	957.8138	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)		
mechanical ventilation fans (SFP = 0.1790)	55.8892	(230a)
Total electricity for the above, kWh/year	55.8892	(231)
Electricity for lighting (calculated in Appendix L)	217.3176	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2443.0198	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1211.9992	0.1547	187.4674	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	957.8138	0.1410	135.0326	(264)
Space and water heating			322.5000	(265)
Pumps, fans and electric keep-hot	55.8892	0.1387	7.7525	(267)
Energy for lighting	217.3176	0.1443	31.3656	(268)
Total CO2, kg/year			361.6181	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.8000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1211.9992	1.5726	1906.0057	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	957.8138	1.5213	1457.1193	(278)
Space and water heating			3363.1249	(279)
Pumps, fans and electric keep-hot	55.8892	1.5128	84.5493	(281)
Energy for lighting	217.3176	1.5338	333.3289	(282)
Total Primary energy kWh/year			3781.0031	(286)
Dwelling Primary energy Rate (DPER)			39.7400	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700	(1b) x	2.5500	(2b) =	121.3035	(1b) - (3b)
First floor	47.5700	(1c) x	2.8300	(2c) =	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 95.1400						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		255.9266	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 = 0.0000	(6a)
Number of open flues	0 * 20 = 0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000	(6d)
Number of flues attached to other heater	0 * 35 = 0.0000	(6e)
Number of blocked chimneys	0 * 20 = 0.0000	(6f)
Number of intermittent extract fans	3 * 10 = 30.0000	(7a)
Number of passive vents	0 * 10 = 0.0000	(7b)
Number of flueless gas fires	0 * 40 = 0.0000	(7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1172	(8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3672	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3121	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)

Adj infilt rate													
	0.3980	0.3902	0.3824	0.3434	0.3355	0.2965	0.2965	0.2887	0.3121	0.3355	0.3512	0.3668	(22b)
Effective ac	0.5792	0.5761	0.5731	0.5589	0.5563	0.5440	0.5440	0.5417	0.5487	0.5563	0.5617	0.5673	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type			16.7100	1.1450	19.1336			(27)
GF			47.5700	0.1300	6.1841			(28a)
Main	115.8314	18.8600	96.9714	0.1800	17.4549			(29a)
PIJ	47.5700		47.5700	0.1100	5.2327			(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.1552			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	82.6614 (35)
List of Thermal Bridges	

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.2600	0.0500	0.6130
E3 Sill	12.2600	0.0500	0.6130
E4 Jamb	37.2000	0.0500	1.8600
E5 Ground floor (normal)	21.5300	0.1600	3.4448
E10 Eaves (insulation at ceiling level)	15.3200	0.0600	0.9192
E12 Gable (insulation at ceiling level)	6.2100	0.0600	0.3726
E16 Corner (normal)	10.7600	0.0900	0.9684
E18 Party wall between dwellings	10.7600	0.0600	0.6456
P1 Party wall - Ground floor	6.2100	0.0800	0.4968
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.1200	0.7452
E6 Intermediate floor within a dwelling	21.5300	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.6786	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	60.8338	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.9161	48.6564	48.4019	47.2062	46.9824	45.9410	45.9410	45.7482	46.3422	46.9824	47.4350	47.9081	(38)
Heat transfer coeff	109.7500	109.4903	109.2357	108.0400	107.8163	106.7749	106.7749	106.5820	107.1760	107.8163	108.2688	108.7420	(39)
Average = Sum(39)m / 12 =												108.0389	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1536	1.1508	1.1482	1.1356	1.1332	1.1223	1.1223	1.1203	1.1265	1.1332	1.1380	1.1430	(40)
HLP (average)												1.1356	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6898	(42)
Hot water usage for mixer showers													
	69.3181	68.2763	66.7584	63.8540	61.7106	59.3203	57.9617	59.4682	61.1196	63.6860	66.6528	69.0525	(42a)
Hot water usage for baths													
	29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)
Hot water usage for other uses													
	42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)
Average daily hot water use (litres/day)												130.0024	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	141.4261	138.4062	134.7285	129.1362	124.5949	119.7126	117.8364	121.4982	125.3600	130.4856	136.1640	141.0593	(44)
Energy conte	223.9843	197.0885	207.0727	176.7810	167.7287	147.2007	142.5129	150.4401	154.5815	177.0677	193.9906	220.8648	(45)
Energy content (annual)										Total = Sum(45)m =		2159.3135	
Distribution loss (46)m = 0.15 x (45)m													
	33.5976	29.5633	31.0609	26.5172	25.1593	22.0801	21.3769	22.5660	23.1872	26.5602	29.0986	33.1297	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6426	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8870	(55)
Total storage loss													
	27.4979	24.8369	27.4979	26.6109	27.4979	26.6109	27.4979	27.4979	26.6109	27.4979	26.6109	27.4979	(56)
If cylinder contains dedicated solar storage													
	27.4979	24.8369	27.4979	26.6109	27.4979	26.6109	27.4979	27.4979	26.6109	27.4979	26.6109	27.4979	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	274.7447	242.9366	257.8330	225.9039	218.4890	196.3236	193.2732	201.2004	203.7044	227.8281	243.1135	271.6251	(62)
WWHRS	-31.6893	-28.0263	-29.3475	-24.3009	-22.6476	-19.3797	-18.1654	-19.3170	-20.0510	-23.6379	-26.7789	-31.1025	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	243.0553	214.9103	228.4855	201.6030	195.8415	176.9439	175.1079	181.8834	183.6534	204.1902	216.3347	240.5226	(64)
										Total per year (kWh/year) = Sum(64)m =		2462.5316	(64)
12Total per year (kWh/year)												2463	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	115.0831	102.2104	109.4599	98.0780	96.3781	88.2426	87.9938	90.6296	90.6967	99.4833	103.8002	114.0458	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	128.3915	142.1477	128.3915	132.6712	128.3915	132.6712	128.3915	128.3915	132.6712	128.3915	132.6712	128.3915	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													

	248.2231	250.7989	244.3080	230.4897	213.0465	196.6524	185.7002	183.1244	189.6153	203.4336	220.8767	237.2708 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901 (71)
Water heating gains (Table 5)												
	154.6815	152.0988	147.1236	136.2195	129.5404	122.5591	118.2712	121.8140	125.9676	133.7141	144.1670	153.2874 (72)
Total internal gains												
	597.6424	611.3916	586.1693	565.7266	537.3247	515.2290	495.7092	496.6761	511.6003	531.8854	564.0611	585.2959 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.9500	11.2829	0.6300	0.7000	0.7700	37.7579	(75)
Southwest	5.7600	36.7938	0.6300	0.7000	0.7700	64.7693	(79)

Solar gains	102.5273	187.1835	289.4255	414.4498	515.1842	533.8768	505.3848	426.8051	332.1811	215.8597	125.0880	86.2641	(83)
Total gains	700.1696	798.5751	875.5948	980.1764	1052.5089	1049.1058	1001.0940	923.4812	843.7815	747.7451	689.1491	671.5600	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.9048	19.9521	19.9986	20.2199	20.2618	20.4595	20.4595	20.4965	20.3829	20.2618	20.1771	20.0894	
alpha	2.3270	2.3301	2.3332	2.3480	2.3508	2.3640	2.3640	2.3664	2.3589	2.3508	2.3451	2.3393	
util living area													
	0.9314	0.9069	0.8698	0.7943	0.6844	0.5434	0.4241	0.4677	0.6547	0.8270	0.9063	0.9369	(86)
MIT	18.1785	18.5155	19.0308	19.7277	20.3199	20.7260	20.8906	20.8588	20.5483	19.7886	18.8835	18.1262	(87)
Th 2	19.9573	19.9595	19.9617	19.9719	19.9738	19.9827	19.9827	19.9843	19.9792	19.9738	19.9699	19.9659	(88)
util rest of house													
	0.9228	0.8954	0.8533	0.7675	0.6417	0.4790	0.3394	0.3820	0.5948	0.7984	0.8929	0.9290	(89)
MIT 2	16.6692	17.0931	17.7389	18.6012	19.3042	19.7586	19.9161	19.8935	19.5819	18.6954	17.5696	16.6081	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	17.0038	17.4084	18.0252	18.8509	19.5293	19.9731	20.1321	20.1075	19.7961	18.9378	17.8608	16.9446	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.0038	17.4084	18.0252	18.8509	19.5293	19.9731	20.1321	20.1075	19.7961	18.9378	17.8608	16.9446	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8885	0.8578	0.8141	0.7330	0.6211	0.4784	0.3525	0.3931	0.5828	0.7631	0.8559	0.8961	(94)
Useful gains	622.1005	685.0011	712.8020	718.4703	653.7264	501.8644	352.8490	362.9780	491.7948	570.5944	589.8307	601.7860	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1394.2402	1369.5514	1258.9669	1075.0984	844.1304	573.7081	377.1447	395.1511	610.4905	898.9463	1165.0629	1385.8749	(97)
Space heating kWh													
	574.4719	460.0178	406.3466	256.7722	141.6606	0.0000	0.0000	0.0000	0.0000	244.2938	414.1671	583.3622	(98a)
Space heating requirement - total per year (kWh/year)												3081.0922	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	574.4719	460.0178	406.3466	256.7722	141.6606	0.0000	0.0000	0.0000	0.0000	244.2938	414.1671	583.3622	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3081.0922	
Space heating per m2											(98c) / (4) =	32.3848	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	574.4719	460.0178	406.3466	256.7722	141.6606	0.0000	0.0000	0.0000	0.0000	244.2938	414.1671	583.3622	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	622.3964	498.3942	440.2456	278.1931	153.4784	0.0000	0.0000	0.0000	0.0000	264.6736	448.7184	632.0284	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	243.0553	214.9103	228.4855	201.6030	195.8415	176.9439	175.1079	181.8834	183.6534	204.1902	216.3347	240.5226	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.9191	85.7216	85.3360	84.6033	83.3456	79.8000	79.8000	79.8000	79.8000	84.4630	85.4917	85.9694	(217)
Fuel for water heating, kWh/month													
	282.8887	250.7073	267.7479	238.2920	234.9753	221.7342	219.4334	227.9240	230.1421	241.7511	253.0475	279.7769	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	26.6772	21.4014	19.2696	14.1178	10.9050	8.9094	9.9479	12.9306	16.7956	22.0367	24.8904	27.4187	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-43.7273	-61.2512	-87.4769	-97.6894	-104.7589	-97.5416	-96.2965	-91.1670	-82.0635	-69.6860	-47.9165	-37.8482	(233a)

Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-25.9245	-54.3936	-107.8641	-161.6637	-213.4533	-214.3907	-211.9042	-179.5910	-131.8391	-77.7180	-34.5868	-20.5145 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3338.1281	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2948.4206	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	215.3004	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2351.2664	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4236.5827	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3338.1281	0.2100	701.0069	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2948.4206	0.2100	619.1683	(264)
Space and water heating			1320.1752	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	215.3004	0.1443	31.0745	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-917.4229	0.1347	-123.6078	
PV Unit electricity exported	-1433.8435	0.1260	-180.5987	
Total			-304.2065	(269)
Total CO2, kg/year			1058.9725	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.1300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3338.1281	1.1300	3772.0847	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2948.4206	1.1300	3331.7153	(278)
Space and water heating			7103.8001	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	215.3004	1.5338	330.2349	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-917.4229	1.4980	-1374.2639	
PV Unit electricity exported	-1433.8435	0.4623	-662.9248	
Total			-2037.1887	(283)
Total Primary energy kWh/year			5526.9471	(286)
Target Primary Energy Rate (TPER)			58.0900	(287)

Full SAP Calculation Printout

Plot Reference	79841-03	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	3B5P (Semi)
Plot Address	Plot 3, Amberley Drive, Wythenshawe , MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	84 B	**DER**	3.80	**TER**	11.13
Environmental	97 A	**% DER < TER**			65.86
CO_2 Emissions (t/year)	0.33	**DFEE**	38.63	**TFEE**	39.28
Compliance Check	See BREL	**% DFEE < TFEE**			1.65
% DPER < TPER	31.59	**DPER**	39.74	**TPER**	58.09

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700 (1b)	x	2.5500 (2b)	=	121.3035	(1b) - (3b)
First floor	47.5700 (1c)	x	2.8300 (2c)	=	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	255.9266	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1172	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3172	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2696	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3438	0.3370	0.3303	0.2966	0.2899	0.2562	0.2562	0.2494	0.2696	0.2899	0.3033	0.3168	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5591	0.5568	0.5546	0.5440	0.5420	0.5328	0.5328	0.5311	0.5364	0.5420	0.5460	0.5502	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.0000	1.1450	12.5954			(27)
Glazed Doors			5.7100	1.1450	6.5382			(27)
GF			47.5700	0.1100	5.2327	75.0000	3567.7500	(28a)
Main	115.8314	18.8600	96.9714	0.1900	18.4246	9.0000	872.7426	(29a)
PIJ	47.5700		47.5700	0.0900	4.2813	9.0000	428.1300	(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.2222			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000	20.0000	668.2000	(32)
Timber			93.9800			9.0000	845.8200	(32c)
Timber			21.9300			9.0000	197.3700	(32c)
FF			47.5700			18.0000	856.2600	(32d)
GF			47.5700			9.0000	428.1300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	7864.4026 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		82.6614 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	12.2600	0.0460	0.5640	
E3 Sill	12.2600	0.0470	0.5762	
E4 Jamb	37.2000	0.0530	1.9716	
E5 Ground floor (normal)	21.5300	0.0680	1.4640	
E10 Eaves (insulation at ceiling level)	15.3200	0.0910	1.3941	
E12 Gable (insulation at ceiling level)	6.2100	0.0750	0.4657	
E16 Corner (normal)	10.7600	0.0460	0.4950	
E18 Party wall between dwellings	10.7600	0.0540	0.5810	
P1 Party wall - Ground floor	6.2100	0.1160	0.7204	
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.0460	0.2857	
E6 Intermediate floor within a dwelling	21.5300	0.0540	1.1626	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			9.6803	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	58.9025	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.2188	47.0250	46.8351	45.9428	45.7758	44.9987	44.9987	44.8548	45.2981	45.7758	46.1136	46.4666	(38)
Heat transfer coeff	106.1213	105.9275	105.7375	104.8453	104.6783	103.9012	103.9012	103.7573	104.2005	104.6783	105.0160	105.3691	(39)
Average = Sum(39)m / 12 =												104.8445	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1154	1.1134	1.1114	1.1020	1.1003	1.0921	1.0921	1.0906	1.0952	1.1003	1.1038	1.1075	(40)
HLP (average)												1.1020	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6898 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)
Hot water usage for other uses	42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)
Average daily hot water use (litres/day)												66.0935	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	72.1080	70.1298	67.9701	65.2822	62.8843	60.3923	59.8747	62.0299	64.2404	66.7996	69.5112	72.0068	(44)
Energy conte	114.2015	99.8639	104.4676	89.3681	84.6544	74.2594	72.4132	76.8060	79.2149	90.6464	99.0315	112.7453	(45)
Energy content (annual)										Total = Sum(45)m =		1097.6720	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	97.0712	84.8843	88.7974	75.9629	71.9562	63.1205	61.5512	65.2851	67.3326	77.0494	84.1768	95.8335	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	97.0712	84.8843	88.7974	75.9629	71.9562	63.1205	61.5512	65.2851	67.3326	77.0494	84.1768	95.8335	(64)
										Total per year (kWh/year) = Sum(64)m =		933.0212	(64)
12Total per year (kWh/year)												933	(64)
Electric shower(s)	55.5122	49.4618	54.0104	51.5415	52.5087	50.0882	51.7578	52.5087	51.5415	54.0104	52.9948	55.5122	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		631.4482	(64a)
Heat gains from water heating, kWh/month	38.1459	33.5865	35.7020	31.8761	31.1162	28.3022	28.3272	29.4484	29.7185	32.7650	34.2929	37.8364	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	128.3915	142.1477	128.3915	132.6712	128.3915	132.6712	128.3915	128.3915	132.6712	128.3915	132.6712	128.3915	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	248.2231	250.7989	244.3080	230.4897	213.0465	196.6524	185.7002	183.1244	189.6153	203.4336	220.8767	237.2708	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	(71)
Water heating gains (Table 5)	51.2713	49.9800	47.9865	44.2724	41.8229	39.3086	38.0743	39.5812	41.2757	44.0389	47.6290	50.8554	(72)
Total internal gains	491.2321	506.2728	484.0322	470.7795	446.6071	431.9784	415.5122	414.4434	426.9085	439.2103	464.5232	479.8640	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.2400	11.2829	0.3000	0.0000	0.7700	13.6573	(75)
Southwest	5.7600	36.7938	0.3000	0.0000	0.7700	48.9564	(79)
Northeast	5.7100	11.2829	0.3000	0.0000	0.7700	14.8823	(75)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	77.4960	141.4841	218.7646	313.2651	389.4060	403.5350	381.9991	322.6040	251.0817	163.1592	94.5487	65.2034	(83)

Total gains	568.7282	647.7569	702.7968	784.0446	836.0132	835.5135	797.5113	737.0474	677.9902	602.3695	559.0719	545.0673	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.5855	20.6231	20.6602	20.8360	20.8692	21.0253	21.0253	21.0545	20.9649	20.8692	20.8021	20.7324	
alpha	2.3724	2.3749	2.3773	2.3891	2.3913	2.4017	2.4017	2.4036	2.3977	2.3913	2.3868	2.3822	
util living area	0.9532	0.9353	0.9087	0.8496	0.7567	0.6220	0.4976	0.5436	0.7261	0.8747	0.9350	0.9574	(86)
MIT	18.0164	18.3309	18.8268	19.5309	20.1682	20.6445	20.8522	20.8122	20.4458	19.6293	18.7171	17.9628	(87)
Th 2	19.9883	19.9899	19.9915	19.9992	20.0006	20.0073	20.0073	20.0085	20.0047	20.0006	19.9977	19.9947	(88)
util rest of house	0.9471	0.9269	0.8962	0.8278	0.7186	0.5578	0.4064	0.4535	0.6707	0.8521	0.9252	0.9518	(89)
MIT 2	17.2567	17.5674	18.0562	18.7444	19.3464	19.7728	19.9342	19.9101	19.6123	18.8519	17.9579	17.2078	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	17.4251	17.7366	18.2270	18.9187	19.5286	19.9661	20.1377	20.1101	19.7970	19.0243	18.1262	17.3752	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.4251	17.7366	18.2270	18.9187	19.5286	19.9661	20.1377	20.1101	19.7970	19.0243	18.1262	17.3752	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9257	0.9020	0.8683	0.7995	0.6981	0.5549	0.4192	0.4635	0.6575	0.8244	0.9006	0.9316	(94)
Useful gains	526.4754	584.2673	610.2529	626.8489	583.5811	463.6020	334.3474	341.6049	445.7919	496.5917	503.4925	507.7860	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1392.8536	1359.7515	1239.9842	1050.4170	819.4813	557.5393	367.5683	384.9514	593.6340	881.8364	1157.9236	1388.2559	(97)
Space heating kWh	644.5854	521.1254	468.5201	304.9690	175.5097	0.0000	0.0000	0.0000	0.0000	286.6221	471.1904	655.0696	(98a)
Space heating requirement - total per year (kWh/year)												3527.5917	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	644.5854	521.1254	468.5201	304.9690	175.5097	0.0000	0.0000	0.0000	0.0000	286.6221	471.1904	655.0696	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3527.5917	
Space heating per m2											(98c) / (4) =	37.0779	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	976.6712	768.8688	788.5553	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6860	0.7526	0.7171	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	669.9562	578.6296	565.4383	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	923.3410	881.4929	813.3722	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	182.4370	225.3303	184.4628	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	45.6093	56.3326	46.1157	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												148.0575	(107)
Energy for space heating												37.0779	(99)
Energy for space cooling												1.5562	(108)
Total												38.6341	(109)
Fabric Energy Efficiency (DFEE)												38.6	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700	(1b) x	2.5500	(2b) =	121.3035	(1b) - (3b)
First floor	47.5700	(1c) x	2.8300	(2c) =	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		255.9266	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)

Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1172 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3672 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3121 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3980	0.3902	0.3824	0.3434	0.3355	0.2965	0.2965	0.2887	0.3121	0.3355	0.3512	0.3668	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0.0000 (23c)

Effective ac	0.5792	0.5761	0.5731	0.5589	0.5563	0.5440	0.5440	0.5417	0.5487	0.5563	0.5617	0.5673	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type			16.7100	1.1450	19.1336			(27)
GF			47.5700	0.1300	6.1841			(28a)
Main	115.8314	18.8600	96.9714	0.1800	17.4549			(29a)
PIJ	47.5700		47.5700	0.1100	5.2327			(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.1552			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	82.6614 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.2600	0.0500	0.6130
E3 Sill	12.2600	0.0500	0.6130
E4 Jamb	37.2000	0.0500	1.8600
E5 Ground floor (normal)	21.5300	0.1600	3.4448
E10 Eaves (insulation at ceiling level)	15.3200	0.0600	0.9192
E12 Gable (insulation at ceiling level)	6.2100	0.0600	0.3726
E16 Corner (normal)	10.7600	0.0900	0.9684
E18 Party wall between dwellings	10.7600	0.0600	0.6456
P1 Party wall - Ground floor	6.2100	0.0800	0.4968
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.1200	0.7452
E6 Intermediate floor within a dwelling	21.5300	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.6786 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	60.8338 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.9161	48.6564	48.4019	47.2062	46.9824	45.9410	45.9410	45.7482	46.3422	46.9824	47.4350	47.9081	(38)
Heat transfer coeff	109.7500	109.4903	109.2357	108.0400	107.8163	106.7749	106.7749	106.5820	107.1760	107.8163	108.2688	108.7420	(39)
Average = Sum(39)m / 12 =												108.0389	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1536	1.1508	1.1482	1.1356	1.1332	1.1223	1.1223	1.1203	1.1265	1.1332	1.1380	1.1430	(40)
HLP (average)												1.1356	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6898 (42)

Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)

Hot water usage for other uses

42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)

Average daily hot water use (litres/day)	66.0935 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	72.1080	70.1298	67.9701	65.2822	62.8843	60.3923	59.8747	62.0299	64.2404	66.7996	69.5112	72.0068	(44)
Energy conte	114.2015	99.8639	104.4676	89.3681	84.6544	74.2594	72.4132	76.8060	79.2149	90.6464	99.0315	112.7453	(45)
Energy content (annual)										Total = Sum(45)m =		1097.6720	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	97.0712	84.8843	88.7974	75.9629	71.9562	63.1205	61.5512	65.2851	67.3326	77.0494	84.1768	95.8335	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	97.0712	84.8843	88.7974	75.9629	71.9562	63.1205	61.5512	65.2851	67.3326	77.0494	84.1768	95.8335	(64)
										Total per year (kWh/year) = Sum(64)m =		933.0212	(64)
12Total per year (kWh/year)												933	(64)

Electric shower(s)

	55.5122	49.4618	54.0104	51.5415	52.5087	50.0882	51.7578	52.5087	51.5415	54.0104	52.9948	55.5122 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												631.4482 (64a)
Heat gains from water heating, kWh/month												
	38.1459	33.5865	35.7020	31.8761	31.1162	28.3022	28.3272	29.4484	29.7185	32.7650	34.2929	37.8364 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	128.3915	142.1477	128.3915	132.6712	128.3915	132.6712	128.3915	128.3915	132.6712	128.3915	132.6712	128.3915	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.2231	250.7989	244.3080	230.4897	213.0465	196.6524	185.7002	183.1244	189.6153	203.4336	220.8767	237.2708	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	(71)
Water heating gains (Table 5)													
	51.2713	49.9800	47.9865	44.2724	41.8229	39.3086	38.0743	39.5812	41.2757	44.0389	47.6290	50.8554	(72)
Total internal gains													
	491.2321	506.2728	484.0322	470.7795	446.6071	431.9784	415.5122	414.4434	426.9085	439.2103	464.5232	479.8640	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.9500	11.2829	0.6300	0.7000	0.7700	37.7579	(75)
Southwest	5.7600	36.7938	0.6300	0.7000	0.7700	64.7693	(79)

Solar gains	102.5273	187.1835	289.4255	414.4498	515.1842	533.8768	505.3848	426.8051	332.1811	215.8597	125.0880	86.2641	(83)
Total gains	593.7594	693.4563	773.4578	885.2293	961.7913	965.8553	920.8970	841.2485	759.0896	655.0699	589.6112	566.1280	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.9048	19.9521	19.9986	20.2199	20.2618	20.4595	20.4595	20.4965	20.3829	20.2618	20.1771	20.0894	
alpha	2.3270	2.3301	2.3332	2.3480	2.3508	2.3640	2.3640	2.3664	2.3589	2.3508	2.3451	2.3393	
util living area													
	0.9497	0.9278	0.8942	0.8227	0.7160	0.5747	0.4534	0.5019	0.6931	0.8592	0.9294	0.9546	(86)
MIT	17.9677	18.3221	18.8633	19.6066	20.2437	20.6897	20.8734	20.8352	20.4846	19.6550	18.6993	17.9131	(87)
Th 2	19.9573	19.9595	19.9617	19.9719	19.9738	19.9827	19.9827	19.9843	19.9792	19.9738	19.9699	19.9659	(88)
util rest of house													
	0.9431	0.9184	0.8800	0.7981	0.6747	0.5095	0.3650	0.4129	0.6346	0.8343	0.9187	0.9486	(89)
MIT 2	17.1891	17.5387	18.0703	18.7935	19.3883	19.7828	19.9220	19.9005	19.6209	18.8559	17.9222	17.1407	(90)
Living area fraction									fLA = Living area / (4) =			0.2217	(91)
MIT	17.3617	17.7124	18.2461	18.9737	19.5779	19.9838	20.1329	20.1077	19.8123	19.0330	18.0944	17.3120	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.3617	17.7124	18.2461	18.9737	19.5779	19.9838	20.1329	20.1077	19.8123	19.0330	18.0944	17.3120	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9204	0.8917	0.8504	0.7698	0.6569	0.5096	0.3788	0.4245	0.6238	0.8060	0.8926	0.9272	(94)
Useful gains	546.5122	618.3632	657.7375	681.4821	631.7763	492.1761	348.8078	357.1278	473.5438	527.9803	526.2865	524.9062	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1433.5247	1402.8286	1283.0935	1088.3651	849.3649	574.8578	377.2228	395.1734	612.2266	909.2163	1190.3561	1425.8196	(97)
Space heating kWh													
	659.9373	527.1608	465.2648	292.9557	161.8860	0.0000	0.0000	0.0000	0.0000	283.6395	478.1301	670.2795	(98a)
Space heating requirement - total per year (kWh/year)												3539.2538	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	659.9373	527.1608	465.2648	292.9557	161.8860	0.0000	0.0000	0.0000	0.0000	283.6395	478.1301	670.2795	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3539.2538	
Space heating per m2											(98c) / (4) =	37.2005	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1003.6836	790.1339	810.0232	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7267	0.7879	0.7516	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	729.3467	622.5318	608.8108	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1075.6886	1025.7100	935.1657	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	249.3662	299.9646	242.8080	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	62.3415	74.9911	60.7020	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												198.0347	(107)

Energy for space heating	37.2005 (99)
Energy for space cooling	2.0815 (108)
Total	39.2820 (109)
Fabric Energy Efficiency (TFEE)	39.3 (109)

Full SAP Calculation Printout

Plot Reference	79841-03	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	3B5P (Semi)
Plot Address	Plot 3, Amberley Drive, Wythenshawe , MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	84 B	**DER**	3.80	**TER**	11.13
Environmental	97 A	**% DER < TER**			65.86
CO_2 Emissions (t/year)	0.33	**DFEE**	38.63	**TFEE**	39.28
Compliance Check	See BREL	**% DFEE < TFEE**			1.65
% DPER < TPER	31.59	**DPER**	39.74	**TPER**	58.09

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700 (1b)	x	2.5500 (2b)	=	121.3035	(1b) - (3b)
First floor	47.5700 (1c)	x	2.8300 (2c)	=	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	255.9266	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1172	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3172	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2696	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3438	0.3370	0.3303	0.2966	0.2899	0.2562	0.2562	0.2494	0.2696	0.2899	0.3033	0.3168	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

Effective ac	0.5938	0.5870	0.5803	0.5466	0.5399	0.5062	0.5062	0.5000	0.5196	0.5399	0.5533	0.5668	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.0000	1.1450	12.5954			(27)
Glazed Doors			5.7100	1.1450	6.5382			(27)
GF			47.5700	0.1100	5.2327	75.0000	3567.7500	(28a)
Main	115.8314	18.8600	96.9714	0.1900	18.4246	9.0000	872.7426	(29a)
PIJ	47.5700		47.5700	0.0900	4.2813	9.0000	428.1300	(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.2222			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000	20.0000	668.2000	(32)
Timber			93.9800			9.0000	845.8200	(32c)
Timber			21.9300			9.0000	197.3700	(32c)
FF			47.5700			18.0000	856.2600	(32d)
GF			47.5700			9.0000	428.1300	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7864.4026 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 82.6614 (35)
List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	12.2600	0.0460	0.5640	
E3 Sill	12.2600	0.0470	0.5762	
E4 Jamb	37.2000	0.0530	1.9716	
E5 Ground floor (normal)	21.5300	0.0680	1.4640	
E10 Eaves (insulation at ceiling level)	15.3200	0.0910	1.3941	
E12 Gable (insulation at ceiling level)	6.2100	0.0750	0.4657	
E16 Corner (normal)	10.7600	0.0460	0.4950	
E18 Party wall between dwellings	10.7600	0.0540	0.5810	
P1 Party wall - Ground floor	6.2100	0.1160	0.7204	
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.0460	0.2857	
E6 Intermediate floor within a dwelling	21.5300	0.0540	1.1626	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.6803 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 58.9025 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.1489	49.5795	49.0102	46.1637	45.5944	42.7478	42.7478	42.2279	43.8864	45.5944	46.7330	47.8716	(38)
Heat transfer coeff	109.0513	108.4820	107.9127	105.0662	104.4968	101.6503	101.6503	101.1304	102.7889	104.4968	105.6355	106.7741	(39)
Average = Sum(39)m / 12 =												104.9279	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1462	1.1402	1.1343	1.1043	1.0983	1.0684	1.0684	1.0630	1.0804	1.0983	1.1103	1.1223	(40)
HLP (average)												1.1029	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6898 (42)
Hot water usage for mixer showers

69.3181	68.2763	66.7584	63.8540	61.7106	59.3203	57.9617	59.4682	61.1196	63.6860	66.6528	69.0525	(42a)

Hot water usage for baths

29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)

Hot water usage for other uses

42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)

Average daily hot water use (litres/day) 130.0024 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	141.4261	138.4062	134.7285	129.1362	124.5949	119.7126	117.8364	121.4982	125.3600	130.4856	136.1640	141.0593	(44)
Energy conte	223.9843	197.0885	207.0727	176.7810	167.7287	147.2007	142.5129	150.4401	154.5815	177.0677	193.9906	220.8648	(45)
Energy content (annual)										Total = Sum(45)m =		2159.3135	
Distribution loss (46)m = 0.15 x (45)m	33.5976	29.5633	31.0609	26.5172	25.1593	22.0801	21.3769	22.5660	23.1872	26.5602	29.0986	33.1297	(46)

Water storage loss (or HIU loss):
Store volume 198.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.5000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.8100 (55)
Total storage loss

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)

If cylinder contains dedicated solar storage

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(64)
									Total per year (kWh/year) = Sum(64)m =		2728.8595	(64)
12Total per year (kWh/year)											2729	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

113.1727	100.4849	107.5496	96.2293	94.4677	86.3938	86.0835	88.7193	88.8479	97.5729	101.9515	112.1355	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	128.3915	142.1477	128.3915	132.6712	128.3915	132.6712	128.3915	128.3915	132.6712	128.3915	132.6712	128.3915	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	248.2231	250.7989	244.3080	230.4897	213.0465	196.6524	185.7002	183.1244	189.6153	203.4336	220.8767	237.2708	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	(71)
Water heating gains (Table 5)	152.1139	149.5311	144.5559	133.6518	126.9727	119.9914	115.7036	119.2463	123.3999	131.1464	141.5993	150.7197	(72)
Total internal gains	592.0747	605.8239	580.6016	560.1589	531.7570	512.6613	493.1415	494.1084	509.0326	526.3177	558.4935	579.7283	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

Northeast			5.2400		11.2829		0.3000		0.0000		0.7700		13.6573 (75)
Southwest			5.7600		36.7938		0.3000		0.0000		0.7700		48.9564 (79)
Northeast			5.7100		11.2829		0.3000		0.0000		0.7700		14.8823 (75)
Solar gains	77.4960	141.4841	218.7646	313.2651	389.4060	403.5350	381.9991	322.6040	251.0817	163.1592	94.5487	65.2034	(83)
Total gains	669.5707	747.3080	799.3662	873.4241	921.1630	916.1963	875.1406	816.7124	760.1144	689.4770	653.0422	644.9316	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.0324	20.1375	20.2437	20.7922	20.9055	21.4909	21.4909	21.6014	21.2528	20.9055	20.6801	20.4596	
alpha	2.3355	2.3425	2.3496	2.3861	2.3937	2.4327	2.4327	2.4401	2.4169	2.3937	2.3787	2.3640	
util living area	0.9366	0.9168	0.8872	0.8224	0.7240	0.5806	0.4568	0.4970	0.6825	0.8436	0.9136	0.9411	(86)
Living	18.1386	18.4504	18.9401	19.6529	20.2554	20.7069	20.8827	20.8533	20.5315	19.7666	18.8815	18.1290	
Non living	17.3599	17.6687	18.1515	18.8553	19.4221	19.8353	19.9692	19.9552	19.6898	18.9792	18.1128	17.3629	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.5362	18.4504	18.9401	19.6529	20.2554	20.7069	20.8827	20.8533	20.5315	19.7666	18.8815	18.5306	(87)
Th 2	19.9633	19.9681	19.9730	19.9973	20.0022	20.0267	20.0267	20.0312	20.0169	20.0022	19.9924	19.9827	(88)
util rest of house	0.9286	0.9064	0.8724	0.7982	0.6839	0.5175	0.3714	0.4120	0.6252	0.8173	0.9011	0.9336	(89)
MIT 2	18.6315	17.6687	18.1515	18.8553	19.4221	19.8353	19.9692	19.9552	19.6898	18.9792	18.1128	17.7293	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	18.8320	17.8420	18.3263	19.0321	19.6068	20.0285	20.1717	20.1542	19.8764	19.1537	18.2832	17.9070	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8320	17.8420	18.3263	19.0321	19.6068	20.0285	20.1717	20.1542	19.8764	19.1537	18.2832	17.9070	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9182	0.8785	0.8427	0.7707	0.6661	0.5177	0.3848	0.4235	0.6160	0.7903	0.8738	0.9139	(94)
Useful gains	614.7754	656.4768	673.6300	673.1595	613.5941	474.2825	336.7945	345.9045	468.2536	544.8730	570.6176	589.4234	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1584.7391	1403.9725	1276.2062	1064.5413	826.2405	551.8096	363.0626	379.6677	593.7502	893.8365	1181.3436	1463.5487	(97)
Space heating kWh	721.6530	502.3171	448.3167	281.7949	158.2089	0.0000	0.0000	0.0000	0.0000	259.6288	439.7228	650.3492	(98a)
Space heating requirement - total per year (kWh/year)												3461.9915	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	721.6530	502.3171	448.3167	281.7949	158.2089	0.0000	0.0000	0.0000	0.0000	259.6288	439.7228	650.3492	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3461.9915	
Space heating per m2											(98c) / (4) =	36.3884	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												285.6431	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	721.6530	502.3171	448.3167	281.7949	158.2089	0.0000	0.0000	0.0000	0.0000	259.6288	439.7228	650.3492	(98)
Space heating efficiency (main heating system 1)	285.6431	285.6431	285.6431	285.6431	285.6431	0.0000	0.0000	0.0000	0.0000	285.6431	285.6431	285.6431	(210)
Space heating fuel (main heating system)	252.6415	175.8548	156.9500	98.6528	55.3869	0.0000	0.0000	0.0000	0.0000	90.8927	153.9414	227.6790	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	95.5956	84.5123	89.6597	78.4799	75.8502	68.0973	66.9996	69.7820	70.6879	79.1282	84.5203	94.5007	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.7468	4.2874	4.7468	4.5936	4.7468	4.5936	4.7468	4.7468	4.5936	4.7468	4.5936	4.7468	(231)
Lighting	26.9272	21.6020	19.4502	14.2500	11.0071	8.9929	10.0411	13.0518	16.9530	22.2432	25.1236	27.6755	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	1211.9992	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	284.9050	
Water heating fuel used	957.8138	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)		
mechanical ventilation fans (SFP = 0.1790)	55.8892	(230a)
Total electricity for the above, kWh/year	55.8892	(231)
Electricity for lighting (calculated in Appendix L)	217.3176	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2443.0198	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1211.9992	0.1547	187.4674	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	957.8138	0.1410	135.0326	(264)
Space and water heating			322.5000	(265)
Pumps, fans and electric keep-hot	55.8892	0.1387	7.7525	(267)
Energy for lighting	217.3176	0.1443	31.3656	(268)
Total CO2, kg/year			361.6181	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.8000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1211.9992	1.5726	1906.0057	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	957.8138	1.5213	1457.1193	(278)
Space and water heating			3363.1249	(279)
Pumps, fans and electric keep-hot	55.8892	1.5128	84.5493	(281)
Energy for lighting	217.3176	1.5338	333.3289	(282)
Total Primary energy kWh/year			3781.0031	(286)
Dwelling Primary energy Rate (DPER)			39.7400	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700	(1b) x	2.5500	(2b) =	121.3035	(1b) - (3b)
First floor	47.5700	(1c) x	2.8300	(2c) =	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 95.1400						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		255.9266	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 = 0.0000	(6a)
Number of open flues	0 * 20 = 0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000	(6d)
Number of flues attached to other heater	0 * 35 = 0.0000	(6e)
Number of blocked chimneys	0 * 20 = 0.0000	(6f)
Number of intermittent extract fans	3 * 10 = 30.0000	(7a)
Number of passive vents	0 * 10 = 0.0000	(7b)
Number of flueless gas fires	0 * 40 = 0.0000	(7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1172	(8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3672	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3121	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)

Adj infilt rate													
	0.3980	0.3902	0.3824	0.3434	0.3355	0.2965	0.2965	0.2887	0.3121	0.3355	0.3512	0.3668	(22b)
Effective ac	0.5792	0.5761	0.5731	0.5589	0.5563	0.5440	0.5440	0.5417	0.5487	0.5563	0.5617	0.5673	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type			16.7100	1.1450	19.1336			(27)
GF			47.5700	0.1300	6.1841			(28a)
Main	115.8314	18.8600	96.9714	0.1800	17.4549			(29a)
PIJ	47.5700		47.5700	0.1100	5.2327			(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.1552			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	82.6614 (35)
List of Thermal Bridges	

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.2600	0.0500	0.6130
E3 Sill	12.2600	0.0500	0.6130
E4 Jamb	37.2000	0.0500	1.8600
E5 Ground floor (normal)	21.5300	0.1600	3.4448
E10 Eaves (insulation at ceiling level)	15.3200	0.0600	0.9192
E12 Gable (insulation at ceiling level)	6.2100	0.0600	0.3726
E16 Corner (normal)	10.7600	0.0900	0.9684
E18 Party wall between dwellings	10.7600	0.0600	0.6456
P1 Party wall - Ground floor	6.2100	0.0800	0.4968
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.1200	0.7452
E6 Intermediate floor within a dwelling	21.5300	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.6786	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	60.8338	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.9161	48.6564	48.4019	47.2062	46.9824	45.9410	45.9410	45.7482	46.3422	46.9824	47.4350	47.9081	(38)
Heat transfer coeff	109.7500	109.4903	109.2357	108.0400	107.8163	106.7749	106.7749	106.5820	107.1760	107.8163	108.2688	108.7420	(39)
Average = Sum(39)m / 12 =												108.0389	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1536	1.1508	1.1482	1.1356	1.1332	1.1223	1.1223	1.1203	1.1265	1.1332	1.1380	1.1430	(40)
HLP (average)												1.1356	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6898	(42)
Hot water usage for mixer showers													
	69.3181	68.2763	66.7584	63.8540	61.7106	59.3203	57.9617	59.4682	61.1196	63.6860	66.6528	69.0525	(42a)
Hot water usage for baths													
	29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)
Hot water usage for other uses													
	42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)
Average daily hot water use (litres/day)												130.0024	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	141.4261	138.4062	134.7285	129.1362	124.5949	119.7126	117.8364	121.4982	125.3600	130.4856	136.1640	141.0593	(44)
Energy conte	223.9843	197.0885	207.0727	176.7810	167.7287	147.2007	142.5129	150.4401	154.5815	177.0677	193.9906	220.8648	(45)
Energy content (annual)										Total = Sum(45)m =		2159.3135	
Distribution loss (46)m = 0.15 x (45)m													
	33.5976	29.5633	31.0609	26.5172	25.1593	22.0801	21.3769	22.5660	23.1872	26.5602	29.0986	33.1297	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6426	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8870	(55)
Total storage loss													
	27.4979	24.8369	27.4979	26.6109	27.4979	26.6109	27.4979	27.4979	26.6109	27.4979	26.6109	27.4979	(56)
If cylinder contains dedicated solar storage													
	27.4979	24.8369	27.4979	26.6109	27.4979	26.6109	27.4979	27.4979	26.6109	27.4979	26.6109	27.4979	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	274.7447	242.9366	257.8330	225.9039	218.4890	196.3236	193.2732	201.2004	203.7044	227.8281	243.1135	271.6251	(62)
WWHRS	-31.6893	-28.0263	-29.3475	-24.3009	-22.6476	-19.3797	-18.1654	-19.3170	-20.0510	-23.6379	-26.7789	-31.1025	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	243.0553	214.9103	228.4855	201.6030	195.8415	176.9439	175.1079	181.8834	183.6534	204.1902	216.3347	240.5226	(64)
										Total per year (kWh/year) = Sum(64)m =		2462.5316	(64)
12Total per year (kWh/year)												2463	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	115.0831	102.2104	109.4599	98.0780	96.3781	88.2426	87.9938	90.6296	90.6967	99.4833	103.8002	114.0458	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	128.3915	142.1477	128.3915	132.6712	128.3915	132.6712	128.3915	128.3915	132.6712	128.3915	132.6712	128.3915	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													

	248.2231	250.7989	244.3080	230.4897	213.0465	196.6524	185.7002	183.1244	189.6153	203.4336	220.8767	237.2708 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901 (71)
Water heating gains (Table 5)												
	154.6815	152.0988	147.1236	136.2195	129.5404	122.5591	118.2712	121.8140	125.9676	133.7141	144.1670	153.2874 (72)
Total internal gains												
	597.6424	611.3916	586.1693	565.7266	537.3247	515.2290	495.7092	496.6761	511.6003	531.8854	564.0611	585.2959 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.9500	11.2829	0.6300	0.7000	0.7700	37.7579	(75)
Southwest	5.7600	36.7938	0.6300	0.7000	0.7700	64.7693	(79)

Solar gains	102.5273	187.1835	289.4255	414.4498	515.1842	533.8768	505.3848	426.8051	332.1811	215.8597	125.0880	86.2641	(83)
Total gains	700.1696	798.5751	875.5948	980.1764	1052.5089	1049.1058	1001.0940	923.4812	843.7815	747.7451	689.1491	671.5600	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.9048	19.9521	19.9986	20.2199	20.2618	20.4595	20.4595	20.4965	20.3829	20.2618	20.1771	20.0894	
alpha	2.3270	2.3301	2.3332	2.3480	2.3508	2.3640	2.3640	2.3664	2.3589	2.3508	2.3451	2.3393	
util living area													
	0.9314	0.9069	0.8698	0.7943	0.6844	0.5434	0.4241	0.4677	0.6547	0.8270	0.9063	0.9369	(86)
MIT	18.1785	18.5155	19.0308	19.7277	20.3199	20.7260	20.8906	20.8588	20.5483	19.7886	18.8835	18.1262	(87)
Th 2	19.9573	19.9595	19.9617	19.9719	19.9738	19.9827	19.9827	19.9843	19.9792	19.9738	19.9699	19.9659	(88)
util rest of house													
	0.9228	0.8954	0.8533	0.7675	0.6417	0.4790	0.3394	0.3820	0.5948	0.7984	0.8929	0.9290	(89)
MIT 2	16.6692	17.0931	17.7389	18.6012	19.3042	19.7586	19.9161	19.8935	19.5819	18.6954	17.5696	16.6081	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	17.0038	17.4084	18.0252	18.8509	19.5293	19.9731	20.1321	20.1075	19.7961	18.9378	17.8608	16.9446	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.0038	17.4084	18.0252	18.8509	19.5293	19.9731	20.1321	20.1075	19.7961	18.9378	17.8608	16.9446	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8885	0.8578	0.8141	0.7330	0.6211	0.4784	0.3525	0.3931	0.5828	0.7631	0.8559	0.8961	(94)
Useful gains	622.1005	685.0011	712.8020	718.4703	653.7264	501.8644	352.8490	362.9780	491.7948	570.5944	589.8307	601.7860	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1394.2402	1369.5514	1258.9669	1075.0984	844.1304	573.7081	377.1447	395.1511	610.4905	898.9463	1165.0629	1385.8749	(97)
Space heating kWh													
	574.4719	460.0178	406.3466	256.7722	141.6606	0.0000	0.0000	0.0000	0.0000	244.2938	414.1671	583.3622	(98a)
Space heating requirement - total per year (kWh/year)												3081.0922	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	574.4719	460.0178	406.3466	256.7722	141.6606	0.0000	0.0000	0.0000	0.0000	244.2938	414.1671	583.3622	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3081.0922	
Space heating per m2											(98c) / (4) =	32.3848	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	574.4719	460.0178	406.3466	256.7722	141.6606	0.0000	0.0000	0.0000	0.0000	244.2938	414.1671	583.3622	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	622.3964	498.3942	440.2456	278.1931	153.4784	0.0000	0.0000	0.0000	0.0000	264.6736	448.7184	632.0284	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	243.0553	214.9103	228.4855	201.6030	195.8415	176.9439	175.1079	181.8834	183.6534	204.1902	216.3347	240.5226	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.9191	85.7216	85.3360	84.6033	83.3456	79.8000	79.8000	79.8000	79.8000	84.4630	85.4917	85.9694	(217)
Fuel for water heating, kWh/month													
	282.8887	250.7073	267.7479	238.2920	234.9753	221.7342	219.4334	227.9240	230.1421	241.7511	253.0475	279.7769	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	26.6772	21.4014	19.2696	14.1178	10.9050	8.9094	9.9479	12.9306	16.7956	22.0367	24.8904	27.4187	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-43.7273	-61.2512	-87.4769	-97.6894	-104.7589	-97.5416	-96.2965	-91.1670	-82.0635	-69.6860	-47.9165	-37.8482	(233a)

Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-25.9245	-54.3936	-107.8641	-161.6637	-213.4533	-214.3907	-211.9042	-179.5910	-131.8391	-77.7180	-34.5868	-20.5145 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3338.1281	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2948.4206	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	215.3004	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2351.2664	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4236.5827	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3338.1281	0.2100	701.0069	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2948.4206	0.2100	619.1683	(264)
Space and water heating			1320.1752	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	215.3004	0.1443	31.0745	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-917.4229	0.1347	-123.6078	
PV Unit electricity exported	-1433.8435	0.1260	-180.5987	
Total			-304.2065	(269)
Total CO2, kg/year			1058.9725	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.1300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3338.1281	1.1300	3772.0847	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2948.4206	1.1300	3331.7153	(278)
Space and water heating			7103.8001	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	215.3004	1.5338	330.2349	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-917.4229	1.4980	-1374.2639	
PV Unit electricity exported	-1433.8435	0.4623	-662.9248	
Total			-2037.1887	(283)
Total Primary energy kWh/year			5526.9471	(286)
Target Primary Energy Rate (TPER)			58.0900	(287)

Full SAP Calculation Printout

Plot Reference	79841-03	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	3B5P (Semi)
Plot Address	Plot 3, Amberley Drive, Wythenshawe , MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	84 B	**DER**	3.80	**TER**	11.13
Environmental	97 A	**% DER < TER**			65.86
CO_2 Emissions (t/year)	0.33	**DFEE**	38.63	**TFEE**	39.28
Compliance Check	See BREL	**% DFEE < TFEE**			1.65
% DPER < TPER	31.59	**DPER**	39.74	**TPER**	58.09

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700 (1b)	x	2.5500 (2b)	=	121.3035	(1b) - (3b)
First floor	47.5700 (1c)	x	2.8300 (2c)	=	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	255.9266	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1172	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3172	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2696	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3438	0.3370	0.3303	0.2966	0.2899	0.2562	0.2562	0.2494	0.2696	0.2899	0.3033	0.3168	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

Effective ac	0.5938	0.5870	0.5803	0.5466	0.5399	0.5062	0.5062	0.5000	0.5196	0.5399	0.5533	0.5668	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.0000	1.1450	12.5954			(27)
Glazed Doors			5.7100	1.1450	6.5382			(27)
GF			47.5700	0.1100	5.2327	75.0000	3567.7500	(28a)
Main	115.8314	18.8600	96.9714	0.1900	18.4246	9.0000	872.7426	(29a)
PIJ	47.5700		47.5700	0.0900	4.2813	9.0000	428.1300	(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.2222			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000	20.0000	668.2000	(32)
Timber			93.9800			9.0000	845.8200	(32c)
Timber			21.9300			9.0000	197.3700	(32c)
FF			47.5700			18.0000	856.2600	(32d)
GF			47.5700			9.0000	428.1300	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7864.4026 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 82.6614 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.2600	0.0460	0.5640
E3 Sill	12.2600	0.0470	0.5762
E4 Jamb	37.2000	0.0530	1.9716
E5 Ground floor (normal)	21.5300	0.0680	1.4640
E10 Eaves (insulation at ceiling level)	15.3200	0.0910	1.3941
E12 Gable (insulation at ceiling level)	6.2100	0.0750	0.4657
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	6.2100	0.1160	0.7204
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.0460	0.2857
E6 Intermediate floor within a dwelling	21.5300	0.0540	1.1626

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.6803 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 58.9025 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.1489	49.5795	49.0102	46.1637	45.5944	42.7478	42.7478	42.2279	43.8864	45.5944	46.7330	47.8716	(38)
Heat transfer coeff	109.0513	108.4820	107.9127	105.0662	104.4968	101.6503	101.6503	101.1304	102.7889	104.4968	105.6355	106.7741	(39)
Average = Sum(39)m / 12 =												104.9279	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1462	1.1402	1.1343	1.1043	1.0983	1.0684	1.0684	1.0630	1.0804	1.0983	1.1103	1.1223	(40)
HLP (average)												1.1029	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6898 (42)
Hot water usage for mixer showers

69.3181	68.2763	66.7584	63.8540	61.7106	59.3203	57.9617	59.4682	61.1196	63.6860	66.6528	69.0525	(42a)

Hot water usage for baths

29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)

Hot water usage for other uses

42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)

Average daily hot water use (litres/day) 130.0024 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	141.4261	138.4062	134.7285	129.1362	124.5949	119.7126	117.8364	121.4982	125.3600	130.4856	136.1640	141.0593	(44)
Energy conte	223.9843	197.0885	207.0727	176.7810	167.7287	147.2007	142.5129	150.4401	154.5815	177.0677	193.9906	220.8648	(45)
Energy content (annual)										Total = Sum(45)m =		2159.3135	
Distribution loss (46)m = 0.15 x (45)m	33.5976	29.5633	31.0609	26.5172	25.1593	22.0801	21.3769	22.5660	23.1872	26.5602	29.0986	33.1297	(46)

Water storage loss (or HIU loss):
Store volume 198.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.5000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.8100 (55)
Total storage loss

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)

If cylinder contains dedicated solar storage

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(64)
										Total per year (kWh/year) = Sum(64)m =		2728.8595	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

113.1727	100.4849	107.5496	96.2293	94.4677	86.3938	86.0835	88.7193	88.8479	97.5729	101.9515	112.1355	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.7636	27.3239	22.2213	16.8230	12.5754	10.6166	11.4717	14.9113	20.0139	25.4123	29.6599	31.6186	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	370.4822	374.3267	364.6388	344.0144	317.9799	293.5111	277.1644	273.3200	283.0079	303.6322	329.6668	354.1356	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	(71)
Water heating gains (Table 5)	152.1139	149.5311	144.5559	133.6518	126.9727	119.9914	115.7036	119.2463	123.3999	131.1464	141.5993	150.7197	(72)
Total internal gains	660.9829	658.8050	639.0393	602.1125	565.1513	531.7425	511.9630	515.1009	534.0450	567.8142	608.5492	644.0971	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.2400	11.2829	0.3000	0.0000	0.7700	13.6573	(75)

Southwest			5.7600		36.7938		0.3000		0.0000		0.7700		48.9564 (79)
Northeast			5.7100		11.2829		0.3000		0.0000		0.7700		14.8823 (75)
Solar gains	77.4960	141.4841	218.7646	313.2651	389.4060	403.5350	381.9991	322.6040	251.0817	163.1592	94.5487	65.2034	(83)
Total gains	738.4790	800.2891	857.8039	915.3776	954.5573	935.2775	893.9621	837.7049	785.1267	730.9734	703.0979	709.3005	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.0324	20.1375	20.2437	20.7922	20.9055	21.4909	21.4909	21.6014	21.2528	20.9055	20.6801	20.4596	
alpha	2.3355	2.3425	2.3496	2.3861	2.3937	2.4327	2.4327	2.4401	2.4169	2.3937	2.3787	2.3640	
util living area	0.9240	0.9060	0.8730	0.8095	0.7116	0.5727	0.4492	0.4876	0.6706	0.8287	0.9014	0.9295	(86)
Living	18.2710	18.5463	19.0357	19.7082	20.2857	20.7160	20.8871	20.8595	20.5506	19.8255	18.9718	18.2556	
Non living	17.4886	17.7612	18.2422	18.9059	19.4477	19.8417	19.9715	19.9587	19.7045	19.0326	18.1993	17.4863	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.6039	18.5463	19.0357	19.7082	20.2857	20.7160	20.8871	20.8595	20.5506	19.8255	18.9718	18.6395	(87)
Th 2	19.9633	19.9681	19.9730	19.9973	20.0022	20.0267	20.0267	20.0312	20.0169	20.0022	19.9924	19.9827	(88)
util rest of house	0.9147	0.8945	0.8569	0.7843	0.6709	0.5098	0.3646	0.4034	0.6129	0.8009	0.8876	0.9208	(89)
MIT 2	18.6973	17.7612	18.2422	18.9059	19.4477	19.8417	19.9715	19.9587	19.7045	19.0326	18.1993	17.8355	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	18.8983	17.9353	18.4181	19.0837	19.6334	20.0355	20.1744	20.1584	19.8921	19.2084	18.3705	18.0137	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8983	17.9353	18.4181	19.0837	19.6334	20.0355	20.1744	20.1584	19.8921	19.2084	18.3705	18.0137	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9034	0.8655	0.8268	0.7574	0.6542	0.5104	0.3782	0.4151	0.6047	0.7744	0.8593	0.8995	(94)
Useful gains	667.1350	692.6899	709.2373	693.3322	624.4582	477.3398	338.0626	347.7645	474.7788	566.0790	604.1585	637.9921	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1591.9656	1414.0915	1286.1111	1069.9632	829.0197	552.5224	363.3436	380.0839	595.3595	899.5481	1190.5652	1474.9447	(97)
Space heating kWh	688.0740	484.7819	429.1941	271.1743	152.1938	0.0000	0.0000	0.0000	0.0000	248.1010	422.2128	622.6927	(98a)
Space heating requirement - total per year (kWh/year)												3318.4246	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	688.0740	484.7819	429.1941	271.1743	152.1938	0.0000	0.0000	0.0000	0.0000	248.1010	422.2128	622.6927	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3318.4246	
Space heating per m2											(98c) / (4) =	34.8794	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												285.6431	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement	688.0740	484.7819	429.1941	271.1743	152.1938	0.0000	0.0000	0.0000	0.0000	248.1010	422.2128	622.6927	(98)
Space heating efficiency (main heating system 1)	285.6431	285.6431	285.6431	285.6431	285.6431	0.0000	0.0000	0.0000	0.0000	285.6431	285.6431	285.6431	(210)
Space heating fuel (main heating system)	240.8859	169.7160	150.2554	94.9347	53.2811	0.0000	0.0000	0.0000	0.0000	86.8570	147.8113	217.9968	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	95.5956	84.5123	89.6597	78.4799	75.8502	68.0973	66.9996	69.7820	70.6879	79.1282	84.5203	94.5007	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.7468	4.2874	4.7468	4.5936	4.7468	4.5936	4.7468	4.7468	4.5936	4.7468	4.5936	4.7468	(231)
Lighting	26.9272	21.6020	19.4502	14.2500	11.0071	8.9929	10.0411	13.0518	16.9530	22.2432	25.1236	27.6755	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1161.7383	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	284.9050	
Water heating fuel used	957.8138	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)		
mechanical ventilation fans (SFP = 0.1790)	55.8892	(230a)
Total electricity for the above, kWh/year	55.8892	(231)
Electricity for lighting (calculated in Appendix L)	217.3176	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2392.7589	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1161.7383	16.4900	191.5706	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	957.8138	16.4900	157.9435	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	55.8892	16.4900	9.2161	(249)
Energy for lighting	217.3176	16.4900	35.8357	(250)
Additional standing charges			0.0000	(251)
Total energy cost			394.5659	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0136	(257)
SAP value		83.5698	
SAP rating (Section 12)		84	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1161.7383	0.1547	179.6824	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	957.8138	0.1410	135.0326	(264)
Space and water heating			314.7150	(265)
Pumps, fans and electric keep-hot	55.8892	0.1387	7.7525	(267)
Energy for lighting	217.3176	0.1443	31.3656	(268)
Total CO2, kg/year			353.8331	(272)
CO2 emissions per m2			3.7200	(273)
EI value			96.6167	
EI rating			97	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700	(1b) x	2.5500	(2b) =	121.3035	(1b) - (3b)
First floor	47.5700	(1c) x	2.8300	(2c) =	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		255.9266	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1172 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.3172 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2696 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.5000	4.4000	4.4000	4.0000	4.1000	3.5000	3.4000	3.4000	3.5000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1250	1.1000	1.1000	1.0000	1.0250	0.8750	0.8500	0.8500	0.8750	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.3033	0.2966	0.2966	0.2696	0.2764	0.2359	0.2292	0.2292	0.2359	0.2629	0.2629	0.2696	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5533	0.5466	0.5466	0.5196	0.5264	0.5000	0.5000	0.5000	0.5000	0.5129	0.5129	0.5196	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.0000	1.1450	12.5954			(27)
Glazed Doors			5.7100	1.1450	6.5382			(27)
GF			47.5700	0.1100	5.2327	75.0000	3567.7500	(28a)
Main	115.8314	18.8600	96.9714	0.1900	18.4246	9.0000	872.7426	(29a)
PIJ	47.5700		47.5700	0.0900	4.2813	9.0000	428.1300	(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.2222			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000	20.0000	668.2000	(32)
Timber			93.9800			9.0000	845.8200	(32c)
Timber			21.9300			9.0000	197.3700	(32c)
FF			47.5700			18.0000	856.2600	(32d)
GF			47.5700			9.0000	428.1300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 7864.4026 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	82.6614 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.2600	0.0460	0.5640
E3 Sill	12.2600	0.0470	0.5762
E4 Jamb	37.2000	0.0530	1.9716
E5 Ground floor (normal)	21.5300	0.0680	1.4640
E10 Eaves (insulation at ceiling level)	15.3200	0.0910	1.3941
E12 Gable (insulation at ceiling level)	6.2100	0.0750	0.4657
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	6.2100	0.1160	0.7204
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.0460	0.2857
E6 Intermediate floor within a dwelling	21.5300	0.0540	1.1626

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.6803 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	58.9025 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.7330	46.1637	46.1637	43.8864	44.4557	42.2279	42.2279	42.2279	42.2279	43.3171	43.3171	43.8864	(38)
Heat transfer coeff	105.6355	105.0662	105.0662	102.7889	103.3582	101.1304	101.1304	101.1304	101.1304	102.2196	102.2196	102.7889	(39)
Average = Sum(39)m / 12 =												102.8054	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1103	1.1043	1.1043	1.0804	1.0864	1.0630	1.0630	1.0630	1.0630	1.0744	1.0744	1.0804	(40)
HLP (average)												1.0806	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6898 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
69.3181	68.2763	66.7584	63.8540	61.7106	59.3203	57.9617	59.4682	61.1196	63.6860	66.6528	69.0525	(42a)

Hot water usage for baths

29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)

Hot water usage for other uses

42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)

Average daily hot water use (litres/day)	130.0024 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	141.4261	138.4062	134.7285	129.1362	124.5949	119.7126	117.8364	121.4982	125.3600	130.4856	136.1640	141.0593	(44)
Energy conte	223.9843	197.0885	207.0727	176.7810	167.7287	147.2007	142.5129	150.4401	154.5815	177.0677	193.9906	220.8648	(45)
Energy content (annual)										Total = Sum(45)m =		2159.3135	
Distribution loss (46)m = 0.15 x (45)m	33.5976	29.5633	31.0609	26.5172	25.1593	22.0801	21.3769	22.5660	23.1872	26.5602	29.0986	33.1297	(46)

Water storage loss (or HIU loss):	
Store volume	198.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.5000 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.8100 (55)

Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)

PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(64)
											Total per year (kWh/year) = Sum(64)m =	2728.8595	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	(64a)
Heat gains from water heating, kWh/month													
	113.1727	100.4849	107.5496	96.2293	94.4677	86.3938	86.0835	88.7193	88.8479	97.5729	101.9515	112.1355	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	30.7636	27.3239	22.2213	16.8230	12.5754	10.6166	11.4717	14.9113	20.0139	25.4123	29.6599	31.6186	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	370.4822	374.3267	364.6388	344.0144	317.9799	293.5111	277.1644	273.3200	283.0079	303.6322	329.6668	354.1356	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	(71)
Water heating gains (Table 5)													
	152.1139	149.5311	144.5559	133.6518	126.9727	119.9914	115.7036	119.2463	123.3999	131.1464	141.5993	150.7197	(72)
Total internal gains													
	660.9829	658.8050	639.0393	602.1125	565.1513	531.7425	511.9630	515.1009	534.0450	567.8142	608.5492	644.0971	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.2400	9.9768	0.3000	0.0000	0.7700	12.0763	(75)
Southwest	5.7600	32.4665	0.3000	0.0000	0.7700	43.1986	(79)
Northeast	5.7100	9.9768	0.3000	0.0000	0.7700	13.1595	(75)

Solar gains	68.4345	128.1917	209.4359	304.7615	367.0320	391.4022	361.7471	301.9532	246.5183	158.0045	88.6690	61.9867	(83)
Total gains	729.4174	786.9967	848.4751	906.8740	932.1833	923.1446	873.7100	817.0541	780.5633	725.8187	697.2182	706.0838	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.6801	20.7922	20.7922	21.2528	21.1358	21.6014	21.6014	21.6014	21.6014	21.3712	21.3712	21.2528	
alpha	2.3787	2.3861	2.3861	2.4169	2.4091	2.4401	2.4401	2.4401	2.4401	2.4247	2.4247	2.4169	
util living area													
	0.9182	0.8992	0.8620	0.7888	0.6768	0.5250	0.4134	0.4546	0.6463	0.8113	0.8926	0.9235	(86)
Living	18.5201	18.7824	19.2497	19.9027	20.4431	20.7978	20.9177	20.8930	20.6214	19.9822	19.1828	18.5086	
Non living	17.7531	18.0124	18.4669	19.1048	19.5977	19.9104	19.9956	19.9818	19.7760	19.1949	18.4250	17.7576	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.7314	18.7824	19.2497	19.9027	20.4431	20.7978	20.9177	20.8930	20.6214	19.9822	19.1828	18.8571	(87)
Th 2	19.9924	19.9973	19.9973	20.0169	20.0120	20.0312	20.0312	20.0312	20.0312	20.0218	20.0218	20.0169	(88)
util rest of house													
	0.9080	0.8867	0.8442	0.7604	0.6296	0.4545	0.3228	0.3631	0.5846	0.7802	0.8774	0.9141	(89)
MIT 2	18.8469	18.0124	18.4669	19.1048	19.5977	19.9104	19.9956	19.9818	19.7760	19.1949	18.4250	18.0736	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	19.0429	18.1831	18.6404	19.2816	19.7851	20.1071	20.2000	20.1838	19.9634	19.3694	18.5930	18.2473	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0429	18.1831	18.6404	19.2816	19.7851	20.1071	20.2000	20.1838	19.9634	19.3694	18.5930	18.2473	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8967	0.8581	0.8150	0.7359	0.6176	0.4604	0.3394	0.3784	0.5799	0.7558	0.8496	0.8927	(94)
Useful gains	654.0588	675.3372	691.5218	667.3790	575.7410	424.9959	296.5230	309.1414	452.6128	548.5783	592.3479	630.3348	(95)
Ext temp.	5.0000	5.6000	7.2000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.2000	7.7000	4.8000	(96)
Heat loss rate W													
	1483.4318	1322.0540	1202.0000	984.8867	732.3009	476.0312	313.5081	332.0882	552.5144	835.0712	1113.4747	1382.2329	(97)
Space heating kWh													
	617.0535	434.5937	379.7958	228.6056	116.4806	0.0000	0.0000	0.0000	0.0000	213.1507	375.2113	559.4122	(98a)
Space heating requirement - total per year (kWh/year)												2924.3033	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	617.0535	434.5937	379.7958	228.6056	116.4806	0.0000	0.0000	0.0000	0.0000	213.1507	375.2113	559.4122	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2924.3033	
Space heating per m2											(98c) / (4) =	30.7368	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	286.1613	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	617.0535	434.5937	379.7958	228.6056	116.4806	0.0000	0.0000	0.0000	0.0000	213.1507	375.2113	559.4122	(98)
Space heating efficiency (main heating system 1)	286.1613	286.1613	286.1613	286.1613	286.1613	0.0000	0.0000	0.0000	0.0000	286.1613	286.1613	286.1613	(210)
Space heating fuel (main heating system)	215.6314	151.8702	132.7209	79.8870	40.7045	0.0000	0.0000	0.0000	0.0000	74.4862	131.1188	195.4884	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	95.5956	84.5123	89.6597	78.4799	75.8502	68.0973	66.9996	69.7820	70.6879	79.1282	84.5203	94.5007	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.7468	4.2874	4.7468	4.5936	4.7468	4.5936	4.7468	4.7468	4.5936	4.7468	4.5936	4.7468	(231)
Lighting	26.9272	21.6020	19.4502	14.2500	11.0071	8.9929	10.0411	13.0518	16.9530	22.2432	25.1236	27.6755	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1021.9074	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	284.9050	
Water heating fuel used	957.8138	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)		
mechanical ventilation fans (SFP = 0.1790)	55.8892	(230a)
Total electricity for the above, kWh/year	55.8892	(231)
Electricity for lighting (calculated in Appendix L)	217.3176	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2252.9280	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1021.9074	26.0000	265.6959	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	957.8138	26.0000	249.0316	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	55.8892	26.0000	14.5312	(249)
Energy for lighting	217.3176	26.0000	56.5026	(250)
Additional standing charges			0.0000	(251)
Total energy cost			585.7613	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1021.9074	0.1549	158.3440	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	957.8138	0.1410	135.0326	(264)
Space and water heating			293.3766	(265)
Pumps, fans and electric keep-hot	55.8892	0.1387	7.7525	(267)
Energy for lighting	217.3176	0.1443	31.3656	(268)
Total CO2, kg/year			332.4947	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1021.9074	1.5736	1608.1055	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	957.8138	1.5213	1457.1193	(278)
Space and water heating			3065.2248	(279)
Pumps, fans and electric keep-hot	55.8892	1.5128	84.5493	(281)
Energy for lighting	217.3176	1.5338	333.3289	(282)

Total Primary energy kWh/year 3483.1030 (286)

SAP 10 EPC IMPROVEMENTS

001

Current energy efficiency rating: B 84
Current environmental impact rating: A 97

N	Solar water heating		Recommended
U	Solar photovoltaic panels		Recommended
V2	Wind turbine		Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.4	-£ 49	-23 kg (7.0%)
U Solar photovoltaic panels	+ 7.9	-£ 262	-212 kg (68.5%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£49	0.25 kg/m²	B 85	A 97
Solar photovoltaic panels	£262	2.23 kg/m²	A 93	A 99
Total Savings	£311	2.47 kg/m²		

Potential energy efficiency rating: A 93
Potential environmental impact rating: A 99

Fuel prices for cost data on this page from database revision number 599 TEST (30 Sep 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, West Pennines (England)):

	Current	Potential	Saving
Electricity	£586	£537	£49
Space heating	£280	£304	-£24
Water heating	£249	£176	£73
Lighting	£57	£57	£0
Generated (PV)	-£0	-£262	£262
Total cost of fuels	£586	£275	£311
Total cost of uses	£586	£275	£311
Delivered energy	24 kWh/m²	4 kWh/m²	19 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.1 tonnes	0.2 tonnes
CO2 emissions per m²	3 kg/m²	1 kg/m²	2 kg/m²
Primary energy	37 kWh/m²	17 kWh/m²	20 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700	(1b) x	2.5500	(2b) =	121.3035	(1b) - (3b)
First floor	47.5700	(1c) x	2.8300	(2c) =	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		255.9266	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1172	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3172	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2696	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)

Adj infilt rate

	0.3438	0.3370	0.3303	0.2966	0.2899	0.2562	0.2562	0.2494	0.2696	0.2899	0.3033	0.3168 (22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

Effective ac	0.5938	0.5870	0.5803	0.5466	0.5399	0.5062	0.5062	0.5000	0.5196	0.5399	0.5533	0.5668 (25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.0000	1.1450	12.5954			(27)
Glazed Doors			5.7100	1.1450	6.5382			(27)
GF			47.5700	0.1100	5.2327	75.0000	3567.7500	(28a)
Main	115.8314	18.8600	96.9714	0.1900	18.4246	9.0000	872.7426	(29a)
PIJ	47.5700		47.5700	0.0900	4.2813	9.0000	428.1300	(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.2222			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000	20.0000	668.2000	(32)
Timber			93.9800			9.0000	845.8200	(32c)
Timber			21.9300			9.0000	197.3700	(32c)
FF			47.5700			18.0000	856.2600	(32d)
GF			47.5700			9.0000	428.1300	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7864.4026 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 82.6614 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.2600	0.0460	0.5640
E3 Sill	12.2600	0.0470	0.5762
E4 Jamb	37.2000	0.0530	1.9716
E5 Ground floor (normal)	21.5300	0.0680	1.4640
E10 Eaves (insulation at ceiling level)	15.3200	0.0910	1.3941
E12 Gable (insulation at ceiling level)	6.2100	0.0750	0.4657
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	6.2100	0.1160	0.7204
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.0460	0.2857
E6 Intermediate floor within a dwelling	21.5300	0.0540	1.1626

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.6803 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 58.9025 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.1489	49.5795	49.0102	46.1637	45.5944	42.7478	42.7478	42.2279	43.8864	45.5944	46.7330	47.8716	(38)
Heat transfer coeff	109.0513	108.4820	107.9127	105.0662	104.4968	101.6503	101.6503	101.1304	102.7889	104.4968	105.6355	106.7741	(39)
Average = Sum(39)m / 12 =												104.9279	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1462	1.1402	1.1343	1.1043	1.0983	1.0684	1.0684	1.0630	1.0804	1.0983	1.1103	1.1223	(40)
HLP (average)												1.1029	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6898 (42)

Hot water usage for mixer showers

69.3181	68.2763	66.7584	63.8540	61.7106	59.3203	57.9617	59.4682	61.1196	63.6860	66.6528	69.0525	(42a)

Hot water usage for baths

29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)

Hot water usage for other uses

42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)

Average daily hot water use (litres/day) 130.0024 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	141.4261	138.4062	134.7285	129.1362	124.5949	119.7126	117.8364	121.4982	125.3600	130.4856	136.1640	141.0593	(44)
Energy conte	223.9843	197.0885	207.0727	176.7810	167.7287	147.2007	142.5129	150.4401	154.5815	177.0677	193.9906	220.8648	(45)
Energy content (annual)										Total = Sum(45)m =		2159.3135	
Distribution loss (46)m = 0.15 x (45)m	33.5976	29.5633	31.0609	26.5172	25.1593	22.0801	21.3769	22.5660	23.1872	26.5602	29.0986	33.1297	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage	15.5986	14.0891	15.5986	15.0955	15.5986	15.0955	15.5986	15.5986	15.0955	15.5986	15.0955	15.5986	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	262.8454	232.1888	244.5380	207.6349	193.7954	172.2014	168.3470	177.2047	186.7860	214.5330	231.5981	259.7258	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
If combined cylinder, total volume of cylinder												198.0000	(H13)
Effective solar volume												111.9000	(H14)
Reference volume												225.0000	(H15)

Storage tank correction coefficient												1.1908	(H16)
Heat delivered to hot water												652.0514	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												652.0514	
Solar input	-0.0000	-19.9133	-62.1742	-83.6265	-107.4087	-98.8285	-98.0326	-86.6188	-61.4012	-32.9585	-1.0890	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	262.8454	212.2755	182.3638	124.0084	86.3867	73.3729	70.3143	90.5859	125.3849	181.5745	230.5090	259.7258	(64)
									Total per year (kWh/year) = Sum(64)m =			1899.3470	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
							Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =					0.0000	(64a)
Heat gains from water heating, kWh/month													
	105.5636	93.6122	98.8239	83.4628	76.6232	68.9448	68.0528	71.4330	77.1620	88.8472	94.5878	104.5264	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	30.7636	27.3239	22.2213	16.8230	12.5754	10.6166	11.4717	14.9113	20.0139	25.4123	29.6599	31.6186	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	370.4822	374.3267	364.6388	344.0144	317.9799	293.5111	277.1644	273.3200	283.0079	303.6322	329.6668	354.1356	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	(71)
Water heating gains (Table 5)													
	141.8866	139.3038	132.8278	115.9205	102.9881	95.7567	91.4688	96.0121	107.1694	119.4183	131.3720	140.4924	(72)
Total internal gains													
	650.7556	648.5777	627.3112	584.3812	541.1667	507.5077	487.7282	491.8667	517.8145	556.0861	598.3219	633.8698	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.2400	11.2829	0.3000	0.0000	0.7700	13.6573	(75)
Southwest	5.7600	36.7938	0.3000	0.0000	0.7700	48.9564	(79)
Northeast	5.7100	11.2829	0.3000	0.0000	0.7700	14.8823	(75)

Solar gains	77.4960	141.4841	218.7646	313.2651	389.4060	403.5350	381.9991	322.6040	251.0817	163.1592	94.5487	65.2034	(83)
Total gains	728.2517	790.0618	846.0758	897.6463	930.5727	911.0427	869.7273	814.4707	768.8963	719.2454	692.8707	699.0732	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.0324	20.1375	20.2437	20.7922	20.9055	21.4909	21.4909	21.6014	21.2528	20.9055	20.6801	20.4596	
alpha	2.3355	2.3425	2.3496	2.3861	2.3937	2.4327	2.4327	2.4401	2.4169	2.3937	2.3787	2.3640	
util living area													
	0.9260	0.9081	0.8759	0.8149	0.7205	0.5828	0.4591	0.4981	0.6783	0.8329	0.9039	0.9313	(86)
Living	18.2517	18.5281	19.0168	19.6851	20.2641	20.7044	20.8814	20.8526	20.5383	19.8092	18.9536	18.2358	
Non living	17.4699	17.7436	18.2243	18.8848	19.4295	19.8335	19.9685	19.9548	19.6951	19.0178	18.1819	17.4670	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.5941	18.5281	19.0168	19.6851	20.2641	20.7044	20.8814	20.8526	20.5383	19.8092	18.9536	18.6225	(87)
Th 2	19.9633	19.9681	19.9730	19.9973	20.0022	20.0267	20.0267	20.0312	20.0169	20.0022	19.9924	19.9827	(88)
util rest of house													
	0.9168	0.8968	0.8600	0.7901	0.6802	0.5197	0.3734	0.4130	0.6208	0.8055	0.8904	0.9229	(89)
MIT 2	18.6878	17.7436	18.2243	18.8848	19.4295	19.8335	19.9685	19.9548	19.6951	19.0178	18.1819	17.8189	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	18.8887	17.9175	18.4000	19.0622	19.6145	20.0266	20.1709	20.1538	19.8820	19.1932	18.3530	17.9970	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8887	17.9175	18.4000	19.0622	19.6145	20.0266	20.1709	20.1538	19.8820	19.1932	18.3530	17.9970	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9056	0.8680	0.8300	0.7630	0.6627	0.5197	0.3868	0.4244	0.6120	0.7789	0.8622	0.9018	(94)
Useful gains	659.5153	685.8089	702.2323	684.9189	616.7090	473.4353	336.4173	345.6993	470.5826	560.1999	597.4258	630.4165	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1590.9131	1412.1682	1284.1640	1067.7050	827.0390	551.6116	362.9789	379.6217	594.3257	897.9674	1188.7140	1473.1650	(97)
Space heating kWh													
	692.9599	488.1135	432.9572	275.6060	156.4855	0.0000	0.0000	0.0000	0.0000	251.2990	425.7275	627.0049	(98a)
Space heating requirement - total per year (kWh/year)												3350.1535	
Solar heating kWh													
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	692.9599	488.1135	432.9572	275.6060	156.4855	0.0000	0.0000	0.0000	0.0000	251.2990	425.7275	627.0049	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3350.1535	
Space heating per m2											(98c) / (4) =	35.2129	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)

Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												285.6431	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	692.9599	488.1135	432.9572	275.6060	156.4855	0.0000	0.0000	0.0000	0.0000	251.2990	425.7275	627.0049	(98)
Space heating efficiency (main heating system 1)													
	285.6431	285.6431	285.6431	285.6431	285.6431	0.0000	0.0000	0.0000	0.0000	285.6431	285.6431	285.6431	(210)
Space heating fuel (main heating system)													
	242.5965	170.8823	151.5728	96.4861	54.7836	0.0000	0.0000	0.0000	0.0000	87.9766	149.0418	219.5064	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	262.8454	212.2755	182.3638	124.0084	86.3867	73.3729	70.3143	90.5859	125.3849	181.5745	230.5090	259.7258	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month													
	92.2572	74.5075	64.0086	43.5262	30.3212	25.7535	24.6799	31.7951	44.0094	63.7316	80.9073	91.1622	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5413	10.4244	11.5413	11.1690	11.5413	11.1690	11.5413	11.5413	11.1690	11.5413	11.1690	11.5413	(231)
Lighting	26.9272	21.6020	19.4502	14.2500	11.0071	8.9929	10.0411	13.0518	16.9530	22.2432	25.1236	27.6755	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-38.0992	-56.3669	-84.4848	-96.8839	-103.3352	-90.3781	-89.0958	-83.8778	-74.2858	-64.5119	-42.3440	-32.4195	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-11.9873	-27.2131	-57.8614	-93.8882	-132.3476	-141.3356	-139.5557	-115.8962	-82.1773	-42.3340	-17.0658	-9.4943	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1172.8462	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												284.9050	
Water heating fuel used												666.6598	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)													
mechanical ventilation fans (SFP = 0.1790)												55.8892	(230a)
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												135.8892	(231)
Electricity for lighting (calculated in Appendix L)												217.3176	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1727.2394	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												465.4733	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1172.8462	16.4900	193.4023	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	666.6598	16.4900	109.9322	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	55.8892	16.4900	9.2161	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	217.3176	16.4900	35.8357	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-856.0828	16.4900	-141.1681	
PV Unit electricity exported	-871.1566	5.5900	-48.6977	
Total			-189.8657	(252)
Total energy cost			171.7126	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4411	(257)
SAP value		92.8497	
SAP rating (Section 12)		93	(258)
SAP band		A	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	

Space heating - main system 1	1172.8462	0.1546	181.3537	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	666.6598	0.1462	97.4831	(264)
Space and water heating			278.8368	(265)
Pumps, fans and electric keep-hot	135.8892	0.1387	18.8495	(267)
Energy for lighting	217.3176	0.1443	31.3656	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-856.0828	0.1347	-115.2938	
PV Unit electricity exported	-871.1566	0.1232	-107.3186	
Total			-222.6124	(269)
Total CO2, kg/year			106.4395	(272)
CO2 emissions per m2			1.1200	(273)
EI value			98.9822	
EI rating			99	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700 (1b)	x	2.5500 (2b)	=	121.3035	(1b) - (3b)
First floor	47.5700 (1c)	x	2.8300 (2c)	=	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		255.9266	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1172	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3172	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2696	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.5000	4.4000	4.4000	4.0000	4.1000	3.5000	3.4000	3.4000	3.5000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1250	1.1000	1.1000	1.0000	1.0250	0.8750	0.8500	0.8500	0.8750	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.3033	0.2966	0.2966	0.2696	0.2764	0.2359	0.2292	0.2292	0.2359	0.2629	0.2629	0.2696	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
Effective ac	0.5533	0.5466	0.5466	0.5196	0.5264	0.5000	0.5000	0.5000	0.5000	0.5129	0.5129	0.5196	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.0000	1.1450	12.5954			(27)
Glazed Doors			5.7100	1.1450	6.5382			(27)
GF			47.5700	0.1100	5.2327	75.0000	3567.7500	(28a)
Main	115.8314	18.8600	96.9714	0.1900	18.4246	9.0000	872.7426	(29a)
PIJ	47.5700		47.5700	0.0900	4.2813	9.0000	428.1300	(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.2222			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000	20.0000	668.2000	(32)
Timber			93.9800			9.0000	845.8200	(32c)
Timber			21.9300			9.0000	197.3700	(32c)
FF			47.5700			18.0000	856.2600	(32d)
GF			47.5700			9.0000	428.1300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	7864.4026 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		82.6614 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.2600	0.0460	0.5640
E3 Sill	12.2600	0.0470	0.5762
E4 Jamb	37.2000	0.0530	1.9716

E5 Ground floor (normal)	21.5300	0.0680	1.4640	
E10 Eaves (insulation at ceiling level)	15.3200	0.0910	1.3941	
E12 Gable (insulation at ceiling level)	6.2100	0.0750	0.4657	
E16 Corner (normal)	10.7600	0.0460	0.4950	
E18 Party wall between dwellings	10.7600	0.0540	0.5810	
P1 Party wall - Ground floor	6.2100	0.1160	0.7204	
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.0460	0.2857	
E6 Intermediate floor within a dwelling	21.5300	0.0540	1.1626	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				9.6803 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	58.9025 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.7330	46.1637	46.1637	43.8864	44.4557	42.2279	42.2279	42.2279	42.2279	43.3171	43.3171	43.8864	(38)
Heat transfer coeff	105.6355	105.0662	105.0662	102.7889	103.3582	101.1304	101.1304	101.1304	101.1304	102.2196	102.2196	102.7889	(39)
Average = Sum(39)m / 12 =												102.8054	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1103	1.1043	1.1043	1.0804	1.0864	1.0630	1.0630	1.0630	1.0630	1.0744	1.0744	1.0804	(40)
HLP (average)												1.0806	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6898	(42)
Hot water usage for mixer showers	69.3181	68.2763	66.7584	63.8540	61.7106	59.3203	57.9617	59.4682	61.1196	63.6860	66.6528	69.0525	(42a)
Hot water usage for baths	29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)
Hot water usage for other uses	42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)
Average daily hot water use (litres/day)												130.0024	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	141.4261	138.4062	134.7285	129.1362	124.5949	119.7126	117.8364	121.4982	125.3600	130.4856	136.1640	141.0593	(44)
Energy conte	223.9843	197.0885	207.0727	176.7810	167.7287	147.2007	142.5129	150.4401	154.5815	177.0677	193.9906	220.8648	(45)
Energy content (annual)										Total = Sum(45)m =		2159.3135	
Distribution loss (46)m = 0.15 x (45)m	33.5976	29.5633	31.0609	26.5172	25.1593	22.0801	21.3769	22.5660	23.1872	26.5602	29.0986	33.1297	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage	15.5986	14.0891	15.5986	15.0955	15.5986	15.0955	15.5986	15.5986	15.0955	15.5986	15.0955	15.5986	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	262.8454	232.1888	244.5380	207.6349	193.7954	172.2014	168.3470	177.2047	186.7860	214.5330	231.5981	259.7258	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
If combined cylinder, total volume of cylinder												198.0000	(H13)
Effective solar volume												111.9000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.1908	(H16)
Heat delivered to hot water												618.9847	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												618.9847	
Solar input	-0.0000	-15.4923	-59.0081	-81.5881	-101.6969	-96.4015	-92.8449	-80.4442	-60.1659	-31.3427	-0.0000	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	262.8454	216.6965	185.5299	126.0468	92.0985	75.7999	75.5021	96.7604	126.6201	183.1903	231.5981	259.7258	(64)
									Total per year (kWh/year) = Sum(64)m =			1932.4138	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	105.5636	93.6122	98.8239	83.4628	76.6232	68.9448	68.0528	71.4330	77.1620	88.8472	94.5878	104.5264	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.7636	27.3239	22.2213	16.8230	12.5754	10.6166	11.4717	14.9113	20.0139	25.4123	29.6599	31.6186	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	370.4822	374.3267	364.6388	344.0144	317.9799	293.5111	277.1644	273.3200	283.0079	303.6322	329.6668	354.1356	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	(71)
Water heating gains (Table 5)	141.8866	139.3038	132.8278	115.9205	102.9881	95.7567	91.4688	96.0121	107.1694	119.4183	131.3720	140.4924	(72)
Total internal gains	650.7556	648.5777	627.3112	584.3812	541.1667	507.5077	487.7282	491.8667	517.8145	556.0861	598.3219	633.8698	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.2400	9.9768	0.3000	0.0000	0.7700	12.0763	(75)
Southwest	5.7600	32.4665	0.3000	0.0000	0.7700	43.1986	(79)
Northeast	5.7100	9.9768	0.3000	0.0000	0.7700	13.1595	(75)

Solar gains	68.4345	128.1917	209.4359	304.7615	367.0320	391.4022	361.7471	301.9532	246.5183	158.0045	88.6690	61.9867	(83)
Total gains	719.1901	776.7694	836.7471	889.1427	908.1987	898.9099	849.4753	793.8199	764.3328	714.0906	686.9909	695.8565	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.6801	20.7922	20.7922	21.2528	21.1358	21.6014	21.6014	21.6014	21.6014	21.3712	21.3712	21.2528	
alpha	2.3787	2.3861	2.3861	2.4169	2.4091	2.4401	2.4401	2.4401	2.4401	2.4247	2.4247	2.4169	
util living area	0.9203	0.9015	0.8651	0.7947	0.6863	0.5352	0.4231	0.4650	0.6542	0.8159	0.8954	0.9256	(86)
Living	18.5009	18.7644	19.2314	19.8812	20.4244	20.7889	20.9133	20.8874	20.6103	19.9668	19.1650	18.4889	
Non living	17.7345	17.9950	18.4497	19.0854	19.5825	19.9046	19.9936	19.9789	19.7678	19.1811	18.4080	17.7385	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.7216	18.7644	19.2314	19.8812	20.4244	20.7889	20.9133	20.8874	20.6103	19.9668	19.1650	18.8401	(87)
Th 2	19.9924	19.9973	19.9973	20.0169	20.0120	20.0312	20.0312	20.0312	20.0312	20.0218	20.0218	20.0169	(88)
util rest of house	0.9103	0.8892	0.8476	0.7667	0.6394	0.4641	0.3311	0.3723	0.5927	0.7852	0.8805	0.9164	(89)
MIT 2	18.8374	17.9950	18.4497	19.0854	19.5825	19.9046	19.9936	19.9789	19.7678	19.1811	18.4080	18.0572	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	19.0334	18.1656	18.6230	19.2618	19.7691	20.1006	20.1975	20.1803	19.9546	19.3553	18.5758	18.2308	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0334	18.1656	18.6230	19.2618	19.7691	20.1006	20.1975	20.1803	19.9546	19.3553	18.5758	18.2308	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8991	0.8608	0.8184	0.7419	0.6267	0.4696	0.3477	0.3875	0.5873	0.7605	0.8528	0.8952	(94)
Useful gains	646.6185	668.6364	684.8036	659.6225	569.1298	422.0954	295.3349	307.5664	448.9051	543.0922	585.8426	622.9395	(95)
Ext temp.	5.0000	5.6000	7.2000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.2000	7.7000	4.8000	(96)
Heat loss rate W	1482.4222	1320.2176	1200.1677	982.8514	730.6544	475.3719	313.2473	331.7390	551.6221	833.6267	1111.7232	1380.5331	(97)
Space heating kWh	621.8380	437.8626	383.4309	232.7248	120.1743	0.0000	0.0000	0.0000	0.0000	216.1576	378.6340	563.6496	(98a)
Space heating requirement - total per year (kWh/year)												2954.4718	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	621.8380	437.8626	383.4309	232.7248	120.1743	0.0000	0.0000	0.0000	0.0000	216.1576	378.6340	563.6496	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2954.4718	
Space heating per m2											(98c) / (4) =	31.0539	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	286.1613 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	621.8380	437.8626	383.4309	232.7248	120.1743	0.0000	0.0000	0.0000	0.0000	216.1576	378.6340	563.6496	(98)
Space heating efficiency (main heating system 1)	286.1613	286.1613	286.1613	286.1613	286.1613	0.0000	0.0000	0.0000	0.0000	286.1613	286.1613	286.1613	(210)
Space heating fuel (main heating system)	217.3033	153.0125	133.9912	81.3265	41.9953	0.0000	0.0000	0.0000	0.0000	75.5370	132.3149	196.9692	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	262.8454	216.6965	185.5299	126.0468	92.0985	75.7999	75.5021	96.7604	126.6201	183.1903	231.5981	259.7258	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	92.2572	76.0592	65.1199	44.2417	32.3260	26.6053	26.5008	33.9624	44.4429	64.2987	81.2896	91.1622	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5413	10.4244	11.5413	11.1690	11.5413	11.1690	11.5413	11.5413	11.1690	11.5413	11.1690	11.5413	(231)
Lighting	26.9272	21.6020	19.4502	14.2500	11.0071	8.9929	10.0411	13.0518	16.9530	22.2432	25.1236	27.6755	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-34.0473	-51.7688	-81.1382	-94.0147	-98.5583	-89.0565	-86.8343	-81.0552	-73.4727	-62.5386	-39.9377	-30.8844	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)

Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-10.1922	-23.9644	-55.1146	-91.5066	-123.4807	-135.5875	-129.5950	-105.8499	-80.1049	-40.9300	-15.7876	-8.9717 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	1032.4499 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	284.9050
Water heating fuel used	678.2660 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)	
mechanical ventilation fans (SFP = 0.1790)	55.8892 (230a)
pump for solar water heating	80.0000 (230g)
Total electricity for the above, kWh/year	135.8892 (231)
Electricity for lighting (calculated in Appendix L)	217.3176 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1644.3918 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	419.5309 (238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1032.4499	26.0000	268.4370	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	678.2660	26.0000	176.3492	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	55.8892	26.0000	14.5312	(249)
Pump for solar water heating	80.0000	26.0000	20.8000	(249)
Energy for lighting	217.3176	26.0000	56.5026	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-823.3066	26.0000	-214.0597	
PV Unit electricity exported	-821.0852	5.8100	-47.7050	
Total			-261.7648	(252)
Total energy cost			274.8551	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1032.4499	0.1549	159.9347	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	678.2660	0.1460	99.0032	(264)
Space and water heating			258.9379	(265)
Pumps, fans and electric keep-hot	135.8892	0.1387	18.8495	(267)
Energy for lighting	217.3176	0.1443	31.3656	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-823.3066	0.1344	-110.6379	
PV Unit electricity exported	-821.0852	0.1232	-101.1600	
Total			-211.7979	(269)
Total CO2, kg/year			97.3552	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1032.4499	1.5735	1624.5364	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	678.2660	1.5399	1044.4947	(278)
Space and water heating			2669.0311	(279)
Pumps, fans and electric keep-hot	135.8892	1.5128	205.5733	(281)
Energy for lighting	217.3176	1.5338	333.3289	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-823.3066	1.4967	-1232.2140	
PV Unit electricity exported	-821.0852	0.4521	-371.2400	
Total			-1603.4540	(283)
Total Primary energy kWh/year			1604.4793	(286)

Full SAP Calculation Printout

Plot Reference	79841-04	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	3B5P (Semi)
Plot Address	Plot 4, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	84 B	**DER**	3.80	**TER**	11.13
Environmental	97 A	**% DER < TER**			65.86
CO_2 Emissions (t/year)	0.33	**DFEE**	38.63	**TFEE**	39.28
Compliance Check	See BREL	**% DFEE < TFEE**			1.65
% DPER < TPER	31.59	**DPER**	39.74	**TPER**	58.09

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700 (1b)	x	2.5500 (2b)	=	121.3035	(1b) - (3b)
First floor	47.5700 (1c)	x	2.8300 (2c)	=	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	255.9266	(5)

---

2. Ventilation rate

---

			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		3 * 10 =	30.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		30.0000 / (5) =	0.1172	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			4.0000	(17)
Infiltration rate			0.3172	(18)
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.2696	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3438	0.3370	0.3303	0.2966	0.2899	0.2562	0.2562	0.2494	0.2696	0.2899	0.3033	0.3168	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

Effective ac	0.5938	0.5870	0.5803	0.5466	0.5399	0.5062	0.5062	0.5000	0.5196	0.5399	0.5533	0.5668	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.0000	1.1450	12.5954			(27)
Glazed Doors			5.7100	1.1450	6.5382			(27)
GF			47.5700	0.1100	5.2327	75.0000	3567.7500	(28a)
Main	115.8314	18.8600	96.9714	0.1900	18.4246	9.0000	872.7426	(29a)
PIJ	47.5700		47.5700	0.0900	4.2813	9.0000	428.1300	(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.2222			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000	20.0000	668.2000	(32)
Timber			93.9800			9.0000	845.8200	(32c)
Timber			21.9300			9.0000	197.3700	(32c)
FF			47.5700			18.0000	856.2600	(32d)
GF			47.5700			9.0000	428.1300	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7864.4026 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 82.6614 (35)
List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	12.2600	0.0460	0.5640	
E3 Sill	12.2600	0.0470	0.5762	
E4 Jamb	37.2000	0.0530	1.9716	
E5 Ground floor (normal)	21.5300	0.0680	1.4640	
E10 Eaves (insulation at ceiling level)	15.3200	0.0910	1.3941	
E12 Gable (insulation at ceiling level)	6.2100	0.0750	0.4657	
E16 Corner (normal)	10.7600	0.0460	0.4950	
E18 Party wall between dwellings	10.7600	0.0540	0.5810	
P1 Party wall - Ground floor	6.2100	0.1160	0.7204	
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.0460	0.2857	
E6 Intermediate floor within a dwelling	21.5300	0.0540	1.1626	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.6803 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 58.9025 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.1489	49.5795	49.0102	46.1637	45.5944	42.7478	42.7478	42.2279	43.8864	45.5944	46.7330	47.8716	(38)
Heat transfer coeff	109.0513	108.4820	107.9127	105.0662	104.4968	101.6503	101.6503	101.1304	102.7889	104.4968	105.6355	106.7741	(39)
Average = Sum(39)m / 12 =												104.9279	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1462	1.1402	1.1343	1.1043	1.0983	1.0684	1.0684	1.0630	1.0804	1.0983	1.1103	1.1223	(40)
HLP (average)												1.1029	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6898 (42)
Hot water usage for mixer showers

69.3181	68.2763	66.7584	63.8540	61.7106	59.3203	57.9617	59.4682	61.1196	63.6860	66.6528	69.0525	(42a)

Hot water usage for baths

29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)

Hot water usage for other uses

42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)

Average daily hot water use (litres/day) 130.0024 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	141.4261	138.4062	134.7285	129.1362	124.5949	119.7126	117.8364	121.4982	125.3600	130.4856	136.1640	141.0593	(44)
Energy conte	223.9843	197.0885	207.0727	176.7810	167.7287	147.2007	142.5129	150.4401	154.5815	177.0677	193.9906	220.8648	(45)
Energy content (annual)										Total = Sum(45)m =		2159.3135	
Distribution loss (46)m = 0.15 x (45)m	33.5976	29.5633	31.0609	26.5172	25.1593	22.0801	21.3769	22.5660	23.1872	26.5602	29.0986	33.1297	(46)

Water storage loss (or HIU loss):
Store volume 198.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.5000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.8100 (55)
Total storage loss

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)

If cylinder contains dedicated solar storage

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(64)
									Total per year (kWh/year) = Sum(64)m =		2728.8595	(64)
12Total per year (kWh/year)											2729	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

113.1727	100.4849	107.5496	96.2293	94.4677	86.3938	86.0835	88.7193	88.8479	97.5729	101.9515	112.1355	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	128.3915	142.1477	128.3915	132.6712	128.3915	132.6712	128.3915	128.3915	132.6712	128.3915	132.6712	128.3915	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	248.2231	250.7989	244.3080	230.4897	213.0465	196.6524	185.7002	183.1244	189.6153	203.4336	220.8767	237.2708	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	(71)
Water heating gains (Table 5)	152.1139	149.5311	144.5559	133.6518	126.9727	119.9914	115.7036	119.2463	123.3999	131.1464	141.5993	150.7197	(72)
Total internal gains	592.0747	605.8239	580.6016	560.1589	531.7570	512.6613	493.1415	494.1084	509.0326	526.3177	558.4935	579.7283	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

Northeast			5.2400		11.2829		0.3000		0.0000		0.7700		13.6573 (75)
Southwest			5.7600		36.7938		0.3000		0.0000		0.7700		48.9564 (79)
Northeast			5.7100		11.2829		0.3000		0.0000		0.7700		14.8823 (75)
Solar gains	77.4960	141.4841	218.7646	313.2651	389.4060	403.5350	381.9991	322.6040	251.0817	163.1592	94.5487	65.2034	(83)
Total gains	669.5707	747.3080	799.3662	873.4241	921.1630	916.1963	875.1406	816.7124	760.1144	689.4770	653.0422	644.9316	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.0324	20.1375	20.2437	20.7922	20.9055	21.4909	21.4909	21.6014	21.2528	20.9055	20.6801	20.4596	
alpha	2.3355	2.3425	2.3496	2.3861	2.3937	2.4327	2.4327	2.4401	2.4169	2.3937	2.3787	2.3640	
util living area	0.9366	0.9168	0.8872	0.8224	0.7240	0.5806	0.4568	0.4970	0.6825	0.8436	0.9136	0.9411	(86)
Living	18.1386	18.4504	18.9401	19.6529	20.2554	20.7069	20.8827	20.8533	20.5315	19.7666	18.8815	18.1290	
Non living	17.3599	17.6687	18.1515	18.8553	19.4221	19.8353	19.9692	19.9552	19.6898	18.9792	18.1128	17.3629	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.5362	18.4504	18.9401	19.6529	20.2554	20.7069	20.8827	20.8533	20.5315	19.7666	18.8815	18.5306	(87)
Th 2	19.9633	19.9681	19.9730	19.9973	20.0022	20.0267	20.0267	20.0312	20.0169	20.0022	19.9924	19.9827	(88)
util rest of house	0.9286	0.9064	0.8724	0.7982	0.6839	0.5175	0.3714	0.4120	0.6252	0.8173	0.9011	0.9336	(89)
MIT 2	18.6315	17.6687	18.1515	18.8553	19.4221	19.8353	19.9692	19.9552	19.6898	18.9792	18.1128	17.7293	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	18.8320	17.8420	18.3263	19.0321	19.6068	20.0285	20.1717	20.1542	19.8764	19.1537	18.2832	17.9070	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8320	17.8420	18.3263	19.0321	19.6068	20.0285	20.1717	20.1542	19.8764	19.1537	18.2832	17.9070	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9182	0.8785	0.8427	0.7707	0.6661	0.5177	0.3848	0.4235	0.6160	0.7903	0.8738	0.9139	(94)
Useful gains	614.7754	656.4768	673.6300	673.1595	613.5941	474.2825	336.7945	345.9045	468.2536	544.8730	570.6176	589.4234	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1584.7391	1403.9725	1276.2062	1064.5413	826.2405	551.8096	363.0626	379.6677	593.7502	893.8365	1181.3436	1463.5487	(97)
Space heating kWh	721.6530	502.3171	448.3167	281.7949	158.2089	0.0000	0.0000	0.0000	0.0000	259.6288	439.7228	650.3492	(98a)
Space heating requirement - total per year (kWh/year)												3461.9915	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	721.6530	502.3171	448.3167	281.7949	158.2089	0.0000	0.0000	0.0000	0.0000	259.6288	439.7228	650.3492	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3461.9915	
Space heating per m2											(98c) / (4) =	36.3884	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												285.6431	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	721.6530	502.3171	448.3167	281.7949	158.2089	0.0000	0.0000	0.0000	0.0000	259.6288	439.7228	650.3492	(98)
Space heating efficiency (main heating system 1)	285.6431	285.6431	285.6431	285.6431	285.6431	0.0000	0.0000	0.0000	0.0000	285.6431	285.6431	285.6431	(210)
Space heating fuel (main heating system)	252.6415	175.8548	156.9500	98.6528	55.3869	0.0000	0.0000	0.0000	0.0000	90.8927	153.9414	227.6790	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	95.5956	84.5123	89.6597	78.4799	75.8502	68.0973	66.9996	69.7820	70.6879	79.1282	84.5203	94.5007	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.7468	4.2874	4.7468	4.5936	4.7468	4.5936	4.7468	4.7468	4.5936	4.7468	4.5936	4.7468	(231)
Lighting	26.9272	21.6020	19.4502	14.2500	11.0071	8.9929	10.0411	13.0518	16.9530	22.2432	25.1236	27.6755	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	1211.9992	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	284.9050	
Water heating fuel used	957.8138	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)		
mechanical ventilation fans (SFP = 0.1790)	55.8892	(230a)
Total electricity for the above, kWh/year	55.8892	(231)
Electricity for lighting (calculated in Appendix L)	217.3176	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2443.0198	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1211.9992	0.1547	187.4674	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	957.8138	0.1410	135.0326	(264)
Space and water heating			322.5000	(265)
Pumps, fans and electric keep-hot	55.8892	0.1387	7.7525	(267)
Energy for lighting	217.3176	0.1443	31.3656	(268)
Total CO2, kg/year			361.6181	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.8000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1211.9992	1.5726	1906.0057	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	957.8138	1.5213	1457.1193	(278)
Space and water heating			3363.1249	(279)
Pumps, fans and electric keep-hot	55.8892	1.5128	84.5493	(281)
Energy for lighting	217.3176	1.5338	333.3289	(282)
Total Primary energy kWh/year			3781.0031	(286)
Dwelling Primary energy Rate (DPER)			39.7400	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700	(1b) x	2.5500	(2b) =	121.3035	(1b) - (3b)
First floor	47.5700	(1c) x	2.8300	(2c) =	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 95.1400						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		255.9266	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 = 0.0000	(6a)
Number of open flues	0 * 20 = 0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000	(6d)
Number of flues attached to other heater	0 * 35 = 0.0000	(6e)
Number of blocked chimneys	0 * 20 = 0.0000	(6f)
Number of intermittent extract fans	3 * 10 = 30.0000	(7a)
Number of passive vents	0 * 10 = 0.0000	(7b)
Number of flueless gas fires	0 * 40 = 0.0000	(7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1172	(8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3672	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3121	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)

Adj infilt rate													
	0.3980	0.3902	0.3824	0.3434	0.3355	0.2965	0.2965	0.2887	0.3121	0.3355	0.3512	0.3668	(22b)
Effective ac	0.5792	0.5761	0.5731	0.5589	0.5563	0.5440	0.5440	0.5417	0.5487	0.5563	0.5617	0.5673	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type			16.7100	1.1450	19.1336			(27)
GF			47.5700	0.1300	6.1841			(28a)
Main	115.8314	18.8600	96.9714	0.1800	17.4549			(29a)
PIJ	47.5700		47.5700	0.1100	5.2327			(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.1552			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	82.6614 (35)
List of Thermal Bridges	

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.2600	0.0500	0.6130
E3 Sill	12.2600	0.0500	0.6130
E4 Jamb	37.2000	0.0500	1.8600
E5 Ground floor (normal)	21.5300	0.1600	3.4448
E10 Eaves (insulation at ceiling level)	15.3200	0.0600	0.9192
E12 Gable (insulation at ceiling level)	6.2100	0.0600	0.3726
E16 Corner (normal)	10.7600	0.0900	0.9684
E18 Party wall between dwellings	10.7600	0.0600	0.6456
P1 Party wall - Ground floor	6.2100	0.0800	0.4968
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.1200	0.7452
E6 Intermediate floor within a dwelling	21.5300	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.6786	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	60.8338	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.9161	48.6564	48.4019	47.2062	46.9824	45.9410	45.9410	45.7482	46.3422	46.9824	47.4350	47.9081	(38)
Heat transfer coeff	109.7500	109.4903	109.2357	108.0400	107.8163	106.7749	106.7749	106.5820	107.1760	107.8163	108.2688	108.7420	(39)
Average = Sum(39)m / 12 =												108.0389	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1536	1.1508	1.1482	1.1356	1.1332	1.1223	1.1223	1.1203	1.1265	1.1332	1.1380	1.1430	(40)
HLP (average)												1.1356	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6898	(42)
Hot water usage for mixer showers													
	69.3181	68.2763	66.7584	63.8540	61.7106	59.3203	57.9617	59.4682	61.1196	63.6860	66.6528	69.0525	(42a)
Hot water usage for baths													
	29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)
Hot water usage for other uses													
	42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)
Average daily hot water use (litres/day)												130.0024	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	141.4261	138.4062	134.7285	129.1362	124.5949	119.7126	117.8364	121.4982	125.3600	130.4856	136.1640	141.0593	(44)
Energy conte	223.9843	197.0885	207.0727	176.7810	167.7287	147.2007	142.5129	150.4401	154.5815	177.0677	193.9906	220.8648	(45)
Energy content (annual)										Total = Sum(45)m =		2159.3135	
Distribution loss (46)m = 0.15 x (45)m													
	33.5976	29.5633	31.0609	26.5172	25.1593	22.0801	21.3769	22.5660	23.1872	26.5602	29.0986	33.1297	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6426	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8870	(55)
Total storage loss													
	27.4979	24.8369	27.4979	26.6109	27.4979	26.6109	27.4979	27.4979	26.6109	27.4979	26.6109	27.4979	(56)
If cylinder contains dedicated solar storage													
	27.4979	24.8369	27.4979	26.6109	27.4979	26.6109	27.4979	27.4979	26.6109	27.4979	26.6109	27.4979	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	274.7447	242.9366	257.8330	225.9039	218.4890	196.3236	193.2732	201.2004	203.7044	227.8281	243.1135	271.6251	(62)
WWHRS	-31.6893	-28.0263	-29.3475	-24.3009	-22.6476	-19.3797	-18.1654	-19.3170	-20.0510	-23.6379	-26.7789	-31.1025	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	243.0553	214.9103	228.4855	201.6030	195.8415	176.9439	175.1079	181.8834	183.6534	204.1902	216.3347	240.5226	(64)
										Total per year (kWh/year) = Sum(64)m =		2462.5316	(64)
12Total per year (kWh/year)												2463	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	115.0831	102.2104	109.4599	98.0780	96.3781	88.2426	87.9938	90.6296	90.6967	99.4833	103.8002	114.0458	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	128.3915	142.1477	128.3915	132.6712	128.3915	132.6712	128.3915	128.3915	132.6712	128.3915	132.6712	128.3915	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													

	248.2231	250.7989	244.3080	230.4897	213.0465	196.6524	185.7002	183.1244	189.6153	203.4336	220.8767	237.2708 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901 (71)
Water heating gains (Table 5)												
	154.6815	152.0988	147.1236	136.2195	129.5404	122.5591	118.2712	121.8140	125.9676	133.7141	144.1670	153.2874 (72)
Total internal gains												
	597.6424	611.3916	586.1693	565.7266	537.3247	515.2290	495.7092	496.6761	511.6003	531.8854	564.0611	585.2959 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.9500	11.2829	0.6300	0.7000	0.7700	37.7579	(75)
Southwest	5.7600	36.7938	0.6300	0.7000	0.7700	64.7693	(79)

Solar gains	102.5273	187.1835	289.4255	414.4498	515.1842	533.8768	505.3848	426.8051	332.1811	215.8597	125.0880	86.2641	(83)
Total gains	700.1696	798.5751	875.5948	980.1764	1052.5089	1049.1058	1001.0940	923.4812	843.7815	747.7451	689.1491	671.5600	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.9048	19.9521	19.9986	20.2199	20.2618	20.4595	20.4595	20.4965	20.3829	20.2618	20.1771	20.0894	
alpha	2.3270	2.3301	2.3332	2.3480	2.3508	2.3640	2.3640	2.3664	2.3589	2.3508	2.3451	2.3393	
util living area													
	0.9314	0.9069	0.8698	0.7943	0.6844	0.5434	0.4241	0.4677	0.6547	0.8270	0.9063	0.9369	(86)
MIT	18.1785	18.5155	19.0308	19.7277	20.3199	20.7260	20.8906	20.8588	20.5483	19.7886	18.8835	18.1262	(87)
Th 2	19.9573	19.9595	19.9617	19.9719	19.9738	19.9827	19.9827	19.9843	19.9792	19.9738	19.9699	19.9659	(88)
util rest of house													
	0.9228	0.8954	0.8533	0.7675	0.6417	0.4790	0.3394	0.3820	0.5948	0.7984	0.8929	0.9290	(89)
MIT 2	16.6692	17.0931	17.7389	18.6012	19.3042	19.7586	19.9161	19.8935	19.5819	18.6954	17.5696	16.6081	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	17.0038	17.4084	18.0252	18.8509	19.5293	19.9731	20.1321	20.1075	19.7961	18.9378	17.8608	16.9446	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.0038	17.4084	18.0252	18.8509	19.5293	19.9731	20.1321	20.1075	19.7961	18.9378	17.8608	16.9446	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8885	0.8578	0.8141	0.7330	0.6211	0.4784	0.3525	0.3931	0.5828	0.7631	0.8559	0.8961	(94)
Useful gains	622.1005	685.0011	712.8020	718.4703	653.7264	501.8644	352.8490	362.9780	491.7948	570.5944	589.8307	601.7860	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1394.2402	1369.5514	1258.9669	1075.0984	844.1304	573.7081	377.1447	395.1511	610.4905	898.9463	1165.0629	1385.8749	(97)
Space heating kWh													
	574.4719	460.0178	406.3466	256.7722	141.6606	0.0000	0.0000	0.0000	0.0000	244.2938	414.1671	583.3622	(98a)
Space heating requirement - total per year (kWh/year)												3081.0922	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	574.4719	460.0178	406.3466	256.7722	141.6606	0.0000	0.0000	0.0000	0.0000	244.2938	414.1671	583.3622	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3081.0922	
Space heating per m2											(98c) / (4) =	32.3848	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	574.4719	460.0178	406.3466	256.7722	141.6606	0.0000	0.0000	0.0000	0.0000	244.2938	414.1671	583.3622	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	622.3964	498.3942	440.2456	278.1931	153.4784	0.0000	0.0000	0.0000	0.0000	264.6736	448.7184	632.0284	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	243.0553	214.9103	228.4855	201.6030	195.8415	176.9439	175.1079	181.8834	183.6534	204.1902	216.3347	240.5226	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.9191	85.7216	85.3360	84.6033	83.3456	79.8000	79.8000	79.8000	79.8000	84.4630	85.4917	85.9694	(217)
Fuel for water heating, kWh/month													
	282.8887	250.7073	267.7479	238.2920	234.9753	221.7342	219.4334	227.9240	230.1421	241.7511	253.0475	279.7769	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	26.6772	21.4014	19.2696	14.1178	10.9050	8.9094	9.9479	12.9306	16.7956	22.0367	24.8904	27.4187	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-43.7273	-61.2512	-87.4769	-97.6894	-104.7589	-97.5416	-96.2965	-91.1670	-82.0635	-69.6860	-47.9165	-37.8482	(233a)

Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-25.9245	-54.3936	-107.8641	-161.6637	-213.4533	-214.3907	-211.9042	-179.5910	-131.8391	-77.7180	-34.5868	-20.5145 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3338.1281	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2948.4206	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	215.3004	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2351.2664	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4236.5827	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3338.1281	0.2100	701.0069	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2948.4206	0.2100	619.1683	(264)
Space and water heating			1320.1752	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	215.3004	0.1443	31.0745	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-917.4229	0.1347	-123.6078	
PV Unit electricity exported	-1433.8435	0.1260	-180.5987	
Total			-304.2065	(269)
Total CO2, kg/year			1058.9725	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.1300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3338.1281	1.1300	3772.0847	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2948.4206	1.1300	3331.7153	(278)
Space and water heating			7103.8001	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	215.3004	1.5338	330.2349	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-917.4229	1.4980	-1374.2639	
PV Unit electricity exported	-1433.8435	0.4623	-662.9248	
Total			-2037.1887	(283)
Total Primary energy kWh/year			5526.9471	(286)
Target Primary Energy Rate (TPER)			58.0900	(287)

Full SAP Calculation Printout

Plot Reference	79841-04	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	3B5P (Semi)
Plot Address	Plot 4, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	84 B	**DER**	3.80	**TER**	11.13
Environmental	97 A	**% DER < TER**			65.86
CO_2 Emissions (t/year)	0.33	**DFEE**	38.63	**TFEE**	39.28
Compliance Check	See BREL	**% DFEE < TFEE**			1.65
% DPER < TPER	31.59	**DPER**	39.74	**TPER**	58.09

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700 (1b)	x	2.5500 (2b)	=	121.3035	(1b) - (3b)
First floor	47.5700 (1c)	x	2.8300 (2c)	=	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	255.9266	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1172	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3172	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2696	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3438	0.3370	0.3303	0.2966	0.2899	0.2562	0.2562	0.2494	0.2696	0.2899	0.3033	0.3168	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0.0000	(23c)

Effective ac	0.5591	0.5568	0.5546	0.5440	0.5420	0.5328	0.5328	0.5311	0.5364	0.5420	0.5460	0.5502	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.0000	1.1450	12.5954			(27)
Glazed Doors			5.7100	1.1450	6.5382			(27)
GF			47.5700	0.1100	5.2327	75.0000	3567.7500	(28a)
Main	115.8314	18.8600	96.9714	0.1900	18.4246	9.0000	872.7426	(29a)
PIJ	47.5700		47.5700	0.0900	4.2813	9.0000	428.1300	(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.2222			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000	20.0000	668.2000	(32)
Timber			93.9800			9.0000	845.8200	(32c)
Timber			21.9300			9.0000	197.3700	(32c)
FF			47.5700			18.0000	856.2600	(32d)
GF			47.5700			9.0000	428.1300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	7864.4026 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		82.6614 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	12.2600	0.0460	0.5640	
E3 Sill	12.2600	0.0470	0.5762	
E4 Jamb	37.2000	0.0530	1.9716	
E5 Ground floor (normal)	21.5300	0.0680	1.4640	
E10 Eaves (insulation at ceiling level)	15.3200	0.0910	1.3941	
E12 Gable (insulation at ceiling level)	6.2100	0.0750	0.4657	
E16 Corner (normal)	10.7600	0.0460	0.4950	
E18 Party wall between dwellings	10.7600	0.0540	0.5810	
P1 Party wall - Ground floor	6.2100	0.1160	0.7204	
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.0460	0.2857	
E6 Intermediate floor within a dwelling	21.5300	0.0540	1.1626	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			9.6803	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	58.9025	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.2188	47.0250	46.8351	45.9428	45.7758	44.9987	44.9987	44.8548	45.2981	45.7758	46.1136	46.4666	(38)
Heat transfer coeff	106.1213	105.9275	105.7375	104.8453	104.6783	103.9012	103.9012	103.7573	104.2005	104.6783	105.0160	105.3691	(39)
Average = Sum(39)m / 12 =												104.8445	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1154	1.1134	1.1114	1.1020	1.1003	1.0921	1.0921	1.0906	1.0952	1.1003	1.1038	1.1075	(40)
HLP (average)												1.1020	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6898 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)
Hot water usage for other uses	42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)
Average daily hot water use (litres/day)												66.0935	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	72.1080	70.1298	67.9701	65.2822	62.8843	60.3923	59.8747	62.0299	64.2404	66.7996	69.5112	72.0068	(44)
Energy conte	114.2015	99.8639	104.4676	89.3681	84.6544	74.2594	72.4132	76.8060	79.2149	90.6464	99.0315	112.7453	(45)
Energy content (annual)										Total = Sum(45)m =		1097.6720	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	97.0712	84.8843	88.7974	75.9629	71.9562	63.1205	61.5512	65.2851	67.3326	77.0494	84.1768	95.8335	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	97.0712	84.8843	88.7974	75.9629	71.9562	63.1205	61.5512	65.2851	67.3326	77.0494	84.1768	95.8335	(64)
										Total per year (kWh/year) = Sum(64)m =		933.0212	(64)
12Total per year (kWh/year)												933	(64)
Electric shower(s)	55.5122	49.4618	54.0104	51.5415	52.5087	50.0882	51.7578	52.5087	51.5415	54.0104	52.9948	55.5122	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		631.4482	(64a)
Heat gains from water heating, kWh/month	38.1459	33.5865	35.7020	31.8761	31.1162	28.3022	28.3272	29.4484	29.7185	32.7650	34.2929	37.8364	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	128.3915	142.1477	128.3915	132.6712	128.3915	132.6712	128.3915	128.3915	132.6712	128.3915	132.6712	128.3915	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	248.2231	250.7989	244.3080	230.4897	213.0465	196.6524	185.7002	183.1244	189.6153	203.4336	220.8767	237.2708	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	(71)
Water heating gains (Table 5)	51.2713	49.9800	47.9865	44.2724	41.8229	39.3086	38.0743	39.5812	41.2757	44.0389	47.6290	50.8554	(72)
Total internal gains	491.2321	506.2728	484.0322	470.7795	446.6071	431.9784	415.5122	414.4434	426.9085	439.2103	464.5232	479.8640	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.2400	11.2829	0.3000	0.0000	0.7700	13.6573	(75)
Southwest	5.7600	36.7938	0.3000	0.0000	0.7700	48.9564	(79)
Northeast	5.7100	11.2829	0.3000	0.0000	0.7700	14.8823	(75)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	77.4960	141.4841	218.7646	313.2651	389.4060	403.5350	381.9991	322.6040	251.0817	163.1592	94.5487	65.2034	(83)

Total gains	568.7282	647.7569	702.7968	784.0446	836.0132	835.5135	797.5113	737.0474	677.9902	602.3695	559.0719	545.0673	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.5855	20.6231	20.6602	20.8360	20.8692	21.0253	21.0253	21.0545	20.9649	20.8692	20.8021	20.7324	
alpha	2.3724	2.3749	2.3773	2.3891	2.3913	2.4017	2.4017	2.4036	2.3977	2.3913	2.3868	2.3822	
util living area	0.9532	0.9353	0.9087	0.8496	0.7567	0.6220	0.4976	0.5436	0.7261	0.8747	0.9350	0.9574	(86)
MIT	18.0164	18.3309	18.8268	19.5309	20.1682	20.6445	20.8522	20.8122	20.4458	19.6293	18.7171	17.9628	(87)
Th 2	19.9883	19.9899	19.9915	19.9992	20.0006	20.0073	20.0073	20.0085	20.0047	20.0006	19.9977	19.9947	(88)
util rest of house	0.9471	0.9269	0.8962	0.8278	0.7186	0.5578	0.4064	0.4535	0.6707	0.8521	0.9252	0.9518	(89)
MIT 2	17.2567	17.5674	18.0562	18.7444	19.3464	19.7728	19.9342	19.9101	19.6123	18.8519	17.9579	17.2078	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	17.4251	17.7366	18.2270	18.9187	19.5286	19.9661	20.1377	20.1101	19.7970	19.0243	18.1262	17.3752	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.4251	17.7366	18.2270	18.9187	19.5286	19.9661	20.1377	20.1101	19.7970	19.0243	18.1262	17.3752	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9257	0.9020	0.8683	0.7995	0.6981	0.5549	0.4192	0.4635	0.6575	0.8244	0.9006	0.9316	(94)
Useful gains	526.4754	584.2673	610.2529	626.8489	583.5811	463.6020	334.3474	341.6049	445.7919	496.5917	503.4925	507.7860	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1392.8536	1359.7515	1239.9842	1050.4170	819.4813	557.5393	367.5683	384.9514	593.6340	881.8364	1157.9236	1388.2559	(97)
Space heating kWh	644.5854	521.1254	468.5201	304.9690	175.5097	0.0000	0.0000	0.0000	0.0000	286.6221	471.1904	655.0696	(98a)
Space heating requirement - total per year (kWh/year)												3527.5917	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	644.5854	521.1254	468.5201	304.9690	175.5097	0.0000	0.0000	0.0000	0.0000	286.6221	471.1904	655.0696	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3527.5917	
Space heating per m2											(98c) / (4) =	37.0779	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	976.6712	768.8688	788.5553	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6860	0.7526	0.7171	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	669.9562	578.6296	565.4383	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	923.3410	881.4929	813.3722	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	182.4370	225.3303	184.4628	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	45.6093	56.3326	46.1157	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												148.0575	(107)
Energy for space heating												37.0779	(99)
Energy for space cooling												1.5562	(108)
Total												38.6341	(109)
Fabric Energy Efficiency (DFEE)												38.6	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700	(1b) x	2.5500	(2b) =	121.3035	(1b) - (3b)
First floor	47.5700	(1c) x	2.8300	(2c) =	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		255.9266	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)

Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1172 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3672 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3121 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3980	0.3902	0.3824	0.3434	0.3355	0.2965	0.2965	0.2887	0.3121	0.3355	0.3512	0.3668	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0.0000 (23c)

Effective ac	0.5792	0.5761	0.5731	0.5589	0.5563	0.5440	0.5440	0.5417	0.5487	0.5563	0.5617	0.5673	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type			16.7100	1.1450	19.1336			(27)
GF			47.5700	0.1300	6.1841			(28a)
Main	115.8314	18.8600	96.9714	0.1800	17.4549			(29a)
PIJ	47.5700		47.5700	0.1100	5.2327			(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.1552			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	82.6614 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.2600	0.0500	0.6130
E3 Sill	12.2600	0.0500	0.6130
E4 Jamb	37.2000	0.0500	1.8600
E5 Ground floor (normal)	21.5300	0.1600	3.4448
E10 Eaves (insulation at ceiling level)	15.3200	0.0600	0.9192
E12 Gable (insulation at ceiling level)	6.2100	0.0600	0.3726
E16 Corner (normal)	10.7600	0.0900	0.9684
E18 Party wall between dwellings	10.7600	0.0600	0.6456
P1 Party wall - Ground floor	6.2100	0.0800	0.4968
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.1200	0.7452
E6 Intermediate floor within a dwelling	21.5300	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.6786 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	60.8338 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.9161	48.6564	48.4019	47.2062	46.9824	45.9410	45.9410	45.7482	46.3422	46.9824	47.4350	47.9081	(38)
Heat transfer coeff	109.7500	109.4903	109.2357	108.0400	107.8163	106.7749	106.7749	106.5820	107.1760	107.8163	108.2688	108.7420	(39)
Average = Sum(39)m / 12 =												108.0389	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1536	1.1508	1.1482	1.1356	1.1332	1.1223	1.1223	1.1203	1.1265	1.1332	1.1380	1.1430	(40)
HLP (average)												1.1356	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6898 (42)

Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)

Hot water usage for other uses

42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)

Average daily hot water use (litres/day)	66.0935 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	72.1080	70.1298	67.9701	65.2822	62.8843	60.3923	59.8747	62.0299	64.2404	66.7996	69.5112	72.0068	(44)
Energy conte	114.2015	99.8639	104.4676	89.3681	84.6544	74.2594	72.4132	76.8060	79.2149	90.6464	99.0315	112.7453	(45)
Energy content (annual)										Total = Sum(45)m =		1097.6720	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	97.0712	84.8843	88.7974	75.9629	71.9562	63.1205	61.5512	65.2851	67.3326	77.0494	84.1768	95.8335	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	97.0712	84.8843	88.7974	75.9629	71.9562	63.1205	61.5512	65.2851	67.3326	77.0494	84.1768	95.8335	(64)
										Total per year (kWh/year) = Sum(64)m =		933.0212	(64)
12Total per year (kWh/year)												933	(64)

Electric shower(s)

	55.5122	49.4618	54.0104	51.5415	52.5087	50.0882	51.7578	52.5087	51.5415	54.0104	52.9948	55.5122 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												631.4482 (64a)
Heat gains from water heating, kWh/month												
	38.1459	33.5865	35.7020	31.8761	31.1162	28.3022	28.3272	29.4484	29.7185	32.7650	34.2929	37.8364 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	128.3915	142.1477	128.3915	132.6712	128.3915	132.6712	128.3915	128.3915	132.6712	128.3915	132.6712	128.3915	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.2231	250.7989	244.3080	230.4897	213.0465	196.6524	185.7002	183.1244	189.6153	203.4336	220.8767	237.2708	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	(71)
Water heating gains (Table 5)													
	51.2713	49.9800	47.9865	44.2724	41.8229	39.3086	38.0743	39.5812	41.2757	44.0389	47.6290	50.8554	(72)
Total internal gains													
	491.2321	506.2728	484.0322	470.7795	446.6071	431.9784	415.5122	414.4434	426.9085	439.2103	464.5232	479.8640	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.9500	11.2829	0.6300	0.7000	0.7700	37.7579	(75)
Southwest	5.7600	36.7938	0.6300	0.7000	0.7700	64.7693	(79)

Solar gains	102.5273	187.1835	289.4255	414.4498	515.1842	533.8768	505.3848	426.8051	332.1811	215.8597	125.0880	86.2641	(83)
Total gains	593.7594	693.4563	773.4578	885.2293	961.7913	965.8553	920.8970	841.2485	759.0896	655.0699	589.6112	566.1280	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.9048	19.9521	19.9986	20.2199	20.2618	20.4595	20.4595	20.4965	20.3829	20.2618	20.1771	20.0894	
alpha	2.3270	2.3301	2.3332	2.3480	2.3508	2.3640	2.3640	2.3664	2.3589	2.3508	2.3451	2.3393	
util living area													
	0.9497	0.9278	0.8942	0.8227	0.7160	0.5747	0.4534	0.5019	0.6931	0.8592	0.9294	0.9546	(86)
MIT	17.9677	18.3221	18.8633	19.6066	20.2437	20.6897	20.8734	20.8352	20.4846	19.6550	18.6993	17.9131	(87)
Th 2	19.9573	19.9595	19.9617	19.9719	19.9738	19.9827	19.9827	19.9843	19.9792	19.9738	19.9699	19.9659	(88)
util rest of house													
	0.9431	0.9184	0.8800	0.7981	0.6747	0.5095	0.3650	0.4129	0.6346	0.8343	0.9187	0.9486	(89)
MIT 2	17.1891	17.5387	18.0703	18.7935	19.3883	19.7828	19.9220	19.9005	19.6209	18.8559	17.9222	17.1407	(90)
Living area fraction									fLA = Living area / (4) =			0.2217	(91)
MIT	17.3617	17.7124	18.2461	18.9737	19.5779	19.9838	20.1329	20.1077	19.8123	19.0330	18.0944	17.3120	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.3617	17.7124	18.2461	18.9737	19.5779	19.9838	20.1329	20.1077	19.8123	19.0330	18.0944	17.3120	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9204	0.8917	0.8504	0.7698	0.6569	0.5096	0.3788	0.4245	0.6238	0.8060	0.8926	0.9272	(94)
Useful gains	546.5122	618.3632	657.7375	681.4821	631.7763	492.1761	348.8078	357.1278	473.5438	527.9803	526.2865	524.9062	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1433.5247	1402.8286	1283.0935	1088.3651	849.3649	574.8578	377.2228	395.1734	612.2266	909.2163	1190.3561	1425.8196	(97)
Space heating kWh													
	659.9373	527.1608	465.2648	292.9557	161.8860	0.0000	0.0000	0.0000	0.0000	283.6395	478.1301	670.2795	(98a)
Space heating requirement - total per year (kWh/year)												3539.2538	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	659.9373	527.1608	465.2648	292.9557	161.8860	0.0000	0.0000	0.0000	0.0000	283.6395	478.1301	670.2795	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3539.2538	
Space heating per m2											(98c) / (4) =	37.2005	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1003.6836	790.1339	810.0232	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7267	0.7879	0.7516	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	729.3467	622.5318	608.8108	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1075.6886	1025.7100	935.1657	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	249.3662	299.9646	242.8080	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	62.3415	74.9911	60.7020	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												198.0347	(107)

Energy for space heating	37.2005 (99)
Energy for space cooling	2.0815 (108)
Total	39.2820 (109)
Fabric Energy Efficiency (TFEE)	39.3 (109)

Full SAP Calculation Printout

Plot Reference	79841-04	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	3B5P (Semi)
Plot Address	Plot 4, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	84 B	**DER**	3.80	**TER**	11.13
Environmental	97 A	**% DER < TER**			65.86
CO_2 Emissions (t/year)	0.33	**DFEE**	38.63	**TFEE**	39.28
Compliance Check	See BREL	**% DFEE < TFEE**			1.65
% DPER < TPER	31.59	**DPER**	39.74	**TPER**	58.09

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700 (1b)	x	2.5500 (2b)	=	121.3035	(1b) - (3b)
First floor	47.5700 (1c)	x	2.8300 (2c)	=	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	255.9266	(5)

---

2. Ventilation rate

---

			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		3 * 10 =	30.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		30.0000 / (5) =	0.1172	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			4.0000	(17)
Infiltration rate			0.3172	(18)
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.2696	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3438	0.3370	0.3303	0.2966	0.2899	0.2562	0.2562	0.2494	0.2696	0.2899	0.3033	0.3168	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

Effective ac	0.5938	0.5870	0.5803	0.5466	0.5399	0.5062	0.5062	0.5000	0.5196	0.5399	0.5533	0.5668	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.0000	1.1450	12.5954			(27)
Glazed Doors			5.7100	1.1450	6.5382			(27)
GF			47.5700	0.1100	5.2327	75.0000	3567.7500	(28a)
Main	115.8314	18.8600	96.9714	0.1900	18.4246	9.0000	872.7426	(29a)
PIJ	47.5700		47.5700	0.0900	4.2813	9.0000	428.1300	(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.2222			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000	20.0000	668.2000	(32)
Timber			93.9800			9.0000	845.8200	(32c)
Timber			21.9300			9.0000	197.3700	(32c)
FF			47.5700			18.0000	856.2600	(32d)
GF			47.5700			9.0000	428.1300	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7864.4026 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 82.6614 (35)
List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	12.2600	0.0460	0.5640	
E3 Sill	12.2600	0.0470	0.5762	
E4 Jamb	37.2000	0.0530	1.9716	
E5 Ground floor (normal)	21.5300	0.0680	1.4640	
E10 Eaves (insulation at ceiling level)	15.3200	0.0910	1.3941	
E12 Gable (insulation at ceiling level)	6.2100	0.0750	0.4657	
E16 Corner (normal)	10.7600	0.0460	0.4950	
E18 Party wall between dwellings	10.7600	0.0540	0.5810	
P1 Party wall - Ground floor	6.2100	0.1160	0.7204	
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.0460	0.2857	
E6 Intermediate floor within a dwelling	21.5300	0.0540	1.1626	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.6803 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 58.9025 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.1489	49.5795	49.0102	46.1637	45.5944	42.7478	42.7478	42.2279	43.8864	45.5944	46.7330	47.8716	(38)
Heat transfer coeff	109.0513	108.4820	107.9127	105.0662	104.4968	101.6503	101.6503	101.1304	102.7889	104.4968	105.6355	106.7741	(39)
Average = Sum(39)m / 12 =												104.9279	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1462	1.1402	1.1343	1.1043	1.0983	1.0684	1.0684	1.0630	1.0804	1.0983	1.1103	1.1223	(40)
HLP (average)												1.1029	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6898 (42)
Hot water usage for mixer showers

69.3181	68.2763	66.7584	63.8540	61.7106	59.3203	57.9617	59.4682	61.1196	63.6860	66.6528	69.0525	(42a)

Hot water usage for baths

29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)

Hot water usage for other uses

42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)

Average daily hot water use (litres/day) 130.0024 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	141.4261	138.4062	134.7285	129.1362	124.5949	119.7126	117.8364	121.4982	125.3600	130.4856	136.1640	141.0593	(44)
Energy conte	223.9843	197.0885	207.0727	176.7810	167.7287	147.2007	142.5129	150.4401	154.5815	177.0677	193.9906	220.8648	(45)
Energy content (annual)										Total = Sum(45)m =		2159.3135	
Distribution loss (46)m = 0.15 x (45)m	33.5976	29.5633	31.0609	26.5172	25.1593	22.0801	21.3769	22.5660	23.1872	26.5602	29.0986	33.1297	(46)

Water storage loss (or HIU loss):
Store volume 198.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.5000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.8100 (55)
Total storage loss

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)

If cylinder contains dedicated solar storage

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(64)
									Total per year (kWh/year) = Sum(64)m =		2728.8595	(64)
12Total per year (kWh/year)											2729	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

113.1727	100.4849	107.5496	96.2293	94.4677	86.3938	86.0835	88.7193	88.8479	97.5729	101.9515	112.1355	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	128.3915	142.1477	128.3915	132.6712	128.3915	132.6712	128.3915	128.3915	132.6712	128.3915	132.6712	128.3915	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	248.2231	250.7989	244.3080	230.4897	213.0465	196.6524	185.7002	183.1244	189.6153	203.4336	220.8767	237.2708	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	(71)
Water heating gains (Table 5)	152.1139	149.5311	144.5559	133.6518	126.9727	119.9914	115.7036	119.2463	123.3999	131.1464	141.5993	150.7197	(72)
Total internal gains	592.0747	605.8239	580.6016	560.1589	531.7570	512.6613	493.1415	494.1084	509.0326	526.3177	558.4935	579.7283	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

Northeast			5.2400		11.2829		0.3000		0.0000		0.7700		13.6573 (75)
Southwest			5.7600		36.7938		0.3000		0.0000		0.7700		48.9564 (79)
Northeast			5.7100		11.2829		0.3000		0.0000		0.7700		14.8823 (75)
Solar gains	77.4960	141.4841	218.7646	313.2651	389.4060	403.5350	381.9991	322.6040	251.0817	163.1592	94.5487	65.2034	(83)
Total gains	669.5707	747.3080	799.3662	873.4241	921.1630	916.1963	875.1406	816.7124	760.1144	689.4770	653.0422	644.9316	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.0324	20.1375	20.2437	20.7922	20.9055	21.4909	21.4909	21.6014	21.2528	20.9055	20.6801	20.4596	
alpha	2.3355	2.3425	2.3496	2.3861	2.3937	2.4327	2.4327	2.4401	2.4169	2.3937	2.3787	2.3640	
util living area	0.9366	0.9168	0.8872	0.8224	0.7240	0.5806	0.4568	0.4970	0.6825	0.8436	0.9136	0.9411	(86)
Living	18.1386	18.4504	18.9401	19.6529	20.2554	20.7069	20.8827	20.8533	20.5315	19.7666	18.8815	18.1290	
Non living	17.3599	17.6687	18.1515	18.8553	19.4221	19.8353	19.9692	19.9552	19.6898	18.9792	18.1128	17.3629	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.5362	18.4504	18.9401	19.6529	20.2554	20.7069	20.8827	20.8533	20.5315	19.7666	18.8815	18.5306	(87)
Th 2	19.9633	19.9681	19.9730	19.9973	20.0022	20.0267	20.0267	20.0312	20.0169	20.0022	19.9924	19.9827	(88)
util rest of house	0.9286	0.9064	0.8724	0.7982	0.6839	0.5175	0.3714	0.4120	0.6252	0.8173	0.9011	0.9336	(89)
MIT 2	18.6315	17.6687	18.1515	18.8553	19.4221	19.8353	19.9692	19.9552	19.6898	18.9792	18.1128	17.7293	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	18.8320	17.8420	18.3263	19.0321	19.6068	20.0285	20.1717	20.1542	19.8764	19.1537	18.2832	17.9070	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8320	17.8420	18.3263	19.0321	19.6068	20.0285	20.1717	20.1542	19.8764	19.1537	18.2832	17.9070	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9182	0.8785	0.8427	0.7707	0.6661	0.5177	0.3848	0.4235	0.6160	0.7903	0.8738	0.9139	(94)
Useful gains	614.7754	656.4768	673.6300	673.1595	613.5941	474.2825	336.7945	345.9045	468.2536	544.8730	570.6176	589.4234	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1584.7391	1403.9725	1276.2062	1064.5413	826.2405	551.8096	363.0626	379.6677	593.7502	893.8365	1181.3436	1463.5487	(97)
Space heating kWh	721.6530	502.3171	448.3167	281.7949	158.2089	0.0000	0.0000	0.0000	0.0000	259.6288	439.7228	650.3492	(98a)
Space heating requirement - total per year (kWh/year)												3461.9915	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	721.6530	502.3171	448.3167	281.7949	158.2089	0.0000	0.0000	0.0000	0.0000	259.6288	439.7228	650.3492	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3461.9915	
Space heating per m2											(98c) / (4) =	36.3884	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												285.6431	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	721.6530	502.3171	448.3167	281.7949	158.2089	0.0000	0.0000	0.0000	0.0000	259.6288	439.7228	650.3492	(98)
Space heating efficiency (main heating system 1)	285.6431	285.6431	285.6431	285.6431	285.6431	0.0000	0.0000	0.0000	0.0000	285.6431	285.6431	285.6431	(210)
Space heating fuel (main heating system)	252.6415	175.8548	156.9500	98.6528	55.3869	0.0000	0.0000	0.0000	0.0000	90.8927	153.9414	227.6790	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	95.5956	84.5123	89.6597	78.4799	75.8502	68.0973	66.9996	69.7820	70.6879	79.1282	84.5203	94.5007	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.7468	4.2874	4.7468	4.5936	4.7468	4.5936	4.7468	4.7468	4.5936	4.7468	4.5936	4.7468	(231)
Lighting	26.9272	21.6020	19.4502	14.2500	11.0071	8.9929	10.0411	13.0518	16.9530	22.2432	25.1236	27.6755	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	1211.9992	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	284.9050	
Water heating fuel used	957.8138	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)		
mechanical ventilation fans (SFP = 0.1790)	55.8892	(230a)
Total electricity for the above, kWh/year	55.8892	(231)
Electricity for lighting (calculated in Appendix L)	217.3176	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2443.0198	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1211.9992	0.1547	187.4674	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	957.8138	0.1410	135.0326	(264)
Space and water heating			322.5000	(265)
Pumps, fans and electric keep-hot	55.8892	0.1387	7.7525	(267)
Energy for lighting	217.3176	0.1443	31.3656	(268)
Total CO2, kg/year			361.6181	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.8000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1211.9992	1.5726	1906.0057	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	957.8138	1.5213	1457.1193	(278)
Space and water heating			3363.1249	(279)
Pumps, fans and electric keep-hot	55.8892	1.5128	84.5493	(281)
Energy for lighting	217.3176	1.5338	333.3289	(282)
Total Primary energy kWh/year			3781.0031	(286)
Dwelling Primary energy Rate (DPER)			39.7400	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700	(1b) x	2.5500	(2b) =	121.3035	(1b) - (3b)
First floor	47.5700	(1c) x	2.8300	(2c) =	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 95.1400						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		255.9266	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 = 0.0000	(6a)
Number of open flues	0 * 20 = 0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000	(6d)
Number of flues attached to other heater	0 * 35 = 0.0000	(6e)
Number of blocked chimneys	0 * 20 = 0.0000	(6f)
Number of intermittent extract fans	3 * 10 = 30.0000	(7a)
Number of passive vents	0 * 10 = 0.0000	(7b)
Number of flueless gas fires	0 * 40 = 0.0000	(7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1172	(8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3672	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3121	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)

Adj infilt rate													
	0.3980	0.3902	0.3824	0.3434	0.3355	0.2965	0.2965	0.2887	0.3121	0.3355	0.3512	0.3668	(22b)
Effective ac	0.5792	0.5761	0.5731	0.5589	0.5563	0.5440	0.5440	0.5417	0.5487	0.5563	0.5617	0.5673	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type			16.7100	1.1450	19.1336			(27)
GF			47.5700	0.1300	6.1841			(28a)
Main	115.8314	18.8600	96.9714	0.1800	17.4549			(29a)
PIJ	47.5700		47.5700	0.1100	5.2327			(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.1552			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	82.6614 (35)
List of Thermal Bridges	

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.2600	0.0500	0.6130
E3 Sill	12.2600	0.0500	0.6130
E4 Jamb	37.2000	0.0500	1.8600
E5 Ground floor (normal)	21.5300	0.1600	3.4448
E10 Eaves (insulation at ceiling level)	15.3200	0.0600	0.9192
E12 Gable (insulation at ceiling level)	6.2100	0.0600	0.3726
E16 Corner (normal)	10.7600	0.0900	0.9684
E18 Party wall between dwellings	10.7600	0.0600	0.6456
P1 Party wall - Ground floor	6.2100	0.0800	0.4968
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.1200	0.7452
E6 Intermediate floor within a dwelling	21.5300	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.6786	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	60.8338	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.9161	48.6564	48.4019	47.2062	46.9824	45.9410	45.9410	45.7482	46.3422	46.9824	47.4350	47.9081	(38)
Heat transfer coeff	109.7500	109.4903	109.2357	108.0400	107.8163	106.7749	106.7749	106.5820	107.1760	107.8163	108.2688	108.7420	(39)
Average = Sum(39)m / 12 =												108.0389	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1536	1.1508	1.1482	1.1356	1.1332	1.1223	1.1223	1.1203	1.1265	1.1332	1.1380	1.1430	(40)
HLP (average)												1.1356	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6898	(42)
Hot water usage for mixer showers													
	69.3181	68.2763	66.7584	63.8540	61.7106	59.3203	57.9617	59.4682	61.1196	63.6860	66.6528	69.0525	(42a)
Hot water usage for baths													
	29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)
Hot water usage for other uses													
	42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)
Average daily hot water use (litres/day)												130.0024	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	141.4261	138.4062	134.7285	129.1362	124.5949	119.7126	117.8364	121.4982	125.3600	130.4856	136.1640	141.0593	(44)
Energy conte	223.9843	197.0885	207.0727	176.7810	167.7287	147.2007	142.5129	150.4401	154.5815	177.0677	193.9906	220.8648	(45)
Energy content (annual)										Total = Sum(45)m =		2159.3135	
Distribution loss (46)m = 0.15 x (45)m													
	33.5976	29.5633	31.0609	26.5172	25.1593	22.0801	21.3769	22.5660	23.1872	26.5602	29.0986	33.1297	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6426	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8870	(55)
Total storage loss													
	27.4979	24.8369	27.4979	26.6109	27.4979	26.6109	27.4979	27.4979	26.6109	27.4979	26.6109	27.4979	(56)
If cylinder contains dedicated solar storage													
	27.4979	24.8369	27.4979	26.6109	27.4979	26.6109	27.4979	27.4979	26.6109	27.4979	26.6109	27.4979	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	274.7447	242.9366	257.8330	225.9039	218.4890	196.3236	193.2732	201.2004	203.7044	227.8281	243.1135	271.6251	(62)
WWHRS	-31.6893	-28.0263	-29.3475	-24.3009	-22.6476	-19.3797	-18.1654	-19.3170	-20.0510	-23.6379	-26.7789	-31.1025	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	243.0553	214.9103	228.4855	201.6030	195.8415	176.9439	175.1079	181.8834	183.6534	204.1902	216.3347	240.5226	(64)
										Total per year (kWh/year) = Sum(64)m =		2462.5316	(64)
12Total per year (kWh/year)												2463	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	115.0831	102.2104	109.4599	98.0780	96.3781	88.2426	87.9938	90.6296	90.6967	99.4833	103.8002	114.0458	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	134.4876	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	128.3915	142.1477	128.3915	132.6712	128.3915	132.6712	128.3915	128.3915	132.6712	128.3915	132.6712	128.3915	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													

	248.2231	250.7989	244.3080	230.4897	213.0465	196.6524	185.7002	183.1244	189.6153	203.4336	220.8767	237.2708 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488	36.4488 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901 (71)
Water heating gains (Table 5)												
	154.6815	152.0988	147.1236	136.2195	129.5404	122.5591	118.2712	121.8140	125.9676	133.7141	144.1670	153.2874 (72)
Total internal gains												
	597.6424	611.3916	586.1693	565.7266	537.3247	515.2290	495.7092	496.6761	511.6003	531.8854	564.0611	585.2959 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.9500	11.2829	0.6300	0.7000	0.7700	37.7579	(75)
Southwest	5.7600	36.7938	0.6300	0.7000	0.7700	64.7693	(79)

Solar gains	102.5273	187.1835	289.4255	414.4498	515.1842	533.8768	505.3848	426.8051	332.1811	215.8597	125.0880	86.2641	(83)
Total gains	700.1696	798.5751	875.5948	980.1764	1052.5089	1049.1058	1001.0940	923.4812	843.7815	747.7451	689.1491	671.5600	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.9048	19.9521	19.9986	20.2199	20.2618	20.4595	20.4595	20.4965	20.3829	20.2618	20.1771	20.0894	
alpha	2.3270	2.3301	2.3332	2.3480	2.3508	2.3640	2.3640	2.3664	2.3589	2.3508	2.3451	2.3393	
util living area													
	0.9314	0.9069	0.8698	0.7943	0.6844	0.5434	0.4241	0.4677	0.6547	0.8270	0.9063	0.9369	(86)
MIT	18.1785	18.5155	19.0308	19.7277	20.3199	20.7260	20.8906	20.8588	20.5483	19.7886	18.8835	18.1262	(87)
Th 2	19.9573	19.9595	19.9617	19.9719	19.9738	19.9827	19.9827	19.9843	19.9792	19.9738	19.9699	19.9659	(88)
util rest of house													
	0.9228	0.8954	0.8533	0.7675	0.6417	0.4790	0.3394	0.3820	0.5948	0.7984	0.8929	0.9290	(89)
MIT 2	16.6692	17.0931	17.7389	18.6012	19.3042	19.7586	19.9161	19.8935	19.5819	18.6954	17.5696	16.6081	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	17.0038	17.4084	18.0252	18.8509	19.5293	19.9731	20.1321	20.1075	19.7961	18.9378	17.8608	16.9446	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.0038	17.4084	18.0252	18.8509	19.5293	19.9731	20.1321	20.1075	19.7961	18.9378	17.8608	16.9446	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8885	0.8578	0.8141	0.7330	0.6211	0.4784	0.3525	0.3931	0.5828	0.7631	0.8559	0.8961	(94)
Useful gains	622.1005	685.0011	712.8020	718.4703	653.7264	501.8644	352.8490	362.9780	491.7948	570.5944	589.8307	601.7860	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1394.2402	1369.5514	1258.9669	1075.0984	844.1304	573.7081	377.1447	395.1511	610.4905	898.9463	1165.0629	1385.8749	(97)
Space heating kWh													
	574.4719	460.0178	406.3466	256.7722	141.6606	0.0000	0.0000	0.0000	0.0000	244.2938	414.1671	583.3622	(98a)
Space heating requirement - total per year (kWh/year)												3081.0922	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	574.4719	460.0178	406.3466	256.7722	141.6606	0.0000	0.0000	0.0000	0.0000	244.2938	414.1671	583.3622	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3081.0922	
Space heating per m2											(98c) / (4) =	32.3848	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	574.4719	460.0178	406.3466	256.7722	141.6606	0.0000	0.0000	0.0000	0.0000	244.2938	414.1671	583.3622	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	622.3964	498.3942	440.2456	278.1931	153.4784	0.0000	0.0000	0.0000	0.0000	264.6736	448.7184	632.0284	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	243.0553	214.9103	228.4855	201.6030	195.8415	176.9439	175.1079	181.8834	183.6534	204.1902	216.3347	240.5226	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.9191	85.7216	85.3360	84.6033	83.3456	79.8000	79.8000	79.8000	79.8000	84.4630	85.4917	85.9694	(217)
Fuel for water heating, kWh/month													
	282.8887	250.7073	267.7479	238.2920	234.9753	221.7342	219.4334	227.9240	230.1421	241.7511	253.0475	279.7769	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	26.6772	21.4014	19.2696	14.1178	10.9050	8.9094	9.9479	12.9306	16.7956	22.0367	24.8904	27.4187	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-43.7273	-61.2512	-87.4769	-97.6894	-104.7589	-97.5416	-96.2965	-91.1670	-82.0635	-69.6860	-47.9165	-37.8482	(233a)

Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-25.9245	-54.3936	-107.8641	-161.6637	-213.4533	-214.3907	-211.9042	-179.5910	-131.8391	-77.7180	-34.5868	-20.5145 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3338.1281	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2948.4206	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	215.3004	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2351.2664	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4236.5827	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3338.1281	0.2100	701.0069	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2948.4206	0.2100	619.1683	(264)
Space and water heating			1320.1752	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	215.3004	0.1443	31.0745	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-917.4229	0.1347	-123.6078	
PV Unit electricity exported	-1433.8435	0.1260	-180.5987	
Total			-304.2065	(269)
Total CO2, kg/year			1058.9725	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.1300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3338.1281	1.1300	3772.0847	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2948.4206	1.1300	3331.7153	(278)
Space and water heating			7103.8001	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	215.3004	1.5338	330.2349	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-917.4229	1.4980	-1374.2639	
PV Unit electricity exported	-1433.8435	0.4623	-662.9248	
Total			-2037.1887	(283)
Total Primary energy kWh/year			5526.9471	(286)
Target Primary Energy Rate (TPER)			58.0900	(287)

Full SAP Calculation Printout

Plot Reference	79841-04	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	3B5P (Semi)
Plot Address	Plot 4, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	84 B	**DER**	3.80	**TER**	11.13
Environmental	97 A	**% DER < TER**			65.86
CO_2 Emissions (t/year)	0.33	**DFEE**	38.63	**TFEE**	39.28
Compliance Check	See BREL	**% DFEE < TFEE**			1.65
% DPER < TPER	31.59	**DPER**	39.74	**TPER**	58.09

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700 (1b)	x	2.5500 (2b)	=	121.3035	(1b) - (3b)
First floor	47.5700 (1c)	x	2.8300 (2c)	=	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	255.9266	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1172	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3172	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2696	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3438	0.3370	0.3303	0.2966	0.2899	0.2562	0.2562	0.2494	0.2696	0.2899	0.3033	0.3168	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

Effective ac	0.5938	0.5870	0.5803	0.5466	0.5399	0.5062	0.5062	0.5000	0.5196	0.5399	0.5533	0.5668	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.0000	1.1450	12.5954			(27)
Glazed Doors			5.7100	1.1450	6.5382			(27)
GF			47.5700	0.1100	5.2327	75.0000	3567.7500	(28a)
Main	115.8314	18.8600	96.9714	0.1900	18.4246	9.0000	872.7426	(29a)
PIJ	47.5700		47.5700	0.0900	4.2813	9.0000	428.1300	(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.2222			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000	20.0000	668.2000	(32)
Timber			93.9800			9.0000	845.8200	(32c)
Timber			21.9300			9.0000	197.3700	(32c)
FF			47.5700			18.0000	856.2600	(32d)
GF			47.5700			9.0000	428.1300	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7864.4026 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 82.6614 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.2600	0.0460	0.5640
E3 Sill	12.2600	0.0470	0.5762
E4 Jamb	37.2000	0.0530	1.9716
E5 Ground floor (normal)	21.5300	0.0680	1.4640
E10 Eaves (insulation at ceiling level)	15.3200	0.0910	1.3941
E12 Gable (insulation at ceiling level)	6.2100	0.0750	0.4657
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	6.2100	0.1160	0.7204
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.0460	0.2857
E6 Intermediate floor within a dwelling	21.5300	0.0540	1.1626

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.6803 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 58.9025 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.1489	49.5795	49.0102	46.1637	45.5944	42.7478	42.7478	42.2279	43.8864	45.5944	46.7330	47.8716	(38)
Heat transfer coeff	109.0513	108.4820	107.9127	105.0662	104.4968	101.6503	101.6503	101.1304	102.7889	104.4968	105.6355	106.7741	(39)
Average = Sum(39)m / 12 =												104.9279	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1462	1.1402	1.1343	1.1043	1.0983	1.0684	1.0684	1.0630	1.0804	1.0983	1.1103	1.1223	(40)
HLP (average)												1.1029	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6898 (42)
Hot water usage for mixer showers

69.3181	68.2763	66.7584	63.8540	61.7106	59.3203	57.9617	59.4682	61.1196	63.6860	66.6528	69.0525	(42a)

Hot water usage for baths

29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)

Hot water usage for other uses

42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)

Average daily hot water use (litres/day) 130.0024 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	141.4261	138.4062	134.7285	129.1362	124.5949	119.7126	117.8364	121.4982	125.3600	130.4856	136.1640	141.0593	(44)
Energy conte	223.9843	197.0885	207.0727	176.7810	167.7287	147.2007	142.5129	150.4401	154.5815	177.0677	193.9906	220.8648	(45)
Energy content (annual)										Total = Sum(45)m =		2159.3135	
Distribution loss (46)m = 0.15 x (45)m	33.5976	29.5633	31.0609	26.5172	25.1593	22.0801	21.3769	22.5660	23.1872	26.5602	29.0986	33.1297	(46)

Water storage loss (or HIU loss):
Store volume 198.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.5000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.8100 (55)
Total storage loss

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)

If cylinder contains dedicated solar storage

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(64)
										Total per year (kWh/year) = Sum(64)m =		2728.8595	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

113.1727	100.4849	107.5496	96.2293	94.4677	86.3938	86.0835	88.7193	88.8479	97.5729	101.9515	112.1355	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.7636	27.3239	22.2213	16.8230	12.5754	10.6166	11.4717	14.9113	20.0139	25.4123	29.6599	31.6186	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	370.4822	374.3267	364.6388	344.0144	317.9799	293.5111	277.1644	273.3200	283.0079	303.6322	329.6668	354.1356	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	(71)
Water heating gains (Table 5)	152.1139	149.5311	144.5559	133.6518	126.9727	119.9914	115.7036	119.2463	123.3999	131.1464	141.5993	150.7197	(72)
Total internal gains	660.9829	658.8050	639.0393	602.1125	565.1513	531.7425	511.9630	515.1009	534.0450	567.8142	608.5492	644.0971	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.2400	11.2829	0.3000	0.0000	0.7700	13.6573	(75)

Southwest			5.7600		36.7938		0.3000		0.0000		0.7700		48.9564 (79)
Northeast			5.7100		11.2829		0.3000		0.0000		0.7700		14.8823 (75)
Solar gains	77.4960	141.4841	218.7646	313.2651	389.4060	403.5350	381.9991	322.6040	251.0817	163.1592	94.5487	65.2034	(83)
Total gains	738.4790	800.2891	857.8039	915.3776	954.5573	935.2775	893.9621	837.7049	785.1267	730.9734	703.0979	709.3005	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.0324	20.1375	20.2437	20.7922	20.9055	21.4909	21.4909	21.6014	21.2528	20.9055	20.6801	20.4596	
alpha	2.3355	2.3425	2.3496	2.3861	2.3937	2.4327	2.4327	2.4401	2.4169	2.3937	2.3787	2.3640	
util living area	0.9240	0.9060	0.8730	0.8095	0.7116	0.5727	0.4492	0.4876	0.6706	0.8287	0.9014	0.9295	(86)
Living	18.2710	18.5463	19.0357	19.7082	20.2857	20.7160	20.8871	20.8595	20.5506	19.8255	18.9718	18.2556	
Non living	17.4886	17.7612	18.2422	18.9059	19.4477	19.8417	19.9715	19.9587	19.7045	19.0326	18.1993	17.4863	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.6039	18.5463	19.0357	19.7082	20.2857	20.7160	20.8871	20.8595	20.5506	19.8255	18.9718	18.6395	(87)
Th 2	19.9633	19.9681	19.9730	19.9973	20.0022	20.0267	20.0267	20.0312	20.0169	20.0022	19.9924	19.9827	(88)
util rest of house	0.9147	0.8945	0.8569	0.7843	0.6709	0.5098	0.3646	0.4034	0.6129	0.8009	0.8876	0.9208	(89)
MIT 2	18.6973	17.7612	18.2422	18.9059	19.4477	19.8417	19.9715	19.9587	19.7045	19.0326	18.1993	17.8355	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	18.8983	17.9353	18.4181	19.0837	19.6334	20.0355	20.1744	20.1584	19.8921	19.2084	18.3705	18.0137	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8983	17.9353	18.4181	19.0837	19.6334	20.0355	20.1744	20.1584	19.8921	19.2084	18.3705	18.0137	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9034	0.8655	0.8268	0.7574	0.6542	0.5104	0.3782	0.4151	0.6047	0.7744	0.8593	0.8995	(94)
Useful gains	667.1350	692.6899	709.2373	693.3322	624.4582	477.3398	338.0626	347.7645	474.7788	566.0790	604.1585	637.9921	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1591.9656	1414.0915	1286.1111	1069.9632	829.0197	552.5224	363.3436	380.0839	595.3595	899.5481	1190.5652	1474.9447	(97)
Space heating kWh	688.0740	484.7819	429.1941	271.1743	152.1938	0.0000	0.0000	0.0000	0.0000	248.1010	422.2128	622.6927	(98a)
Space heating requirement - total per year (kWh/year)												3318.4246	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	688.0740	484.7819	429.1941	271.1743	152.1938	0.0000	0.0000	0.0000	0.0000	248.1010	422.2128	622.6927	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3318.4246	
Space heating per m2											(98c) / (4) =	34.8794	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												285.6431	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement	688.0740	484.7819	429.1941	271.1743	152.1938	0.0000	0.0000	0.0000	0.0000	248.1010	422.2128	622.6927	(98)
Space heating efficiency (main heating system 1)	285.6431	285.6431	285.6431	285.6431	285.6431	0.0000	0.0000	0.0000	0.0000	285.6431	285.6431	285.6431	(210)
Space heating fuel (main heating system)	240.8859	169.7160	150.2554	94.9347	53.2811	0.0000	0.0000	0.0000	0.0000	86.8570	147.8113	217.9968	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	95.5956	84.5123	89.6597	78.4799	75.8502	68.0973	66.9996	69.7820	70.6879	79.1282	84.5203	94.5007	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.7468	4.2874	4.7468	4.5936	4.7468	4.5936	4.7468	4.7468	4.5936	4.7468	4.5936	4.7468	(231)
Lighting	26.9272	21.6020	19.4502	14.2500	11.0071	8.9929	10.0411	13.0518	16.9530	22.2432	25.1236	27.6755	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1161.7383	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	284.9050	
Water heating fuel used	957.8138	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)		
mechanical ventilation fans (SFP = 0.1790)	55.8892	(230a)
Total electricity for the above, kWh/year	55.8892	(231)
Electricity for lighting (calculated in Appendix L)	217.3176	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2392.7589	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1161.7383	16.4900	191.5706	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	957.8138	16.4900	157.9435	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	55.8892	16.4900	9.2161	(249)
Energy for lighting	217.3176	16.4900	35.8357	(250)
Additional standing charges			0.0000	(251)
Total energy cost			394.5659	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0136	(257)
SAP value		83.5698	
SAP rating (Section 12)		84	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1161.7383	0.1547	179.6824	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	957.8138	0.1410	135.0326	(264)
Space and water heating			314.7150	(265)
Pumps, fans and electric keep-hot	55.8892	0.1387	7.7525	(267)
Energy for lighting	217.3176	0.1443	31.3656	(268)
Total CO2, kg/year			353.8331	(272)
CO2 emissions per m2			3.7200	(273)
EI value			96.6167	
EI rating			97	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700	(1b) x	2.5500	(2b) =	121.3035	(1b) - (3b)
First floor	47.5700	(1c) x	2.8300	(2c) =	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		255.9266	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1172 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.3172 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2696 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.5000	4.4000	4.4000	4.0000	4.1000	3.5000	3.4000	3.4000	3.5000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1250	1.1000	1.1000	1.0000	1.0250	0.8750	0.8500	0.8500	0.8750	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.3033	0.2966	0.2966	0.2696	0.2764	0.2359	0.2292	0.2292	0.2359	0.2629	0.2629	0.2696	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5533	0.5466	0.5466	0.5196	0.5264	0.5000	0.5000	0.5000	0.5000	0.5129	0.5129	0.5196	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.0000	1.1450	12.5954			(27)
Glazed Doors			5.7100	1.1450	6.5382			(27)
GF			47.5700	0.1100	5.2327	75.0000	3567.7500	(28a)
Main	115.8314	18.8600	96.9714	0.1900	18.4246	9.0000	872.7426	(29a)
PIJ	47.5700		47.5700	0.0900	4.2813	9.0000	428.1300	(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.2222			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000	20.0000	668.2000	(32)
Timber			93.9800			9.0000	845.8200	(32c)
Timber			21.9300			9.0000	197.3700	(32c)
FF			47.5700			18.0000	856.2600	(32d)
GF			47.5700			9.0000	428.1300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 7864.4026 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	82.6614 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.2600	0.0460	0.5640
E3 Sill	12.2600	0.0470	0.5762
E4 Jamb	37.2000	0.0530	1.9716
E5 Ground floor (normal)	21.5300	0.0680	1.4640
E10 Eaves (insulation at ceiling level)	15.3200	0.0910	1.3941
E12 Gable (insulation at ceiling level)	6.2100	0.0750	0.4657
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	6.2100	0.1160	0.7204
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.0460	0.2857
E6 Intermediate floor within a dwelling	21.5300	0.0540	1.1626

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.6803 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	58.9025 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.7330	46.1637	46.1637	43.8864	44.4557	42.2279	42.2279	42.2279	42.2279	43.3171	43.3171	43.8864	(38)
Heat transfer coeff	105.6355	105.0662	105.0662	102.7889	103.3582	101.1304	101.1304	101.1304	101.1304	102.2196	102.2196	102.7889	(39)
Average = Sum(39)m / 12 =												102.8054	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1103	1.1043	1.1043	1.0804	1.0864	1.0630	1.0630	1.0630	1.0630	1.0744	1.0744	1.0804	(40)
HLP (average)												1.0806	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6898 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
69.3181	68.2763	66.7584	63.8540	61.7106	59.3203	57.9617	59.4682	61.1196	63.6860	66.6528	69.0525	(42a)

Hot water usage for baths

29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)

Hot water usage for other uses

42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)

Average daily hot water use (litres/day)	130.0024 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	141.4261	138.4062	134.7285	129.1362	124.5949	119.7126	117.8364	121.4982	125.3600	130.4856	136.1640	141.0593	(44)
Energy conte	223.9843	197.0885	207.0727	176.7810	167.7287	147.2007	142.5129	150.4401	154.5815	177.0677	193.9906	220.8648	(45)
Energy content (annual)										Total = Sum(45)m =		2159.3135	
Distribution loss (46)m = 0.15 x (45)m	33.5976	29.5633	31.0609	26.5172	25.1593	22.0801	21.3769	22.5660	23.1872	26.5602	29.0986	33.1297	(46)

Water storage loss (or HIU loss):	
Store volume	198.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.5000 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.8100 (55)

Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)

PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(64)
											Total per year (kWh/year) = Sum(64)m =	2728.8595	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	(64a)
Heat gains from water heating, kWh/month													
	113.1727	100.4849	107.5496	96.2293	94.4677	86.3938	86.0835	88.7193	88.8479	97.5729	101.9515	112.1355	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	30.7636	27.3239	22.2213	16.8230	12.5754	10.6166	11.4717	14.9113	20.0139	25.4123	29.6599	31.6186	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	370.4822	374.3267	364.6388	344.0144	317.9799	293.5111	277.1644	273.3200	283.0079	303.6322	329.6668	354.1356	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	(71)
Water heating gains (Table 5)													
	152.1139	149.5311	144.5559	133.6518	126.9727	119.9914	115.7036	119.2463	123.3999	131.1464	141.5993	150.7197	(72)
Total internal gains													
	660.9829	658.8050	639.0393	602.1125	565.1513	531.7425	511.9630	515.1009	534.0450	567.8142	608.5492	644.0971	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.2400	9.9768	0.3000	0.0000	0.7700	12.0763	(75)
Southwest	5.7600	32.4665	0.3000	0.0000	0.7700	43.1986	(79)
Northeast	5.7100	9.9768	0.3000	0.0000	0.7700	13.1595	(75)

Solar gains	68.4345	128.1917	209.4359	304.7615	367.0320	391.4022	361.7471	301.9532	246.5183	158.0045	88.6690	61.9867	(83)
Total gains	729.4174	786.9967	848.4751	906.8740	932.1833	923.1446	873.7100	817.0541	780.5633	725.8187	697.2182	706.0838	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.6801	20.7922	20.7922	21.2528	21.1358	21.6014	21.6014	21.6014	21.6014	21.3712	21.3712	21.2528	
alpha	2.3787	2.3861	2.3861	2.4169	2.4091	2.4401	2.4401	2.4401	2.4401	2.4247	2.4247	2.4169	
util living area													
	0.9182	0.8992	0.8620	0.7888	0.6768	0.5250	0.4134	0.4546	0.6463	0.8113	0.8926	0.9235	(86)
Living	18.5201	18.7824	19.2497	19.9027	20.4431	20.7978	20.9177	20.8930	20.6214	19.9822	19.1828	18.5086	
Non living	17.7531	18.0124	18.4669	19.1048	19.5977	19.9104	19.9956	19.9818	19.7760	19.1949	18.4250	17.7576	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.7314	18.7824	19.2497	19.9027	20.4431	20.7978	20.9177	20.8930	20.6214	19.9822	19.1828	18.8571	(87)
Th 2	19.9924	19.9973	19.9973	20.0169	20.0120	20.0312	20.0312	20.0312	20.0312	20.0218	20.0218	20.0169	(88)
util rest of house													
	0.9080	0.8867	0.8442	0.7604	0.6296	0.4545	0.3228	0.3631	0.5846	0.7802	0.8774	0.9141	(89)
MIT 2	18.8469	18.0124	18.4669	19.1048	19.5977	19.9104	19.9956	19.9818	19.7760	19.1949	18.4250	18.0736	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	19.0429	18.1831	18.6404	19.2816	19.7851	20.1071	20.2000	20.1838	19.9634	19.3694	18.5930	18.2473	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0429	18.1831	18.6404	19.2816	19.7851	20.1071	20.2000	20.1838	19.9634	19.3694	18.5930	18.2473	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8967	0.8581	0.8150	0.7359	0.6176	0.4604	0.3394	0.3784	0.5799	0.7558	0.8496	0.8927	(94)
Useful gains	654.0588	675.3372	691.5218	667.3790	575.7410	424.9959	296.5230	309.1414	452.6128	548.5783	592.3479	630.3348	(95)
Ext temp.	5.0000	5.6000	7.2000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.2000	7.7000	4.8000	(96)
Heat loss rate W													
	1483.4318	1322.0540	1202.0000	984.8867	732.3009	476.0312	313.5081	332.0882	552.5144	835.0712	1113.4747	1382.2329	(97)
Space heating kWh													
	617.0535	434.5937	379.7958	228.6056	116.4806	0.0000	0.0000	0.0000	0.0000	213.1507	375.2113	559.4122	(98a)
Space heating requirement - total per year (kWh/year)												2924.3033	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	617.0535	434.5937	379.7958	228.6056	116.4806	0.0000	0.0000	0.0000	0.0000	213.1507	375.2113	559.4122	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2924.3033	
Space heating per m2											(98c) / (4) =	30.7368	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	286.1613	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	617.0535	434.5937	379.7958	228.6056	116.4806	0.0000	0.0000	0.0000	0.0000	213.1507	375.2113	559.4122	(98)
Space heating efficiency (main heating system 1)	286.1613	286.1613	286.1613	286.1613	286.1613	0.0000	0.0000	0.0000	0.0000	286.1613	286.1613	286.1613	(210)
Space heating fuel (main heating system)	215.6314	151.8702	132.7209	79.8870	40.7045	0.0000	0.0000	0.0000	0.0000	74.4862	131.1188	195.4884	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	272.3567	240.7797	255.4451	223.5930	216.1011	194.0127	190.8853	198.8125	201.3935	225.4401	240.8026	269.2372	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	95.5956	84.5123	89.6597	78.4799	75.8502	68.0973	66.9996	69.7820	70.6879	79.1282	84.5203	94.5007	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.7468	4.2874	4.7468	4.5936	4.7468	4.5936	4.7468	4.7468	4.5936	4.7468	4.5936	4.7468	(231)
Lighting	26.9272	21.6020	19.4502	14.2500	11.0071	8.9929	10.0411	13.0518	16.9530	22.2432	25.1236	27.6755	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1021.9074	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	284.9050	
Water heating fuel used	957.8138	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)		
mechanical ventilation fans (SFP = 0.1790)	55.8892	(230a)
Total electricity for the above, kWh/year	55.8892	(231)
Electricity for lighting (calculated in Appendix L)	217.3176	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2252.9280	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1021.9074	26.0000	265.6959	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	957.8138	26.0000	249.0316	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	55.8892	26.0000	14.5312	(249)
Energy for lighting	217.3176	26.0000	56.5026	(250)
Additional standing charges			0.0000	(251)
Total energy cost			585.7613	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1021.9074	0.1549	158.3440	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	957.8138	0.1410	135.0326	(264)
Space and water heating			293.3766	(265)
Pumps, fans and electric keep-hot	55.8892	0.1387	7.7525	(267)
Energy for lighting	217.3176	0.1443	31.3656	(268)
Total CO2, kg/year			332.4947	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1021.9074	1.5736	1608.1055	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	957.8138	1.5213	1457.1193	(278)
Space and water heating			3065.2248	(279)
Pumps, fans and electric keep-hot	55.8892	1.5128	84.5493	(281)
Energy for lighting	217.3176	1.5338	333.3289	(282)

Total Primary energy kWh/year 3483.1030 (286)

SAP 10 EPC IMPROVEMENTS

001

Current energy efficiency rating: B 84
Current environmental impact rating: A 97

N	Solar water heating		Recommended
U	Solar photovoltaic panels		Recommended
V2	Wind turbine		Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.4	-£ 49	-23 kg (7.0%)
U Solar photovoltaic panels	+ 7.9	-£ 262	-212 kg (68.5%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£49	0.25 kg/m²	B 85	A 97
Solar photovoltaic panels	£262	2.23 kg/m²	A 93	A 99
Total Savings	£311	2.47 kg/m²		

Potential energy efficiency rating: A 93
Potential environmental impact rating: A 99

Fuel prices for cost data on this page from database revision number 599 TEST (30 Sep 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, West Pennines (England)):

	Current	Potential	Saving
Electricity	£586	£537	£49
Space heating	£280	£304	-£24
Water heating	£249	£176	£73
Lighting	£57	£57	£0
Generated (PV)	-£0	-£262	£262
Total cost of fuels	£586	£275	£311
Total cost of uses	£586	£275	£311
Delivered energy	24 kWh/m²	4 kWh/m²	19 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.1 tonnes	0.2 tonnes
CO2 emissions per m²	3 kg/m²	1 kg/m²	2 kg/m²
Primary energy	37 kWh/m²	17 kWh/m²	20 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700	(1b) x	2.5500	(2b) =	121.3035	(1b) - (3b)
First floor	47.5700	(1c) x	2.8300	(2c) =	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		255.9266	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1172	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3172	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2696	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)

Adj infilt rate

	0.3438	0.3370	0.3303	0.2966	0.2899	0.2562	0.2562	0.2494	0.2696	0.2899	0.3033	0.3168 (22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

Effective ac	0.5938	0.5870	0.5803	0.5466	0.5399	0.5062	0.5062	0.5000	0.5196	0.5399	0.5533	0.5668 (25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.0000	1.1450	12.5954			(27)
Glazed Doors			5.7100	1.1450	6.5382			(27)
GF			47.5700	0.1100	5.2327	75.0000	3567.7500	(28a)
Main	115.8314	18.8600	96.9714	0.1900	18.4246	9.0000	872.7426	(29a)
PIJ	47.5700		47.5700	0.0900	4.2813	9.0000	428.1300	(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.2222			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000	20.0000	668.2000	(32)
Timber			93.9800			9.0000	845.8200	(32c)
Timber			21.9300			9.0000	197.3700	(32c)
FF			47.5700			18.0000	856.2600	(32d)
GF			47.5700			9.0000	428.1300	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7864.4026 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 82.6614 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.2600	0.0460	0.5640
E3 Sill	12.2600	0.0470	0.5762
E4 Jamb	37.2000	0.0530	1.9716
E5 Ground floor (normal)	21.5300	0.0680	1.4640
E10 Eaves (insulation at ceiling level)	15.3200	0.0910	1.3941
E12 Gable (insulation at ceiling level)	6.2100	0.0750	0.4657
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	6.2100	0.1160	0.7204
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.0460	0.2857
E6 Intermediate floor within a dwelling	21.5300	0.0540	1.1626

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.6803 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 58.9025 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.1489	49.5795	49.0102	46.1637	45.5944	42.7478	42.7478	42.2279	43.8864	45.5944	46.7330	47.8716	(38)
Heat transfer coeff	109.0513	108.4820	107.9127	105.0662	104.4968	101.6503	101.6503	101.1304	102.7889	104.4968	105.6355	106.7741	(39)
Average = Sum(39)m / 12 =												104.9279	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1462	1.1402	1.1343	1.1043	1.0983	1.0684	1.0684	1.0630	1.0804	1.0983	1.1103	1.1223	(40)
HLP (average)												1.1029	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6898 (42)

Hot water usage for mixer showers

69.3181	68.2763	66.7584	63.8540	61.7106	59.3203	57.9617	59.4682	61.1196	63.6860	66.6528	69.0525	(42a)

Hot water usage for baths

29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)

Hot water usage for other uses

42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)

Average daily hot water use (litres/day) 130.0024 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	141.4261	138.4062	134.7285	129.1362	124.5949	119.7126	117.8364	121.4982	125.3600	130.4856	136.1640	141.0593	(44)
Energy conte	223.9843	197.0885	207.0727	176.7810	167.7287	147.2007	142.5129	150.4401	154.5815	177.0677	193.9906	220.8648	(45)
Energy content (annual)										Total = Sum(45)m =		2159.3135	
Distribution loss (46)m = 0.15 x (45)m	33.5976	29.5633	31.0609	26.5172	25.1593	22.0801	21.3769	22.5660	23.1872	26.5602	29.0986	33.1297	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage	15.5986	14.0891	15.5986	15.0955	15.5986	15.0955	15.5986	15.5986	15.0955	15.5986	15.0955	15.5986	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	262.8454	232.1888	244.5380	207.6349	193.7954	172.2014	168.3470	177.2047	186.7860	214.5330	231.5981	259.7258	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
If combined cylinder, total volume of cylinder												198.0000	(H13)
Effective solar volume												111.9000	(H14)
Reference volume												225.0000	(H15)

Storage tank correction coefficient												1.1908	(H16)
Heat delivered to hot water												652.0514	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												652.0514	
Solar input	-0.0000	-19.9133	-62.1742	-83.6265	-107.4087	-98.8285	-98.0326	-86.6188	-61.4012	-32.9585	-1.0890	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	262.8454	212.2755	182.3638	124.0084	86.3867	73.3729	70.3143	90.5859	125.3849	181.5745	230.5090	259.7258	(64)
									Total per year (kWh/year) = Sum(64)m =			1899.3470	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
							Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =					0.0000	(64a)
Heat gains from water heating, kWh/month													
	105.5636	93.6122	98.8239	83.4628	76.6232	68.9448	68.0528	71.4330	77.1620	88.8472	94.5878	104.5264	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	30.7636	27.3239	22.2213	16.8230	12.5754	10.6166	11.4717	14.9113	20.0139	25.4123	29.6599	31.6186	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	370.4822	374.3267	364.6388	344.0144	317.9799	293.5111	277.1644	273.3200	283.0079	303.6322	329.6668	354.1356	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	(71)
Water heating gains (Table 5)													
	141.8866	139.3038	132.8278	115.9205	102.9881	95.7567	91.4688	96.0121	107.1694	119.4183	131.3720	140.4924	(72)
Total internal gains													
	650.7556	648.5777	627.3112	584.3812	541.1667	507.5077	487.7282	491.8667	517.8145	556.0861	598.3219	633.8698	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.2400	11.2829	0.3000	0.0000	0.7700	13.6573	(75)
Southwest	5.7600	36.7938	0.3000	0.0000	0.7700	48.9564	(79)
Northeast	5.7100	11.2829	0.3000	0.0000	0.7700	14.8823	(75)

Solar gains	77.4960	141.4841	218.7646	313.2651	389.4060	403.5350	381.9991	322.6040	251.0817	163.1592	94.5487	65.2034	(83)
Total gains	728.2517	790.0618	846.0758	897.6463	930.5727	911.0427	869.7273	814.4707	768.8963	719.2454	692.8707	699.0732	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.0324	20.1375	20.2437	20.7922	20.9055	21.4909	21.4909	21.6014	21.2528	20.9055	20.6801	20.4596	
alpha	2.3355	2.3425	2.3496	2.3861	2.3937	2.4327	2.4327	2.4401	2.4169	2.3937	2.3787	2.3640	
util living area													
	0.9260	0.9081	0.8759	0.8149	0.7205	0.5828	0.4591	0.4981	0.6783	0.8329	0.9039	0.9313	(86)
Living	18.2517	18.5281	19.0168	19.6851	20.2641	20.7044	20.8814	20.8526	20.5383	19.8092	18.9536	18.2358	
Non living	17.4699	17.7436	18.2243	18.8848	19.4295	19.8335	19.9685	19.9548	19.6951	19.0178	18.1819	17.4670	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.5941	18.5281	19.0168	19.6851	20.2641	20.7044	20.8814	20.8526	20.5383	19.8092	18.9536	18.6225	(87)
Th 2	19.9633	19.9681	19.9730	19.9973	20.0022	20.0267	20.0267	20.0312	20.0169	20.0022	19.9924	19.9827	(88)
util rest of house													
	0.9168	0.8968	0.8600	0.7901	0.6802	0.5197	0.3734	0.4130	0.6208	0.8055	0.8904	0.9229	(89)
MIT 2	18.6878	17.7436	18.2243	18.8848	19.4295	19.8335	19.9685	19.9548	19.6951	19.0178	18.1819	17.8189	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	18.8887	17.9175	18.4000	19.0622	19.6145	20.0266	20.1709	20.1538	19.8820	19.1932	18.3530	17.9970	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8887	17.9175	18.4000	19.0622	19.6145	20.0266	20.1709	20.1538	19.8820	19.1932	18.3530	17.9970	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9056	0.8680	0.8300	0.7630	0.6627	0.5197	0.3868	0.4244	0.6120	0.7789	0.8622	0.9018	(94)
Useful gains	659.5153	685.8089	702.2323	684.9189	616.7090	473.4353	336.4173	345.6993	470.5826	560.1999	597.4258	630.4165	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1590.9131	1412.1682	1284.1640	1067.7050	827.0390	551.6116	362.9789	379.6217	594.3257	897.9674	1188.7140	1473.1650	(97)
Space heating kWh													
	692.9599	488.1135	432.9572	275.6060	156.4855	0.0000	0.0000	0.0000	0.0000	251.2990	425.7275	627.0049	(98a)
Space heating requirement - total per year (kWh/year)												3350.1535	
Solar heating kWh													
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	692.9599	488.1135	432.9572	275.6060	156.4855	0.0000	0.0000	0.0000	0.0000	251.2990	425.7275	627.0049	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3350.1535	
Space heating per m2											(98c) / (4) =	35.2129	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)

Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												285.6431	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	692.9599	488.1135	432.9572	275.6060	156.4855	0.0000	0.0000	0.0000	0.0000	251.2990	425.7275	627.0049	(98)
Space heating efficiency (main heating system 1)													
	285.6431	285.6431	285.6431	285.6431	285.6431	0.0000	0.0000	0.0000	0.0000	285.6431	285.6431	285.6431	(210)
Space heating fuel (main heating system)													
	242.5965	170.8823	151.5728	96.4861	54.7836	0.0000	0.0000	0.0000	0.0000	87.9766	149.0418	219.5064	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	262.8454	212.2755	182.3638	124.0084	86.3867	73.3729	70.3143	90.5859	125.3849	181.5745	230.5090	259.7258	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month													
	92.2572	74.5075	64.0086	43.5262	30.3212	25.7535	24.6799	31.7951	44.0094	63.7316	80.9073	91.1622	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5413	10.4244	11.5413	11.1690	11.5413	11.1690	11.5413	11.5413	11.1690	11.5413	11.1690	11.5413	(231)
Lighting	26.9272	21.6020	19.4502	14.2500	11.0071	8.9929	10.0411	13.0518	16.9530	22.2432	25.1236	27.6755	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-38.0992	-56.3669	-84.4848	-96.8839	-103.3352	-90.3781	-89.0958	-83.8778	-74.2858	-64.5119	-42.3440	-32.4195	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-11.9873	-27.2131	-57.8614	-93.8882	-132.3476	-141.3356	-139.5557	-115.8962	-82.1773	-42.3340	-17.0658	-9.4943	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1172.8462	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												284.9050	
Water heating fuel used												666.6598	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)													
mechanical ventilation fans (SFP = 0.1790)												55.8892	(230a)
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												135.8892	(231)
Electricity for lighting (calculated in Appendix L)												217.3176	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1727.2394	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												465.4733	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1172.8462	16.4900	193.4023	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	666.6598	16.4900	109.9322	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	55.8892	16.4900	9.2161	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	217.3176	16.4900	35.8357	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-856.0828	16.4900	-141.1681	
PV Unit electricity exported	-871.1566	5.5900	-48.6977	
Total			-189.8657	(252)
Total energy cost			171.7126	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4411	(257)
SAP value		92.8497	
SAP rating (Section 12)		93	(258)
SAP band		A	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	

Space heating - main system 1	1172.8462	0.1546	181.3537	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	666.6598	0.1462	97.4831	(264)
Space and water heating			278.8368	(265)
Pumps, fans and electric keep-hot	135.8892	0.1387	18.8495	(267)
Energy for lighting	217.3176	0.1443	31.3656	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-856.0828	0.1347	-115.2938	
PV Unit electricity exported	-871.1566	0.1232	-107.3186	
Total			-222.6124	(269)
Total CO2, kg/year			106.4395	(272)
CO2 emissions per m2			1.1200	(273)
EI value			98.9822	
EI rating			99	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	47.5700 (1b)	x	2.5500 (2b)	=	121.3035	(1b) - (3b)
First floor	47.5700 (1c)	x	2.8300 (2c)	=	134.6231	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		255.9266	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1172	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3172	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2696	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.5000	4.4000	4.4000	4.0000	4.1000	3.5000	3.4000	3.4000	3.5000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1250	1.1000	1.1000	1.0000	1.0250	0.8750	0.8500	0.8500	0.8750	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.3033	0.2966	0.2966	0.2696	0.2764	0.2359	0.2292	0.2292	0.2359	0.2629	0.2629	0.2696	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
Effective ac	0.5533	0.5466	0.5466	0.5196	0.5264	0.5000	0.5000	0.5000	0.5000	0.5129	0.5129	0.5196	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.0000	1.1450	12.5954			(27)
Glazed Doors			5.7100	1.1450	6.5382			(27)
GF			47.5700	0.1100	5.2327	75.0000	3567.7500	(28a)
Main	115.8314	18.8600	96.9714	0.1900	18.4246	9.0000	872.7426	(29a)
PIJ	47.5700		47.5700	0.0900	4.2813	9.0000	428.1300	(30)
Total net area of external elements Aum(A, m2)			210.9714					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.2222			(33)
Main dwelling								
Party Wall			33.4100	0.0000	0.0000	20.0000	668.2000	(32)
Timber			93.9800			9.0000	845.8200	(32c)
Timber			21.9300			9.0000	197.3700	(32c)
FF			47.5700			18.0000	856.2600	(32d)
GF			47.5700			9.0000	428.1300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	7864.4026 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		82.6614 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.2600	0.0460	0.5640
E3 Sill	12.2600	0.0470	0.5762
E4 Jamb	37.2000	0.0530	1.9716

E5 Ground floor (normal)	21.5300	0.0680	1.4640	
E10 Eaves (insulation at ceiling level)	15.3200	0.0910	1.3941	
E12 Gable (insulation at ceiling level)	6.2100	0.0750	0.4657	
E16 Corner (normal)	10.7600	0.0460	0.4950	
E18 Party wall between dwellings	10.7600	0.0540	0.5810	
P1 Party wall - Ground floor	6.2100	0.1160	0.7204	
P4 Party wall - Roof (insulation at ceiling level)	6.2100	0.0460	0.2857	
E6 Intermediate floor within a dwelling	21.5300	0.0540	1.1626	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				9.6803 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	58.9025 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.7330	46.1637	46.1637	43.8864	44.4557	42.2279	42.2279	42.2279	42.2279	43.3171	43.3171	43.8864	(38)
Heat transfer coeff	105.6355	105.0662	105.0662	102.7889	103.3582	101.1304	101.1304	101.1304	101.1304	102.2196	102.2196	102.7889	(39)
Average = Sum(39)m / 12 =												102.8054	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1103	1.1043	1.1043	1.0804	1.0864	1.0630	1.0630	1.0630	1.0630	1.0744	1.0744	1.0804	(40)
HLP (average)												1.0806	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6898	(42)
Hot water usage for mixer showers	69.3181	68.2763	66.7584	63.8540	61.7106	59.3203	57.9617	59.4682	61.1196	63.6860	66.6528	69.0525	(42a)
Hot water usage for baths	29.9323	29.4877	28.8617	27.7075	26.8432	25.8849	25.3672	25.9888	26.6657	27.6911	28.8691	29.8311	(42b)
Hot water usage for other uses	42.1757	40.6421	39.1084	37.5748	36.0411	34.5074	34.5074	36.0411	37.5748	39.1084	40.6421	42.1757	(42c)
Average daily hot water use (litres/day)												130.0024	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	141.4261	138.4062	134.7285	129.1362	124.5949	119.7126	117.8364	121.4982	125.3600	130.4856	136.1640	141.0593	(44)
Energy conte	223.9843	197.0885	207.0727	176.7810	167.7287	147.2007	142.5129	150.4401	154.5815	177.0677	193.9906	220.8648	(45)
Energy content (annual)										Total = Sum(45)m =		2159.3135	
Distribution loss (46)m = 0.15 x (45)m	33.5976	29.5633	31.0609	26.5172	25.1593	22.0801	21.3769	22.5660	23.1872	26.5602	29.0986	33.1297	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage	15.5986	14.0891	15.5986	15.0955	15.5986	15.0955	15.5986	15.5986	15.0955	15.5986	15.0955	15.5986	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	262.8454	232.1888	244.5380	207.6349	193.7954	172.2014	168.3470	177.2047	186.7860	214.5330	231.5981	259.7258	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
If combined cylinder, total volume of cylinder												198.0000	(H13)
Effective solar volume												111.9000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.1908	(H16)
Heat delivered to hot water												618.9847	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												618.9847	
Solar input	-0.0000	-15.4923	-59.0081	-81.5881	-101.6969	-96.4015	-92.8449	-80.4442	-60.1659	-31.3427	-0.0000	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	262.8454	216.6965	185.5299	126.0468	92.0985	75.7999	75.5021	96.7604	126.6201	183.1903	231.5981	259.7258	(64)
									Total per year (kWh/year) = Sum(64)m =			1932.4138	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	105.5636	93.6122	98.8239	83.4628	76.6232	68.9448	68.0528	71.4330	77.1620	88.8472	94.5878	104.5264	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	161.3851	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.7636	27.3239	22.2213	16.8230	12.5754	10.6166	11.4717	14.9113	20.0139	25.4123	29.6599	31.6186	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	370.4822	374.3267	364.6388	344.0144	317.9799	293.5111	277.1644	273.3200	283.0079	303.6322	329.6668	354.1356	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	53.8283	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	-107.5901	(71)
Water heating gains (Table 5)	141.8866	139.3038	132.8278	115.9205	102.9881	95.7567	91.4688	96.0121	107.1694	119.4183	131.3720	140.4924	(72)
Total internal gains	650.7556	648.5777	627.3112	584.3812	541.1667	507.5077	487.7282	491.8667	517.8145	556.0861	598.3219	633.8698	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.2400	9.9768	0.3000	0.0000	0.7700	12.0763	(75)
Southwest	5.7600	32.4665	0.3000	0.0000	0.7700	43.1986	(79)
Northeast	5.7100	9.9768	0.3000	0.0000	0.7700	13.1595	(75)

Solar gains	68.4345	128.1917	209.4359	304.7615	367.0320	391.4022	361.7471	301.9532	246.5183	158.0045	88.6690	61.9867	(83)
Total gains	719.1901	776.7694	836.7471	889.1427	908.1987	898.9099	849.4753	793.8199	764.3328	714.0906	686.9909	695.8565	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.6801	20.7922	20.7922	21.2528	21.1358	21.6014	21.6014	21.6014	21.6014	21.3712	21.3712	21.2528	
alpha	2.3787	2.3861	2.3861	2.4169	2.4091	2.4401	2.4401	2.4401	2.4401	2.4247	2.4247	2.4169	
util living area	0.9203	0.9015	0.8651	0.7947	0.6863	0.5352	0.4231	0.4650	0.6542	0.8159	0.8954	0.9256	(86)
Living	18.5009	18.7644	19.2314	19.8812	20.4244	20.7889	20.9133	20.8874	20.6103	19.9668	19.1650	18.4889	
Non living	17.7345	17.9950	18.4497	19.0854	19.5825	19.9046	19.9936	19.9789	19.7678	19.1811	18.4080	17.7385	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.7216	18.7644	19.2314	19.8812	20.4244	20.7889	20.9133	20.8874	20.6103	19.9668	19.1650	18.8401	(87)
Th 2	19.9924	19.9973	19.9973	20.0169	20.0120	20.0312	20.0312	20.0312	20.0312	20.0218	20.0218	20.0169	(88)
util rest of house	0.9103	0.8892	0.8476	0.7667	0.6394	0.4641	0.3311	0.3723	0.5927	0.7852	0.8805	0.9164	(89)
MIT 2	18.8374	17.9950	18.4497	19.0854	19.5825	19.9046	19.9936	19.9789	19.7678	19.1811	18.4080	18.0572	(90)
Living area fraction										fLA = Living area / (4) =		0.2217	(91)
MIT	19.0334	18.1656	18.6230	19.2618	19.7691	20.1006	20.1975	20.1803	19.9546	19.3553	18.5758	18.2308	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0334	18.1656	18.6230	19.2618	19.7691	20.1006	20.1975	20.1803	19.9546	19.3553	18.5758	18.2308	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8991	0.8608	0.8184	0.7419	0.6267	0.4696	0.3477	0.3875	0.5873	0.7605	0.8528	0.8952	(94)
Useful gains	646.6185	668.6364	684.8036	659.6225	569.1298	422.0954	295.3349	307.5664	448.9051	543.0922	585.8426	622.9395	(95)
Ext temp.	5.0000	5.6000	7.2000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.2000	7.7000	4.8000	(96)
Heat loss rate W	1482.4222	1320.2176	1200.1677	982.8514	730.6544	475.3719	313.2473	331.7390	551.6221	833.6267	1111.7232	1380.5331	(97)
Space heating kWh	621.8380	437.8626	383.4309	232.7248	120.1743	0.0000	0.0000	0.0000	0.0000	216.1576	378.6340	563.6496	(98a)
Space heating requirement - total per year (kWh/year)												2954.4718	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	621.8380	437.8626	383.4309	232.7248	120.1743	0.0000	0.0000	0.0000	0.0000	216.1576	378.6340	563.6496	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2954.4718	
Space heating per m2											(98c) / (4) =	31.0539	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	286.1613 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	621.8380	437.8626	383.4309	232.7248	120.1743	0.0000	0.0000	0.0000	0.0000	216.1576	378.6340	563.6496	(98)
Space heating efficiency (main heating system 1)	286.1613	286.1613	286.1613	286.1613	286.1613	0.0000	0.0000	0.0000	0.0000	286.1613	286.1613	286.1613	(210)
Space heating fuel (main heating system)	217.3033	153.0125	133.9912	81.3265	41.9953	0.0000	0.0000	0.0000	0.0000	75.5370	132.3149	196.9692	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	262.8454	216.6965	185.5299	126.0468	92.0985	75.7999	75.5021	96.7604	126.6201	183.1903	231.5981	259.7258	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	92.2572	76.0592	65.1199	44.2417	32.3260	26.6053	26.5008	33.9624	44.4429	64.2987	81.2896	91.1622	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5413	10.4244	11.5413	11.1690	11.5413	11.1690	11.5413	11.5413	11.1690	11.5413	11.1690	11.5413	(231)
Lighting	26.9272	21.6020	19.4502	14.2500	11.0071	8.9929	10.0411	13.0518	16.9530	22.2432	25.1236	27.6755	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-34.0473	-51.7688	-81.1382	-94.0147	-98.5583	-89.0565	-86.8343	-81.0552	-73.4727	-62.5386	-39.9377	-30.8844	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)

Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-10.1922	-23.9644	-55.1146	-91.5066	-123.4807	-135.5875	-129.5950	-105.8499	-80.1049	-40.9300	-15.7876	-8.9717 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	1032.4499 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	284.9050
Water heating fuel used	678.2660 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)	
mechanical ventilation fans (SFP = 0.1790)	55.8892 (230a)
pump for solar water heating	80.0000 (230g)
Total electricity for the above, kWh/year	135.8892 (231)
Electricity for lighting (calculated in Appendix L)	217.3176 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1644.3918 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	419.5309 (238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1032.4499	26.0000	268.4370	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	678.2660	26.0000	176.3492	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	55.8892	26.0000	14.5312	(249)
Pump for solar water heating	80.0000	26.0000	20.8000	(249)
Energy for lighting	217.3176	26.0000	56.5026	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-823.3066	26.0000	-214.0597	
PV Unit electricity exported	-821.0852	5.8100	-47.7050	
Total			-261.7648	(252)
Total energy cost			274.8551	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1032.4499	0.1549	159.9347	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	678.2660	0.1460	99.0032	(264)
Space and water heating			258.9379	(265)
Pumps, fans and electric keep-hot	135.8892	0.1387	18.8495	(267)
Energy for lighting	217.3176	0.1443	31.3656	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-823.3066	0.1344	-110.6379	
PV Unit electricity exported	-821.0852	0.1232	-101.1600	
Total			-211.7979	(269)
Total CO2, kg/year			97.3552	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1032.4499	1.5735	1624.5364	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	678.2660	1.5399	1044.4947	(278)
Space and water heating			2669.0311	(279)
Pumps, fans and electric keep-hot	135.8892	1.5128	205.5733	(281)
Energy for lighting	217.3176	1.5338	333.3289	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-823.3066	1.4967	-1232.2140	
PV Unit electricity exported	-821.0852	0.4521	-371.2400	
Total			-1603.4540	(283)
Total Primary energy kWh/year			1604.4793	(286)

Full SAP Calculation Printout

Plot Reference	79841-05	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	2B3P (Semi)
Plot Address	Plot 5, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	83 B	**DER**	3.95	**TER**	11.67
Environmental	97 A	**% DER < TER**			66.15
CO_2 Emissions (t/year)	0.32	**DFEE**	40.01	**TFEE**	40.64
Compliance Check	See BREL	**% DFEE < TFEE**			1.55
% DPER < TPER	32.27	**DPER**	41.25	**TPER**	60.90

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	43.7300 (1b)	x	2.5500 (2b)	=	111.5115	(1b) - (3b)
First floor	43.7300 (1c)	x	2.8300 (2c)	=	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.2674	(5)

---

2. Ventilation rate

---

			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		3 * 10 =	30.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		30.0000 / (5) =	0.1275	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			4.0000	(17)
Infiltration rate			0.3275	(18)
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.2784	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3549	0.3480	0.3410	0.3062	0.2993	0.2645	0.2645	0.2575	0.2784	0.2993	0.3132	0.3271	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

Effective ac	0.6049	0.5980	0.5910	0.5562	0.5493	0.5145	0.5145	0.5075	0.5284	0.5493	0.5632	0.5771	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.4900	1.1450	13.1565			(27)
Glazed Doors			7.6000	1.1450	8.7023			(27)
GF			43.7300	0.1100	4.8103	75.0000	3279.7500	(28a)
Main	110.7742	21.2400	89.5342	0.1900	17.0115	9.0000	805.8078	(29a)
PIJ	43.7300		43.7300	0.0900	3.9357	9.0000	393.5700	(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.7663			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000	20.0000	644.6000	(32)
Timber			113.8200			9.0000	1024.3800	(32c)
Timber			20.4000			9.0000	183.6000	(32c)
FF			43.7300			18.0000	787.1400	(32d)
GF			43.7300			9.0000	393.5700	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7512.4178 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 85.8955 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.5100	0.0460	0.6675
E3 Sill	14.5100	0.0470	0.6820
E4 Jamb	29.8400	0.0530	1.5815
E5 Ground floor (normal)	20.5900	0.0680	1.4001
E10 Eaves (insulation at ceiling level)	14.6000	0.0910	1.3286
E12 Gable (insulation at ceiling level)	5.9900	0.0750	0.4492
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	5.9900	0.1160	0.6948
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.0460	0.2755
E6 Intermediate floor within a dwelling	20.5900	0.0540	1.1119

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2672 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.0334 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.9668	46.4264	45.8861	43.1844	42.6441	39.9424	39.9424	39.4020	41.0231	42.6441	43.7247	44.8054	(38)
Heat transfer coeff	106.0002	105.4599	104.9195	102.2178	101.6775	98.9758	98.9758	98.4355	100.0565	101.6775	102.7582	103.8389	(39)
Average = Sum(39)m / 12 =												102.0828	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2120	1.2058	1.1996	1.1687	1.1626	1.1317	1.1317	1.1255	1.1440	1.1626	1.1749	1.1873	(40)
HLP (average)												1.1672	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5893 (42)
Hot water usage for mixer showers

67.6343	66.6179	65.1368	62.3030	60.2117	57.8795	56.5538	58.0238	59.6350	62.1391	65.0338	67.3752	(42a)

Hot water usage for baths

29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)

Hot water usage for other uses

41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)

Average daily hot water use (litres/day) 126.8439 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.9899	135.0435	131.4552	125.9988	121.5679	116.8042	114.9735	118.5462	122.3142	127.3152	132.8557	137.6320	(44)
Energy conte	218.5423	192.3001	202.0418	172.4860	163.6537	143.6244	139.0504	146.7850	150.8257	172.7656	189.2773	215.4985	(45)
Energy content (annual)											Total = Sum(45)m =	2106.8508	
Distribution loss (46)m = 0.15 x (45)m	32.7813	28.8450	30.3063	25.8729	24.5481	21.5437	20.8576	22.0177	22.6239	25.9148	28.3916	32.3248	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(64)
										Total per year (kWh/year) = Sum(64)m =		2676.3968	(64)
12Total per year (kWh/year)												2676	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	111.3632	98.8927	105.8768	94.8012	93.1128	85.2047	84.9322	87.5039	87.5991	96.1425	100.3843	110.3512	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	118.2644	130.9356	118.2644	122.2065	118.2644	122.2065	118.2644	118.2644	122.2065	118.2644	122.2065	118.2644	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	234.3264	236.7580	230.6305	217.5858	201.1192	185.6429	175.3038	172.8722	178.9997	192.0444	208.5110	223.9873	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)	149.6818	147.1618	142.3075	131.6683	125.1516	118.3399	114.1562	117.6128	121.6655	129.2238	139.4227	148.3215	(72)
Total internal gains	564.1126	576.6954	553.0424	533.3007	506.3752	488.0294	469.5644	470.5894	484.7118	501.3726	531.9802	552.4132	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

East			3.0000		19.6403		0.3000		0.0000		0.7700		13.6107 (76)
West			8.4900		19.6403		0.3000		0.0000		0.7700		38.5183 (80)
East			7.6000		19.6403		0.3000		0.0000		0.7700		34.4804 (76)
Solar gains	86.6094	169.4264	279.0212	406.9358	498.7151	510.5236	486.0393	417.5006	324.5132	201.0387	107.9918	71.2234	(83)
Total gains	650.7220	746.1218	832.0636	940.2365	1005.0903	998.5530	955.6037	888.0900	809.2250	702.4113	639.9720	623.6366	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.6866	19.7875	19.8894	20.4151	20.5235	21.0838	21.0838	21.1995	20.8560	20.5235	20.3077	20.0964	
alpha	2.3124	2.3192	2.3260	2.3610	2.3682	2.4056	2.4056	2.4133	2.3904	2.3682	2.3538	2.3398	
util living area	0.9351	0.9109	0.8714	0.7915	0.6814	0.5358	0.4155	0.4552	0.6473	0.8296	0.9105	0.9402	(86)
Living	18.1081	18.4594	19.0087	19.7538	20.3388	20.7476	20.9014	20.8752	20.5746	19.7963	18.8657	18.0903	
Non living	17.2922	17.6387	18.1768	18.9054	19.4474	19.8162	19.9293	19.9187	19.6772	18.9652	18.0590	17.2873	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.5206	18.4594	19.0087	19.7538	20.3388	20.7476	20.9014	20.8752	20.5746	19.7963	18.8657	18.4973	(87)
Th 2	19.9104	19.9154	19.9203	19.9451	19.9501	19.9751	19.9751	19.9801	19.9650	19.9501	19.9401	19.9302	(88)
util rest of house	0.9266	0.8994	0.8543	0.7637	0.6374	0.4708	0.3309	0.3699	0.5859	0.8005	0.8971	0.9323	(89)
MIT 2	18.5710	17.6387	18.1768	18.9054	19.4474	19.8162	19.9293	19.9187	19.6772	18.9652	18.0590	17.6570	(90)
Living area fraction										fLA = Living area / (4) =		0.2056	(91)
MIT	18.7663	17.8074	18.3478	19.0798	19.6306	20.0077	20.1291	20.1153	19.8617	19.1360	18.2249	17.8297	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7663	17.8074	18.3478	19.0798	19.6306	20.0077	20.1291	20.1153	19.8617	19.1360	18.2249	17.8297	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9158	0.8703	0.8236	0.7372	0.6226	0.4730	0.3442	0.3819	0.5791	0.7733	0.8689	0.9121	(94)
Useful gains	595.9114	649.3608	685.3029	693.1332	625.7317	472.3015	328.9521	339.1532	468.6135	543.1759	556.0840	568.8159	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1533.4264	1361.2162	1243.0667	1040.5582	806.3674	535.2322	349.2998	365.7208	576.4916	867.9212	1143.1712	1415.2964	(97)
Space heating kWh	697.5112	478.3668	414.9762	250.1460	134.3930	0.0000	0.0000	0.0000	0.0000	241.6105	422.7028	629.7815	(98a)
Space heating requirement - total per year (kWh/year)												3269.4881	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	697.5112	478.3668	414.9762	250.1460	134.3930	0.0000	0.0000	0.0000	0.0000	241.6105	422.7028	629.7815	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3269.4881	
Space heating per m2											(98c) / (4) =	37.3827	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	286.3431 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	697.5112	478.3668	414.9762	250.1460	134.3930	0.0000	0.0000	0.0000	0.0000	241.6105	422.7028	629.7815	(98)
Space heating efficiency (main heating system 1)	286.3431	286.3431	286.3431	286.3431	286.3431	0.0000	0.0000	0.0000	0.0000	286.3431	286.3431	286.3431	(210)
Space heating fuel (main heating system)	243.5928	167.0607	144.9228	87.3589	46.9343	0.0000	0.0000	0.0000	0.0000	84.3780	147.6211	219.9395	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	93.6855	82.8316	87.8939	76.9723	74.4199	66.8421	65.7843	68.4991	69.3697	77.6181	82.8660	92.6172	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.3636	3.9413	4.3636	4.2228	4.3636	4.2228	4.3636	4.3636	4.2228	4.3636	4.2228	4.3636	(231)
Lighting	24.5730	19.7134	17.7497	13.0042	10.0448	8.2067	9.1632	11.9107	15.4708	20.2986	22.9272	25.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	1141.8080	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	284.9050	
Water heating fuel used	939.3997	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)		
mechanical ventilation fans (SFP = 0.1790)	51.3777	(230a)
Total electricity for the above, kWh/year	51.3777	(231)
Electricity for lighting (calculated in Appendix L)	198.3182	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2330.9037	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1141.8080	0.1549	176.9125	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	939.3997	0.1410	132.4256	(264)
Space and water heating			309.3381	(265)
Pumps, fans and electric keep-hot	51.3777	0.1387	7.1267	(267)
Energy for lighting	198.3182	0.1443	28.6234	(268)
Total CO2, kg/year			345.0882	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.9500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1141.8080	1.5736	1796.7338	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	939.3997	1.5213	1429.0647	(278)
Space and water heating			3225.7985	(279)
Pumps, fans and electric keep-hot	51.3777	1.5128	77.7242	(281)
Energy for lighting	198.3182	1.5338	304.1871	(282)
Total Primary energy kWh/year			3607.7098	(286)
Dwelling Primary energy Rate (DPER)			41.2500	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling							
Ground floor		43.7300 (1b)	x	2.5500 (2b)	=	111.5115	(1b) - (3b)
First floor		43.7300 (1c)	x	2.8300 (2c)	=	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.2674	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1275	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3775	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3209	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)

Adj infilt rate													
	0.4091	0.4011	0.3931	0.3530	0.3450	0.3048	0.3048	0.2968	0.3209	0.3450	0.3610	0.3770	(22b)
Effective ac	0.5837	0.5804	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711	(25)

---

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type			19.0900	1.1450	21.8588			(27)
GF			43.7300	0.1300	5.6849			(28a)
Main	110.7742	21.2400	89.5342	0.1800	16.1162			(29a)
PIJ	43.7300		43.7300	0.1100	4.8103			(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.6201			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 85.8955 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	14.5100	0.0500	0.7255	
E3 Sill	14.5100	0.0500	0.7255	
E4 Jamb	29.8400	0.0500	1.4920	
E5 Ground floor (normal)	20.5900	0.1600	3.2944	
E10 Eaves (insulation at ceiling level)	14.6000	0.0600	0.8760	
E12 Gable (insulation at ceiling level)	5.9900	0.0600	0.3594	
E16 Corner (normal)	10.7600	0.0900	0.9684	
E18 Party wall between dwellings	10.7600	0.0600	0.6456	
P1 Party wall - Ground floor	5.9900	0.0800	0.4792	
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.1200	0.7188	
E6 Intermediate floor within a dwelling	20.5900	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.2848	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	60.9049	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.3170	45.0647	44.8173	43.6557	43.4383	42.4266	42.4266	42.2392	42.8163	43.4383	43.8780	44.3377	(38)
Heat transfer coeff	106.2219	105.9696	105.7223	104.5606	104.3433	103.3315	103.3315	103.1441	103.7212	104.3433	104.7830	105.2426	(39)
Average = Sum(39)m / 12 =												104.5596	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2145	1.2116	1.2088	1.1955	1.1930	1.1815	1.1815	1.1793	1.1859	1.1930	1.1981	1.2033	(40)
HLP (average)												1.1955	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5893	(42)
Hot water usage for mixer showers													
	67.6343	66.6179	65.1368	62.3030	60.2117	57.8795	56.5538	58.0238	59.6350	62.1391	65.0338	67.3752	(42a)
Hot water usage for baths													
	29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)
Hot water usage for other uses													
	41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)
Average daily hot water use (litres/day)												126.8439	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	137.9899	135.0435	131.4552	125.9988	121.5679	116.8042	114.9735	118.5462	122.3142	127.3152	132.8557	137.6320	(44)
Energy conte	218.5423	192.3001	202.0418	172.4860	163.6537	143.6244	139.0504	146.7850	150.8257	172.7656	189.2773	215.4985	(45)
Energy content (annual)										Total = Sum(45)m =		2106.8508	
Distribution loss (46)m = 0.15 x (45)m													
	32.7813	28.8450	30.3063	25.8729	24.5481	21.5437	20.8576	22.0177	22.6239	25.9148	28.3916	32.3248	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6426	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8870	(55)
Total storage loss													
	27.4979	24.8369	27.4979	26.6109	27.4979	26.6109	27.4979	27.4979	26.6109	27.4979	26.6109	27.4979	(56)
If cylinder contains dedicated solar storage													
	27.4979	24.8369	27.4979	26.6109	27.4979	26.6109	27.4979	27.4979	26.6109	27.4979	26.6109	27.4979	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	269.3026	238.1481	252.8021	221.6090	214.4140	192.7473	189.8108	197.5453	199.9486	223.5259	238.4002	266.2588	(62)
WWHRS	-30.9196	-27.3455	-28.6347	-23.7106	-22.0975	-18.9090	-17.7241	-18.8478	-19.5639	-23.0637	-26.1284	-30.3470	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	238.3830	210.8026	224.1674	197.8983	192.3166	173.8384	172.0866	178.6975	180.3847	200.4622	212.2718	235.9118	(64)
										Total per year (kWh/year) = Sum(64)m =		2417.2209	(64)
12Total per year (kWh/year)												2417	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	113.2736	100.6182	107.7872	96.6499	95.0231	87.0534	86.8425	89.4143	89.4479	98.0528	102.2330	112.2615	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	118.2644	130.9356	118.2644	122.2065	118.2644	122.2065	118.2644	118.2644	122.2065	118.2644	122.2065	118.2644	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													

	234.3264	236.7580	230.6305	217.5858	201.1192	185.6429	175.3038	172.8722	178.9997	192.0444	208.5110	223.9873	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)													
	152.2494	149.7295	144.8752	134.2360	127.7193	120.9076	116.7239	120.1805	124.2332	131.7914	141.9903	150.8892	(72)
Total internal gains													
	569.6802	582.2631	558.6101	538.8684	511.9429	490.5970	472.1321	473.1571	487.2794	506.9403	537.5479	557.9809	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.6000	19.6403	0.6300	0.7000	0.7700	63.6246	(76)
West	8.4900	19.6403	0.6300	0.7000	0.7700	50.9597	(80)

Solar gains	114.5843	224.1512	369.1451	538.3761	659.8001	675.4228	643.0300	552.3533	429.3310	265.9743	142.8731	94.2285	(83)
Total gains	684.2645	806.4142	927.7552	1077.2444	1171.7429	1166.0198	1115.1621	1025.5104	916.6104	772.9145	680.4210	652.2094	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.6455	19.6923	19.7383	19.9576	19.9992	20.1950	20.1950	20.2317	20.1192	19.9992	19.9153	19.8283	
alpha	2.3097	2.3128	2.3159	2.3305	2.3333	2.3463	2.3463	2.3488	2.3413	2.3333	2.3277	2.3219	
util living area													
	0.9289	0.8983	0.8478	0.7537	0.6317	0.4908	0.3767	0.4187	0.6103	0.8075	0.9016	0.9353	(86)
MIT	18.1691	18.5559	19.1398	19.8649	20.4230	20.7759	20.9131	20.8863	20.6073	19.8443	18.8905	18.1080	(87)
Th 2	19.9084	19.9107	19.9130	19.9236	19.9256	19.9349	19.9349	19.9366	19.9313	19.9256	19.9215	19.9173	(88)
util rest of house													
	0.9197	0.8855	0.8286	0.7230	0.5857	0.4260	0.2952	0.3348	0.5469	0.7757	0.8870	0.9269	(89)
MIT 2	16.6258	17.1103	17.8364	18.7224	19.3724	19.7586	19.8850	19.8674	19.5973	18.7241	17.5456	16.5538	(90)
Living area fraction										fLA = Living area / (4) =		0.2056	(91)
MIT	16.9431	17.4075	18.1044	18.9573	19.5883	19.9677	20.0963	20.0768	19.8049	18.9544	17.8221	16.8733	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.9431	17.4075	18.1044	18.9573	19.5883	19.9677	20.0963	20.0768	19.8049	18.9544	17.8221	16.8733	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8842	0.8463	0.7887	0.6913	0.5699	0.4281	0.3080	0.3464	0.5387	0.7409	0.8488	0.8930	(94)
Useful gains	605.0532	682.4476	731.7367	744.6670	667.8221	499.1628	343.5218	355.2840	493.7427	572.6229	577.5182	582.4271	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1342.9696	1325.4119	1226.8417	1051.5951	823.0951	554.6541	361.2803	379.2433	591.7237	871.7217	1123.4926	1333.7762	(97)
Space heating kWh													
	549.0098	432.0720	368.3582	220.9882	115.5231	0.0000	0.0000	0.0000	0.0000	222.5295	393.1016	559.0037	(98a)
Space heating requirement - total per year (kWh/year)												2860.5862	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	549.0098	432.0720	368.3582	220.9882	115.5231	0.0000	0.0000	0.0000	0.0000	222.5295	393.1016	559.0037	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2860.5862	
Space heating per m2											(98c) / (4) =	32.7074	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	549.0098	432.0720	368.3582	220.9882	115.5231	0.0000	0.0000	0.0000	0.0000	222.5295	393.1016	559.0037	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	594.8102	468.1170	399.0879	239.4239	125.1605	0.0000	0.0000	0.0000	0.0000	241.0938	425.8955	605.6378	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	238.3830	210.8026	224.1674	197.8983	192.3166	173.8384	172.0866	178.6975	180.3847	200.4622	212.2718	235.9118	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.8681	85.6331	85.1661	84.3079	82.9551	79.8000	79.8000	79.8000	79.8000	84.2945	85.4219	85.9240	(217)
Fuel for water heating, kWh/month													
	277.6155	246.1694	263.2120	234.7329	231.8320	217.8426	215.6474	223.9317	226.0459	237.8116	248.4983	274.5586	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	24.5730	19.7134	17.7497	13.0042	10.0448	8.2067	9.1632	11.9107	15.4708	20.2986	22.9272	25.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-40.4681	-56.8289	-81.3729	-91.1293	-97.9537	-91.3009	-90.1428	-85.2277	-76.5407	-64.7751	-44.3982	-35.0109	(233a)

Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-23.5612	-49.4807	-98.1995	-147.2879	-194.5714	-195.4512	-193.1789	-163.6739	-120.0949	-70.7300	-31.4452	-18.6406 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3099.2266	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2897.8980	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	198.3182	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2161.4648	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4119.9781	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3099.2266	0.2100	650.8376	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2897.8980	0.2100	608.5586	(264)
Space and water heating			1259.3962	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	198.3182	0.1443	28.6234	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-855.1493	0.1347	-115.1661	
PV Unit electricity exported	-1306.3155	0.1259	-164.5086	
Total			-279.6747	(269)
Total CO2, kg/year			1020.2742	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.6700	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3099.2266	1.1300	3502.1261	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2897.8980	1.1300	3274.6247	(278)
Space and water heating			6776.7508	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	198.3182	1.5338	304.1871	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-855.1493	1.4977	-1280.7879	
PV Unit electricity exported	-1306.3155	0.4623	-603.8616	
Total			-1884.6496	(283)
Total Primary energy kWh/year			5326.3892	(286)
Target Primary Energy Rate (TPER)			60.9000	(287)

Full SAP Calculation Printout

Plot Reference	79841-05	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	2B3P (Semi)
Plot Address	Plot 5, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	83 B	**DER**	3.95	**TER**	11.67
Environmental	97 A	**% DER < TER**			66.15
CO_2 Emissions (t/year)	0.32	**DFEE**	40.01	**TFEE**	40.64
Compliance Check	See BREL	**% DFEE < TFEE**			1.55
% DPER < TPER	32.27	**DPER**	41.25	**TPER**	60.90

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	43.7300 (1b)	x	2.5500 (2b)	=	111.5115	(1b) - (3b)
First floor	43.7300 (1c)	x	2.8300 (2c)	=	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.2674	(5)

---

2. Ventilation rate

---

			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		3 * 10 =	30.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		30.0000 / (5) =	0.1275	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			4.0000	(17)
Infiltration rate			0.3275	(18)
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.2784	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3549	0.3480	0.3410	0.3062	0.2993	0.2645	0.2645	0.2575	0.2784	0.2993	0.3132	0.3271	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5630	0.5605	0.5581	0.5469	0.5448	0.5350	0.5350	0.5332	0.5387	0.5448	0.5490	0.5535	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.4900	1.1450	13.1565			(27)
Glazed Doors			7.6000	1.1450	8.7023			(27)
GF			43.7300	0.1100	4.8103	75.0000	3279.7500	(28a)
Main	110.7742	21.2400	89.5342	0.1900	17.0115	9.0000	805.8078	(29a)
PIJ	43.7300		43.7300	0.0900	3.9357	9.0000	393.5700	(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.7663			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000	20.0000	644.6000	(32)
Timber			113.8200			9.0000	1024.3800	(32c)
Timber			20.4000			9.0000	183.6000	(32c)
FF			43.7300			18.0000	787.1400	(32d)
GF			43.7300			9.0000	393.5700	(32e)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			7512.4178	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							85.8955	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.5100	0.0460	0.6675
E3 Sill	14.5100	0.0470	0.6820
E4 Jamb	29.8400	0.0530	1.5815
E5 Ground floor (normal)	20.5900	0.0680	1.4001
E10 Eaves (insulation at ceiling level)	14.6000	0.0910	1.3286
E12 Gable (insulation at ceiling level)	5.9900	0.0750	0.4492
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	5.9900	0.1160	0.6948
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.0460	0.2755
E6 Intermediate floor within a dwelling	20.5900	0.0540	1.1119

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2672 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.0334 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.7098	43.5198	43.3337	42.4594	42.2958	41.5343	41.5343	41.3932	41.8276	42.2958	42.6267	42.9727	(38)
Heat transfer coeff	102.7432	102.5533	102.3671	101.4928	101.3292	100.5677	100.5677	100.4267	100.8610	101.3292	101.6601	102.0061	(39)
Average = Sum(39)m / 12 =												101.4920	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1747	1.1726	1.1704	1.1604	1.1586	1.1499	1.1499	1.1483	1.1532	1.1586	1.1624	1.1663	(40)
HLP (average)												1.1604	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5893 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)
Hot water usage for other uses	41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)
Average daily hot water use (litres/day)												64.4873	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	70.3556	68.4255	66.3184	63.6958	61.3562	58.9247	58.4196	60.5225	62.6792	65.1761	67.8219	70.2568	(44)
Energy conte	111.4260	97.4370	101.9289	87.1964	82.5972	72.4549	70.6535	74.9395	77.2897	88.4434	96.6247	110.0052	(45)
Energy content (annual)										Total = Sum(45)m =		1070.9963	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	94.7121	82.8215	86.6396	74.1169	70.2076	61.5866	60.0554	63.6985	65.6963	75.1769	82.1310	93.5044	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	94.7121	82.8215	86.6396	74.1169	70.2076	61.5866	60.0554	63.6985	65.6963	75.1769	82.1310	93.5044	(64)
										Total per year (kWh/year) = Sum(64)m =		910.3469	(64)
12Total per year (kWh/year)												910	(64)
Electric shower(s)	54.1638	48.2604	52.6985	50.2896	51.2332	48.8715	50.5006	51.2332	50.2896	52.6985	51.7076	54.1638	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		616.1105	(64a)
Heat gains from water heating, kWh/month	37.2190	32.7705	34.8345	31.1016	30.3602	27.6145	27.6390	28.7329	28.9965	31.9689	33.4597	36.9171	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	118.2644	130.9356	118.2644	122.2065	118.2644	122.2065	118.2644	118.2644	122.2065	118.2644	122.2065	118.2644	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	234.3264	236.7580	230.6305	217.5858	201.1192	185.6429	175.3038	172.8722	178.9997	192.0444	208.5110	223.9873	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)	50.0255	48.7656	46.8206	43.1967	40.8067	38.3535	37.1492	38.6195	40.2729	42.9689	46.4717	49.6197	(72)
Total internal gains	464.4563	478.2991	457.5555	444.8290	422.0303	408.0430	392.5574	391.5962	403.3191	415.1177	439.0293	453.7114	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.0000	19.6403	0.3000	0.0000	0.7700	13.6107	(76)
West	8.4900	19.6403	0.3000	0.0000	0.7700	38.5183	(80)
East	7.6000	19.6403	0.3000	0.0000	0.7700	34.4804	(76)

Solar gains	86.6094	169.4264	279.0212	406.9358	498.7151	510.5236	486.0393	417.5006	324.5132	201.0387	107.9918	71.2234	(83)

Total gains	551.0658	647.7256	736.5767	851.7648	920.7454	918.5666	878.5967	809.0968	727.8323	616.1565	547.0211	524.9348	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.3107	20.3483	20.3853	20.5609	20.5941	20.7500	20.7500	20.7792	20.6897	20.5941	20.5270	20.4574	
alpha	2.3540	2.3566	2.3590	2.3707	2.3729	2.3833	2.3833	2.3853	2.3793	2.3729	2.3685	2.3638	
util living area	0.9521	0.9300	0.8934	0.8184	0.7116	0.5723	0.4496	0.4953	0.6882	0.8610	0.9325	0.9569	(86)
MIT	17.9934	18.3507	18.9111	19.6525	20.2709	20.6995	20.8790	20.8438	20.5036	19.6711	18.7101	17.9326	(87)
Th 2	19.9403	19.9420	19.9437	19.9518	19.9533	19.9603	19.9603	19.9616	19.9576	19.9533	19.9502	19.9470	(88)
util rest of house	0.9456	0.9206	0.8788	0.7928	0.6690	0.5054	0.3594	0.4045	0.6278	0.8356	0.9219	0.9510	(89)
MIT 2	17.1995	17.5515	18.1009	18.8189	19.3938	19.7696	19.9037	19.8841	19.6170	18.8539	17.9163	17.1438	(90)
Living area fraction										fLA = Living area / (4) =		0.2056	(91)
MIT	17.3627	17.7158	18.2674	18.9902	19.5741	19.9607	20.1042	20.0814	19.7992	19.0219	18.0795	17.3059	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.3627	17.7158	18.2674	18.9902	19.5741	19.9607	20.1042	20.0814	19.7992	19.0219	18.0795	17.3059	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9236	0.8945	0.8494	0.7650	0.6517	0.5054	0.3726	0.4157	0.6175	0.8075	0.8965	0.9304	(94)
Useful gains	508.9841	579.3716	625.6387	651.5923	600.0514	464.2360	327.3480	336.3579	449.4177	497.5398	490.3814	488.3771	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1342.1013	1314.3024	1204.5986	1024.0859	797.8752	539.1180	352.4118	369.7135	574.8297	853.3843	1116.1749	1336.8853	(97)
Space heating kWh	619.8392	493.8735	430.7461	268.1954	147.1809	0.0000	0.0000	0.0000	0.0000	264.7483	450.5713	631.2902	(98a)
Space heating requirement - total per year (kWh/year)												3306.4450	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	619.8392	493.8735	430.7461	268.1954	147.1809	0.0000	0.0000	0.0000	0.0000	264.7483	450.5713	631.2902	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3306.4450	
Space heating per m2											(98c) / (4) =	37.8052	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	945.3363	744.2009	763.2427	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7332	0.7948	0.7616	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	693.0782	591.5151	581.2933	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1027.4081	982.9876	904.0710	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	240.7176	291.2555	240.1466	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	60.1794	72.8139	60.0367	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												193.0299	(107)
Energy for space heating												37.8052	(99)
Energy for space cooling												2.2071	(108)
Total												40.0123	(109)
Fabric Energy Efficiency (DFEE)												40.0	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	43.7300	(1b)	x 2.5500	(2b) =	111.5115	(1b) - (3b)
First floor	43.7300	(1c)	x 2.8300	(2c) =	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		235.2674	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)

Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1275 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3775 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3209 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4091	0.4011	0.3931	0.3530	0.3450	0.3048	0.3048	0.2968	0.3209	0.3450	0.3610	0.3770	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		0.0000 (23c)

Effective ac	0.5837	0.5804	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type			19.0900	1.1450	21.8588			(27)
GF			43.7300	0.1300	5.6849			(28a)
Main	110.7742	21.2400	89.5342	0.1800	16.1162			(29a)
PIJ	43.7300		43.7300	0.1100	4.8103			(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.6201			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		85.8955 (35)
List of Thermal Bridges		

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.5100	0.0500	0.7255
E3 Sill	14.5100	0.0500	0.7255
E4 Jamb	29.8400	0.0500	1.4920
E5 Ground floor (normal)	20.5900	0.1600	3.2944
E10 Eaves (insulation at ceiling level)	14.6000	0.0600	0.8760
E12 Gable (insulation at ceiling level)	5.9900	0.0600	0.3594
E16 Corner (normal)	10.7600	0.0900	0.9684
E18 Party wall between dwellings	10.7600	0.0600	0.6456
P1 Party wall - Ground floor	5.9900	0.0800	0.4792
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.1200	0.7188
E6 Intermediate floor within a dwelling	20.5900	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.2848 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	60.9049 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.3170	45.0647	44.8173	43.6557	43.4383	42.4266	42.4266	42.2392	42.8163	43.4383	43.8780	44.3377	(38)
Heat transfer coeff	106.2219	105.9696	105.7223	104.5606	104.3433	103.3315	103.3315	103.1441	103.7212	104.3433	104.7830	105.2426	(39)
Average = Sum(39)m / 12 =												104.5596	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2145	1.2116	1.2088	1.1955	1.1930	1.1815	1.1815	1.1793	1.1859	1.1930	1.1981	1.2033	(40)
HLP (average)												1.1955	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.5893 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)
Hot water usage for other uses	41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)
Average daily hot water use (litres/day)												64.4873	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	70.3556	68.4255	66.3184	63.6958	61.3562	58.9247	58.4196	60.5225	62.6792	65.1761	67.8219	70.2568	(44)
Energy conte	111.4260	97.4370	101.9289	87.1964	82.5972	72.4549	70.6535	74.9395	77.2897	88.4434	96.6247	110.0052	(45)
Energy content (annual)										Total = Sum(45)m =		1070.9963	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	94.7121	82.8215	86.6396	74.1169	70.2076	61.5866	60.0554	63.6985	65.6963	75.1769	82.1310	93.5044	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	94.7121	82.8215	86.6396	74.1169	70.2076	61.5866	60.0554	63.6985	65.6963	75.1769	82.1310	93.5044	(64)
									Total per year (kWh/year) = Sum(64)m =			910.3469	(64)
12Total per year (kWh/year)												910	(64)

Electric shower(s)

	54.1638	48.2604	52.6985	50.2896	51.2332	48.8715	50.5006	51.2332	50.2896	52.6985	51.7076	54.1638 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												616.1105 (64a)
Heat gains from water heating, kWh/month												
	37.2190	32.7705	34.8345	31.1016	30.3602	27.6145	27.6390	28.7329	28.9965	31.9689	33.4597	36.9171 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	118.2644	130.9356	118.2644	122.2065	118.2644	122.2065	118.2644	118.2644	122.2065	118.2644	122.2065	118.2644	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	234.3264	236.7580	230.6305	217.5858	201.1192	185.6429	175.3038	172.8722	178.9997	192.0444	208.5110	223.9873	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)													
	50.0255	48.7656	46.8206	43.1967	40.8067	38.3535	37.1492	38.6195	40.2729	42.9689	46.4717	49.6197	(72)
Total internal gains													
	464.4563	478.2991	457.5555	444.8290	422.0303	408.0430	392.5574	391.5962	403.3191	415.1177	439.0293	453.7114	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.6000	19.6403	0.6300	0.7000	0.7700	63.6246	(76)
West	8.4900	19.6403	0.6300	0.7000	0.7700	50.9597	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	114.5843	224.1512	369.1451	538.3761	659.8001	675.4228	643.0300	552.3533	429.3310	265.9743	142.8731	94.2285	(83)
Total gains	579.0406	702.4503	826.7005	983.2051	1081.8304	1083.4658	1035.5874	943.9495	832.6501	681.0920	581.9024	547.9400	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000	(85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.6455	19.6923	19.7383	19.9576	19.9992	20.1950	20.1950	20.2317	20.1192	19.9992	19.9153	19.8283	
alpha	2.3097	2.3128	2.3159	2.3305	2.3333	2.3463	2.3463	2.3488	2.3413	2.3333	2.3277	2.3219	
util living area													
	0.9480	0.9202	0.8734	0.7821	0.6611	0.5180	0.4009	0.4474	0.6461	0.8407	0.9255	0.9536	(86)
MIT	17.9534	18.3617	18.9790	19.7571	20.3603	20.7480	20.9006	20.8687	20.5534	19.7150	18.7032	17.8894	(87)
Th 2	19.9084	19.9107	19.9130	19.9236	19.9256	19.9349	19.9349	19.9366	19.9313	19.9256	19.9215	19.9173	(88)
util rest of house													
	0.9409	0.9096	0.8565	0.7532	0.6157	0.4516	0.3155	0.3599	0.5831	0.8123	0.9138	0.9472	(89)
MIT 2	17.1400	17.5413	18.1435	18.8914	19.4438	19.7789	19.8899	19.8735	19.6314	18.8732	17.8904	17.0826	(90)
Living area fraction									fLA = Living area / (4) =			0.2056	(91)
MIT	17.3072	17.7100	18.3153	19.0693	19.6322	19.9782	20.0977	20.0781	19.8210	19.0463	18.0575	17.2484	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.3072	17.7100	18.3153	19.0693	19.6322	19.9782	20.0977	20.0781	19.8210	19.0463	18.0575	17.2484	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9174	0.8815	0.8256	0.7266	0.6021	0.4545	0.3292	0.3722	0.5759	0.7840	0.8868	0.9253	(94)
Useful gains	531.2217	619.2031	682.5330	714.4382	651.3609	492.4424	340.9147	351.3836	479.5377	533.9661	516.0422	506.9994	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1381.6513	1357.4659	1249.1362	1063.3119	827.6707	555.7328	361.4232	379.3746	593.3862	881.3100	1148.1613	1373.2531	(97)
Space heating kWh													
	632.7196	496.1126	421.5528	251.1891	131.1745	0.0000	0.0000	0.0000	0.0000	258.4239	455.1258	644.4928	(98a)
Space heating requirement - total per year (kWh/year)												3290.7910	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	632.7196	496.1126	421.5528	251.1891	131.1745	0.0000	0.0000	0.0000	0.0000	258.4239	455.1258	644.4928	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3290.7910	
Space heating per m2											(98c) / (4) =	37.6262	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	971.3160	764.6530	783.8953	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7763	0.8310	0.7988	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	754.0270	635.4170	626.2047	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1220.1474	1166.4832	1061.6911	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	335.6067	395.1133	324.0019	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	83.9017	98.7783	81.0005	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												263.6805	(107)

Energy for space heating	37.6262 (99)
Energy for space cooling	3.0149 (108)
Total	40.6411 (109)
Fabric Energy Efficiency (TFEE)	40.6 (109)

Full SAP Calculation Printout

Plot Reference	79841-05	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	2B3P (Semi)
Plot Address	Plot 5, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	83 B	**DER**	3.95	**TER**	11.67
Environmental	97 A	**% DER < TER**			66.15
CO_2 Emissions (t/year)	0.32	**DFEE**	40.01	**TFEE**	40.64
Compliance Check	See BREL	**% DFEE < TFEE**			1.55
% DPER < TPER	32.27	**DPER**	41.25	**TPER**	60.90

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	43.7300 (1b)	x	2.5500 (2b)	=	111.5115	(1b) - (3b)
First floor	43.7300 (1c)	x	2.8300 (2c)	=	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.2674	(5)

---

2. Ventilation rate

---

			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		3 * 10 =	30.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		30.0000 / (5) =	0.1275	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			4.0000	(17)
Infiltration rate			0.3275	(18)
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.2784	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3549	0.3480	0.3410	0.3062	0.2993	0.2645	0.2645	0.2575	0.2784	0.2993	0.3132	0.3271	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

Effective ac	0.6049	0.5980	0.5910	0.5562	0.5493	0.5145	0.5145	0.5075	0.5284	0.5493	0.5632	0.5771	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.4900	1.1450	13.1565			(27)
Glazed Doors			7.6000	1.1450	8.7023			(27)
GF			43.7300	0.1100	4.8103	75.0000	3279.7500	(28a)
Main	110.7742	21.2400	89.5342	0.1900	17.0115	9.0000	805.8078	(29a)
PIJ	43.7300		43.7300	0.0900	3.9357	9.0000	393.5700	(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.7663			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000	20.0000	644.6000	(32)
Timber			113.8200			9.0000	1024.3800	(32c)
Timber			20.4000			9.0000	183.6000	(32c)
FF			43.7300			18.0000	787.1400	(32d)
GF			43.7300			9.0000	393.5700	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7512.4178 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 85.8955 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.5100	0.0460	0.6675
E3 Sill	14.5100	0.0470	0.6820
E4 Jamb	29.8400	0.0530	1.5815
E5 Ground floor (normal)	20.5900	0.0680	1.4001
E10 Eaves (insulation at ceiling level)	14.6000	0.0910	1.3286
E12 Gable (insulation at ceiling level)	5.9900	0.0750	0.4492
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	5.9900	0.1160	0.6948
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.0460	0.2755
E6 Intermediate floor within a dwelling	20.5900	0.0540	1.1119

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2672 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.0334 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.9668	46.4264	45.8861	43.1844	42.6441	39.9424	39.9424	39.4020	41.0231	42.6441	43.7247	44.8054	(38)
Heat transfer coeff	106.0002	105.4599	104.9195	102.2178	101.6775	98.9758	98.9758	98.4355	100.0565	101.6775	102.7582	103.8389	(39)
Average = Sum(39)m / 12 =												102.0828	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2120	1.2058	1.1996	1.1687	1.1626	1.1317	1.1317	1.1255	1.1440	1.1626	1.1749	1.1873	(40)
HLP (average)												1.1672	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5893 (42)
Hot water usage for mixer showers

67.6343	66.6179	65.1368	62.3030	60.2117	57.8795	56.5538	58.0238	59.6350	62.1391	65.0338	67.3752	(42a)

Hot water usage for baths

29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)

Hot water usage for other uses

41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)

Average daily hot water use (litres/day) 126.8439 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.9899	135.0435	131.4552	125.9988	121.5679	116.8042	114.9735	118.5462	122.3142	127.3152	132.8557	137.6320	(44)
Energy conte	218.5423	192.3001	202.0418	172.4860	163.6537	143.6244	139.0504	146.7850	150.8257	172.7656	189.2773	215.4985	(45)
Energy content (annual)											Total = Sum(45)m =	2106.8508	
Distribution loss (46)m = 0.15 x (45)m	32.7813	28.8450	30.3063	25.8729	24.5481	21.5437	20.8576	22.0177	22.6239	25.9148	28.3916	32.3248	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(64)
										Total per year (kWh/year) = Sum(64)m =		2676.3968	(64)
12Total per year (kWh/year)												2676	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	111.3632	98.8927	105.8768	94.8012	93.1128	85.2047	84.9322	87.5039	87.5991	96.1425	100.3843	110.3512	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	118.2644	130.9356	118.2644	122.2065	118.2644	122.2065	118.2644	118.2644	122.2065	118.2644	122.2065	118.2644	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	234.3264	236.7580	230.6305	217.5858	201.1192	185.6429	175.3038	172.8722	178.9997	192.0444	208.5110	223.9873	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)	149.6818	147.1618	142.3075	131.6683	125.1516	118.3399	114.1562	117.6128	121.6655	129.2238	139.4227	148.3215	(72)
Total internal gains	564.1126	576.6954	553.0424	533.3007	506.3752	488.0294	469.5644	470.5894	484.7118	501.3726	531.9802	552.4132	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

East			3.0000		19.6403		0.3000		0.0000		0.7700		13.6107 (76)
West			8.4900		19.6403		0.3000		0.0000		0.7700		38.5183 (80)
East			7.6000		19.6403		0.3000		0.0000		0.7700		34.4804 (76)
Solar gains	86.6094	169.4264	279.0212	406.9358	498.7151	510.5236	486.0393	417.5006	324.5132	201.0387	107.9918	71.2234	(83)
Total gains	650.7220	746.1218	832.0636	940.2365	1005.0903	998.5530	955.6037	888.0900	809.2250	702.4113	639.9720	623.6366	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.6866	19.7875	19.8894	20.4151	20.5235	21.0838	21.0838	21.1995	20.8560	20.5235	20.3077	20.0964	
alpha	2.3124	2.3192	2.3260	2.3610	2.3682	2.4056	2.4056	2.4133	2.3904	2.3682	2.3538	2.3398	
util living area	0.9351	0.9109	0.8714	0.7915	0.6814	0.5358	0.4155	0.4552	0.6473	0.8296	0.9105	0.9402	(86)
Living	18.1081	18.4594	19.0087	19.7538	20.3388	20.7476	20.9014	20.8752	20.5746	19.7963	18.8657	18.0903	
Non living	17.2922	17.6387	18.1768	18.9054	19.4474	19.8162	19.9293	19.9187	19.6772	18.9652	18.0590	17.2873	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.5206	18.4594	19.0087	19.7538	20.3388	20.7476	20.9014	20.8752	20.5746	19.7963	18.8657	18.4973	(87)
Th 2	19.9104	19.9154	19.9203	19.9451	19.9501	19.9751	19.9751	19.9801	19.9650	19.9501	19.9401	19.9302	(88)
util rest of house	0.9266	0.8994	0.8543	0.7637	0.6374	0.4708	0.3309	0.3699	0.5859	0.8005	0.8971	0.9323	(89)
MIT 2	18.5710	17.6387	18.1768	18.9054	19.4474	19.8162	19.9293	19.9187	19.6772	18.9652	18.0590	17.6570	(90)
Living area fraction										fLA = Living area / (4) =		0.2056	(91)
MIT	18.7663	17.8074	18.3478	19.0798	19.6306	20.0077	20.1291	20.1153	19.8617	19.1360	18.2249	17.8297	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7663	17.8074	18.3478	19.0798	19.6306	20.0077	20.1291	20.1153	19.8617	19.1360	18.2249	17.8297	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9158	0.8703	0.8236	0.7372	0.6226	0.4730	0.3442	0.3819	0.5791	0.7733	0.8689	0.9121	(94)
Useful gains	595.9114	649.3608	685.3029	693.1332	625.7317	472.3015	328.9521	339.1532	468.6135	543.1759	556.0840	568.8159	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1533.4264	1361.2162	1243.0667	1040.5582	806.3674	535.2322	349.2998	365.7208	576.4916	867.9212	1143.1712	1415.2964	(97)
Space heating kWh	697.5112	478.3668	414.9762	250.1460	134.3930	0.0000	0.0000	0.0000	0.0000	241.6105	422.7028	629.7815	(98a)
Space heating requirement - total per year (kWh/year)												3269.4881	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	697.5112	478.3668	414.9762	250.1460	134.3930	0.0000	0.0000	0.0000	0.0000	241.6105	422.7028	629.7815	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3269.4881	
Space heating per m2											(98c) / (4) =	37.3827	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	286.3431 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	697.5112	478.3668	414.9762	250.1460	134.3930	0.0000	0.0000	0.0000	0.0000	241.6105	422.7028	629.7815	(98)
Space heating efficiency (main heating system 1)	286.3431	286.3431	286.3431	286.3431	286.3431	0.0000	0.0000	0.0000	0.0000	286.3431	286.3431	286.3431	(210)
Space heating fuel (main heating system)	243.5928	167.0607	144.9228	87.3589	46.9343	0.0000	0.0000	0.0000	0.0000	84.3780	147.6211	219.9395	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	93.6855	82.8316	87.8939	76.9723	74.4199	66.8421	65.7843	68.4991	69.3697	77.6181	82.8660	92.6172	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.3636	3.9413	4.3636	4.2228	4.3636	4.2228	4.3636	4.3636	4.2228	4.3636	4.2228	4.3636	(231)
Lighting	24.5730	19.7134	17.7497	13.0042	10.0448	8.2067	9.1632	11.9107	15.4708	20.2986	22.9272	25.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	1141.8080	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	284.9050	
Water heating fuel used	939.3997	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)		
mechanical ventilation fans (SFP = 0.1790)	51.3777	(230a)
Total electricity for the above, kWh/year	51.3777	(231)
Electricity for lighting (calculated in Appendix L)	198.3182	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2330.9037	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1141.8080	0.1549	176.9125	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	939.3997	0.1410	132.4256	(264)
Space and water heating			309.3381	(265)
Pumps, fans and electric keep-hot	51.3777	0.1387	7.1267	(267)
Energy for lighting	198.3182	0.1443	28.6234	(268)
Total CO2, kg/year			345.0882	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.9500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1141.8080	1.5736	1796.7338	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	939.3997	1.5213	1429.0647	(278)
Space and water heating			3225.7985	(279)
Pumps, fans and electric keep-hot	51.3777	1.5128	77.7242	(281)
Energy for lighting	198.3182	1.5338	304.1871	(282)
Total Primary energy kWh/year			3607.7098	(286)
Dwelling Primary energy Rate (DPER)			41.2500	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling							
Ground floor		43.7300 (1b)	x	2.5500 (2b)	=	111.5115	(1b) - (3b)
First floor		43.7300 (1c)	x	2.8300 (2c)	=	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.2674	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1275	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3775	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3209	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)

Adj infilt rate													
	0.4091	0.4011	0.3931	0.3530	0.3450	0.3048	0.3048	0.2968	0.3209	0.3450	0.3610	0.3770	(22b)
Effective ac	0.5837	0.5804	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711	(25)

---

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type			19.0900	1.1450	21.8588			(27)
GF			43.7300	0.1300	5.6849			(28a)
Main	110.7742	21.2400	89.5342	0.1800	16.1162			(29a)
PIJ	43.7300		43.7300	0.1100	4.8103			(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.6201			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 85.8955 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	14.5100	0.0500	0.7255	
E3 Sill	14.5100	0.0500	0.7255	
E4 Jamb	29.8400	0.0500	1.4920	
E5 Ground floor (normal)	20.5900	0.1600	3.2944	
E10 Eaves (insulation at ceiling level)	14.6000	0.0600	0.8760	
E12 Gable (insulation at ceiling level)	5.9900	0.0600	0.3594	
E16 Corner (normal)	10.7600	0.0900	0.9684	
E18 Party wall between dwellings	10.7600	0.0600	0.6456	
P1 Party wall - Ground floor	5.9900	0.0800	0.4792	
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.1200	0.7188	
E6 Intermediate floor within a dwelling	20.5900	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.2848	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	60.9049	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.3170	45.0647	44.8173	43.6557	43.4383	42.4266	42.4266	42.2392	42.8163	43.4383	43.8780	44.3377	(38)
Heat transfer coeff	106.2219	105.9696	105.7223	104.5606	104.3433	103.3315	103.3315	103.1441	103.7212	104.3433	104.7830	105.2426	(39)
Average = Sum(39)m / 12 =												104.5596	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2145	1.2116	1.2088	1.1955	1.1930	1.1815	1.1815	1.1793	1.1859	1.1930	1.1981	1.2033	(40)
HLP (average)												1.1955	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5893	(42)
Hot water usage for mixer showers													
	67.6343	66.6179	65.1368	62.3030	60.2117	57.8795	56.5538	58.0238	59.6350	62.1391	65.0338	67.3752	(42a)
Hot water usage for baths													
	29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)
Hot water usage for other uses													
	41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)
Average daily hot water use (litres/day)												126.8439	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	137.9899	135.0435	131.4552	125.9988	121.5679	116.8042	114.9735	118.5462	122.3142	127.3152	132.8557	137.6320	(44)
Energy conte	218.5423	192.3001	202.0418	172.4860	163.6537	143.6244	139.0504	146.7850	150.8257	172.7656	189.2773	215.4985	(45)
Energy content (annual)										Total = Sum(45)m =		2106.8508	
Distribution loss (46)m = 0.15 x (45)m													
	32.7813	28.8450	30.3063	25.8729	24.5481	21.5437	20.8576	22.0177	22.6239	25.9148	28.3916	32.3248	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6426	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8870	(55)
Total storage loss													
	27.4979	24.8369	27.4979	26.6109	27.4979	26.6109	27.4979	27.4979	26.6109	27.4979	26.6109	27.4979	(56)
If cylinder contains dedicated solar storage													
	27.4979	24.8369	27.4979	26.6109	27.4979	26.6109	27.4979	27.4979	26.6109	27.4979	26.6109	27.4979	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	269.3026	238.1481	252.8021	221.6090	214.4140	192.7473	189.8108	197.5453	199.9486	223.5259	238.4002	266.2588	(62)
WWHRS	-30.9196	-27.3455	-28.6347	-23.7106	-22.0975	-18.9090	-17.7241	-18.8478	-19.5639	-23.0637	-26.1284	-30.3470	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	238.3830	210.8026	224.1674	197.8983	192.3166	173.8384	172.0866	178.6975	180.3847	200.4622	212.2718	235.9118	(64)
										Total per year (kWh/year) = Sum(64)m =		2417.2209	(64)
12Total per year (kWh/year)												2417	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	113.2736	100.6182	107.7872	96.6499	95.0231	87.0534	86.8425	89.4143	89.4479	98.0528	102.2330	112.2615	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	118.2644	130.9356	118.2644	122.2065	118.2644	122.2065	118.2644	118.2644	122.2065	118.2644	122.2065	118.2644	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													

	234.3264	236.7580	230.6305	217.5858	201.1192	185.6429	175.3038	172.8722	178.9997	192.0444	208.5110	223.9873	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)													
	152.2494	149.7295	144.8752	134.2360	127.7193	120.9076	116.7239	120.1805	124.2332	131.7914	141.9903	150.8892	(72)
Total internal gains													
	569.6802	582.2631	558.6101	538.8684	511.9429	490.5970	472.1321	473.1571	487.2794	506.9403	537.5479	557.9809	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.6000	19.6403	0.6300	0.7000	0.7700	63.6246	(76)
West	8.4900	19.6403	0.6300	0.7000	0.7700	50.9597	(80)

Solar gains	114.5843	224.1512	369.1451	538.3761	659.8001	675.4228	643.0300	552.3533	429.3310	265.9743	142.8731	94.2285	(83)
Total gains	684.2645	806.4142	927.7552	1077.2444	1171.7429	1166.0198	1115.1621	1025.5104	916.6104	772.9145	680.4210	652.2094	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.6455	19.6923	19.7383	19.9576	19.9992	20.1950	20.1950	20.2317	20.1192	19.9992	19.9153	19.8283	
alpha	2.3097	2.3128	2.3159	2.3305	2.3333	2.3463	2.3463	2.3488	2.3413	2.3333	2.3277	2.3219	
util living area													
	0.9289	0.8983	0.8478	0.7537	0.6317	0.4908	0.3767	0.4187	0.6103	0.8075	0.9016	0.9353	(86)
MIT	18.1691	18.5559	19.1398	19.8649	20.4230	20.7759	20.9131	20.8863	20.6073	19.8443	18.8905	18.1080	(87)
Th 2	19.9084	19.9107	19.9130	19.9236	19.9256	19.9349	19.9349	19.9366	19.9313	19.9256	19.9215	19.9173	(88)
util rest of house													
	0.9197	0.8855	0.8286	0.7230	0.5857	0.4260	0.2952	0.3348	0.5469	0.7757	0.8870	0.9269	(89)
MIT 2	16.6258	17.1103	17.8364	18.7224	19.3724	19.7586	19.8850	19.8674	19.5973	18.7241	17.5456	16.5538	(90)
Living area fraction										fLA = Living area / (4) =		0.2056	(91)
MIT	16.9431	17.4075	18.1044	18.9573	19.5883	19.9677	20.0963	20.0768	19.8049	18.9544	17.8221	16.8733	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.9431	17.4075	18.1044	18.9573	19.5883	19.9677	20.0963	20.0768	19.8049	18.9544	17.8221	16.8733	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8842	0.8463	0.7887	0.6913	0.5699	0.4281	0.3080	0.3464	0.5387	0.7409	0.8488	0.8930	(94)
Useful gains	605.0532	682.4476	731.7367	744.6670	667.8221	499.1628	343.5218	355.2840	493.7427	572.6229	577.5182	582.4271	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1342.9696	1325.4119	1226.8417	1051.5951	823.0951	554.6541	361.2803	379.2433	591.7237	871.7217	1123.4926	1333.7762	(97)
Space heating kWh													
	549.0098	432.0720	368.3582	220.9882	115.5231	0.0000	0.0000	0.0000	0.0000	222.5295	393.1016	559.0037	(98a)
Space heating requirement - total per year (kWh/year)												2860.5862	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	549.0098	432.0720	368.3582	220.9882	115.5231	0.0000	0.0000	0.0000	0.0000	222.5295	393.1016	559.0037	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2860.5862	
Space heating per m2											(98c) / (4) =	32.7074	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	549.0098	432.0720	368.3582	220.9882	115.5231	0.0000	0.0000	0.0000	0.0000	222.5295	393.1016	559.0037	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	594.8102	468.1170	399.0879	239.4239	125.1605	0.0000	0.0000	0.0000	0.0000	241.0938	425.8955	605.6378	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	238.3830	210.8026	224.1674	197.8983	192.3166	173.8384	172.0866	178.6975	180.3847	200.4622	212.2718	235.9118	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.8681	85.6331	85.1661	84.3079	82.9551	79.8000	79.8000	79.8000	79.8000	84.2945	85.4219	85.9240	(217)
Fuel for water heating, kWh/month													
	277.6155	246.1694	263.2120	234.7329	231.8320	217.8426	215.6474	223.9317	226.0459	237.8116	248.4983	274.5586	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	24.5730	19.7134	17.7497	13.0042	10.0448	8.2067	9.1632	11.9107	15.4708	20.2986	22.9272	25.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-40.4681	-56.8289	-81.3729	-91.1293	-97.9537	-91.3009	-90.1428	-85.2277	-76.5407	-64.7751	-44.3982	-35.0109	(233a)

Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-23.5612	-49.4807	-98.1995	-147.2879	-194.5714	-195.4512	-193.1789	-163.6739	-120.0949	-70.7300	-31.4452	-18.6406 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3099.2266	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2897.8980	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	198.3182	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2161.4648	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4119.9781	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3099.2266	0.2100	650.8376	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2897.8980	0.2100	608.5586	(264)
Space and water heating			1259.3962	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	198.3182	0.1443	28.6234	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-855.1493	0.1347	-115.1661	
PV Unit electricity exported	-1306.3155	0.1259	-164.5086	
Total			-279.6747	(269)
Total CO2, kg/year			1020.2742	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.6700	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3099.2266	1.1300	3502.1261	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2897.8980	1.1300	3274.6247	(278)
Space and water heating			6776.7508	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	198.3182	1.5338	304.1871	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-855.1493	1.4977	-1280.7879	
PV Unit electricity exported	-1306.3155	0.4623	-603.8616	
Total			-1884.6496	(283)
Total Primary energy kWh/year			5326.3892	(286)
Target Primary Energy Rate (TPER)			60.9000	(287)

Full SAP Calculation Printout

Plot Reference	79841-05	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	2B3P (Semi)
Plot Address	Plot 5, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	83 B	**DER**	3.95	**TER**	11.67
Environmental	97 A	**% DER < TER**			66.15
CO_2 Emissions (t/year)	0.32	**DFEE**	40.01	**TFEE**	40.64
Compliance Check	See BREL	**% DFEE < TFEE**			1.55
% DPER < TPER	32.27	**DPER**	41.25	**TPER**	60.90

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	43.7300 (1b)	x	2.5500 (2b)	=	111.5115	(1b) - (3b)
First floor	43.7300 (1c)	x	2.8300 (2c)	=	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.2674	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1275	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3275	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2784	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3549	0.3480	0.3410	0.3062	0.2993	0.2645	0.2645	0.2575	0.2784	0.2993	0.3132	0.3271	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.6049	0.5980	0.5910	0.5562	0.5493	0.5145	0.5145	0.5075	0.5284	0.5493	0.5632	0.5771	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.4900	1.1450	13.1565			(27)
Glazed Doors			7.6000	1.1450	8.7023			(27)
GF			43.7300	0.1100	4.8103	75.0000	3279.7500	(28a)
Main	110.7742	21.2400	89.5342	0.1900	17.0115	9.0000	805.8078	(29a)
PIJ	43.7300		43.7300	0.0900	3.9357	9.0000	393.5700	(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.7663			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000	20.0000	644.6000	(32)
Timber			113.8200			9.0000	1024.3800	(32c)
Timber			20.4000			9.0000	183.6000	(32c)
FF			43.7300			18.0000	787.1400	(32d)
GF			43.7300			9.0000	393.5700	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7512.4178 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 85.8955 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.5100	0.0460	0.6675
E3 Sill	14.5100	0.0470	0.6820
E4 Jamb	29.8400	0.0530	1.5815
E5 Ground floor (normal)	20.5900	0.0680	1.4001
E10 Eaves (insulation at ceiling level)	14.6000	0.0910	1.3286
E12 Gable (insulation at ceiling level)	5.9900	0.0750	0.4492
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	5.9900	0.1160	0.6948
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.0460	0.2755
E6 Intermediate floor within a dwelling	20.5900	0.0540	1.1119

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2672 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.0334 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.9668	46.4264	45.8861	43.1844	42.6441	39.9424	39.9424	39.4020	41.0231	42.6441	43.7247	44.8054	(38)
Heat transfer coeff	106.0002	105.4599	104.9195	102.2178	101.6775	98.9758	98.9758	98.4355	100.0565	101.6775	102.7582	103.8389	(39)
Average = Sum(39)m / 12 =												102.0828	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2120	1.2058	1.1996	1.1687	1.1626	1.1317	1.1317	1.1255	1.1440	1.1626	1.1749	1.1873	(40)
HLP (average)												1.1672	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5893 (42)
Hot water usage for mixer showers

67.6343	66.6179	65.1368	62.3030	60.2117	57.8795	56.5538	58.0238	59.6350	62.1391	65.0338	67.3752	(42a)

Hot water usage for baths

29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)

Hot water usage for other uses

41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)

Average daily hot water use (litres/day) 126.8439 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.9899	135.0435	131.4552	125.9988	121.5679	116.8042	114.9735	118.5462	122.3142	127.3152	132.8557	137.6320	(44)
Energy conte	218.5423	192.3001	202.0418	172.4860	163.6537	143.6244	139.0504	146.7850	150.8257	172.7656	189.2773	215.4985	(45)
Energy content (annual)										Total = Sum(45)m =		2106.8508	
Distribution loss (46)m = 0.15 x (45)m	32.7813	28.8450	30.3063	25.8729	24.5481	21.5437	20.8576	22.0177	22.6239	25.9148	28.3916	32.3248	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(64)
										Total per year (kWh/year) = Sum(64)m =		2676.3968	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	111.3632	98.8927	105.8768	94.8012	93.1128	85.2047	84.9322	87.5039	87.5991	96.1425	100.3843	110.3512	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.0740	24.9351	20.2786	15.3522	11.4759	9.6885	10.4687	13.6077	18.2642	23.1905	27.0668	28.8543	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	349.7409	353.3701	344.2246	324.7549	300.1779	277.0790	261.6475	258.0183	267.1638	286.6335	311.2105	334.3094	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)	149.6818	147.1618	142.3075	131.6683	125.1516	118.3399	114.1562	117.6128	121.6655	129.2238	139.4227	148.3215	(72)
Total internal gains	632.4087	630.3790	611.7227	576.6874	541.7174	510.0193	491.1844	494.1507	512.0054	543.9598	582.6119	616.3971	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.0000	19.6403	0.3000	0.0000	0.7700	13.6107	(76)

West				8.4900	19.6403	0.3000	0.0000	0.7700				38.5183	(80)
East				7.6000	19.6403	0.3000	0.0000	0.7700				34.4804	(76)
Solar gains	86.6094	169.4264	279.0212	406.9358	498.7151	510.5236	486.0393	417.5006	324.5132	201.0387	107.9918	71.2234	(83)
Total gains	719.0181	799.8054	890.7439	983.6232	1040.4325	1020.5430	977.2237	911.6513	836.5186	744.9985	690.6037	687.6205	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.6866	19.7875	19.8894	20.4151	20.5235	21.0838	21.0838	21.1995	20.8560	20.5235	20.3077	20.0964	
alpha	2.3124	2.3192	2.3260	2.3610	2.3682	2.4056	2.4056	2.4133	2.3904	2.3682	2.3538	2.3398	
util living area	0.9221	0.8994	0.8565	0.7780	0.6688	0.5276	0.4079	0.4458	0.6349	0.8139	0.8977	0.9282	(86)
Living	18.2439	18.5585	19.1033	19.8070	20.3668	20.7562	20.9053	20.8808	20.5932	19.8561	18.9597	18.2208	
Non living	17.4239	17.7339	18.2659	18.9532	19.4704	19.8221	19.9313	19.9217	19.6910	19.0188	18.1487	17.4142	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.5901	18.5585	19.1033	19.8070	20.3668	20.7562	20.9053	20.8808	20.5932	19.8561	18.9597	18.6095	(87)
Th 2	19.9104	19.9154	19.9203	19.9451	19.9501	19.9751	19.9751	19.9801	19.9650	19.9501	19.9401	19.9302	(88)
util rest of house	0.9122	0.8867	0.8380	0.7492	0.6244	0.4629	0.3244	0.3617	0.5732	0.7832	0.8828	0.9190	(89)
MIT 2	18.6384	17.7339	18.2659	18.9532	19.4704	19.8221	19.9313	19.9217	19.6910	19.0188	18.1487	17.7661	(90)
Living area fraction									fLA = Living area / (4) =			0.2056	(91)
MIT	18.8341	17.9035	18.4380	19.1287	19.6546	20.0141	20.1315	20.1189	19.8765	19.1910	18.3154	17.9395	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8341	17.9035	18.4380	19.1287	19.6546	20.0141	20.1315	20.1189	19.8765	19.1910	18.3154	17.9395	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9005	0.8567	0.8072	0.7236	0.6107	0.4655	0.3377	0.3737	0.5674	0.7568	0.8537	0.8971	(94)
Useful gains	647.4596	685.2036	719.0477	711.7549	635.3708	475.0557	330.0172	340.7173	474.6623	563.7859	589.5519	616.8669	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1540.6142	1371.3424	1252.5307	1045.5591	808.8081	535.8682	349.5354	366.0694	577.9733	873.5081	1152.4766	1426.6951	(97)
Space heating kWh	664.5070	461.0852	396.9114	240.3390	129.0373	0.0000	0.0000	0.0000	0.0000	230.4333	405.3058	602.5122	(98a)
Space heating requirement - total per year (kWh/year)												3130.1313	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	664.5070	461.0852	396.9114	240.3390	129.0373	0.0000	0.0000	0.0000	0.0000	230.4333	405.3058	602.5122	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3130.1313	
Space heating per m2											(98c) / (4) =	35.7893	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												286.3431	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement	664.5070	461.0852	396.9114	240.3390	129.0373	0.0000	0.0000	0.0000	0.0000	230.4333	405.3058	602.5122	(98)
Space heating efficiency (main heating system 1)	286.3431	286.3431	286.3431	286.3431	286.3431	0.0000	0.0000	0.0000	0.0000	286.3431	286.3431	286.3431	(210)
Space heating fuel (main heating system)	232.0667	161.0255	138.6139	83.9339	45.0639	0.0000	0.0000	0.0000	0.0000	80.4745	141.5455	210.4162	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	93.6855	82.8316	87.8939	76.9723	74.4199	66.8421	65.7843	68.4991	69.3697	77.6181	82.8660	92.6172	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.3636	3.9413	4.3636	4.2228	4.3636	4.2228	4.3636	4.3636	4.2228	4.3636	4.2228	4.3636	(231)
Lighting	24.5730	19.7134	17.7497	13.0042	10.0448	8.2067	9.1632	11.9107	15.4708	20.2986	22.9272	25.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1093.1402	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	284.9050	
Water heating fuel used	939.3997	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)		
mechanical ventilation fans (SFP = 0.1790)	51.3777	(230a)
Total electricity for the above, kWh/year	51.3777	(231)
Electricity for lighting (calculated in Appendix L)	198.3182	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2282.2359	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1093.1402	16.4900	180.2588	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	939.3997	16.4900	154.9070	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	51.3777	16.4900	8.4722	(249)
Energy for lighting	198.3182	16.4900	32.7027	(250)
Additional standing charges			0.0000	(251)
Total energy cost			376.3407	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0228	(257)
SAP value		83.4201	
SAP rating (Section 12)		83	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1093.1402	0.1549	169.3656	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	939.3997	0.1410	132.4256	(264)
Space and water heating			301.7912	(265)
Pumps, fans and electric keep-hot	51.3777	0.1387	7.1267	(267)
Energy for lighting	198.3182	0.1443	28.6234	(268)
Total CO2, kg/year			337.5414	(272)
CO2 emissions per m2			3.8600	(273)
EI value			96.5853	
EI rating			97	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	43.7300	(1b)	x 2.5500	(2b) =	111.5115	(1b) - (3b)
First floor	43.7300	(1c)	x 2.8300	(2c) =	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		235.2674	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 30.0000 / (5) =	0.1275	(8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	4.0000	(17)
Infiltration rate	0.3275	(18)
Number of sides sheltered	2	(19)
Shelter factor (20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) =	0.2784	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.5000	4.4000	4.4000	4.0000	4.1000	3.5000	3.4000	3.4000	3.5000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1250	1.1000	1.1000	1.0000	1.0250	0.8750	0.8500	0.8500	0.8750	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.3132	0.3062	0.3062	0.2784	0.2853	0.2436	0.2366	0.2366	0.2436	0.2714	0.2714	0.2784	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
Effective ac	0.5632	0.5562	0.5562	0.5284	0.5353	0.5000	0.5000	0.5000	0.5000	0.5214	0.5214	0.5284	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.4900	1.1450	13.1565			(27)
Glazed Doors			7.6000	1.1450	8.7023			(27)
GF			43.7300	0.1100	4.8103	75.0000	3279.7500	(28a)
Main	110.7742	21.2400	89.5342	0.1900	17.0115	9.0000	805.8078	(29a)
PIJ	43.7300		43.7300	0.0900	3.9357	9.0000	393.5700	(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.7663			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000	20.0000	644.6000	(32)
Timber			113.8200			9.0000	1024.3800	(32c)
Timber			20.4000			9.0000	183.6000	(32c)
FF			43.7300			18.0000	787.1400	(32d)
GF			43.7300			9.0000	393.5700	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) =	7512.4178	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	85.8955	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.5100	0.0460	0.6675
E3 Sill	14.5100	0.0470	0.6820
E4 Jamb	29.8400	0.0530	1.5815
E5 Ground floor (normal)	20.5900	0.0680	1.4001
E10 Eaves (insulation at ceiling level)	14.6000	0.0910	1.3286
E12 Gable (insulation at ceiling level)	5.9900	0.0750	0.4492
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	5.9900	0.1160	0.6948
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.0460	0.2755
E6 Intermediate floor within a dwelling	20.5900	0.0540	1.1119

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2672	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	59.0334	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.7247	43.1844	43.1844	41.0231	41.5634	38.8191	38.8191	38.8191	38.8191	40.4827	40.4827	41.0231	(38)
Heat transfer coeff	102.7582	102.2178	102.2178	100.0565	100.5968	97.8526	97.8526	97.8526	97.8526	99.5162	99.5162	100.0565	(39)
Average = Sum(39)m / 12 =												99.8622	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1749	1.1687	1.1687	1.1440	1.1502	1.1188	1.1188	1.1188	1.1188	1.1378	1.1378	1.1440	(40)
HLP (average)												1.1418	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5893	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	67.6343	66.6179	65.1368	62.3030	60.2117	57.8795	56.5538	58.0238	59.6350	62.1391	65.0338	67.3752	(42a)
Hot water usage for baths	29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)
Hot water usage for other uses	41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)
Average daily hot water use (litres/day)												126.8439	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.9899	135.0435	131.4552	125.9988	121.5679	116.8042	114.9735	118.5462	122.3142	127.3152	132.8557	137.6320	(44)
Energy conte	218.5423	192.3001	202.0418	172.4860	163.6537	143.6244	139.0504	146.7850	150.8257	172.7656	189.2773	215.4985	(45)
Energy content (annual)										Total = Sum(45)m =		2106.8508	
Distribution loss (46)m = 0.15 x (45)m	32.7813	28.8450	30.3063	25.8729	24.5481	21.5437	20.8576	22.0177	22.6239	25.9148	28.3916	32.3248	(46)

Water storage loss (or HIU loss):		
Store volume	198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.5000	(48)
Temperature factor from Table 2b	0.5400	(49)
Enter (49) or (54) in (55)	0.8100	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)

PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(64)
									Total per year (kWh/year) = Sum(64)m =			2676.3968	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =				0.0000	(64a)
Heat gains from water heating, kWh/month													
	111.3632	98.8927	105.8768	94.8012	93.1128	85.2047	84.9322	87.5039	87.5991	96.1425	100.3843	110.3512	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.0740	24.9351	20.2786	15.3522	11.4759	9.6885	10.4687	13.6077	18.2642	23.1905	27.0668	28.8543	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	349.7409	353.3701	344.2246	324.7549	300.1779	277.0790	261.6475	258.0183	267.1638	286.6335	311.2105	334.3094	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)													
	149.6818	147.1618	142.3075	131.6683	125.1516	118.3399	114.1562	117.6128	121.6655	129.2238	139.4227	148.3215	(72)
Total internal gains													
	632.4087	630.3790	611.7227	576.6874	541.7174	510.0193	491.1844	494.1507	512.0054	543.9598	582.6119	616.3971	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.0000	17.3606	0.3000	0.0000	0.7700	12.0309	(76)
West	8.4900	17.3606	0.3000	0.0000	0.7700	34.0474	(80)
East	7.6000	17.3606	0.3000	0.0000	0.7700	30.4782	(76)

Solar gains	76.5565	153.6258	267.2216	395.8729	469.9406	495.0205	460.1381	390.7168	318.6765	194.8089	101.3691	67.7785	(83)
Total gains	708.9652	784.0048	878.9443	972.5604	1011.6580	1005.0398	951.3225	884.8675	830.6819	738.7687	683.9810	684.1756	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.3077	20.4151	20.4151	20.8560	20.7440	21.3258	21.3258	21.3258	21.3258	20.9693	20.9693	20.8560	
alpha	2.3538	2.3610	2.3610	2.3904	2.3829	2.4217	2.4217	2.4217	2.4217	2.3980	2.3980	2.3904	
util living area													
	0.9165	0.8929	0.8450	0.7561	0.6343	0.4800	0.3736	0.4143	0.6088	0.7960	0.8890	0.9223	(86)
Living	18.4903	18.7886	19.3104	19.9905	20.5077	20.8309	20.9325	20.9108	20.6639	20.0090	19.1686	18.4723	
Non living	17.6858	17.9793	18.4835	19.1404	19.6037	19.8885	19.9580	19.9466	19.7662	19.1769	18.3724	17.6843	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.7161	18.7886	19.3104	19.9905	20.5077	20.8309	20.9325	20.9108	20.6639	20.0090	19.1686	18.8258	(87)
Th 2	19.9401	19.9451	19.9451	19.9650	19.9600	19.9855	19.9855	19.9855	19.9855	19.9700	19.9700	19.9650	(88)
util rest of house													
	0.9056	0.8792	0.8249	0.7240	0.5836	0.4090	0.2856	0.3241	0.5438	0.7619	0.8726	0.9123	(89)
MIT 2	18.7869	17.9793	18.4835	19.1404	19.6037	19.8885	19.9580	19.9466	19.7662	19.1769	18.3724	18.0033	(90)
Living area fraction										fLA = Living area / (4) =		0.2056	(91)
MIT	18.9779	18.1456	18.6535	19.3152	19.7895	20.0822	20.1584	20.1448	19.9508	19.3480	18.5361	18.1724	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9779	18.1456	18.6535	19.3152	19.7895	20.0822	20.1584	20.1448	19.9508	19.3480	18.5361	18.1724	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8940	0.8496	0.7952	0.7012	0.5746	0.4162	0.3012	0.3390	0.5414	0.7378	0.8440	0.8904	(94)
Useful gains	633.7905	666.0991	698.9196	681.9735	581.3000	418.2543	286.5626	299.9722	449.7067	545.0560	577.3130	609.1797	(95)
Ext temp.	5.0000	5.6000	7.2000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.2000	7.7000	4.8000	(96)
Heat loss rate W													
	1436.3453	1282.3892	1170.7484	962.0629	713.1837	458.1691	299.2699	317.5112	533.3708	810.8551	1078.3641	1337.9949	(97)
Space heating kWh													
	597.1007	414.1470	351.0406	201.6644	98.1214	0.0000	0.0000	0.0000	0.0000	197.7545	360.7568	542.2385	(98a)
Space heating requirement - total per year (kWh/year)												2762.8240	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	597.1007	414.1470	351.0406	201.6644	98.1214	0.0000	0.0000	0.0000	0.0000	197.7545	360.7568	542.2385	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2762.8240	
Space heating per m2											(98c) / (4) =	31.5896	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	286.9197	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	597.1007	414.1470	351.0406	201.6644	98.1214	0.0000	0.0000	0.0000	0.0000	197.7545	360.7568	542.2385	(98)
Space heating efficiency (main heating system 1)	286.9197	286.9197	286.9197	286.9197	286.9197	0.0000	0.0000	0.0000	0.0000	286.9197	286.9197	286.9197	(210)
Space heating fuel (main heating system)	208.1073	144.3425	122.3480	70.2860	34.1982	0.0000	0.0000	0.0000	0.0000	68.9233	125.7344	188.9862	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	93.6855	82.8316	87.8939	76.9723	74.4199	66.8421	65.7843	68.4991	69.3697	77.6181	82.8660	92.6172	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.3636	3.9413	4.3636	4.2228	4.3636	4.2228	4.3636	4.3636	4.2228	4.3636	4.2228	4.3636	(231)
Lighting	24.5730	19.7134	17.7497	13.0042	10.0448	8.2067	9.1632	11.9107	15.4708	20.2986	22.9272	25.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	962.9259	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	284.9050	
Water heating fuel used	939.3997	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)		
mechanical ventilation fans (SFP = 0.1790)	51.3777	(230a)
Total electricity for the above, kWh/year	51.3777	(231)
Electricity for lighting (calculated in Appendix L)	198.3182	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2152.0216	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	962.9259	26.0000	250.3607	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	939.3997	26.0000	244.2439	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	51.3777	26.0000	13.3582	(249)
Energy for lighting	198.3182	26.0000	51.5627	(250)
Additional standing charges			0.0000	(251)
Total energy cost			559.5256	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	962.9259	0.1552	149.4648	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	939.3997	0.1410	132.4256	(264)
Space and water heating			281.8904	(265)
Pumps, fans and electric keep-hot	51.3777	0.1387	7.1267	(267)
Energy for lighting	198.3182	0.1443	28.6234	(268)
Total CO2, kg/year			317.6405	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	962.9259	1.5746	1516.2462	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	939.3997	1.5213	1429.0647	(278)
Space and water heating			2945.3109	(279)
Pumps, fans and electric keep-hot	51.3777	1.5128	77.7242	(281)
Energy for lighting	198.3182	1.5338	304.1871	(282)

Total Primary energy kWh/year 3327.2222 (286)

SAP 10 EPC IMPROVEMENTS

001

Current energy efficiency rating: B 83
Current environmental impact rating: A 97

N	Solar water heating		Recommended
U	Solar photovoltaic panels		Recommended
V2	Wind turbine		Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.4	-£ 49	-23 kg (7.3%)
U Solar photovoltaic panels	+ 8.3	-£ 259	-212 kg (71.9%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£49	0.27 kg/m²	B 85	A 97
Solar photovoltaic panels	£259	2.42 kg/m²	A 93	A 99
Total Savings	£308	2.69 kg/m²		

Potential energy efficiency rating: A 93
Potential environmental impact rating: A 99

Fuel prices for cost data on this page from database revision number 599 TEST (30 Sep 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, West Pennines (England)):

	Current	Potential	Saving
Electricity	£560	£510	£49
Space heating	£264	£287	-£23
Water heating	£244	£172	£72
Lighting	£52	£52	£0
Generated (PV)	-£0	-£259	£259
Total cost of fuels	£560	£251	£308
Total cost of uses	£560	£252	£308
Delivered energy	25 kWh/m²	4 kWh/m²	21 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.1 tonnes	0.2 tonnes
CO2 emissions per m²	4 kg/m²	1 kg/m²	3 kg/m²
Primary energy	38 kWh/m²	17 kWh/m²	21 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	43.7300	(1b)	x 2.5500	(2b) =	111.5115	(1b) - (3b)
First floor	43.7300	(1c)	x 2.8300	(2c) =	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		235.2674	(5)

---

2. Ventilation rate

---

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1275 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.3275 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2784 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)

Adj infilt rate

	0.3549	0.3480	0.3410	0.3062	0.2993	0.2645	0.2645	0.2575	0.2784	0.2993	0.3132	0.3271 (22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

Effective ac	0.6049	0.5980	0.5910	0.5562	0.5493	0.5145	0.5145	0.5075	0.5284	0.5493	0.5632	0.5771 (25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.4900	1.1450	13.1565			(27)
Glazed Doors			7.6000	1.1450	8.7023			(27)
GF			43.7300	0.1100	4.8103	75.0000	3279.7500	(28a)
Main	110.7742	21.2400	89.5342	0.1900	17.0115	9.0000	805.8078	(29a)
PIJ	43.7300		43.7300	0.0900	3.9357	9.0000	393.5700	(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.7663			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000	20.0000	644.6000	(32)
Timber			113.8200			9.0000	1024.3800	(32c)
Timber			20.4000			9.0000	183.6000	(32c)
FF			43.7300			18.0000	787.1400	(32d)
GF			43.7300			9.0000	393.5700	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7512.4178 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 85.8955 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.5100	0.0460	0.6675
E3 Sill	14.5100	0.0470	0.6820
E4 Jamb	29.8400	0.0530	1.5815
E5 Ground floor (normal)	20.5900	0.0680	1.4001
E10 Eaves (insulation at ceiling level)	14.6000	0.0910	1.3286
E12 Gable (insulation at ceiling level)	5.9900	0.0750	0.4492
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	5.9900	0.1160	0.6948
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.0460	0.2755
E6 Intermediate floor within a dwelling	20.5900	0.0540	1.1119

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2672 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 59.0334 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.9668	46.4264	45.8861	43.1844	42.6441	39.9424	39.9424	39.4020	41.0231	42.6441	43.7247	44.8054	(38)
Heat transfer coeff	106.0002	105.4599	104.9195	102.2178	101.6775	98.9758	98.9758	98.4355	100.0565	101.6775	102.7582	103.8389	(39)

Average = Sum(39)m / 12 = 102.0828

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2120	1.2058	1.1996	1.1687	1.1626	1.1317	1.1317	1.1255	1.1440	1.1626	1.1749	1.1873	(40)
HLP (average)												1.1672	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5893 (42)

Hot water usage for mixer showers

67.6343	66.6179	65.1368	62.3030	60.2117	57.8795	56.5538	58.0238	59.6350	62.1391	65.0338	67.3752	(42a)

Hot water usage for baths

29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)

Hot water usage for other uses

41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)

Average daily hot water use (litres/day) 126.8439 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.9899	135.0435	131.4552	125.9988	121.5679	116.8042	114.9735	118.5462	122.3142	127.3152	132.8557	137.6320	(44)
Energy conte	218.5423	192.3001	202.0418	172.4860	163.6537	143.6244	139.0504	146.7850	150.8257	172.7656	189.2773	215.4985	(45)
Energy content (annual)										Total = Sum(45)m =		2106.8508	
Distribution loss (46)m = 0.15 x (45)m	32.7813	28.8450	30.3063	25.8729	24.5481	21.5437	20.8576	22.0177	22.6239	25.9148	28.3916	32.3248	(46)

Water storage loss (or HIU loss):

Store volume 198.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.5000 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.8100 (55)

Total storage loss

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)

If cylinder contains dedicated solar storage

15.5986	14.0891	15.5986	15.0955	15.5986	15.0955	15.5986	15.5986	15.0955	15.5986	15.0955	15.5986	(57)
Primary loss 23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

257.4033	227.4004	239.5071	203.3399	189.7204	168.6252	164.8845	173.5496	183.0303	210.2309	226.8848	254.3595	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Aperture area of solar collector 3.0000 (H1)

Zero-loss collector efficiency 0.8000 (H2)

Collector linear heat loss coefficient 1.8000 (H3)

Collector 2nd order heat loss coefficient 0.0000 (H4)

Collector loop efficiency 0.9000 (H5)

Incidence angle modifier 1.0000 (H6)

Overshading factor 0.8000 (H8)

Overall heat loss coefficient of system 6.5000 (H10)

Heat loss coefficient of collector loop 3.9667 (H11)

Dedicated solar storage volume 75.0000 (H12)

If combined cylinder, total volume of cylinder 198.0000 (H13)

Effective solar volume 111.9000 (H14)

Reference volume 225.0000 (H15)

Storage tank correction coefficient												1.1908	(H16)
Heat delivered to hot water												648.7608	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												648.7608	
Solar input	-0.0000	-19.9033	-62.0018	-83.2548	-106.7311	-98.1676	-97.3555	-86.1278	-61.1731	-32.9118	-1.1339	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	257.4033	207.4971	177.5053	120.0851	82.9893	70.4575	67.5290	87.4217	121.8571	177.3191	225.7509	254.3595	(64)
									Total per year (kWh/year) = Sum(64)m =			1850.1749	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =				0.0000	(64a)
Heat gains from water heating, kWh/month													
	103.7541	92.0200	97.1511	82.0347	75.2682	67.7557	66.9015	70.2177	75.9132	87.4168	93.0207	102.7421	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.0740	24.9351	20.2786	15.3522	11.4759	9.6885	10.4687	13.6077	18.2642	23.1905	27.0668	28.8543	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	349.7409	353.3701	344.2246	324.7549	300.1779	277.0790	261.6475	258.0183	267.1638	286.6335	311.2105	334.3094	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)													
	139.4545	136.9345	130.5795	113.9371	101.1670	94.1051	89.9214	94.3786	105.4350	117.4957	129.1954	138.0942	(72)
Total internal gains													
	622.1814	620.1517	599.9946	558.9562	517.7328	485.7846	466.9497	470.9165	495.7749	532.2317	572.3847	606.1699	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.0000	19.6403	0.3000	0.0000	0.7700	13.6107	(76)
West	8.4900	19.6403	0.3000	0.0000	0.7700	38.5183	(80)
East	7.6000	19.6403	0.3000	0.0000	0.7700	34.4804	(76)

Solar gains	86.6094	169.4264	279.0212	406.9358	498.7151	510.5236	486.0393	417.5006	324.5132	201.0387	107.9918	71.2234	(83)
Total gains	708.7908	789.5782	879.0159	965.8920	1016.4479	996.3082	952.9890	888.4171	820.2882	733.2705	680.3765	677.3933	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.6866	19.7875	19.8894	20.4151	20.5235	21.0838	21.0838	21.1995	20.8560	20.5235	20.3077	20.0964	
alpha	2.3124	2.3192	2.3260	2.3610	2.3682	2.4056	2.4056	2.4133	2.3904	2.3682	2.3538	2.3398	
util living area													
	0.9241	0.9016	0.8595	0.7835	0.6773	0.5367	0.4164	0.4551	0.6422	0.8182	0.9003	0.9302	(86)
Living	18.2239	18.5399	19.0848	19.7856	20.3480	20.7467	20.9009	20.8752	20.5823	19.8400	18.9410	18.2002	
Non living	17.4046	17.7161	18.2485	18.9340	19.4549	19.8156	19.9291	19.9188	19.6829	19.0044	18.1309	17.3943	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.5799	18.5399	19.0848	19.7856	20.3480	20.7467	20.9009	20.8752	20.5823	19.8400	18.9410	18.5919	(87)
Th 2	19.9104	19.9154	19.9203	19.9451	19.9501	19.9751	19.9751	19.9801	19.9650	19.9501	19.9401	19.9302	(88)
util rest of house													
	0.9144	0.8892	0.8413	0.7551	0.6332	0.4716	0.3317	0.3698	0.5807	0.7879	0.8857	0.9212	(89)
MIT 2	18.6285	17.7161	18.2485	18.9340	19.4549	19.8156	19.9291	19.9188	19.6829	19.0044	18.1309	17.7490	(90)
Living area fraction										fLA = Living area / (4) =		0.2056	(91)
MIT	18.8241	17.8855	18.4204	19.1091	19.6385	20.0070	20.1288	20.1154	19.8678	19.1762	18.2975	17.9223	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8241	17.8855	18.4204	19.1091	19.6385	20.0070	20.1288	20.1154	19.8678	19.1762	18.2975	17.9223	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9028	0.8593	0.8105	0.7291	0.6187	0.4738	0.3450	0.3818	0.5743	0.7613	0.8568	0.8995	(94)
Useful gains	639.8952	678.4883	712.4428	704.2543	628.8844	472.0132	328.8191	339.1756	471.1064	558.2261	582.9166	609.3312	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1539.5586	1369.4450	1250.6806	1043.5482	807.1674	535.1655	349.2704	365.7258	577.1033	872.0041	1150.6318	1424.9053	(97)
Space heating kWh													
	669.3495	464.3229	400.4489	244.2916	132.6426	0.0000	0.0000	0.0000	0.0000	233.4508	408.7550	606.7871	(98a)
Space heating requirement - total per year (kWh/year)												3160.0485	
Solar heating kWh													
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	669.3495	464.3229	400.4489	244.2916	132.6426	0.0000	0.0000	0.0000	0.0000	233.4508	408.7550	606.7871	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3160.0485	
Space heating per m2											(98c) / (4) =	36.1314	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)

Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												286.3431	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	669.3495	464.3229	400.4489	244.2916	132.6426	0.0000	0.0000	0.0000	0.0000	233.4508	408.7550	606.7871	(98)
Space heating efficiency (main heating system 1)													
	286.3431	286.3431	286.3431	286.3431	286.3431	0.0000	0.0000	0.0000	0.0000	286.3431	286.3431	286.3431	(210)
Space heating fuel (main heating system)													
	233.7579	162.1562	139.8494	85.3143	46.3230	0.0000	0.0000	0.0000	0.0000	81.5284	142.7501	211.9091	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	257.4033	207.4971	177.5053	120.0851	82.9893	70.4575	67.5290	87.4217	121.8571	177.3191	225.7509	254.3595	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month													
	90.3471	72.8303	62.3033	42.1492	29.1288	24.7302	23.7023	30.6845	42.7711	62.2380	79.2372	89.2787	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.1581	10.0783	11.1581	10.7982	11.1581	10.7982	11.1581	11.1581	10.7982	11.1581	10.7982	11.1581	(231)
Lighting	24.5730	19.7134	17.7497	13.0042	10.0448	8.2067	9.1632	11.9107	15.4708	20.2986	22.9272	25.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-37.8592	-55.7876	-83.1360	-94.5943	-100.2805	-88.0622	-86.8110	-81.9151	-72.8247	-63.5837	-41.9951	-32.2301	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-12.2273	-27.7924	-59.2102	-96.1777	-135.4023	-143.6515	-141.8405	-117.8589	-83.6384	-43.2621	-17.4147	-9.6838	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1103.5883	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												284.9050	
Water heating fuel used												649.4007	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)													
mechanical ventilation fans (SFP = 0.1790)												51.3777	(230a)
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												131.3777	(231)
Electricity for lighting (calculated in Appendix L)												198.3182	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1727.2394	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												355.4454	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1103.5883	16.4900	181.9817	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	649.4007	16.4900	107.0862	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	51.3777	16.4900	8.4722	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	198.3182	16.4900	32.7027	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-839.0794	16.4900	-138.3642	
PV Unit electricity exported	-888.1600	5.5900	-49.6481	
Total			-188.0123	(252)
Total energy cost			155.4224	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4224	(257)
SAP value		93.1528	
SAP rating (Section 12)		93	(258)
SAP band		A	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	

Space heating - main system 1	1103.5883	0.1549	170.9434	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	649.4007	0.1463	95.0191	(264)
Space and water heating			265.9625	(265)
Pumps, fans and electric keep-hot	131.3777	0.1387	18.2237	(267)
Energy for lighting	198.3182	0.1443	28.6234	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-839.0794	0.1348	-113.0856	
PV Unit electricity exported	-888.1600	0.1233	-109.4795	
Total			-222.5651	(269)
Total CO2, kg/year			90.2445	(272)
CO2 emissions per m2			1.0300	(273)
EI value			99.0871	
EI rating			99	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	43.7300 (1b)	x	2.5500 (2b)	=	111.5115	(1b) - (3b)
First floor	43.7300 (1c)	x	2.8300 (2c)	=	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.2674	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1275	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3275	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2784	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.5000	4.4000	4.4000	4.0000	4.1000	3.5000	3.4000	3.4000	3.5000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1250	1.1000	1.1000	1.0000	1.0250	0.8750	0.8500	0.8500	0.8750	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.3132	0.3062	0.3062	0.2784	0.2853	0.2436	0.2366	0.2366	0.2436	0.2714	0.2714	0.2784	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
Effective ac	0.5632	0.5562	0.5562	0.5284	0.5353	0.5000	0.5000	0.5000	0.5000	0.5214	0.5214	0.5284	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.4900	1.1450	13.1565			(27)
Glazed Doors			7.6000	1.1450	8.7023			(27)
GF			43.7300	0.1100	4.8103	75.0000	3279.7500	(28a)
Main	110.7742	21.2400	89.5342	0.1900	17.0115	9.0000	805.8078	(29a)
PIJ	43.7300		43.7300	0.0900	3.9357	9.0000	393.5700	(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.7663			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000	20.0000	644.6000	(32)
Timber			113.8200			9.0000	1024.3800	(32c)
Timber			20.4000			9.0000	183.6000	(32c)
FF			43.7300			18.0000	787.1400	(32d)
GF			43.7300			9.0000	393.5700	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	7512.4178 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		85.8955 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.5100	0.0460	0.6675
E3 Sill	14.5100	0.0470	0.6820
E4 Jamb	29.8400	0.0530	1.5815

E5 Ground floor (normal)	20.5900	0.0680	1.4001	
E10 Eaves (insulation at ceiling level)	14.6000	0.0910	1.3286	
E12 Gable (insulation at ceiling level)	5.9900	0.0750	0.4492	
E16 Corner (normal)	10.7600	0.0460	0.4950	
E18 Party wall between dwellings	10.7600	0.0540	0.5810	
P1 Party wall - Ground floor	5.9900	0.1160	0.6948	
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.0460	0.2755	
E6 Intermediate floor within a dwelling	20.5900	0.0540	1.1119	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				9.2672 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	59.0334 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.7247	43.1844	43.1844	41.0231	41.5634	38.8191	38.8191	38.8191	38.8191	40.4827	40.4827	41.0231	(38)
Heat transfer coeff	102.7582	102.2178	102.2178	100.0565	100.5968	97.8526	97.8526	97.8526	97.8526	99.5162	99.5162	100.0565	(39)
Average = Sum(39)m / 12 =												99.8622	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1749	1.1687	1.1687	1.1440	1.1502	1.1188	1.1188	1.1188	1.1188	1.1378	1.1378	1.1440	(40)
HLP (average)												1.1418	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5893	(42)
Hot water usage for mixer showers	67.6343	66.6179	65.1368	62.3030	60.2117	57.8795	56.5538	58.0238	59.6350	62.1391	65.0338	67.3752	(42a)
Hot water usage for baths	29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)
Hot water usage for other uses	41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)
Average daily hot water use (litres/day)												126.8439	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.9899	135.0435	131.4552	125.9988	121.5679	116.8042	114.9735	118.5462	122.3142	127.3152	132.8557	137.6320	(44)
Energy conte	218.5423	192.3001	202.0418	172.4860	163.6537	143.6244	139.0504	146.7850	150.8257	172.7656	189.2773	215.4985	(45)
Energy content (annual)										Total = Sum(45)m =		2106.8508	
Distribution loss (46)m = 0.15 x (45)m	32.7813	28.8450	30.3063	25.8729	24.5481	21.5437	20.8576	22.0177	22.6239	25.9148	28.3916	32.3248	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage	15.5986	14.0891	15.5986	15.0955	15.5986	15.0955	15.5986	15.5986	15.0955	15.5986	15.0955	15.5986	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	257.4033	227.4004	239.5071	203.3399	189.7204	168.6252	164.8845	173.5496	183.0303	210.2309	226.8848	254.3595	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
If combined cylinder, total volume of cylinder												198.0000	(H13)
Effective solar volume												111.9000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.1908	(H16)
Heat delivered to hot water												615.9643	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												615.9643	
Solar input	-0.0000	-15.4930	-58.8525	-81.2359	-101.0942	-95.7775	-92.2407	-80.0212	-59.9473	-31.3019	-0.0000	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	257.4033	211.9073	180.6545	122.1040	88.6262	72.8477	72.6438	93.5284	123.0830	178.9290	226.8848	254.3595	(64)
										Total per year (kWh/year) = Sum(64)m =		1882.9715	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	103.7541	92.0200	97.1511	82.0347	75.2682	67.7557	66.9015	70.2177	75.9132	87.4168	93.0207	102.7421	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.0740	24.9351	20.2786	15.3522	11.4759	9.6885	10.4687	13.6077	18.2642	23.1905	27.0668	28.8543	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	349.7409	353.3701	344.2246	324.7549	300.1779	277.0790	261.6475	258.0183	267.1638	286.6335	311.2105	334.3094	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)	139.4545	136.9345	130.5795	113.9371	101.1670	94.1051	89.9214	94.3786	105.4350	117.4957	129.1954	138.0942	(72)
Total internal gains	622.1814	620.1517	599.9946	558.9562	517.7328	485.7846	466.9497	470.9165	495.7749	532.2317	572.3847	606.1699	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.0000	17.3606	0.3000	0.0000	0.7700	12.0309	(76)
West	8.4900	17.3606	0.3000	0.0000	0.7700	34.0474	(80)
East	7.6000	17.3606	0.3000	0.0000	0.7700	30.4782	(76)

Solar gains	76.5565	153.6258	267.2216	395.8729	469.9406	495.0205	460.1381	390.7168	318.6765	194.8089	101.3691	67.7785	(83)
Total gains	698.7379	773.7775	867.2162	954.8291	987.6734	980.8051	927.0878	861.6333	814.4514	727.0406	673.7537	673.9484	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.3077	20.4151	20.4151	20.8560	20.7440	21.3258	21.3258	21.3258	21.3258	20.9693	20.9693	20.8560	
alpha	2.3538	2.3610	2.3610	2.3904	2.3829	2.4217	2.4217	2.4217	2.4217	2.3980	2.3980	2.3904	
util living area	0.9187	0.8953	0.8483	0.7620	0.6433	0.4890	0.3820	0.4235	0.6163	0.8007	0.8919	0.9244	(86)
Living	18.4704	18.7703	19.2925	19.9707	20.4915	20.8237	20.9291	20.9063	20.6542	19.9938	19.1503	18.4519	
Non living	17.6666	17.9617	18.4667	19.1230	19.5910	19.8841	19.9566	19.9445	19.7593	19.1635	18.3550	17.6645	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.7060	18.7703	19.2925	19.9707	20.4915	20.8237	20.9291	20.9063	20.6542	19.9938	19.1503	18.8083	(87)
Th 2	19.9401	19.9451	19.9451	19.9650	19.9600	19.9855	19.9855	19.9855	19.9855	19.9700	19.9700	19.9650	(88)
util rest of house	0.9080	0.8818	0.8284	0.7303	0.5928	0.4174	0.2925	0.3319	0.5513	0.7670	0.8758	0.9147	(89)
MIT 2	18.7771	17.9617	18.4667	19.1230	19.5910	19.8841	19.9566	19.9445	19.7593	19.1635	18.3550	17.9863	(90)
Living area fraction										fLA = Living area / (4) =		0.2056	(91)
MIT	18.9680	18.1279	18.6365	19.2972	19.7761	20.0772	20.1565	20.1422	19.9433	19.3342	18.5185	18.1553	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9680	18.1279	18.6365	19.2972	19.7761	20.0772	20.1565	20.1422	19.9433	19.3342	18.5185	18.1553	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8965	0.8524	0.7986	0.7070	0.5830	0.4242	0.3082	0.3468	0.5484	0.7426	0.8473	0.8930	(94)
Useful gains	626.3989	659.5539	692.5971	675.1110	575.8256	416.0702	285.7220	298.8226	446.6244	539.8820	570.9000	601.8214	(95)
Ext temp.	5.0000	5.6000	7.2000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.2000	7.7000	4.8000	(96)
Heat loss rate W	1435.3314	1280.5755	1169.0114	960.2667	711.8345	457.6784	299.0858	317.2575	532.6373	809.4850	1076.6175	1336.2838	(97)
Space heating kWh	601.8458	417.3265	354.4522	205.3121	101.1906	0.0000	0.0000	0.0000	0.0000	200.5846	364.1166	546.4400	(98a)
Space heating requirement - total per year (kWh/year)												2791.2684	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	601.8458	417.3265	354.4522	205.3121	101.1906	0.0000	0.0000	0.0000	0.0000	200.5846	364.1166	546.4400	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2791.2684	
Space heating per m2											(98c) / (4) =	31.9148	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	286.9197	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	601.8458	417.3265	354.4522	205.3121	101.1906	0.0000	0.0000	0.0000	0.0000	200.5846	364.1166	546.4400	(98)
Space heating efficiency (main heating system 1)	286.9197	286.9197	286.9197	286.9197	286.9197	0.0000	0.0000	0.0000	0.0000	286.9197	286.9197	286.9197	(210)
Space heating fuel (main heating system)	209.7611	145.4506	123.5371	71.5573	35.2679	0.0000	0.0000	0.0000	0.0000	69.9097	126.9054	190.4505	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	257.4033	211.9073	180.6545	122.1040	88.6262	72.8477	72.6438	93.5284	123.0830	178.9290	226.8848	254.3595	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	90.3471	74.3782	63.4087	42.8578	31.1073	25.5691	25.4976	32.8279	43.2014	62.8030	79.6352	89.2787	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.1581	10.0783	11.1581	10.7982	11.1581	10.7982	11.1581	11.1581	10.7982	11.1581	10.7982	11.1581	(231)
Lighting	24.5730	19.7134	17.7497	13.0042	10.0448	8.2067	9.1632	11.9107	15.4708	20.2986	22.9272	25.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-33.8434	-51.2621	-79.8649	-91.8240	-95.8102	-86.8184	-84.6865	-79.2398	-72.0440	-61.6481	-39.6160	-30.7059	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)

Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-10.3961	-24.4711	-56.3878	-93.6973	-126.2287	-137.8255	-131.7428	-107.6652	-81.5336	-41.8206	-16.1093	-9.1502 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	972.8396 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	284.9050
Water heating fuel used	660.9121 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)	
mechanical ventilation fans (SFP = 0.1790)	51.3777 (230a)
pump for solar water heating	80.0000 (230g)
Total electricity for the above, kWh/year	131.3777 (231)
Electricity for lighting (calculated in Appendix L)	198.3182 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1644.3918 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	319.0558 (238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	972.8396	26.0000	252.9383	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	660.9121	26.0000	171.8371	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	51.3777	26.0000	13.3582	(249)
Pump for solar water heating	80.0000	26.0000	20.8000	(249)
Energy for lighting	198.3182	26.0000	51.5627	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-807.3634	26.0000	-209.9145	
PV Unit electricity exported	-837.0284	5.8100	-48.6313	
Total			-258.5458	(252)
Total energy cost			251.9505	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	972.8396	0.1552	150.9663	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	660.9121	0.1461	96.5278	(264)
Space and water heating			247.4941	(265)
Pumps, fans and electric keep-hot	131.3777	0.1387	18.2237	(267)
Energy for lighting	198.3182	0.1443	28.6234	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-807.3634	0.1345	-108.5694	
PV Unit electricity exported	-837.0284	0.1233	-103.1819	
Total			-211.7513	(269)
Total CO2, kg/year			82.5899	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	972.8396	1.5745	1531.7177	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	660.9121	1.5403	1017.9862	(278)
Space and water heating			2549.7039	(279)
Pumps, fans and electric keep-hot	131.3777	1.5128	198.7482	(281)
Energy for lighting	198.3182	1.5338	304.1871	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-807.3634	1.4970	-1208.6301	
PV Unit electricity exported	-837.0284	0.4524	-378.6692	
Total			-1587.2994	(283)
Total Primary energy kWh/year			1465.3399	(286)

Full SAP Calculation Printout

Plot Reference	79841-06	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	2B3P (Semi)
Plot Address	Plot 6, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	83 B	**DER**	3.95	**TER**	11.67
Environmental	97 A	**% DER < TER**			66.15
CO_2 Emissions (t/year)	0.32	**DFEE**	40.01	**TFEE**	40.64
Compliance Check	See BREL	**% DFEE < TFEE**			1.55
% DPER < TPER	32.27	**DPER**	41.25	**TPER**	60.90

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	43.7300 (1b)	x	2.5500 (2b)	=	111.5115	(1b) - (3b)
First floor	43.7300 (1c)	x	2.8300 (2c)	=	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.2674	(5)

---

2. Ventilation rate

---

			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		3 * 10 =	30.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		30.0000 / (5) =	0.1275	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			4.0000	(17)
Infiltration rate			0.3275	(18)
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.2784	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3549	0.3480	0.3410	0.3062	0.2993	0.2645	0.2645	0.2575	0.2784	0.2993	0.3132	0.3271	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.6049	0.5980	0.5910	0.5562	0.5493	0.5145	0.5145	0.5075	0.5284	0.5493	0.5632	0.5771	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.4900	1.1450	13.1565			(27)
Glazed Doors			7.6000	1.1450	8.7023			(27)
GF			43.7300	0.1100	4.8103	75.0000	3279.7500	(28a)
Main	110.7742	21.2400	89.5342	0.1900	17.0115	9.0000	805.8078	(29a)
PIJ	43.7300		43.7300	0.0900	3.9357	9.0000	393.5700	(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.7663			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000	20.0000	644.6000	(32)
Timber			113.8200			9.0000	1024.3800	(32c)
Timber			20.4000			9.0000	183.6000	(32c)
FF			43.7300			18.0000	787.1400	(32d)
GF			43.7300			9.0000	393.5700	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7512.4178 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 85.8955 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.5100	0.0460	0.6675
E3 Sill	14.5100	0.0470	0.6820
E4 Jamb	29.8400	0.0530	1.5815
E5 Ground floor (normal)	20.5900	0.0680	1.4001
E10 Eaves (insulation at ceiling level)	14.6000	0.0910	1.3286
E12 Gable (insulation at ceiling level)	5.9900	0.0750	0.4492
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	5.9900	0.1160	0.6948
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.0460	0.2755
E6 Intermediate floor within a dwelling	20.5900	0.0540	1.1119

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2672 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.0334 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.9668	46.4264	45.8861	43.1844	42.6441	39.9424	39.9424	39.4020	41.0231	42.6441	43.7247	44.8054	(38)
Heat transfer coeff	106.0002	105.4599	104.9195	102.2178	101.6775	98.9758	98.9758	98.4355	100.0565	101.6775	102.7582	103.8389	(39)
Average = Sum(39)m / 12 =												102.0828	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2120	1.2058	1.1996	1.1687	1.1626	1.1317	1.1317	1.1255	1.1440	1.1626	1.1749	1.1873	(40)
HLP (average)												1.1672	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5893 (42)
Hot water usage for mixer showers

67.6343	66.6179	65.1368	62.3030	60.2117	57.8795	56.5538	58.0238	59.6350	62.1391	65.0338	67.3752	(42a)

Hot water usage for baths

29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)

Hot water usage for other uses

41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)

Average daily hot water use (litres/day) 126.8439 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.9899	135.0435	131.4552	125.9988	121.5679	116.8042	114.9735	118.5462	122.3142	127.3152	132.8557	137.6320	(44)
Energy conte	218.5423	192.3001	202.0418	172.4860	163.6537	143.6244	139.0504	146.7850	150.8257	172.7656	189.2773	215.4985	(45)
Energy content (annual)											Total = Sum(45)m =	2106.8508	
Distribution loss (46)m = 0.15 x (45)m	32.7813	28.8450	30.3063	25.8729	24.5481	21.5437	20.8576	22.0177	22.6239	25.9148	28.3916	32.3248	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(64)
										Total per year (kWh/year) = Sum(64)m =		2676.3968	(64)
12Total per year (kWh/year)												2676	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	111.3632	98.8927	105.8768	94.8012	93.1128	85.2047	84.9322	87.5039	87.5991	96.1425	100.3843	110.3512	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	118.2644	130.9356	118.2644	122.2065	118.2644	122.2065	118.2644	118.2644	122.2065	118.2644	122.2065	118.2644	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	234.3264	236.7580	230.6305	217.5858	201.1192	185.6429	175.3038	172.8722	178.9997	192.0444	208.5110	223.9873	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)	149.6818	147.1618	142.3075	131.6683	125.1516	118.3399	114.1562	117.6128	121.6655	129.2238	139.4227	148.3215	(72)
Total internal gains	564.1126	576.6954	553.0424	533.3007	506.3752	488.0294	469.5644	470.5894	484.7118	501.3726	531.9802	552.4132	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

East			3.0000		19.6403		0.3000		0.0000		0.7700		13.6107 (76)
West			8.4900		19.6403		0.3000		0.0000		0.7700		38.5183 (80)
East			7.6000		19.6403		0.3000		0.0000		0.7700		34.4804 (76)
Solar gains	86.6094	169.4264	279.0212	406.9358	498.7151	510.5236	486.0393	417.5006	324.5132	201.0387	107.9918	71.2234	(83)
Total gains	650.7220	746.1218	832.0636	940.2365	1005.0903	998.5530	955.6037	888.0900	809.2250	702.4113	639.9720	623.6366	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.6866	19.7875	19.8894	20.4151	20.5235	21.0838	21.0838	21.1995	20.8560	20.5235	20.3077	20.0964	
alpha	2.3124	2.3192	2.3260	2.3610	2.3682	2.4056	2.4056	2.4133	2.3904	2.3682	2.3538	2.3398	
util living area	0.9351	0.9109	0.8714	0.7915	0.6814	0.5358	0.4155	0.4552	0.6473	0.8296	0.9105	0.9402	(86)
Living	18.1081	18.4594	19.0087	19.7538	20.3388	20.7476	20.9014	20.8752	20.5746	19.7963	18.8657	18.0903	
Non living	17.2922	17.6387	18.1768	18.9054	19.4474	19.8162	19.9293	19.9187	19.6772	18.9652	18.0590	17.2873	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.5206	18.4594	19.0087	19.7538	20.3388	20.7476	20.9014	20.8752	20.5746	19.7963	18.8657	18.4973	(87)
Th 2	19.9104	19.9154	19.9203	19.9451	19.9501	19.9751	19.9751	19.9801	19.9650	19.9501	19.9401	19.9302	(88)
util rest of house	0.9266	0.8994	0.8543	0.7637	0.6374	0.4708	0.3309	0.3699	0.5859	0.8005	0.8971	0.9323	(89)
MIT 2	18.5710	17.6387	18.1768	18.9054	19.4474	19.8162	19.9293	19.9187	19.6772	18.9652	18.0590	17.6570	(90)
Living area fraction										fLA = Living area / (4) =		0.2056	(91)
MIT	18.7663	17.8074	18.3478	19.0798	19.6306	20.0077	20.1291	20.1153	19.8617	19.1360	18.2249	17.8297	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7663	17.8074	18.3478	19.0798	19.6306	20.0077	20.1291	20.1153	19.8617	19.1360	18.2249	17.8297	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9158	0.8703	0.8236	0.7372	0.6226	0.4730	0.3442	0.3819	0.5791	0.7733	0.8689	0.9121	(94)
Useful gains	595.9114	649.3608	685.3029	693.1332	625.7317	472.3015	328.9521	339.1532	468.6135	543.1759	556.0840	568.8159	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1533.4264	1361.2162	1243.0667	1040.5582	806.3674	535.2322	349.2998	365.7208	576.4916	867.9212	1143.1712	1415.2964	(97)
Space heating kWh	697.5112	478.3668	414.9762	250.1460	134.3930	0.0000	0.0000	0.0000	0.0000	241.6105	422.7028	629.7815	(98a)
Space heating requirement - total per year (kWh/year)												3269.4881	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	697.5112	478.3668	414.9762	250.1460	134.3930	0.0000	0.0000	0.0000	0.0000	241.6105	422.7028	629.7815	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3269.4881	
Space heating per m2											(98c) / (4) =	37.3827	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	286.3431 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	697.5112	478.3668	414.9762	250.1460	134.3930	0.0000	0.0000	0.0000	0.0000	241.6105	422.7028	629.7815	(98)
Space heating efficiency (main heating system 1)	286.3431	286.3431	286.3431	286.3431	286.3431	0.0000	0.0000	0.0000	0.0000	286.3431	286.3431	286.3431	(210)
Space heating fuel (main heating system)	243.5928	167.0607	144.9228	87.3589	46.9343	0.0000	0.0000	0.0000	0.0000	84.3780	147.6211	219.9395	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	93.6855	82.8316	87.8939	76.9723	74.4199	66.8421	65.7843	68.4991	69.3697	77.6181	82.8660	92.6172	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.3636	3.9413	4.3636	4.2228	4.3636	4.2228	4.3636	4.3636	4.2228	4.3636	4.2228	4.3636	(231)
Lighting	24.5730	19.7134	17.7497	13.0042	10.0448	8.2067	9.1632	11.9107	15.4708	20.2986	22.9272	25.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	1141.8080	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	284.9050	
Water heating fuel used	939.3997	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)		
mechanical ventilation fans (SFP = 0.1790)	51.3777	(230a)
Total electricity for the above, kWh/year	51.3777	(231)
Electricity for lighting (calculated in Appendix L)	198.3182	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2330.9037	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1141.8080	0.1549	176.9125	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	939.3997	0.1410	132.4256	(264)
Space and water heating			309.3381	(265)
Pumps, fans and electric keep-hot	51.3777	0.1387	7.1267	(267)
Energy for lighting	198.3182	0.1443	28.6234	(268)
Total CO2, kg/year			345.0882	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.9500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1141.8080	1.5736	1796.7338	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	939.3997	1.5213	1429.0647	(278)
Space and water heating			3225.7985	(279)
Pumps, fans and electric keep-hot	51.3777	1.5128	77.7242	(281)
Energy for lighting	198.3182	1.5338	304.1871	(282)
Total Primary energy kWh/year			3607.7098	(286)
Dwelling Primary energy Rate (DPER)			41.2500	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling							
Ground floor		43.7300 (1b)	x	2.5500 (2b)	=	111.5115	(1b) - (3b)
First floor		43.7300 (1c)	x	2.8300 (2c)	=	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.2674	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1275	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3775	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3209	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)

Adj infilt rate													
	0.4091	0.4011	0.3931	0.3530	0.3450	0.3048	0.3048	0.2968	0.3209	0.3450	0.3610	0.3770	(22b)
Effective ac	0.5837	0.5804	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711	(25)

---

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type			19.0900	1.1450	21.8588			(27)
GF			43.7300	0.1300	5.6849			(28a)
Main	110.7742	21.2400	89.5342	0.1800	16.1162			(29a)
PIJ	43.7300		43.7300	0.1100	4.8103			(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.6201			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 85.8955 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	14.5100	0.0500	0.7255	
E3 Sill	14.5100	0.0500	0.7255	
E4 Jamb	29.8400	0.0500	1.4920	
E5 Ground floor (normal)	20.5900	0.1600	3.2944	
E10 Eaves (insulation at ceiling level)	14.6000	0.0600	0.8760	
E12 Gable (insulation at ceiling level)	5.9900	0.0600	0.3594	
E16 Corner (normal)	10.7600	0.0900	0.9684	
E18 Party wall between dwellings	10.7600	0.0600	0.6456	
P1 Party wall - Ground floor	5.9900	0.0800	0.4792	
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.1200	0.7188	
E6 Intermediate floor within a dwelling	20.5900	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.2848	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	60.9049	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.3170	45.0647	44.8173	43.6557	43.4383	42.4266	42.4266	42.2392	42.8163	43.4383	43.8780	44.3377	(38)
Heat transfer coeff	106.2219	105.9696	105.7223	104.5606	104.3433	103.3315	103.3315	103.1441	103.7212	104.3433	104.7830	105.2426	(39)
Average = Sum(39)m / 12 =												104.5596	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2145	1.2116	1.2088	1.1955	1.1930	1.1815	1.1815	1.1793	1.1859	1.1930	1.1981	1.2033	(40)
HLP (average)												1.1955	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5893	(42)
Hot water usage for mixer showers													
	67.6343	66.6179	65.1368	62.3030	60.2117	57.8795	56.5538	58.0238	59.6350	62.1391	65.0338	67.3752	(42a)
Hot water usage for baths													
	29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)
Hot water usage for other uses													
	41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)
Average daily hot water use (litres/day)												126.8439	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	137.9899	135.0435	131.4552	125.9988	121.5679	116.8042	114.9735	118.5462	122.3142	127.3152	132.8557	137.6320	(44)
Energy conte	218.5423	192.3001	202.0418	172.4860	163.6537	143.6244	139.0504	146.7850	150.8257	172.7656	189.2773	215.4985	(45)
Energy content (annual)										Total = Sum(45)m =		2106.8508	
Distribution loss (46)m = 0.15 x (45)m													
	32.7813	28.8450	30.3063	25.8729	24.5481	21.5437	20.8576	22.0177	22.6239	25.9148	28.3916	32.3248	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6426	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8870	(55)
Total storage loss													
	27.4979	24.8369	27.4979	26.6109	27.4979	26.6109	27.4979	27.4979	26.6109	27.4979	26.6109	27.4979	(56)
If cylinder contains dedicated solar storage													
	27.4979	24.8369	27.4979	26.6109	27.4979	26.6109	27.4979	27.4979	26.6109	27.4979	26.6109	27.4979	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	269.3026	238.1481	252.8021	221.6090	214.4140	192.7473	189.8108	197.5453	199.9486	223.5259	238.4002	266.2588	(62)
WWHRS	-30.9196	-27.3455	-28.6347	-23.7106	-22.0975	-18.9090	-17.7241	-18.8478	-19.5639	-23.0637	-26.1284	-30.3470	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	238.3830	210.8026	224.1674	197.8983	192.3166	173.8384	172.0866	178.6975	180.3847	200.4622	212.2718	235.9118	(64)
										Total per year (kWh/year) = Sum(64)m =		2417.2209	(64)
12Total per year (kWh/year)												2417	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	113.2736	100.6182	107.7872	96.6499	95.0231	87.0534	86.8425	89.4143	89.4479	98.0528	102.2330	112.2615	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	118.2644	130.9356	118.2644	122.2065	118.2644	122.2065	118.2644	118.2644	122.2065	118.2644	122.2065	118.2644	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													

	234.3264	236.7580	230.6305	217.5858	201.1192	185.6429	175.3038	172.8722	178.9997	192.0444	208.5110	223.9873	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)													
	152.2494	149.7295	144.8752	134.2360	127.7193	120.9076	116.7239	120.1805	124.2332	131.7914	141.9903	150.8892	(72)
Total internal gains													
	569.6802	582.2631	558.6101	538.8684	511.9429	490.5970	472.1321	473.1571	487.2794	506.9403	537.5479	557.9809	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.6000	19.6403	0.6300	0.7000	0.7700	63.6246	(76)
West	8.4900	19.6403	0.6300	0.7000	0.7700	50.9597	(80)

Solar gains	114.5843	224.1512	369.1451	538.3761	659.8001	675.4228	643.0300	552.3533	429.3310	265.9743	142.8731	94.2285	(83)
Total gains	684.2645	806.4142	927.7552	1077.2444	1171.7429	1166.0198	1115.1621	1025.5104	916.6104	772.9145	680.4210	652.2094	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.6455	19.6923	19.7383	19.9576	19.9992	20.1950	20.1950	20.2317	20.1192	19.9992	19.9153	19.8283	
alpha	2.3097	2.3128	2.3159	2.3305	2.3333	2.3463	2.3463	2.3488	2.3413	2.3333	2.3277	2.3219	
util living area													
	0.9289	0.8983	0.8478	0.7537	0.6317	0.4908	0.3767	0.4187	0.6103	0.8075	0.9016	0.9353	(86)
MIT	18.1691	18.5559	19.1398	19.8649	20.4230	20.7759	20.9131	20.8863	20.6073	19.8443	18.8905	18.1080	(87)
Th 2	19.9084	19.9107	19.9130	19.9236	19.9256	19.9349	19.9349	19.9366	19.9313	19.9256	19.9215	19.9173	(88)
util rest of house													
	0.9197	0.8855	0.8286	0.7230	0.5857	0.4260	0.2952	0.3348	0.5469	0.7757	0.8870	0.9269	(89)
MIT 2	16.6258	17.1103	17.8364	18.7224	19.3724	19.7586	19.8850	19.8674	19.5973	18.7241	17.5456	16.5538	(90)
Living area fraction										fLA = Living area / (4) =		0.2056	(91)
MIT	16.9431	17.4075	18.1044	18.9573	19.5883	19.9677	20.0963	20.0768	19.8049	18.9544	17.8221	16.8733	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.9431	17.4075	18.1044	18.9573	19.5883	19.9677	20.0963	20.0768	19.8049	18.9544	17.8221	16.8733	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8842	0.8463	0.7887	0.6913	0.5699	0.4281	0.3080	0.3464	0.5387	0.7409	0.8488	0.8930	(94)
Useful gains	605.0532	682.4476	731.7367	744.6670	667.8221	499.1628	343.5218	355.2840	493.7427	572.6229	577.5182	582.4271	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1342.9696	1325.4119	1226.8417	1051.5951	823.0951	554.6541	361.2803	379.2433	591.7237	871.7217	1123.4926	1333.7762	(97)
Space heating kWh													
	549.0098	432.0720	368.3582	220.9882	115.5231	0.0000	0.0000	0.0000	0.0000	222.5295	393.1016	559.0037	(98a)
Space heating requirement - total per year (kWh/year)												2860.5862	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	549.0098	432.0720	368.3582	220.9882	115.5231	0.0000	0.0000	0.0000	0.0000	222.5295	393.1016	559.0037	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2860.5862	
Space heating per m2											(98c) / (4) =	32.7074	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	549.0098	432.0720	368.3582	220.9882	115.5231	0.0000	0.0000	0.0000	0.0000	222.5295	393.1016	559.0037	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	594.8102	468.1170	399.0879	239.4239	125.1605	0.0000	0.0000	0.0000	0.0000	241.0938	425.8955	605.6378	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	238.3830	210.8026	224.1674	197.8983	192.3166	173.8384	172.0866	178.6975	180.3847	200.4622	212.2718	235.9118	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.8681	85.6331	85.1661	84.3079	82.9551	79.8000	79.8000	79.8000	79.8000	84.2945	85.4219	85.9240	(217)
Fuel for water heating, kWh/month													
	277.6155	246.1694	263.2120	234.7329	231.8320	217.8426	215.6474	223.9317	226.0459	237.8116	248.4983	274.5586	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	24.5730	19.7134	17.7497	13.0042	10.0448	8.2067	9.1632	11.9107	15.4708	20.2986	22.9272	25.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-40.4681	-56.8289	-81.3729	-91.1293	-97.9537	-91.3009	-90.1428	-85.2277	-76.5407	-64.7751	-44.3982	-35.0109	(233a)

Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-23.5612	-49.4807	-98.1995	-147.2879	-194.5714	-195.4512	-193.1789	-163.6739	-120.0949	-70.7300	-31.4452	-18.6406 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3099.2266	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2897.8980	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	198.3182	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2161.4648	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4119.9781	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3099.2266	0.2100	650.8376	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2897.8980	0.2100	608.5586	(264)
Space and water heating			1259.3962	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	198.3182	0.1443	28.6234	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-855.1493	0.1347	-115.1661	
PV Unit electricity exported	-1306.3155	0.1259	-164.5086	
Total			-279.6747	(269)
Total CO2, kg/year			1020.2742	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.6700	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3099.2266	1.1300	3502.1261	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2897.8980	1.1300	3274.6247	(278)
Space and water heating			6776.7508	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	198.3182	1.5338	304.1871	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-855.1493	1.4977	-1280.7879	
PV Unit electricity exported	-1306.3155	0.4623	-603.8616	
Total			-1884.6496	(283)
Total Primary energy kWh/year			5326.3892	(286)
Target Primary Energy Rate (TPER)			60.9000	(287)

Full SAP Calculation Printout

Plot Reference	79841-06	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	2B3P (Semi)
Plot Address	Plot 6, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	83 B	**DER**	3.95	**TER**	11.67
Environmental	97 A	**% DER < TER**			66.15
CO_2 Emissions (t/year)	0.32	**DFEE**	40.01	**TFEE**	40.64
Compliance Check	See BREL	**% DFEE < TFEE**			1.55
% DPER < TPER	32.27	**DPER**	41.25	**TPER**	60.90

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	43.7300 (1b)	x	2.5500 (2b)	=	111.5115	(1b) - (3b)
First floor	43.7300 (1c)	x	2.8300 (2c)	=	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.2674	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1275	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3275	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2784	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3549	0.3480	0.3410	0.3062	0.2993	0.2645	0.2645	0.2575	0.2784	0.2993	0.3132	0.3271	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5630	0.5605	0.5581	0.5469	0.5448	0.5350	0.5350	0.5332	0.5387	0.5448	0.5490	0.5535	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.4900	1.1450	13.1565			(27)
Glazed Doors			7.6000	1.1450	8.7023			(27)
GF			43.7300	0.1100	4.8103	75.0000	3279.7500	(28a)
Main	110.7742	21.2400	89.5342	0.1900	17.0115	9.0000	805.8078	(29a)
PIJ	43.7300		43.7300	0.0900	3.9357	9.0000	393.5700	(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.7663			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000	20.0000	644.6000	(32)
Timber			113.8200			9.0000	1024.3800	(32c)
Timber			20.4000			9.0000	183.6000	(32c)
FF			43.7300			18.0000	787.1400	(32d)
GF			43.7300			9.0000	393.5700	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		7512.4178	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							85.8955	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.5100	0.0460	0.6675
E3 Sill	14.5100	0.0470	0.6820
E4 Jamb	29.8400	0.0530	1.5815
E5 Ground floor (normal)	20.5900	0.0680	1.4001
E10 Eaves (insulation at ceiling level)	14.6000	0.0910	1.3286
E12 Gable (insulation at ceiling level)	5.9900	0.0750	0.4492
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	5.9900	0.1160	0.6948
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.0460	0.2755
E6 Intermediate floor within a dwelling	20.5900	0.0540	1.1119

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2672 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.0334 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.7098	43.5198	43.3337	42.4594	42.2958	41.5343	41.5343	41.3932	41.8276	42.2958	42.6267	42.9727	(38)
Heat transfer coeff	102.7432	102.5533	102.3671	101.4928	101.3292	100.5677	100.5677	100.4267	100.8610	101.3292	101.6601	102.0061	(39)
Average = Sum(39)m / 12 =												101.4920	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1747	1.1726	1.1704	1.1604	1.1586	1.1499	1.1499	1.1483	1.1532	1.1586	1.1624	1.1663	(40)
HLP (average)												1.1604	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5893 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)
Hot water usage for other uses	41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)
Average daily hot water use (litres/day)												64.4873	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	70.3556	68.4255	66.3184	63.6958	61.3562	58.9247	58.4196	60.5225	62.6792	65.1761	67.8219	70.2568	(44)
Energy conte	111.4260	97.4370	101.9289	87.1964	82.5972	72.4549	70.6535	74.9395	77.2897	88.4434	96.6247	110.0052	(45)
Energy content (annual)										Total = Sum(45)m =		1070.9963	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	94.7121	82.8215	86.6396	74.1169	70.2076	61.5866	60.0554	63.6985	65.6963	75.1769	82.1310	93.5044	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	94.7121	82.8215	86.6396	74.1169	70.2076	61.5866	60.0554	63.6985	65.6963	75.1769	82.1310	93.5044	(64)
										Total per year (kWh/year) = Sum(64)m =		910.3469	(64)
12Total per year (kWh/year)												910	(64)
Electric shower(s)	54.1638	48.2604	52.6985	50.2896	51.2332	48.8715	50.5006	51.2332	50.2896	52.6985	51.7076	54.1638	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		616.1105	(64a)
Heat gains from water heating, kWh/month	37.2190	32.7705	34.8345	31.1016	30.3602	27.6145	27.6390	28.7329	28.9965	31.9689	33.4597	36.9171	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	118.2644	130.9356	118.2644	122.2065	118.2644	122.2065	118.2644	118.2644	122.2065	118.2644	122.2065	118.2644	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	234.3264	236.7580	230.6305	217.5858	201.1192	185.6429	175.3038	172.8722	178.9997	192.0444	208.5110	223.9873	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)	50.0255	48.7656	46.8206	43.1967	40.8067	38.3535	37.1492	38.6195	40.2729	42.9689	46.4717	49.6197	(72)
Total internal gains	464.4563	478.2991	457.5555	444.8290	422.0303	408.0430	392.5574	391.5962	403.3191	415.1177	439.0293	453.7114	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.0000	19.6403	0.3000	0.0000	0.7700	13.6107	(76)
West	8.4900	19.6403	0.3000	0.0000	0.7700	38.5183	(80)
East	7.6000	19.6403	0.3000	0.0000	0.7700	34.4804	(76)

Solar gains	86.6094	169.4264	279.0212	406.9358	498.7151	510.5236	486.0393	417.5006	324.5132	201.0387	107.9918	71.2234	(83)

Total gains	551.0658	647.7256	736.5767	851.7648	920.7454	918.5666	878.5967	809.0968	727.8323	616.1565	547.0211	524.9348	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.3107	20.3483	20.3853	20.5609	20.5941	20.7500	20.7500	20.7792	20.6897	20.5941	20.5270	20.4574	
alpha	2.3540	2.3566	2.3590	2.3707	2.3729	2.3833	2.3833	2.3853	2.3793	2.3729	2.3685	2.3638	
util living area	0.9521	0.9300	0.8934	0.8184	0.7116	0.5723	0.4496	0.4953	0.6882	0.8610	0.9325	0.9569	(86)
MIT	17.9934	18.3507	18.9111	19.6525	20.2709	20.6995	20.8790	20.8438	20.5036	19.6711	18.7101	17.9326	(87)
Th 2	19.9403	19.9420	19.9437	19.9518	19.9533	19.9603	19.9603	19.9616	19.9576	19.9533	19.9502	19.9470	(88)
util rest of house	0.9456	0.9206	0.8788	0.7928	0.6690	0.5054	0.3594	0.4045	0.6278	0.8356	0.9219	0.9510	(89)
MIT 2	17.1995	17.5515	18.1009	18.8189	19.3938	19.7696	19.9037	19.8841	19.6170	18.8539	17.9163	17.1438	(90)
Living area fraction										fLA = Living area / (4) =		0.2056	(91)
MIT	17.3627	17.7158	18.2674	18.9902	19.5741	19.9607	20.1042	20.0814	19.7992	19.0219	18.0795	17.3059	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.3627	17.7158	18.2674	18.9902	19.5741	19.9607	20.1042	20.0814	19.7992	19.0219	18.0795	17.3059	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9236	0.8945	0.8494	0.7650	0.6517	0.5054	0.3726	0.4157	0.6175	0.8075	0.8965	0.9304	(94)
Useful gains	508.9841	579.3716	625.6387	651.5923	600.0514	464.2360	327.3480	336.3579	449.4177	497.5398	490.3814	488.3771	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1342.1013	1314.3024	1204.5986	1024.0859	797.8752	539.1180	352.4118	369.7135	574.8297	853.3843	1116.1749	1336.8853	(97)
Space heating kWh	619.8392	493.8735	430.7461	268.1954	147.1809	0.0000	0.0000	0.0000	0.0000	264.7483	450.5713	631.2902	(98a)
Space heating requirement - total per year (kWh/year)												3306.4450	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	619.8392	493.8735	430.7461	268.1954	147.1809	0.0000	0.0000	0.0000	0.0000	264.7483	450.5713	631.2902	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3306.4450	
Space heating per m2											(98c) / (4) =	37.8052	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	945.3363	744.2009	763.2427	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7332	0.7948	0.7616	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	693.0782	591.5151	581.2933	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1027.4081	982.9876	904.0710	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	240.7176	291.2555	240.1466	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	60.1794	72.8139	60.0367	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												193.0299	(107)
Energy for space heating												37.8052	(99)
Energy for space cooling												2.2071	(108)
Total												40.0123	(109)
Fabric Energy Efficiency (DFEE)												40.0	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	43.7300	(1b)	x 2.5500	(2b) =	111.5115	(1b) - (3b)
First floor	43.7300	(1c)	x 2.8300	(2c) =	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		235.2674	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)

Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1275 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3775 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3209 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4091	0.4011	0.3931	0.3530	0.3450	0.3048	0.3048	0.2968	0.3209	0.3450	0.3610	0.3770	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		0.0000 (23c)

Effective ac	0.5837	0.5804	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type			19.0900	1.1450	21.8588			(27)
GF			43.7300	0.1300	5.6849			(28a)
Main	110.7742	21.2400	89.5342	0.1800	16.1162			(29a)
PIJ	43.7300		43.7300	0.1100	4.8103			(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.6201			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		85.8955 (35)
List of Thermal Bridges		

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.5100	0.0500	0.7255
E3 Sill	14.5100	0.0500	0.7255
E4 Jamb	29.8400	0.0500	1.4920
E5 Ground floor (normal)	20.5900	0.1600	3.2944
E10 Eaves (insulation at ceiling level)	14.6000	0.0600	0.8760
E12 Gable (insulation at ceiling level)	5.9900	0.0600	0.3594
E16 Corner (normal)	10.7600	0.0900	0.9684
E18 Party wall between dwellings	10.7600	0.0600	0.6456
P1 Party wall - Ground floor	5.9900	0.0800	0.4792
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.1200	0.7188
E6 Intermediate floor within a dwelling	20.5900	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.2848 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	60.9049 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.3170	45.0647	44.8173	43.6557	43.4383	42.4266	42.4266	42.2392	42.8163	43.4383	43.8780	44.3377	(38)
Heat transfer coeff	106.2219	105.9696	105.7223	104.5606	104.3433	103.3315	103.3315	103.1441	103.7212	104.3433	104.7830	105.2426	(39)
Average = Sum(39)m / 12 =												104.5596	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2145	1.2116	1.2088	1.1955	1.1930	1.1815	1.1815	1.1793	1.1859	1.1930	1.1981	1.2033	(40)
HLP (average)												1.1955	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.5893 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)
Hot water usage for other uses	41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)
Average daily hot water use (litres/day)												64.4873	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	70.3556	68.4255	66.3184	63.6958	61.3562	58.9247	58.4196	60.5225	62.6792	65.1761	67.8219	70.2568	(44)
Energy conte	111.4260	97.4370	101.9289	87.1964	82.5972	72.4549	70.6535	74.9395	77.2897	88.4434	96.6247	110.0052	(45)
Energy content (annual)										Total = Sum(45)m =		1070.9963	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	94.7121	82.8215	86.6396	74.1169	70.2076	61.5866	60.0554	63.6985	65.6963	75.1769	82.1310	93.5044	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	94.7121	82.8215	86.6396	74.1169	70.2076	61.5866	60.0554	63.6985	65.6963	75.1769	82.1310	93.5044	(64)
									Total per year (kWh/year) = Sum(64)m =			910.3469	(64)
12Total per year (kWh/year)												910	(64)

Electric shower(s)

	54.1638	48.2604	52.6985	50.2896	51.2332	48.8715	50.5006	51.2332	50.2896	52.6985	51.7076	54.1638 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												616.1105 (64a)
Heat gains from water heating, kWh/month												
	37.2190	32.7705	34.8345	31.1016	30.3602	27.6145	27.6390	28.7329	28.9965	31.9689	33.4597	36.9171 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	118.2644	130.9356	118.2644	122.2065	118.2644	122.2065	118.2644	118.2644	122.2065	118.2644	122.2065	118.2644	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	234.3264	236.7580	230.6305	217.5858	201.1192	185.6429	175.3038	172.8722	178.9997	192.0444	208.5110	223.9873	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)													
	50.0255	48.7656	46.8206	43.1967	40.8067	38.3535	37.1492	38.6195	40.2729	42.9689	46.4717	49.6197	(72)
Total internal gains													
	464.4563	478.2991	457.5555	444.8290	422.0303	408.0430	392.5574	391.5962	403.3191	415.1177	439.0293	453.7114	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.6000	19.6403	0.6300	0.7000	0.7700	63.6246	(76)
West	8.4900	19.6403	0.6300	0.7000	0.7700	50.9597	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	114.5843	224.1512	369.1451	538.3761	659.8001	675.4228	643.0300	552.3533	429.3310	265.9743	142.8731	94.2285	(83)
Total gains	579.0406	702.4503	826.7005	983.2051	1081.8304	1083.4658	1035.5874	943.9495	832.6501	681.0920	581.9024	547.9400	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000	(85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.6455	19.6923	19.7383	19.9576	19.9992	20.1950	20.1950	20.2317	20.1192	19.9992	19.9153	19.8283	
alpha	2.3097	2.3128	2.3159	2.3305	2.3333	2.3463	2.3463	2.3488	2.3413	2.3333	2.3277	2.3219	
util living area													
	0.9480	0.9202	0.8734	0.7821	0.6611	0.5180	0.4009	0.4474	0.6461	0.8407	0.9255	0.9536	(86)
MIT	17.9534	18.3617	18.9790	19.7571	20.3603	20.7480	20.9006	20.8687	20.5534	19.7150	18.7032	17.8894	(87)
Th 2	19.9084	19.9107	19.9130	19.9236	19.9256	19.9349	19.9349	19.9366	19.9313	19.9256	19.9215	19.9173	(88)
util rest of house													
	0.9409	0.9096	0.8565	0.7532	0.6157	0.4516	0.3155	0.3599	0.5831	0.8123	0.9138	0.9472	(89)
MIT 2	17.1400	17.5413	18.1435	18.8914	19.4438	19.7789	19.8899	19.8735	19.6314	18.8732	17.8904	17.0826	(90)
Living area fraction									fLA = Living area / (4) =			0.2056	(91)
MIT	17.3072	17.7100	18.3153	19.0693	19.6322	19.9782	20.0977	20.0781	19.8210	19.0463	18.0575	17.2484	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.3072	17.7100	18.3153	19.0693	19.6322	19.9782	20.0977	20.0781	19.8210	19.0463	18.0575	17.2484	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9174	0.8815	0.8256	0.7266	0.6021	0.4545	0.3292	0.3722	0.5759	0.7840	0.8868	0.9253	(94)
Useful gains	531.2217	619.2031	682.5330	714.4382	651.3609	492.4424	340.9147	351.3836	479.5377	533.9661	516.0422	506.9994	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1381.6513	1357.4659	1249.1362	1063.3119	827.6707	555.7328	361.4232	379.3746	593.3862	881.3100	1148.1613	1373.2531	(97)
Space heating kWh													
	632.7196	496.1126	421.5528	251.1891	131.1745	0.0000	0.0000	0.0000	0.0000	258.4239	455.1258	644.4928	(98a)
Space heating requirement - total per year (kWh/year)												3290.7910	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	632.7196	496.1126	421.5528	251.1891	131.1745	0.0000	0.0000	0.0000	0.0000	258.4239	455.1258	644.4928	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3290.7910	
Space heating per m2											(98c) / (4) =	37.6262	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	971.3160	764.6530	783.8953	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7763	0.8310	0.7988	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	754.0270	635.4170	626.2047	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1220.1474	1166.4832	1061.6911	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	335.6067	395.1133	324.0019	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	83.9017	98.7783	81.0005	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												263.6805	(107)

Energy for space heating	37.6262 (99)
Energy for space cooling	3.0149 (108)
Total	40.6411 (109)
Fabric Energy Efficiency (TFEE)	40.6 (109)

Full SAP Calculation Printout

Plot Reference	79841-06	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	2B3P (Semi)
Plot Address	Plot 6, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	83 B	**DER**	3.95	**TER**	11.67
Environmental	97 A	**% DER < TER**			66.15
CO_2 Emissions (t/year)	0.32	**DFEE**	40.01	**TFEE**	40.64
Compliance Check	See BREL	**% DFEE < TFEE**			1.55
% DPER < TPER	32.27	**DPER**	41.25	**TPER**	60.90

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	43.7300 (1b)	x	2.5500 (2b)	=	111.5115	(1b) - (3b)
First floor	43.7300 (1c)	x	2.8300 (2c)	=	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.2674	(5)

---

2. Ventilation rate

---

			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		3 * 10 =	30.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		30.0000 / (5) =	0.1275	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			4.0000	(17)
Infiltration rate			0.3275	(18)
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.2784	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3549	0.3480	0.3410	0.3062	0.2993	0.2645	0.2645	0.2575	0.2784	0.2993	0.3132	0.3271	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.6049	0.5980	0.5910	0.5562	0.5493	0.5145	0.5145	0.5075	0.5284	0.5493	0.5632	0.5771	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.4900	1.1450	13.1565			(27)
Glazed Doors			7.6000	1.1450	8.7023			(27)
GF			43.7300	0.1100	4.8103	75.0000	3279.7500	(28a)
Main	110.7742	21.2400	89.5342	0.1900	17.0115	9.0000	805.8078	(29a)
PIJ	43.7300		43.7300	0.0900	3.9357	9.0000	393.5700	(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.7663			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000	20.0000	644.6000	(32)
Timber			113.8200			9.0000	1024.3800	(32c)
Timber			20.4000			9.0000	183.6000	(32c)
FF			43.7300			18.0000	787.1400	(32d)
GF			43.7300			9.0000	393.5700	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7512.4178 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 85.8955 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.5100	0.0460	0.6675
E3 Sill	14.5100	0.0470	0.6820
E4 Jamb	29.8400	0.0530	1.5815
E5 Ground floor (normal)	20.5900	0.0680	1.4001
E10 Eaves (insulation at ceiling level)	14.6000	0.0910	1.3286
E12 Gable (insulation at ceiling level)	5.9900	0.0750	0.4492
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	5.9900	0.1160	0.6948
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.0460	0.2755
E6 Intermediate floor within a dwelling	20.5900	0.0540	1.1119

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2672 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.0334 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.9668	46.4264	45.8861	43.1844	42.6441	39.9424	39.9424	39.4020	41.0231	42.6441	43.7247	44.8054	(38)
Heat transfer coeff	106.0002	105.4599	104.9195	102.2178	101.6775	98.9758	98.9758	98.4355	100.0565	101.6775	102.7582	103.8389	(39)
Average = Sum(39)m / 12 =												102.0828	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2120	1.2058	1.1996	1.1687	1.1626	1.1317	1.1317	1.1255	1.1440	1.1626	1.1749	1.1873	(40)
HLP (average)												1.1672	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5893 (42)
Hot water usage for mixer showers

67.6343	66.6179	65.1368	62.3030	60.2117	57.8795	56.5538	58.0238	59.6350	62.1391	65.0338	67.3752	(42a)

Hot water usage for baths

29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)

Hot water usage for other uses

41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)

Average daily hot water use (litres/day) 126.8439 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.9899	135.0435	131.4552	125.9988	121.5679	116.8042	114.9735	118.5462	122.3142	127.3152	132.8557	137.6320	(44)
Energy conte	218.5423	192.3001	202.0418	172.4860	163.6537	143.6244	139.0504	146.7850	150.8257	172.7656	189.2773	215.4985	(45)
Energy content (annual)											Total = Sum(45)m =	2106.8508	
Distribution loss (46)m = 0.15 x (45)m	32.7813	28.8450	30.3063	25.8729	24.5481	21.5437	20.8576	22.0177	22.6239	25.9148	28.3916	32.3248	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(64)
										Total per year (kWh/year) = Sum(64)m =		2676.3968	(64)
12Total per year (kWh/year)												2676	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	111.3632	98.8927	105.8768	94.8012	93.1128	85.2047	84.9322	87.5039	87.5991	96.1425	100.3843	110.3512	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	118.2644	130.9356	118.2644	122.2065	118.2644	122.2065	118.2644	118.2644	122.2065	118.2644	122.2065	118.2644	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	234.3264	236.7580	230.6305	217.5858	201.1192	185.6429	175.3038	172.8722	178.9997	192.0444	208.5110	223.9873	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)	149.6818	147.1618	142.3075	131.6683	125.1516	118.3399	114.1562	117.6128	121.6655	129.2238	139.4227	148.3215	(72)
Total internal gains	564.1126	576.6954	553.0424	533.3007	506.3752	488.0294	469.5644	470.5894	484.7118	501.3726	531.9802	552.4132	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

East			3.0000		19.6403		0.3000		0.0000		0.7700		13.6107 (76)
West			8.4900		19.6403		0.3000		0.0000		0.7700		38.5183 (80)
East			7.6000		19.6403		0.3000		0.0000		0.7700		34.4804 (76)
Solar gains	86.6094	169.4264	279.0212	406.9358	498.7151	510.5236	486.0393	417.5006	324.5132	201.0387	107.9918	71.2234	(83)
Total gains	650.7220	746.1218	832.0636	940.2365	1005.0903	998.5530	955.6037	888.0900	809.2250	702.4113	639.9720	623.6366	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.6866	19.7875	19.8894	20.4151	20.5235	21.0838	21.0838	21.1995	20.8560	20.5235	20.3077	20.0964	
alpha	2.3124	2.3192	2.3260	2.3610	2.3682	2.4056	2.4056	2.4133	2.3904	2.3682	2.3538	2.3398	
util living area	0.9351	0.9109	0.8714	0.7915	0.6814	0.5358	0.4155	0.4552	0.6473	0.8296	0.9105	0.9402	(86)
Living	18.1081	18.4594	19.0087	19.7538	20.3388	20.7476	20.9014	20.8752	20.5746	19.7963	18.8657	18.0903	
Non living	17.2922	17.6387	18.1768	18.9054	19.4474	19.8162	19.9293	19.9187	19.6772	18.9652	18.0590	17.2873	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.5206	18.4594	19.0087	19.7538	20.3388	20.7476	20.9014	20.8752	20.5746	19.7963	18.8657	18.4973	(87)
Th 2	19.9104	19.9154	19.9203	19.9451	19.9501	19.9751	19.9751	19.9801	19.9650	19.9501	19.9401	19.9302	(88)
util rest of house	0.9266	0.8994	0.8543	0.7637	0.6374	0.4708	0.3309	0.3699	0.5859	0.8005	0.8971	0.9323	(89)
MIT 2	18.5710	17.6387	18.1768	18.9054	19.4474	19.8162	19.9293	19.9187	19.6772	18.9652	18.0590	17.6570	(90)
Living area fraction										fLA = Living area / (4) =		0.2056	(91)
MIT	18.7663	17.8074	18.3478	19.0798	19.6306	20.0077	20.1291	20.1153	19.8617	19.1360	18.2249	17.8297	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7663	17.8074	18.3478	19.0798	19.6306	20.0077	20.1291	20.1153	19.8617	19.1360	18.2249	17.8297	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9158	0.8703	0.8236	0.7372	0.6226	0.4730	0.3442	0.3819	0.5791	0.7733	0.8689	0.9121	(94)
Useful gains	595.9114	649.3608	685.3029	693.1332	625.7317	472.3015	328.9521	339.1532	468.6135	543.1759	556.0840	568.8159	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1533.4264	1361.2162	1243.0667	1040.5582	806.3674	535.2322	349.2998	365.7208	576.4916	867.9212	1143.1712	1415.2964	(97)
Space heating kWh	697.5112	478.3668	414.9762	250.1460	134.3930	0.0000	0.0000	0.0000	0.0000	241.6105	422.7028	629.7815	(98a)
Space heating requirement - total per year (kWh/year)												3269.4881	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	697.5112	478.3668	414.9762	250.1460	134.3930	0.0000	0.0000	0.0000	0.0000	241.6105	422.7028	629.7815	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3269.4881	
Space heating per m2											(98c) / (4) =	37.3827	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	286.3431 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	697.5112	478.3668	414.9762	250.1460	134.3930	0.0000	0.0000	0.0000	0.0000	241.6105	422.7028	629.7815	(98)
Space heating efficiency (main heating system 1)	286.3431	286.3431	286.3431	286.3431	286.3431	0.0000	0.0000	0.0000	0.0000	286.3431	286.3431	286.3431	(210)
Space heating fuel (main heating system)	243.5928	167.0607	144.9228	87.3589	46.9343	0.0000	0.0000	0.0000	0.0000	84.3780	147.6211	219.9395	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	93.6855	82.8316	87.8939	76.9723	74.4199	66.8421	65.7843	68.4991	69.3697	77.6181	82.8660	92.6172	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.3636	3.9413	4.3636	4.2228	4.3636	4.2228	4.3636	4.3636	4.2228	4.3636	4.2228	4.3636	(231)
Lighting	24.5730	19.7134	17.7497	13.0042	10.0448	8.2067	9.1632	11.9107	15.4708	20.2986	22.9272	25.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	1141.8080	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	284.9050	
Water heating fuel used	939.3997	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)		
mechanical ventilation fans (SFP = 0.1790)	51.3777	(230a)
Total electricity for the above, kWh/year	51.3777	(231)
Electricity for lighting (calculated in Appendix L)	198.3182	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2330.9037	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1141.8080	0.1549	176.9125	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	939.3997	0.1410	132.4256	(264)
Space and water heating			309.3381	(265)
Pumps, fans and electric keep-hot	51.3777	0.1387	7.1267	(267)
Energy for lighting	198.3182	0.1443	28.6234	(268)
Total CO2, kg/year			345.0882	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.9500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1141.8080	1.5736	1796.7338	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	939.3997	1.5213	1429.0647	(278)
Space and water heating			3225.7985	(279)
Pumps, fans and electric keep-hot	51.3777	1.5128	77.7242	(281)
Energy for lighting	198.3182	1.5338	304.1871	(282)
Total Primary energy kWh/year			3607.7098	(286)
Dwelling Primary energy Rate (DPER)			41.2500	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling							
Ground floor		43.7300 (1b)	x	2.5500 (2b)	=	111.5115	(1b) - (3b)
First floor		43.7300 (1c)	x	2.8300 (2c)	=	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.2674	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1275	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3775	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3209	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)

Adj infilt rate													
	0.4091	0.4011	0.3931	0.3530	0.3450	0.3048	0.3048	0.2968	0.3209	0.3450	0.3610	0.3770	(22b)
Effective ac	0.5837	0.5804	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711	(25)

---

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type			19.0900	1.1450	21.8588			(27)
GF			43.7300	0.1300	5.6849			(28a)
Main	110.7742	21.2400	89.5342	0.1800	16.1162			(29a)
PIJ	43.7300		43.7300	0.1100	4.8103			(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.6201			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 85.8955 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	14.5100	0.0500	0.7255	
E3 Sill	14.5100	0.0500	0.7255	
E4 Jamb	29.8400	0.0500	1.4920	
E5 Ground floor (normal)	20.5900	0.1600	3.2944	
E10 Eaves (insulation at ceiling level)	14.6000	0.0600	0.8760	
E12 Gable (insulation at ceiling level)	5.9900	0.0600	0.3594	
E16 Corner (normal)	10.7600	0.0900	0.9684	
E18 Party wall between dwellings	10.7600	0.0600	0.6456	
P1 Party wall - Ground floor	5.9900	0.0800	0.4792	
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.1200	0.7188	
E6 Intermediate floor within a dwelling	20.5900	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.2848	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	60.9049	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.3170	45.0647	44.8173	43.6557	43.4383	42.4266	42.4266	42.2392	42.8163	43.4383	43.8780	44.3377	(38)
Heat transfer coeff	106.2219	105.9696	105.7223	104.5606	104.3433	103.3315	103.3315	103.1441	103.7212	104.3433	104.7830	105.2426	(39)
Average = Sum(39)m / 12 =												104.5596	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2145	1.2116	1.2088	1.1955	1.1930	1.1815	1.1815	1.1793	1.1859	1.1930	1.1981	1.2033	(40)
HLP (average)												1.1955	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5893	(42)
Hot water usage for mixer showers													
	67.6343	66.6179	65.1368	62.3030	60.2117	57.8795	56.5538	58.0238	59.6350	62.1391	65.0338	67.3752	(42a)
Hot water usage for baths													
	29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)
Hot water usage for other uses													
	41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)
Average daily hot water use (litres/day)												126.8439	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	137.9899	135.0435	131.4552	125.9988	121.5679	116.8042	114.9735	118.5462	122.3142	127.3152	132.8557	137.6320	(44)
Energy conte	218.5423	192.3001	202.0418	172.4860	163.6537	143.6244	139.0504	146.7850	150.8257	172.7656	189.2773	215.4985	(45)
Energy content (annual)										Total = Sum(45)m =		2106.8508	
Distribution loss (46)m = 0.15 x (45)m													
	32.7813	28.8450	30.3063	25.8729	24.5481	21.5437	20.8576	22.0177	22.6239	25.9148	28.3916	32.3248	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6426	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8870	(55)
Total storage loss													
	27.4979	24.8369	27.4979	26.6109	27.4979	26.6109	27.4979	27.4979	26.6109	27.4979	26.6109	27.4979	(56)
If cylinder contains dedicated solar storage													
	27.4979	24.8369	27.4979	26.6109	27.4979	26.6109	27.4979	27.4979	26.6109	27.4979	26.6109	27.4979	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	269.3026	238.1481	252.8021	221.6090	214.4140	192.7473	189.8108	197.5453	199.9486	223.5259	238.4002	266.2588	(62)
WWHRS	-30.9196	-27.3455	-28.6347	-23.7106	-22.0975	-18.9090	-17.7241	-18.8478	-19.5639	-23.0637	-26.1284	-30.3470	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	238.3830	210.8026	224.1674	197.8983	192.3166	173.8384	172.0866	178.6975	180.3847	200.4622	212.2718	235.9118	(64)
										Total per year (kWh/year) = Sum(64)m =		2417.2209	(64)
12Total per year (kWh/year)												2417	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	113.2736	100.6182	107.7872	96.6499	95.0231	87.0534	86.8425	89.4143	89.4479	98.0528	102.2330	112.2615	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	118.2644	130.9356	118.2644	122.2065	118.2644	122.2065	118.2644	118.2644	122.2065	118.2644	122.2065	118.2644	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													

	234.3264	236.7580	230.6305	217.5858	201.1192	185.6429	175.3038	172.8722	178.9997	192.0444	208.5110	223.9873	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)													
	152.2494	149.7295	144.8752	134.2360	127.7193	120.9076	116.7239	120.1805	124.2332	131.7914	141.9903	150.8892	(72)
Total internal gains													
	569.6802	582.2631	558.6101	538.8684	511.9429	490.5970	472.1321	473.1571	487.2794	506.9403	537.5479	557.9809	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.6000	19.6403	0.6300	0.7000	0.7700	63.6246	(76)
West	8.4900	19.6403	0.6300	0.7000	0.7700	50.9597	(80)

Solar gains	114.5843	224.1512	369.1451	538.3761	659.8001	675.4228	643.0300	552.3533	429.3310	265.9743	142.8731	94.2285	(83)
Total gains	684.2645	806.4142	927.7552	1077.2444	1171.7429	1166.0198	1115.1621	1025.5104	916.6104	772.9145	680.4210	652.2094	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.6455	19.6923	19.7383	19.9576	19.9992	20.1950	20.1950	20.2317	20.1192	19.9992	19.9153	19.8283	
alpha	2.3097	2.3128	2.3159	2.3305	2.3333	2.3463	2.3463	2.3488	2.3413	2.3333	2.3277	2.3219	
util living area													
	0.9289	0.8983	0.8478	0.7537	0.6317	0.4908	0.3767	0.4187	0.6103	0.8075	0.9016	0.9353	(86)
MIT	18.1691	18.5559	19.1398	19.8649	20.4230	20.7759	20.9131	20.8863	20.6073	19.8443	18.8905	18.1080	(87)
Th 2	19.9084	19.9107	19.9130	19.9236	19.9256	19.9349	19.9349	19.9366	19.9313	19.9256	19.9215	19.9173	(88)
util rest of house													
	0.9197	0.8855	0.8286	0.7230	0.5857	0.4260	0.2952	0.3348	0.5469	0.7757	0.8870	0.9269	(89)
MIT 2	16.6258	17.1103	17.8364	18.7224	19.3724	19.7586	19.8850	19.8674	19.5973	18.7241	17.5456	16.5538	(90)
Living area fraction										fLA = Living area / (4) =		0.2056	(91)
MIT	16.9431	17.4075	18.1044	18.9573	19.5883	19.9677	20.0963	20.0768	19.8049	18.9544	17.8221	16.8733	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.9431	17.4075	18.1044	18.9573	19.5883	19.9677	20.0963	20.0768	19.8049	18.9544	17.8221	16.8733	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8842	0.8463	0.7887	0.6913	0.5699	0.4281	0.3080	0.3464	0.5387	0.7409	0.8488	0.8930	(94)
Useful gains	605.0532	682.4476	731.7367	744.6670	667.8221	499.1628	343.5218	355.2840	493.7427	572.6229	577.5182	582.4271	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1342.9696	1325.4119	1226.8417	1051.5951	823.0951	554.6541	361.2803	379.2433	591.7237	871.7217	1123.4926	1333.7762	(97)
Space heating kWh													
	549.0098	432.0720	368.3582	220.9882	115.5231	0.0000	0.0000	0.0000	0.0000	222.5295	393.1016	559.0037	(98a)
Space heating requirement - total per year (kWh/year)												2860.5862	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	549.0098	432.0720	368.3582	220.9882	115.5231	0.0000	0.0000	0.0000	0.0000	222.5295	393.1016	559.0037	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2860.5862	
Space heating per m2											(98c) / (4) =	32.7074	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	549.0098	432.0720	368.3582	220.9882	115.5231	0.0000	0.0000	0.0000	0.0000	222.5295	393.1016	559.0037	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	594.8102	468.1170	399.0879	239.4239	125.1605	0.0000	0.0000	0.0000	0.0000	241.0938	425.8955	605.6378	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	238.3830	210.8026	224.1674	197.8983	192.3166	173.8384	172.0866	178.6975	180.3847	200.4622	212.2718	235.9118	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.8681	85.6331	85.1661	84.3079	82.9551	79.8000	79.8000	79.8000	79.8000	84.2945	85.4219	85.9240	(217)
Fuel for water heating, kWh/month													
	277.6155	246.1694	263.2120	234.7329	231.8320	217.8426	215.6474	223.9317	226.0459	237.8116	248.4983	274.5586	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	24.5730	19.7134	17.7497	13.0042	10.0448	8.2067	9.1632	11.9107	15.4708	20.2986	22.9272	25.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-40.4681	-56.8289	-81.3729	-91.1293	-97.9537	-91.3009	-90.1428	-85.2277	-76.5407	-64.7751	-44.3982	-35.0109	(233a)

Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-23.5612	-49.4807	-98.1995	-147.2879	-194.5714	-195.4512	-193.1789	-163.6739	-120.0949	-70.7300	-31.4452	-18.6406 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3099.2266	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2897.8980	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	198.3182	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2161.4648	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4119.9781	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3099.2266	0.2100	650.8376	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2897.8980	0.2100	608.5586	(264)
Space and water heating			1259.3962	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	198.3182	0.1443	28.6234	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-855.1493	0.1347	-115.1661	
PV Unit electricity exported	-1306.3155	0.1259	-164.5086	
Total			-279.6747	(269)
Total CO2, kg/year			1020.2742	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.6700	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3099.2266	1.1300	3502.1261	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2897.8980	1.1300	3274.6247	(278)
Space and water heating			6776.7508	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	198.3182	1.5338	304.1871	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-855.1493	1.4977	-1280.7879	
PV Unit electricity exported	-1306.3155	0.4623	-603.8616	
Total			-1884.6496	(283)
Total Primary energy kWh/year			5326.3892	(286)
Target Primary Energy Rate (TPER)			60.9000	(287)

Full SAP Calculation Printout

Plot Reference	79841-06	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	2B3P (Semi)
Plot Address	Plot 6, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	83 B	**DER**	3.95	**TER**	11.67
Environmental	97 A	**% DER < TER**			66.15
CO_2 Emissions (t/year)	0.32	**DFEE**	40.01	**TFEE**	40.64
Compliance Check	See BREL	**% DFEE < TFEE**			1.55
% DPER < TPER	32.27	**DPER**	41.25	**TPER**	60.90

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	43.7300 (1b)	x	2.5500 (2b)	=	111.5115	(1b) - (3b)
First floor	43.7300 (1c)	x	2.8300 (2c)	=	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.2674	(5)

---

2. Ventilation rate

---

			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		3 * 10 =	30.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		30.0000 / (5) =	0.1275	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			4.0000	(17)
Infiltration rate			0.3275	(18)
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.2784	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3549	0.3480	0.3410	0.3062	0.2993	0.2645	0.2645	0.2575	0.2784	0.2993	0.3132	0.3271	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.6049	0.5980	0.5910	0.5562	0.5493	0.5145	0.5145	0.5075	0.5284	0.5493	0.5632	0.5771	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.4900	1.1450	13.1565			(27)
Glazed Doors			7.6000	1.1450	8.7023			(27)
GF			43.7300	0.1100	4.8103	75.0000	3279.7500	(28a)
Main	110.7742	21.2400	89.5342	0.1900	17.0115	9.0000	805.8078	(29a)
PIJ	43.7300		43.7300	0.0900	3.9357	9.0000	393.5700	(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.7663			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000	20.0000	644.6000	(32)
Timber			113.8200			9.0000	1024.3800	(32c)
Timber			20.4000			9.0000	183.6000	(32c)
FF			43.7300			18.0000	787.1400	(32d)
GF			43.7300			9.0000	393.5700	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7512.4178 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 85.8955 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.5100	0.0460	0.6675
E3 Sill	14.5100	0.0470	0.6820
E4 Jamb	29.8400	0.0530	1.5815
E5 Ground floor (normal)	20.5900	0.0680	1.4001
E10 Eaves (insulation at ceiling level)	14.6000	0.0910	1.3286
E12 Gable (insulation at ceiling level)	5.9900	0.0750	0.4492
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	5.9900	0.1160	0.6948
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.0460	0.2755
E6 Intermediate floor within a dwelling	20.5900	0.0540	1.1119

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2672 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.0334 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.9668	46.4264	45.8861	43.1844	42.6441	39.9424	39.9424	39.4020	41.0231	42.6441	43.7247	44.8054	(38)
Heat transfer coeff	106.0002	105.4599	104.9195	102.2178	101.6775	98.9758	98.9758	98.4355	100.0565	101.6775	102.7582	103.8389	(39)
Average = Sum(39)m / 12 =												102.0828	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2120	1.2058	1.1996	1.1687	1.1626	1.1317	1.1317	1.1255	1.1440	1.1626	1.1749	1.1873	(40)
HLP (average)												1.1672	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5893 (42)
Hot water usage for mixer showers

67.6343	66.6179	65.1368	62.3030	60.2117	57.8795	56.5538	58.0238	59.6350	62.1391	65.0338	67.3752	(42a)

Hot water usage for baths

29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)

Hot water usage for other uses

41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)

Average daily hot water use (litres/day) 126.8439 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.9899	135.0435	131.4552	125.9988	121.5679	116.8042	114.9735	118.5462	122.3142	127.3152	132.8557	137.6320	(44)
Energy conte	218.5423	192.3001	202.0418	172.4860	163.6537	143.6244	139.0504	146.7850	150.8257	172.7656	189.2773	215.4985	(45)
Energy content (annual)										Total = Sum(45)m =		2106.8508	
Distribution loss (46)m = 0.15 x (45)m	32.7813	28.8450	30.3063	25.8729	24.5481	21.5437	20.8576	22.0177	22.6239	25.9148	28.3916	32.3248	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(64)
										Total per year (kWh/year) = Sum(64)m =		2676.3968	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	111.3632	98.8927	105.8768	94.8012	93.1128	85.2047	84.9322	87.5039	87.5991	96.1425	100.3843	110.3512	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.0740	24.9351	20.2786	15.3522	11.4759	9.6885	10.4687	13.6077	18.2642	23.1905	27.0668	28.8543	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	349.7409	353.3701	344.2246	324.7549	300.1779	277.0790	261.6475	258.0183	267.1638	286.6335	311.2105	334.3094	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)	149.6818	147.1618	142.3075	131.6683	125.1516	118.3399	114.1562	117.6128	121.6655	129.2238	139.4227	148.3215	(72)
Total internal gains	632.4087	630.3790	611.7227	576.6874	541.7174	510.0193	491.1844	494.1507	512.0054	543.9598	582.6119	616.3971	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.0000	19.6403	0.3000	0.0000	0.7700	13.6107	(76)

West				8.4900	19.6403	0.3000	0.0000	0.7700				38.5183	(80)
East				7.6000	19.6403	0.3000	0.0000	0.7700				34.4804	(76)
Solar gains	86.6094	169.4264	279.0212	406.9358	498.7151	510.5236	486.0393	417.5006	324.5132	201.0387	107.9918	71.2234	(83)
Total gains	719.0181	799.8054	890.7439	983.6232	1040.4325	1020.5430	977.2237	911.6513	836.5186	744.9985	690.6037	687.6205	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.6866	19.7875	19.8894	20.4151	20.5235	21.0838	21.0838	21.1995	20.8560	20.5235	20.3077	20.0964	
alpha	2.3124	2.3192	2.3260	2.3610	2.3682	2.4056	2.4056	2.4133	2.3904	2.3682	2.3538	2.3398	
util living area	0.9221	0.8994	0.8565	0.7780	0.6688	0.5276	0.4079	0.4458	0.6349	0.8139	0.8977	0.9282	(86)
Living	18.2439	18.5585	19.1033	19.8070	20.3668	20.7562	20.9053	20.8808	20.5932	19.8561	18.9597	18.2208	
Non living	17.4239	17.7339	18.2659	18.9532	19.4704	19.8221	19.9313	19.9217	19.6910	19.0188	18.1487	17.4142	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.5901	18.5585	19.1033	19.8070	20.3668	20.7562	20.9053	20.8808	20.5932	19.8561	18.9597	18.6095	(87)
Th 2	19.9104	19.9154	19.9203	19.9451	19.9501	19.9751	19.9751	19.9801	19.9650	19.9501	19.9401	19.9302	(88)
util rest of house	0.9122	0.8867	0.8380	0.7492	0.6244	0.4629	0.3244	0.3617	0.5732	0.7832	0.8828	0.9190	(89)
MIT 2	18.6384	17.7339	18.2659	18.9532	19.4704	19.8221	19.9313	19.9217	19.6910	19.0188	18.1487	17.7661	(90)
Living area fraction									fLA = Living area / (4) =			0.2056	(91)
MIT	18.8341	17.9035	18.4380	19.1287	19.6546	20.0141	20.1315	20.1189	19.8765	19.1910	18.3154	17.9395	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8341	17.9035	18.4380	19.1287	19.6546	20.0141	20.1315	20.1189	19.8765	19.1910	18.3154	17.9395	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9005	0.8567	0.8072	0.7236	0.6107	0.4655	0.3377	0.3737	0.5674	0.7568	0.8537	0.8971	(94)
Useful gains	647.4596	685.2036	719.0477	711.7549	635.3708	475.0557	330.0172	340.7173	474.6623	563.7859	589.5519	616.8669	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1540.6142	1371.3424	1252.5307	1045.5591	808.8081	535.8682	349.5354	366.0694	577.9733	873.5081	1152.4766	1426.6951	(97)
Space heating kWh	664.5070	461.0852	396.9114	240.3390	129.0373	0.0000	0.0000	0.0000	0.0000	230.4333	405.3058	602.5122	(98a)
Space heating requirement - total per year (kWh/year)												3130.1313	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	664.5070	461.0852	396.9114	240.3390	129.0373	0.0000	0.0000	0.0000	0.0000	230.4333	405.3058	602.5122	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3130.1313	
Space heating per m2											(98c) / (4) =	35.7893	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												286.3431	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement	664.5070	461.0852	396.9114	240.3390	129.0373	0.0000	0.0000	0.0000	0.0000	230.4333	405.3058	602.5122	(98)
Space heating efficiency (main heating system 1)	286.3431	286.3431	286.3431	286.3431	286.3431	0.0000	0.0000	0.0000	0.0000	286.3431	286.3431	286.3431	(210)
Space heating fuel (main heating system)	232.0667	161.0255	138.6139	83.9339	45.0639	0.0000	0.0000	0.0000	0.0000	80.4745	141.5455	210.4162	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	93.6855	82.8316	87.8939	76.9723	74.4199	66.8421	65.7843	68.4991	69.3697	77.6181	82.8660	92.6172	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.3636	3.9413	4.3636	4.2228	4.3636	4.2228	4.3636	4.3636	4.2228	4.3636	4.2228	4.3636	(231)
Lighting	24.5730	19.7134	17.7497	13.0042	10.0448	8.2067	9.1632	11.9107	15.4708	20.2986	22.9272	25.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1093.1402	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	284.9050	
Water heating fuel used	939.3997	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)		
mechanical ventilation fans (SFP = 0.1790)	51.3777	(230a)
Total electricity for the above, kWh/year	51.3777	(231)
Electricity for lighting (calculated in Appendix L)	198.3182	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2282.2359	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1093.1402	16.4900	180.2588	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	939.3997	16.4900	154.9070	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	51.3777	16.4900	8.4722	(249)
Energy for lighting	198.3182	16.4900	32.7027	(250)
Additional standing charges			0.0000	(251)
Total energy cost			376.3407	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0228	(257)
SAP value		83.4201	
SAP rating (Section 12)		83	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1093.1402	0.1549	169.3656	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	939.3997	0.1410	132.4256	(264)
Space and water heating			301.7912	(265)
Pumps, fans and electric keep-hot	51.3777	0.1387	7.1267	(267)
Energy for lighting	198.3182	0.1443	28.6234	(268)
Total CO2, kg/year			337.5414	(272)
CO2 emissions per m2			3.8600	(273)
EI value			96.5853	
EI rating			97	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	43.7300	(1b)	x 2.5500	(2b) =	111.5115	(1b) - (3b)
First floor	43.7300	(1c)	x 2.8300	(2c) =	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		235.2674	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 30.0000 / (5) =	0.1275	(8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	4.0000	(17)
Infiltration rate	0.3275	(18)
Number of sides sheltered	2	(19)
Shelter factor (20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) =	0.2784	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.5000	4.4000	4.4000	4.0000	4.1000	3.5000	3.4000	3.4000	3.5000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1250	1.1000	1.1000	1.0000	1.0250	0.8750	0.8500	0.8500	0.8750	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.3132	0.3062	0.3062	0.2784	0.2853	0.2436	0.2366	0.2366	0.2436	0.2714	0.2714	0.2784	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
Effective ac	0.5632	0.5562	0.5562	0.5284	0.5353	0.5000	0.5000	0.5000	0.5000	0.5214	0.5214	0.5284	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.4900	1.1450	13.1565			(27)
Glazed Doors			7.6000	1.1450	8.7023			(27)
GF			43.7300	0.1100	4.8103	75.0000	3279.7500	(28a)
Main	110.7742	21.2400	89.5342	0.1900	17.0115	9.0000	805.8078	(29a)
PIJ	43.7300		43.7300	0.0900	3.9357	9.0000	393.5700	(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.7663			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000	20.0000	644.6000	(32)
Timber			113.8200			9.0000	1024.3800	(32c)
Timber			20.4000			9.0000	183.6000	(32c)
FF			43.7300			18.0000	787.1400	(32d)
GF			43.7300			9.0000	393.5700	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) =	7512.4178	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	85.8955	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.5100	0.0460	0.6675
E3 Sill	14.5100	0.0470	0.6820
E4 Jamb	29.8400	0.0530	1.5815
E5 Ground floor (normal)	20.5900	0.0680	1.4001
E10 Eaves (insulation at ceiling level)	14.6000	0.0910	1.3286
E12 Gable (insulation at ceiling level)	5.9900	0.0750	0.4492
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	5.9900	0.1160	0.6948
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.0460	0.2755
E6 Intermediate floor within a dwelling	20.5900	0.0540	1.1119

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2672	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	59.0334	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.7247	43.1844	43.1844	41.0231	41.5634	38.8191	38.8191	38.8191	38.8191	40.4827	40.4827	41.0231	(38)
Heat transfer coeff	102.7582	102.2178	102.2178	100.0565	100.5968	97.8526	97.8526	97.8526	97.8526	99.5162	99.5162	100.0565	(39)
Average = Sum(39)m / 12 =												99.8622	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1749	1.1687	1.1687	1.1440	1.1502	1.1188	1.1188	1.1188	1.1188	1.1378	1.1378	1.1440	(40)
HLP (average)												1.1418	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5893	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	67.6343	66.6179	65.1368	62.3030	60.2117	57.8795	56.5538	58.0238	59.6350	62.1391	65.0338	67.3752	(42a)
Hot water usage for baths	29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)
Hot water usage for other uses	41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)
Average daily hot water use (litres/day)												126.8439	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.9899	135.0435	131.4552	125.9988	121.5679	116.8042	114.9735	118.5462	122.3142	127.3152	132.8557	137.6320	(44)
Energy conte	218.5423	192.3001	202.0418	172.4860	163.6537	143.6244	139.0504	146.7850	150.8257	172.7656	189.2773	215.4985	(45)
Energy content (annual)										Total = Sum(45)m =		2106.8508	
Distribution loss (46)m = 0.15 x (45)m	32.7813	28.8450	30.3063	25.8729	24.5481	21.5437	20.8576	22.0177	22.6239	25.9148	28.3916	32.3248	(46)

Water storage loss (or HIU loss):		
Store volume	198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.5000	(48)
Temperature factor from Table 2b	0.5400	(49)
Enter (49) or (54) in (55)	0.8100	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)

PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(64)
									Total per year (kWh/year) = Sum(64)m =			2676.3968	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =				0.0000	(64a)
Heat gains from water heating, kWh/month													
	111.3632	98.8927	105.8768	94.8012	93.1128	85.2047	84.9322	87.5039	87.5991	96.1425	100.3843	110.3512	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.0740	24.9351	20.2786	15.3522	11.4759	9.6885	10.4687	13.6077	18.2642	23.1905	27.0668	28.8543	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	349.7409	353.3701	344.2246	324.7549	300.1779	277.0790	261.6475	258.0183	267.1638	286.6335	311.2105	334.3094	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)													
	149.6818	147.1618	142.3075	131.6683	125.1516	118.3399	114.1562	117.6128	121.6655	129.2238	139.4227	148.3215	(72)
Total internal gains													
	632.4087	630.3790	611.7227	576.6874	541.7174	510.0193	491.1844	494.1507	512.0054	543.9598	582.6119	616.3971	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.0000	17.3606	0.3000	0.0000	0.7700	12.0309	(76)
West	8.4900	17.3606	0.3000	0.0000	0.7700	34.0474	(80)
East	7.6000	17.3606	0.3000	0.0000	0.7700	30.4782	(76)

Solar gains	76.5565	153.6258	267.2216	395.8729	469.9406	495.0205	460.1381	390.7168	318.6765	194.8089	101.3691	67.7785	(83)
Total gains	708.9652	784.0048	878.9443	972.5604	1011.6580	1005.0398	951.3225	884.8675	830.6819	738.7687	683.9810	684.1756	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.3077	20.4151	20.4151	20.8560	20.7440	21.3258	21.3258	21.3258	21.3258	20.9693	20.9693	20.8560	
alpha	2.3538	2.3610	2.3610	2.3904	2.3829	2.4217	2.4217	2.4217	2.4217	2.3980	2.3980	2.3904	
util living area													
	0.9165	0.8929	0.8450	0.7561	0.6343	0.4800	0.3736	0.4143	0.6088	0.7960	0.8890	0.9223	(86)
Living	18.4903	18.7886	19.3104	19.9905	20.5077	20.8309	20.9325	20.9108	20.6639	20.0090	19.1686	18.4723	
Non living	17.6858	17.9793	18.4835	19.1404	19.6037	19.8885	19.9580	19.9466	19.7662	19.1769	18.3724	17.6843	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.7161	18.7886	19.3104	19.9905	20.5077	20.8309	20.9325	20.9108	20.6639	20.0090	19.1686	18.8258	(87)
Th 2	19.9401	19.9451	19.9451	19.9650	19.9600	19.9855	19.9855	19.9855	19.9855	19.9700	19.9700	19.9650	(88)
util rest of house													
	0.9056	0.8792	0.8249	0.7240	0.5836	0.4090	0.2856	0.3241	0.5438	0.7619	0.8726	0.9123	(89)
MIT 2	18.7869	17.9793	18.4835	19.1404	19.6037	19.8885	19.9580	19.9466	19.7662	19.1769	18.3724	18.0033	(90)
Living area fraction										fLA = Living area / (4) =		0.2056	(91)
MIT	18.9779	18.1456	18.6535	19.3152	19.7895	20.0822	20.1584	20.1448	19.9508	19.3480	18.5361	18.1724	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9779	18.1456	18.6535	19.3152	19.7895	20.0822	20.1584	20.1448	19.9508	19.3480	18.5361	18.1724	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8940	0.8496	0.7952	0.7012	0.5746	0.4162	0.3012	0.3390	0.5414	0.7378	0.8440	0.8904	(94)
Useful gains	633.7905	666.0991	698.9196	681.9735	581.3000	418.2543	286.5626	299.9722	449.7067	545.0560	577.3130	609.1797	(95)
Ext temp.	5.0000	5.6000	7.2000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.2000	7.7000	4.8000	(96)
Heat loss rate W													
	1436.3453	1282.3892	1170.7484	962.0629	713.1837	458.1691	299.2699	317.5112	533.3708	810.8551	1078.3641	1337.9949	(97)
Space heating kWh													
	597.1007	414.1470	351.0406	201.6644	98.1214	0.0000	0.0000	0.0000	0.0000	197.7545	360.7568	542.2385	(98a)
Space heating requirement - total per year (kWh/year)												2762.8240	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	597.1007	414.1470	351.0406	201.6644	98.1214	0.0000	0.0000	0.0000	0.0000	197.7545	360.7568	542.2385	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2762.8240	
Space heating per m2											(98c) / (4) =	31.5896	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	286.9197	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	597.1007	414.1470	351.0406	201.6644	98.1214	0.0000	0.0000	0.0000	0.0000	197.7545	360.7568	542.2385	(98)
Space heating efficiency (main heating system 1)	286.9197	286.9197	286.9197	286.9197	286.9197	0.0000	0.0000	0.0000	0.0000	286.9197	286.9197	286.9197	(210)
Space heating fuel (main heating system)	208.1073	144.3425	122.3480	70.2860	34.1982	0.0000	0.0000	0.0000	0.0000	68.9233	125.7344	188.9862	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	93.6855	82.8316	87.8939	76.9723	74.4199	66.8421	65.7843	68.4991	69.3697	77.6181	82.8660	92.6172	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.3636	3.9413	4.3636	4.2228	4.3636	4.2228	4.3636	4.3636	4.2228	4.3636	4.2228	4.3636	(231)
Lighting	24.5730	19.7134	17.7497	13.0042	10.0448	8.2067	9.1632	11.9107	15.4708	20.2986	22.9272	25.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	962.9259	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	284.9050	
Water heating fuel used	939.3997	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)		
mechanical ventilation fans (SFP = 0.1790)	51.3777	(230a)
Total electricity for the above, kWh/year	51.3777	(231)
Electricity for lighting (calculated in Appendix L)	198.3182	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2152.0216	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	962.9259	26.0000	250.3607	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	939.3997	26.0000	244.2439	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	51.3777	26.0000	13.3582	(249)
Energy for lighting	198.3182	26.0000	51.5627	(250)
Additional standing charges			0.0000	(251)
Total energy cost			559.5256	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	962.9259	0.1552	149.4648	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	939.3997	0.1410	132.4256	(264)
Space and water heating			281.8904	(265)
Pumps, fans and electric keep-hot	51.3777	0.1387	7.1267	(267)
Energy for lighting	198.3182	0.1443	28.6234	(268)
Total CO2, kg/year			317.6405	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	962.9259	1.5746	1516.2462	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	939.3997	1.5213	1429.0647	(278)
Space and water heating			2945.3109	(279)
Pumps, fans and electric keep-hot	51.3777	1.5128	77.7242	(281)
Energy for lighting	198.3182	1.5338	304.1871	(282)

Total Primary energy kWh/year 3327.2222 (286)

SAP 10 EPC IMPROVEMENTS

001

Current energy efficiency rating: B 83
Current environmental impact rating: A 97

N	Solar water heating		Recommended
U	Solar photovoltaic panels		Recommended
V2	Wind turbine		Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.4	-£ 49	-23 kg (7.3%)
U Solar photovoltaic panels	+ 8.3	-£ 259	-212 kg (71.9%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£49	0.27 kg/m²	B 85	A 97
Solar photovoltaic panels	£259	2.42 kg/m²	A 93	A 99
Total Savings	£308	2.69 kg/m²		

Potential energy efficiency rating: A 93
Potential environmental impact rating: A 99

Fuel prices for cost data on this page from database revision number 599 TEST (30 Sep 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, West Pennines (England)):

	Current	Potential	Saving
Electricity	£560	£510	£49
Space heating	£264	£287	-£23
Water heating	£244	£172	£72
Lighting	£52	£52	£0
Generated (PV)	-£0	-£259	£259
Total cost of fuels	£560	£251	£308
Total cost of uses	£560	£252	£308
Delivered energy	25 kWh/m²	4 kWh/m²	21 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.1 tonnes	0.2 tonnes
CO2 emissions per m²	4 kg/m²	1 kg/m²	3 kg/m²
Primary energy	38 kWh/m²	17 kWh/m²	21 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	43.7300	(1b)	x 2.5500	(2b) =	111.5115	(1b) - (3b)
First floor	43.7300	(1c)	x 2.8300	(2c) =	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		235.2674	(5)

---

2. Ventilation rate

---

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1275 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.3275 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2784 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)

Adj infilt rate

	0.3549	0.3480	0.3410	0.3062	0.2993	0.2645	0.2645	0.2575	0.2784	0.2993	0.3132	0.3271 (22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

Effective ac	0.6049	0.5980	0.5910	0.5562	0.5493	0.5145	0.5145	0.5075	0.5284	0.5493	0.5632	0.5771 (25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.4900	1.1450	13.1565			(27)
Glazed Doors			7.6000	1.1450	8.7023			(27)
GF			43.7300	0.1100	4.8103	75.0000	3279.7500	(28a)
Main	110.7742	21.2400	89.5342	0.1900	17.0115	9.0000	805.8078	(29a)
PIJ	43.7300		43.7300	0.0900	3.9357	9.0000	393.5700	(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.7663			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000	20.0000	644.6000	(32)
Timber			113.8200			9.0000	1024.3800	(32c)
Timber			20.4000			9.0000	183.6000	(32c)
FF			43.7300			18.0000	787.1400	(32d)
GF			43.7300			9.0000	393.5700	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7512.4178 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 85.8955 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.5100	0.0460	0.6675
E3 Sill	14.5100	0.0470	0.6820
E4 Jamb	29.8400	0.0530	1.5815
E5 Ground floor (normal)	20.5900	0.0680	1.4001
E10 Eaves (insulation at ceiling level)	14.6000	0.0910	1.3286
E12 Gable (insulation at ceiling level)	5.9900	0.0750	0.4492
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	5.9900	0.1160	0.6948
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.0460	0.2755
E6 Intermediate floor within a dwelling	20.5900	0.0540	1.1119

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2672 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 59.0334 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.9668	46.4264	45.8861	43.1844	42.6441	39.9424	39.9424	39.4020	41.0231	42.6441	43.7247	44.8054	(38)
Heat transfer coeff	106.0002	105.4599	104.9195	102.2178	101.6775	98.9758	98.9758	98.4355	100.0565	101.6775	102.7582	103.8389	(39)

Average = Sum(39)m / 12 = 102.0828

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2120	1.2058	1.1996	1.1687	1.1626	1.1317	1.1317	1.1255	1.1440	1.1626	1.1749	1.1873	(40)
HLP (average)												1.1672	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5893 (42)

Hot water usage for mixer showers

67.6343	66.6179	65.1368	62.3030	60.2117	57.8795	56.5538	58.0238	59.6350	62.1391	65.0338	67.3752	(42a)

Hot water usage for baths

29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)

Hot water usage for other uses

41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)

Average daily hot water use (litres/day) 126.8439 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.9899	135.0435	131.4552	125.9988	121.5679	116.8042	114.9735	118.5462	122.3142	127.3152	132.8557	137.6320	(44)
Energy conte	218.5423	192.3001	202.0418	172.4860	163.6537	143.6244	139.0504	146.7850	150.8257	172.7656	189.2773	215.4985	(45)
Energy content (annual)										Total = Sum(45)m =		2106.8508	
Distribution loss (46)m = 0.15 x (45)m	32.7813	28.8450	30.3063	25.8729	24.5481	21.5437	20.8576	22.0177	22.6239	25.9148	28.3916	32.3248	(46)

Water storage loss (or HIU loss):

Store volume 198.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.5000 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.8100 (55)

Total storage loss

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)

If cylinder contains dedicated solar storage

15.5986	14.0891	15.5986	15.0955	15.5986	15.0955	15.5986	15.5986	15.0955	15.5986	15.0955	15.5986	(57)
Primary loss 23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

257.4033	227.4004	239.5071	203.3399	189.7204	168.6252	164.8845	173.5496	183.0303	210.2309	226.8848	254.3595	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Aperture area of solar collector 3.0000 (H1)

Zero-loss collector efficiency 0.8000 (H2)

Collector linear heat loss coefficient 1.8000 (H3)

Collector 2nd order heat loss coefficient 0.0000 (H4)

Collector loop efficiency 0.9000 (H5)

Incidence angle modifier 1.0000 (H6)

Overshading factor 0.8000 (H8)

Overall heat loss coefficient of system 6.5000 (H10)

Heat loss coefficient of collector loop 3.9667 (H11)

Dedicated solar storage volume 75.0000 (H12)

If combined cylinder, total volume of cylinder 198.0000 (H13)

Effective solar volume 111.9000 (H14)

Reference volume 225.0000 (H15)

Storage tank correction coefficient												1.1908	(H16)
Heat delivered to hot water												648.7608	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												648.7608	
Solar input	-0.0000	-19.9033	-62.0018	-83.2548	-106.7311	-98.1676	-97.3555	-86.1278	-61.1731	-32.9118	-1.1339	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	257.4033	207.4971	177.5053	120.0851	82.9893	70.4575	67.5290	87.4217	121.8571	177.3191	225.7509	254.3595	(64)
									Total per year (kWh/year) = Sum(64)m =			1850.1749	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =				0.0000	(64a)
Heat gains from water heating, kWh/month													
	103.7541	92.0200	97.1511	82.0347	75.2682	67.7557	66.9015	70.2177	75.9132	87.4168	93.0207	102.7421	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.0740	24.9351	20.2786	15.3522	11.4759	9.6885	10.4687	13.6077	18.2642	23.1905	27.0668	28.8543	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	349.7409	353.3701	344.2246	324.7549	300.1779	277.0790	261.6475	258.0183	267.1638	286.6335	311.2105	334.3094	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)													
	139.4545	136.9345	130.5795	113.9371	101.1670	94.1051	89.9214	94.3786	105.4350	117.4957	129.1954	138.0942	(72)
Total internal gains													
	622.1814	620.1517	599.9946	558.9562	517.7328	485.7846	466.9497	470.9165	495.7749	532.2317	572.3847	606.1699	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.0000	19.6403	0.3000	0.0000	0.7700	13.6107	(76)
West	8.4900	19.6403	0.3000	0.0000	0.7700	38.5183	(80)
East	7.6000	19.6403	0.3000	0.0000	0.7700	34.4804	(76)

Solar gains	86.6094	169.4264	279.0212	406.9358	498.7151	510.5236	486.0393	417.5006	324.5132	201.0387	107.9918	71.2234	(83)
Total gains	708.7908	789.5782	879.0159	965.8920	1016.4479	996.3082	952.9890	888.4171	820.2882	733.2705	680.3765	677.3933	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.6866	19.7875	19.8894	20.4151	20.5235	21.0838	21.0838	21.1995	20.8560	20.5235	20.3077	20.0964	
alpha	2.3124	2.3192	2.3260	2.3610	2.3682	2.4056	2.4056	2.4133	2.3904	2.3682	2.3538	2.3398	
util living area													
	0.9241	0.9016	0.8595	0.7835	0.6773	0.5367	0.4164	0.4551	0.6422	0.8182	0.9003	0.9302	(86)
Living	18.2239	18.5399	19.0848	19.7856	20.3480	20.7467	20.9009	20.8752	20.5823	19.8400	18.9410	18.2002	
Non living	17.4046	17.7161	18.2485	18.9340	19.4549	19.8156	19.9291	19.9188	19.6829	19.0044	18.1309	17.3943	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.5799	18.5399	19.0848	19.7856	20.3480	20.7467	20.9009	20.8752	20.5823	19.8400	18.9410	18.5919	(87)
Th 2	19.9104	19.9154	19.9203	19.9451	19.9501	19.9751	19.9751	19.9801	19.9650	19.9501	19.9401	19.9302	(88)
util rest of house													
	0.9144	0.8892	0.8413	0.7551	0.6332	0.4716	0.3317	0.3698	0.5807	0.7879	0.8857	0.9212	(89)
MIT 2	18.6285	17.7161	18.2485	18.9340	19.4549	19.8156	19.9291	19.9188	19.6829	19.0044	18.1309	17.7490	(90)
Living area fraction										fLA = Living area / (4) =		0.2056	(91)
MIT	18.8241	17.8855	18.4204	19.1091	19.6385	20.0070	20.1288	20.1154	19.8678	19.1762	18.2975	17.9223	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8241	17.8855	18.4204	19.1091	19.6385	20.0070	20.1288	20.1154	19.8678	19.1762	18.2975	17.9223	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9028	0.8593	0.8105	0.7291	0.6187	0.4738	0.3450	0.3818	0.5743	0.7613	0.8568	0.8995	(94)
Useful gains	639.8952	678.4883	712.4428	704.2543	628.8844	472.0132	328.8191	339.1756	471.1064	558.2261	582.9166	609.3312	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1539.5586	1369.4450	1250.6806	1043.5482	807.1674	535.1655	349.2704	365.7258	577.1033	872.0041	1150.6318	1424.9053	(97)
Space heating kWh													
	669.3495	464.3229	400.4489	244.2916	132.6426	0.0000	0.0000	0.0000	0.0000	233.4508	408.7550	606.7871	(98a)
Space heating requirement - total per year (kWh/year)												3160.0485	
Solar heating kWh													
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	669.3495	464.3229	400.4489	244.2916	132.6426	0.0000	0.0000	0.0000	0.0000	233.4508	408.7550	606.7871	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3160.0485	
Space heating per m2											(98c) / (4) =	36.1314	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)

Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												286.3431	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	669.3495	464.3229	400.4489	244.2916	132.6426	0.0000	0.0000	0.0000	0.0000	233.4508	408.7550	606.7871	(98)
Space heating efficiency (main heating system 1)													
	286.3431	286.3431	286.3431	286.3431	286.3431	0.0000	0.0000	0.0000	0.0000	286.3431	286.3431	286.3431	(210)
Space heating fuel (main heating system)													
	233.7579	162.1562	139.8494	85.3143	46.3230	0.0000	0.0000	0.0000	0.0000	81.5284	142.7501	211.9091	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	257.4033	207.4971	177.5053	120.0851	82.9893	70.4575	67.5290	87.4217	121.8571	177.3191	225.7509	254.3595	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month													
	90.3471	72.8303	62.3033	42.1492	29.1288	24.7302	23.7023	30.6845	42.7711	62.2380	79.2372	89.2787	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.1581	10.0783	11.1581	10.7982	11.1581	10.7982	11.1581	11.1581	10.7982	11.1581	10.7982	11.1581	(231)
Lighting	24.5730	19.7134	17.7497	13.0042	10.0448	8.2067	9.1632	11.9107	15.4708	20.2986	22.9272	25.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-37.8592	-55.7876	-83.1360	-94.5943	-100.2805	-88.0622	-86.8110	-81.9151	-72.8247	-63.5837	-41.9951	-32.2301	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-12.2273	-27.7924	-59.2102	-96.1777	-135.4023	-143.6515	-141.8405	-117.8589	-83.6384	-43.2621	-17.4147	-9.6838	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1103.5883	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												284.9050	
Water heating fuel used												649.4007	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)													
mechanical ventilation fans (SFP = 0.1790)												51.3777	(230a)
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												131.3777	(231)
Electricity for lighting (calculated in Appendix L)												198.3182	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1727.2394	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												355.4454	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1103.5883	16.4900	181.9817	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	649.4007	16.4900	107.0862	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	51.3777	16.4900	8.4722	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	198.3182	16.4900	32.7027	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-839.0794	16.4900	-138.3642	
PV Unit electricity exported	-888.1600	5.5900	-49.6481	
Total			-188.0123	(252)
Total energy cost			155.4224	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4224	(257)
SAP value		93.1528	
SAP rating (Section 12)		93	(258)
SAP band		A	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	

Space heating - main system 1	1103.5883	0.1549	170.9434	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	649.4007	0.1463	95.0191	(264)
Space and water heating			265.9625	(265)
Pumps, fans and electric keep-hot	131.3777	0.1387	18.2237	(267)
Energy for lighting	198.3182	0.1443	28.6234	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-839.0794	0.1348	-113.0856	
PV Unit electricity exported	-888.1600	0.1233	-109.4795	
Total			-222.5651	(269)
Total CO2, kg/year			90.2445	(272)
CO2 emissions per m2			1.0300	(273)
EI value			99.0871	
EI rating			99	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	43.7300 (1b)	x	2.5500 (2b)	=	111.5115	(1b) - (3b)
First floor	43.7300 (1c)	x	2.8300 (2c)	=	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.2674	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1275	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3275	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2784	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.5000	4.4000	4.4000	4.0000	4.1000	3.5000	3.4000	3.4000	3.5000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1250	1.1000	1.1000	1.0000	1.0250	0.8750	0.8500	0.8500	0.8750	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.3132	0.3062	0.3062	0.2784	0.2853	0.2436	0.2366	0.2366	0.2436	0.2714	0.2714	0.2784	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
Effective ac	0.5632	0.5562	0.5562	0.5284	0.5353	0.5000	0.5000	0.5000	0.5000	0.5214	0.5214	0.5284	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.4900	1.1450	13.1565			(27)
Glazed Doors			7.6000	1.1450	8.7023			(27)
GF			43.7300	0.1100	4.8103	75.0000	3279.7500	(28a)
Main	110.7742	21.2400	89.5342	0.1900	17.0115	9.0000	805.8078	(29a)
PIJ	43.7300		43.7300	0.0900	3.9357	9.0000	393.5700	(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.7663			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000	20.0000	644.6000	(32)
Timber			113.8200			9.0000	1024.3800	(32c)
Timber			20.4000			9.0000	183.6000	(32c)
FF			43.7300			18.0000	787.1400	(32d)
GF			43.7300			9.0000	393.5700	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	7512.4178 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		85.8955 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.5100	0.0460	0.6675
E3 Sill	14.5100	0.0470	0.6820
E4 Jamb	29.8400	0.0530	1.5815

E5 Ground floor (normal)	20.5900	0.0680	1.4001	
E10 Eaves (insulation at ceiling level)	14.6000	0.0910	1.3286	
E12 Gable (insulation at ceiling level)	5.9900	0.0750	0.4492	
E16 Corner (normal)	10.7600	0.0460	0.4950	
E18 Party wall between dwellings	10.7600	0.0540	0.5810	
P1 Party wall - Ground floor	5.9900	0.1160	0.6948	
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.0460	0.2755	
E6 Intermediate floor within a dwelling	20.5900	0.0540	1.1119	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				9.2672 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	59.0334 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.7247	43.1844	43.1844	41.0231	41.5634	38.8191	38.8191	38.8191	38.8191	40.4827	40.4827	41.0231	(38)
Heat transfer coeff	102.7582	102.2178	102.2178	100.0565	100.5968	97.8526	97.8526	97.8526	97.8526	99.5162	99.5162	100.0565	(39)
Average = Sum(39)m / 12 =												99.8622	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1749	1.1687	1.1687	1.1440	1.1502	1.1188	1.1188	1.1188	1.1188	1.1378	1.1378	1.1440	(40)
HLP (average)												1.1418	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5893	(42)
Hot water usage for mixer showers	67.6343	66.6179	65.1368	62.3030	60.2117	57.8795	56.5538	58.0238	59.6350	62.1391	65.0338	67.3752	(42a)
Hot water usage for baths	29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)
Hot water usage for other uses	41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)
Average daily hot water use (litres/day)												126.8439	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.9899	135.0435	131.4552	125.9988	121.5679	116.8042	114.9735	118.5462	122.3142	127.3152	132.8557	137.6320	(44)
Energy conte	218.5423	192.3001	202.0418	172.4860	163.6537	143.6244	139.0504	146.7850	150.8257	172.7656	189.2773	215.4985	(45)
Energy content (annual)										Total = Sum(45)m =		2106.8508	
Distribution loss (46)m = 0.15 x (45)m	32.7813	28.8450	30.3063	25.8729	24.5481	21.5437	20.8576	22.0177	22.6239	25.9148	28.3916	32.3248	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage	15.5986	14.0891	15.5986	15.0955	15.5986	15.0955	15.5986	15.5986	15.0955	15.5986	15.0955	15.5986	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	257.4033	227.4004	239.5071	203.3399	189.7204	168.6252	164.8845	173.5496	183.0303	210.2309	226.8848	254.3595	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
If combined cylinder, total volume of cylinder												198.0000	(H13)
Effective solar volume												111.9000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.1908	(H16)
Heat delivered to hot water												615.9643	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												615.9643	
Solar input	-0.0000	-15.4930	-58.8525	-81.2359	-101.0942	-95.7775	-92.2407	-80.0212	-59.9473	-31.3019	-0.0000	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	257.4033	211.9073	180.6545	122.1040	88.6262	72.8477	72.6438	93.5284	123.0830	178.9290	226.8848	254.3595	(64)
										Total per year (kWh/year) = Sum(64)m =		1882.9715	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	103.7541	92.0200	97.1511	82.0347	75.2682	67.7557	66.9015	70.2177	75.9132	87.4168	93.0207	102.7421	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.0740	24.9351	20.2786	15.3522	11.4759	9.6885	10.4687	13.6077	18.2642	23.1905	27.0668	28.8543	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	349.7409	353.3701	344.2246	324.7549	300.1779	277.0790	261.6475	258.0183	267.1638	286.6335	311.2105	334.3094	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)	139.4545	136.9345	130.5795	113.9371	101.1670	94.1051	89.9214	94.3786	105.4350	117.4957	129.1954	138.0942	(72)
Total internal gains	622.1814	620.1517	599.9946	558.9562	517.7328	485.7846	466.9497	470.9165	495.7749	532.2317	572.3847	606.1699	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.0000	17.3606	0.3000	0.0000	0.7700	12.0309	(76)
West	8.4900	17.3606	0.3000	0.0000	0.7700	34.0474	(80)
East	7.6000	17.3606	0.3000	0.0000	0.7700	30.4782	(76)

Solar gains	76.5565	153.6258	267.2216	395.8729	469.9406	495.0205	460.1381	390.7168	318.6765	194.8089	101.3691	67.7785	(83)
Total gains	698.7379	773.7775	867.2162	954.8291	987.6734	980.8051	927.0878	861.6333	814.4514	727.0406	673.7537	673.9484	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.3077	20.4151	20.4151	20.8560	20.7440	21.3258	21.3258	21.3258	21.3258	20.9693	20.9693	20.8560	
alpha	2.3538	2.3610	2.3610	2.3904	2.3829	2.4217	2.4217	2.4217	2.4217	2.3980	2.3980	2.3904	
util living area	0.9187	0.8953	0.8483	0.7620	0.6433	0.4890	0.3820	0.4235	0.6163	0.8007	0.8919	0.9244	(86)
Living	18.4704	18.7703	19.2925	19.9707	20.4915	20.8237	20.9291	20.9063	20.6542	19.9938	19.1503	18.4519	
Non living	17.6666	17.9617	18.4667	19.1230	19.5910	19.8841	19.9566	19.9445	19.7593	19.1635	18.3550	17.6645	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.7060	18.7703	19.2925	19.9707	20.4915	20.8237	20.9291	20.9063	20.6542	19.9938	19.1503	18.8083	(87)
Th 2	19.9401	19.9451	19.9451	19.9650	19.9600	19.9855	19.9855	19.9855	19.9855	19.9700	19.9700	19.9650	(88)
util rest of house	0.9080	0.8818	0.8284	0.7303	0.5928	0.4174	0.2925	0.3319	0.5513	0.7670	0.8758	0.9147	(89)
MIT 2	18.7771	17.9617	18.4667	19.1230	19.5910	19.8841	19.9566	19.9445	19.7593	19.1635	18.3550	17.9863	(90)
Living area fraction										fLA = Living area / (4) =		0.2056	(91)
MIT	18.9680	18.1279	18.6365	19.2972	19.7761	20.0772	20.1565	20.1422	19.9433	19.3342	18.5185	18.1553	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9680	18.1279	18.6365	19.2972	19.7761	20.0772	20.1565	20.1422	19.9433	19.3342	18.5185	18.1553	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8965	0.8524	0.7986	0.7070	0.5830	0.4242	0.3082	0.3468	0.5484	0.7426	0.8473	0.8930	(94)
Useful gains	626.3989	659.5539	692.5971	675.1110	575.8256	416.0702	285.7220	298.8226	446.6244	539.8820	570.9000	601.8214	(95)
Ext temp.	5.0000	5.6000	7.2000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.2000	7.7000	4.8000	(96)
Heat loss rate W	1435.3314	1280.5755	1169.0114	960.2667	711.8345	457.6784	299.0858	317.2575	532.6373	809.4850	1076.6175	1336.2838	(97)
Space heating kWh	601.8458	417.3265	354.4522	205.3121	101.1906	0.0000	0.0000	0.0000	0.0000	200.5846	364.1166	546.4400	(98a)
Space heating requirement - total per year (kWh/year)												2791.2684	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	601.8458	417.3265	354.4522	205.3121	101.1906	0.0000	0.0000	0.0000	0.0000	200.5846	364.1166	546.4400	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2791.2684	
Space heating per m2											(98c) / (4) =	31.9148	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	286.9197	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	601.8458	417.3265	354.4522	205.3121	101.1906	0.0000	0.0000	0.0000	0.0000	200.5846	364.1166	546.4400	(98)
Space heating efficiency (main heating system 1)	286.9197	286.9197	286.9197	286.9197	286.9197	0.0000	0.0000	0.0000	0.0000	286.9197	286.9197	286.9197	(210)
Space heating fuel (main heating system)	209.7611	145.4506	123.5371	71.5573	35.2679	0.0000	0.0000	0.0000	0.0000	69.9097	126.9054	190.4505	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	257.4033	211.9073	180.6545	122.1040	88.6262	72.8477	72.6438	93.5284	123.0830	178.9290	226.8848	254.3595	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	90.3471	74.3782	63.4087	42.8578	31.1073	25.5691	25.4976	32.8279	43.2014	62.8030	79.6352	89.2787	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.1581	10.0783	11.1581	10.7982	11.1581	10.7982	11.1581	11.1581	10.7982	11.1581	10.7982	11.1581	(231)
Lighting	24.5730	19.7134	17.7497	13.0042	10.0448	8.2067	9.1632	11.9107	15.4708	20.2986	22.9272	25.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-33.8434	-51.2621	-79.8649	-91.8240	-95.8102	-86.8184	-84.6865	-79.2398	-72.0440	-61.6481	-39.6160	-30.7059	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)

Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-10.3961	-24.4711	-56.3878	-93.6973	-126.2287	-137.8255	-131.7428	-107.6652	-81.5336	-41.8206	-16.1093	-9.1502 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	972.8396 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	284.9050
Water heating fuel used	660.9121 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)	
mechanical ventilation fans (SFP = 0.1790)	51.3777 (230a)
pump for solar water heating	80.0000 (230g)
Total electricity for the above, kWh/year	131.3777 (231)
Electricity for lighting (calculated in Appendix L)	198.3182 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1644.3918 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	319.0558 (238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	972.8396	26.0000	252.9383	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	660.9121	26.0000	171.8371	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	51.3777	26.0000	13.3582	(249)
Pump for solar water heating	80.0000	26.0000	20.8000	(249)
Energy for lighting	198.3182	26.0000	51.5627	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-807.3634	26.0000	-209.9145	
PV Unit electricity exported	-837.0284	5.8100	-48.6313	
Total			-258.5458	(252)
Total energy cost			251.9505	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	972.8396	0.1552	150.9663	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	660.9121	0.1461	96.5278	(264)
Space and water heating			247.4941	(265)
Pumps, fans and electric keep-hot	131.3777	0.1387	18.2237	(267)
Energy for lighting	198.3182	0.1443	28.6234	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-807.3634	0.1345	-108.5694	
PV Unit electricity exported	-837.0284	0.1233	-103.1819	
Total			-211.7513	(269)
Total CO2, kg/year			82.5899	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	972.8396	1.5745	1531.7177	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	660.9121	1.5403	1017.9862	(278)
Space and water heating			2549.7039	(279)
Pumps, fans and electric keep-hot	131.3777	1.5128	198.7482	(281)
Energy for lighting	198.3182	1.5338	304.1871	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-807.3634	1.4970	-1208.6301	
PV Unit electricity exported	-837.0284	0.4524	-378.6692	
Total			-1587.2994	(283)
Total Primary energy kWh/year			1465.3399	(286)

Full SAP Calculation Printout

Plot Reference	79841-07	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	2B3P (Semi)
Plot Address	Plot 7, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	83 B	**DER**	3.95	**TER**	11.67
Environmental	97 A	**% DER < TER**			66.15
CO_2 Emissions (t/year)	0.32	**DFEE**	40.01	**TFEE**	40.64
Compliance Check	See BREL	**% DFEE < TFEE**			1.55
% DPER < TPER	32.27	**DPER**	41.25	**TPER**	60.90

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	43.7300 (1b)	x	2.5500 (2b)	=	111.5115	(1b) - (3b)
First floor	43.7300 (1c)	x	2.8300 (2c)	=	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.2674	(5)

---

2. Ventilation rate

---

			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		3 * 10 =	30.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		30.0000 / (5) =	0.1275	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			4.0000	(17)
Infiltration rate			0.3275	(18)
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.2784	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3549	0.3480	0.3410	0.3062	0.2993	0.2645	0.2645	0.2575	0.2784	0.2993	0.3132	0.3271	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.6049	0.5980	0.5910	0.5562	0.5493	0.5145	0.5145	0.5075	0.5284	0.5493	0.5632	0.5771	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.4900	1.1450	13.1565			(27)
Glazed Doors			7.6000	1.1450	8.7023			(27)
GF			43.7300	0.1100	4.8103	75.0000	3279.7500	(28a)
Main	110.7742	21.2400	89.5342	0.1900	17.0115	9.0000	805.8078	(29a)
PIJ	43.7300		43.7300	0.0900	3.9357	9.0000	393.5700	(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.7663			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000	20.0000	644.6000	(32)
Timber			113.8200			9.0000	1024.3800	(32c)
Timber			20.4000			9.0000	183.6000	(32c)
FF			43.7300			18.0000	787.1400	(32d)
GF			43.7300			9.0000	393.5700	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7512.4178 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 85.8955 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.5100	0.0460	0.6675
E3 Sill	14.5100	0.0470	0.6820
E4 Jamb	29.8400	0.0530	1.5815
E5 Ground floor (normal)	20.5900	0.0680	1.4001
E10 Eaves (insulation at ceiling level)	14.6000	0.0910	1.3286
E12 Gable (insulation at ceiling level)	5.9900	0.0750	0.4492
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	5.9900	0.1160	0.6948
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.0460	0.2755
E6 Intermediate floor within a dwelling	20.5900	0.0540	1.1119

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2672 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.0334 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.9668	46.4264	45.8861	43.1844	42.6441	39.9424	39.9424	39.4020	41.0231	42.6441	43.7247	44.8054	(38)
Heat transfer coeff	106.0002	105.4599	104.9195	102.2178	101.6775	98.9758	98.9758	98.4355	100.0565	101.6775	102.7582	103.8389	(39)
Average = Sum(39)m / 12 =												102.0828	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2120	1.2058	1.1996	1.1687	1.1626	1.1317	1.1317	1.1255	1.1440	1.1626	1.1749	1.1873	(40)
HLP (average)												1.1672	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5893 (42)
Hot water usage for mixer showers

67.6343	66.6179	65.1368	62.3030	60.2117	57.8795	56.5538	58.0238	59.6350	62.1391	65.0338	67.3752	(42a)

Hot water usage for baths

29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)

Hot water usage for other uses

41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)

Average daily hot water use (litres/day) 126.8439 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.9899	135.0435	131.4552	125.9988	121.5679	116.8042	114.9735	118.5462	122.3142	127.3152	132.8557	137.6320	(44)
Energy conte	218.5423	192.3001	202.0418	172.4860	163.6537	143.6244	139.0504	146.7850	150.8257	172.7656	189.2773	215.4985	(45)
Energy content (annual)											Total = Sum(45)m =	2106.8508	
Distribution loss (46)m = 0.15 x (45)m	32.7813	28.8450	30.3063	25.8729	24.5481	21.5437	20.8576	22.0177	22.6239	25.9148	28.3916	32.3248	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(64)
										Total per year (kWh/year) = Sum(64)m =		2676.3968	(64)
12Total per year (kWh/year)												2676	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	111.3632	98.8927	105.8768	94.8012	93.1128	85.2047	84.9322	87.5039	87.5991	96.1425	100.3843	110.3512	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	118.2644	130.9356	118.2644	122.2065	118.2644	122.2065	118.2644	118.2644	122.2065	118.2644	122.2065	118.2644	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	234.3264	236.7580	230.6305	217.5858	201.1192	185.6429	175.3038	172.8722	178.9997	192.0444	208.5110	223.9873	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)	149.6818	147.1618	142.3075	131.6683	125.1516	118.3399	114.1562	117.6128	121.6655	129.2238	139.4227	148.3215	(72)
Total internal gains	564.1126	576.6954	553.0424	533.3007	506.3752	488.0294	469.5644	470.5894	484.7118	501.3726	531.9802	552.4132	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

East			3.0000		19.6403		0.3000		0.0000		0.7700		13.6107 (76)
West			8.4900		19.6403		0.3000		0.0000		0.7700		38.5183 (80)
East			7.6000		19.6403		0.3000		0.0000		0.7700		34.4804 (76)
Solar gains	86.6094	169.4264	279.0212	406.9358	498.7151	510.5236	486.0393	417.5006	324.5132	201.0387	107.9918	71.2234	(83)
Total gains	650.7220	746.1218	832.0636	940.2365	1005.0903	998.5530	955.6037	888.0900	809.2250	702.4113	639.9720	623.6366	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.6866	19.7875	19.8894	20.4151	20.5235	21.0838	21.0838	21.1995	20.8560	20.5235	20.3077	20.0964	
alpha	2.3124	2.3192	2.3260	2.3610	2.3682	2.4056	2.4056	2.4133	2.3904	2.3682	2.3538	2.3398	
util living area	0.9351	0.9109	0.8714	0.7915	0.6814	0.5358	0.4155	0.4552	0.6473	0.8296	0.9105	0.9402	(86)
Living	18.1081	18.4594	19.0087	19.7538	20.3388	20.7476	20.9014	20.8752	20.5746	19.7963	18.8657	18.0903	
Non living	17.2922	17.6387	18.1768	18.9054	19.4474	19.8162	19.9293	19.9187	19.6772	18.9652	18.0590	17.2873	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.5206	18.4594	19.0087	19.7538	20.3388	20.7476	20.9014	20.8752	20.5746	19.7963	18.8657	18.4973	(87)
Th 2	19.9104	19.9154	19.9203	19.9451	19.9501	19.9751	19.9751	19.9801	19.9650	19.9501	19.9401	19.9302	(88)
util rest of house	0.9266	0.8994	0.8543	0.7637	0.6374	0.4708	0.3309	0.3699	0.5859	0.8005	0.8971	0.9323	(89)
MIT 2	18.5710	17.6387	18.1768	18.9054	19.4474	19.8162	19.9293	19.9187	19.6772	18.9652	18.0590	17.6570	(90)
Living area fraction										fLA = Living area / (4) =		0.2056	(91)
MIT	18.7663	17.8074	18.3478	19.0798	19.6306	20.0077	20.1291	20.1153	19.8617	19.1360	18.2249	17.8297	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7663	17.8074	18.3478	19.0798	19.6306	20.0077	20.1291	20.1153	19.8617	19.1360	18.2249	17.8297	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9158	0.8703	0.8236	0.7372	0.6226	0.4730	0.3442	0.3819	0.5791	0.7733	0.8689	0.9121	(94)
Useful gains	595.9114	649.3608	685.3029	693.1332	625.7317	472.3015	328.9521	339.1532	468.6135	543.1759	556.0840	568.8159	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1533.4264	1361.2162	1243.0667	1040.5582	806.3674	535.2322	349.2998	365.7208	576.4916	867.9212	1143.1712	1415.2964	(97)
Space heating kWh	697.5112	478.3668	414.9762	250.1460	134.3930	0.0000	0.0000	0.0000	0.0000	241.6105	422.7028	629.7815	(98a)
Space heating requirement - total per year (kWh/year)												3269.4881	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	697.5112	478.3668	414.9762	250.1460	134.3930	0.0000	0.0000	0.0000	0.0000	241.6105	422.7028	629.7815	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3269.4881	
Space heating per m2											(98c) / (4) =	37.3827	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	286.3431 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	697.5112	478.3668	414.9762	250.1460	134.3930	0.0000	0.0000	0.0000	0.0000	241.6105	422.7028	629.7815	(98)
Space heating efficiency (main heating system 1)	286.3431	286.3431	286.3431	286.3431	286.3431	0.0000	0.0000	0.0000	0.0000	286.3431	286.3431	286.3431	(210)
Space heating fuel (main heating system)	243.5928	167.0607	144.9228	87.3589	46.9343	0.0000	0.0000	0.0000	0.0000	84.3780	147.6211	219.9395	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	93.6855	82.8316	87.8939	76.9723	74.4199	66.8421	65.7843	68.4991	69.3697	77.6181	82.8660	92.6172	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.3636	3.9413	4.3636	4.2228	4.3636	4.2228	4.3636	4.3636	4.2228	4.3636	4.2228	4.3636	(231)
Lighting	24.5730	19.7134	17.7497	13.0042	10.0448	8.2067	9.1632	11.9107	15.4708	20.2986	22.9272	25.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	1141.8080	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	284.9050	
Water heating fuel used	939.3997	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)		
mechanical ventilation fans (SFP = 0.1790)	51.3777	(230a)
Total electricity for the above, kWh/year	51.3777	(231)
Electricity for lighting (calculated in Appendix L)	198.3182	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2330.9037	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1141.8080	0.1549	176.9125	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	939.3997	0.1410	132.4256	(264)
Space and water heating			309.3381	(265)
Pumps, fans and electric keep-hot	51.3777	0.1387	7.1267	(267)
Energy for lighting	198.3182	0.1443	28.6234	(268)
Total CO2, kg/year			345.0882	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.9500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1141.8080	1.5736	1796.7338	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	939.3997	1.5213	1429.0647	(278)
Space and water heating			3225.7985	(279)
Pumps, fans and electric keep-hot	51.3777	1.5128	77.7242	(281)
Energy for lighting	198.3182	1.5338	304.1871	(282)
Total Primary energy kWh/year			3607.7098	(286)
Dwelling Primary energy Rate (DPER)			41.2500	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling							
Ground floor		43.7300 (1b)	x	2.5500 (2b)	=	111.5115	(1b) - (3b)
First floor		43.7300 (1c)	x	2.8300 (2c)	=	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.2674	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1275	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3775	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3209	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)

Adj infilt rate													
	0.4091	0.4011	0.3931	0.3530	0.3450	0.3048	0.3048	0.2968	0.3209	0.3450	0.3610	0.3770	(22b)
Effective ac	0.5837	0.5804	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711	(25)

---

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type			19.0900	1.1450	21.8588			(27)
GF			43.7300	0.1300	5.6849			(28a)
Main	110.7742	21.2400	89.5342	0.1800	16.1162			(29a)
PIJ	43.7300		43.7300	0.1100	4.8103			(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.6201			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 85.8955 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	14.5100	0.0500	0.7255	
E3 Sill	14.5100	0.0500	0.7255	
E4 Jamb	29.8400	0.0500	1.4920	
E5 Ground floor (normal)	20.5900	0.1600	3.2944	
E10 Eaves (insulation at ceiling level)	14.6000	0.0600	0.8760	
E12 Gable (insulation at ceiling level)	5.9900	0.0600	0.3594	
E16 Corner (normal)	10.7600	0.0900	0.9684	
E18 Party wall between dwellings	10.7600	0.0600	0.6456	
P1 Party wall - Ground floor	5.9900	0.0800	0.4792	
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.1200	0.7188	
E6 Intermediate floor within a dwelling	20.5900	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.2848	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	60.9049	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.3170	45.0647	44.8173	43.6557	43.4383	42.4266	42.4266	42.2392	42.8163	43.4383	43.8780	44.3377	(38)
Heat transfer coeff	106.2219	105.9696	105.7223	104.5606	104.3433	103.3315	103.3315	103.1441	103.7212	104.3433	104.7830	105.2426	(39)
Average = Sum(39)m / 12 =												104.5596	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2145	1.2116	1.2088	1.1955	1.1930	1.1815	1.1815	1.1793	1.1859	1.1930	1.1981	1.2033	(40)
HLP (average)												1.1955	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5893	(42)
Hot water usage for mixer showers													
	67.6343	66.6179	65.1368	62.3030	60.2117	57.8795	56.5538	58.0238	59.6350	62.1391	65.0338	67.3752	(42a)
Hot water usage for baths													
	29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)
Hot water usage for other uses													
	41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)
Average daily hot water use (litres/day)												126.8439	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	137.9899	135.0435	131.4552	125.9988	121.5679	116.8042	114.9735	118.5462	122.3142	127.3152	132.8557	137.6320	(44)
Energy conte	218.5423	192.3001	202.0418	172.4860	163.6537	143.6244	139.0504	146.7850	150.8257	172.7656	189.2773	215.4985	(45)
Energy content (annual)										Total = Sum(45)m =		2106.8508	
Distribution loss (46)m = 0.15 x (45)m													
	32.7813	28.8450	30.3063	25.8729	24.5481	21.5437	20.8576	22.0177	22.6239	25.9148	28.3916	32.3248	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6426	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8870	(55)
Total storage loss													
	27.4979	24.8369	27.4979	26.6109	27.4979	26.6109	27.4979	27.4979	26.6109	27.4979	26.6109	27.4979	(56)
If cylinder contains dedicated solar storage													
	27.4979	24.8369	27.4979	26.6109	27.4979	26.6109	27.4979	27.4979	26.6109	27.4979	26.6109	27.4979	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	269.3026	238.1481	252.8021	221.6090	214.4140	192.7473	189.8108	197.5453	199.9486	223.5259	238.4002	266.2588	(62)
WWHRS	-30.9196	-27.3455	-28.6347	-23.7106	-22.0975	-18.9090	-17.7241	-18.8478	-19.5639	-23.0637	-26.1284	-30.3470	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	238.3830	210.8026	224.1674	197.8983	192.3166	173.8384	172.0866	178.6975	180.3847	200.4622	212.2718	235.9118	(64)
										Total per year (kWh/year) = Sum(64)m =		2417.2209	(64)
12Total per year (kWh/year)												2417	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	113.2736	100.6182	107.7872	96.6499	95.0231	87.0534	86.8425	89.4143	89.4479	98.0528	102.2330	112.2615	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	118.2644	130.9356	118.2644	122.2065	118.2644	122.2065	118.2644	118.2644	122.2065	118.2644	122.2065	118.2644	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													

	234.3264	236.7580	230.6305	217.5858	201.1192	185.6429	175.3038	172.8722	178.9997	192.0444	208.5110	223.9873	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)													
	152.2494	149.7295	144.8752	134.2360	127.7193	120.9076	116.7239	120.1805	124.2332	131.7914	141.9903	150.8892	(72)
Total internal gains													
	569.6802	582.2631	558.6101	538.8684	511.9429	490.5970	472.1321	473.1571	487.2794	506.9403	537.5479	557.9809	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.6000	19.6403	0.6300	0.7000	0.7700	63.6246	(76)
West	8.4900	19.6403	0.6300	0.7000	0.7700	50.9597	(80)

Solar gains	114.5843	224.1512	369.1451	538.3761	659.8001	675.4228	643.0300	552.3533	429.3310	265.9743	142.8731	94.2285	(83)
Total gains	684.2645	806.4142	927.7552	1077.2444	1171.7429	1166.0198	1115.1621	1025.5104	916.6104	772.9145	680.4210	652.2094	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.6455	19.6923	19.7383	19.9576	19.9992	20.1950	20.1950	20.2317	20.1192	19.9992	19.9153	19.8283	
alpha	2.3097	2.3128	2.3159	2.3305	2.3333	2.3463	2.3463	2.3488	2.3413	2.3333	2.3277	2.3219	
util living area													
	0.9289	0.8983	0.8478	0.7537	0.6317	0.4908	0.3767	0.4187	0.6103	0.8075	0.9016	0.9353	(86)
MIT	18.1691	18.5559	19.1398	19.8649	20.4230	20.7759	20.9131	20.8863	20.6073	19.8443	18.8905	18.1080	(87)
Th 2	19.9084	19.9107	19.9130	19.9236	19.9256	19.9349	19.9349	19.9366	19.9313	19.9256	19.9215	19.9173	(88)
util rest of house													
	0.9197	0.8855	0.8286	0.7230	0.5857	0.4260	0.2952	0.3348	0.5469	0.7757	0.8870	0.9269	(89)
MIT 2	16.6258	17.1103	17.8364	18.7224	19.3724	19.7586	19.8850	19.8674	19.5973	18.7241	17.5456	16.5538	(90)
Living area fraction										fLA = Living area / (4) =		0.2056	(91)
MIT	16.9431	17.4075	18.1044	18.9573	19.5883	19.9677	20.0963	20.0768	19.8049	18.9544	17.8221	16.8733	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.9431	17.4075	18.1044	18.9573	19.5883	19.9677	20.0963	20.0768	19.8049	18.9544	17.8221	16.8733	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8842	0.8463	0.7887	0.6913	0.5699	0.4281	0.3080	0.3464	0.5387	0.7409	0.8488	0.8930	(94)
Useful gains	605.0532	682.4476	731.7367	744.6670	667.8221	499.1628	343.5218	355.2840	493.7427	572.6229	577.5182	582.4271	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1342.9696	1325.4119	1226.8417	1051.5951	823.0951	554.6541	361.2803	379.2433	591.7237	871.7217	1123.4926	1333.7762	(97)
Space heating kWh													
	549.0098	432.0720	368.3582	220.9882	115.5231	0.0000	0.0000	0.0000	0.0000	222.5295	393.1016	559.0037	(98a)
Space heating requirement - total per year (kWh/year)												2860.5862	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	549.0098	432.0720	368.3582	220.9882	115.5231	0.0000	0.0000	0.0000	0.0000	222.5295	393.1016	559.0037	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2860.5862	
Space heating per m2											(98c) / (4) =	32.7074	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	549.0098	432.0720	368.3582	220.9882	115.5231	0.0000	0.0000	0.0000	0.0000	222.5295	393.1016	559.0037	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	594.8102	468.1170	399.0879	239.4239	125.1605	0.0000	0.0000	0.0000	0.0000	241.0938	425.8955	605.6378	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	238.3830	210.8026	224.1674	197.8983	192.3166	173.8384	172.0866	178.6975	180.3847	200.4622	212.2718	235.9118	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.8681	85.6331	85.1661	84.3079	82.9551	79.8000	79.8000	79.8000	79.8000	84.2945	85.4219	85.9240	(217)
Fuel for water heating, kWh/month													
	277.6155	246.1694	263.2120	234.7329	231.8320	217.8426	215.6474	223.9317	226.0459	237.8116	248.4983	274.5586	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	24.5730	19.7134	17.7497	13.0042	10.0448	8.2067	9.1632	11.9107	15.4708	20.2986	22.9272	25.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-40.4681	-56.8289	-81.3729	-91.1293	-97.9537	-91.3009	-90.1428	-85.2277	-76.5407	-64.7751	-44.3982	-35.0109	(233a)

Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-23.5612	-49.4807	-98.1995	-147.2879	-194.5714	-195.4512	-193.1789	-163.6739	-120.0949	-70.7300	-31.4452	-18.6406 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3099.2266	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2897.8980	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	198.3182	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2161.4648	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4119.9781	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3099.2266	0.2100	650.8376	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2897.8980	0.2100	608.5586	(264)
Space and water heating			1259.3962	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	198.3182	0.1443	28.6234	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-855.1493	0.1347	-115.1661	
PV Unit electricity exported	-1306.3155	0.1259	-164.5086	
Total			-279.6747	(269)
Total CO2, kg/year			1020.2742	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.6700	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3099.2266	1.1300	3502.1261	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2897.8980	1.1300	3274.6247	(278)
Space and water heating			6776.7508	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	198.3182	1.5338	304.1871	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-855.1493	1.4977	-1280.7879	
PV Unit electricity exported	-1306.3155	0.4623	-603.8616	
Total			-1884.6496	(283)
Total Primary energy kWh/year			5326.3892	(286)
Target Primary Energy Rate (TPER)			60.9000	(287)

Full SAP Calculation Printout

Plot Reference	79841-07	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	2B3P (Semi)
Plot Address	Plot 7, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	83 B	**DER**	3.95	**TER**	11.67
Environmental	97 A	**% DER < TER**			66.15
CO_2 Emissions (t/year)	0.32	**DFEE**	40.01	**TFEE**	40.64
Compliance Check	See BREL	**% DFEE < TFEE**			1.55
% DPER < TPER	32.27	**DPER**	41.25	**TPER**	60.90

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	43.7300 (1b)	x	2.5500 (2b)	=	111.5115	(1b) - (3b)
First floor	43.7300 (1c)	x	2.8300 (2c)	=	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.2674	(5)

---

2. Ventilation rate

---

			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		3 * 10 =	30.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		30.0000 / (5) =	0.1275	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			4.0000	(17)
Infiltration rate			0.3275	(18)
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.2784	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3549	0.3480	0.3410	0.3062	0.2993	0.2645	0.2645	0.2575	0.2784	0.2993	0.3132	0.3271	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5630	0.5605	0.5581	0.5469	0.5448	0.5350	0.5350	0.5332	0.5387	0.5448	0.5490	0.5535	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.4900	1.1450	13.1565			(27)
Glazed Doors			7.6000	1.1450	8.7023			(27)
GF			43.7300	0.1100	4.8103	75.0000	3279.7500	(28a)
Main	110.7742	21.2400	89.5342	0.1900	17.0115	9.0000	805.8078	(29a)
PIJ	43.7300		43.7300	0.0900	3.9357	9.0000	393.5700	(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.7663			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000	20.0000	644.6000	(32)
Timber			113.8200			9.0000	1024.3800	(32c)
Timber			20.4000			9.0000	183.6000	(32c)
FF			43.7300			18.0000	787.1400	(32d)
GF			43.7300			9.0000	393.5700	(32e)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			7512.4178	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							85.8955	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.5100	0.0460	0.6675
E3 Sill	14.5100	0.0470	0.6820
E4 Jamb	29.8400	0.0530	1.5815
E5 Ground floor (normal)	20.5900	0.0680	1.4001
E10 Eaves (insulation at ceiling level)	14.6000	0.0910	1.3286
E12 Gable (insulation at ceiling level)	5.9900	0.0750	0.4492
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	5.9900	0.1160	0.6948
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.0460	0.2755
E6 Intermediate floor within a dwelling	20.5900	0.0540	1.1119

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2672 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.0334 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.7098	43.5198	43.3337	42.4594	42.2958	41.5343	41.5343	41.3932	41.8276	42.2958	42.6267	42.9727	(38)
Heat transfer coeff	102.7432	102.5533	102.3671	101.4928	101.3292	100.5677	100.5677	100.4267	100.8610	101.3292	101.6601	102.0061	(39)
Average = Sum(39)m / 12 =												101.4920	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1747	1.1726	1.1704	1.1604	1.1586	1.1499	1.1499	1.1483	1.1532	1.1586	1.1624	1.1663	(40)
HLP (average)												1.1604	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5893 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)
Hot water usage for other uses	41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)
Average daily hot water use (litres/day)												64.4873	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	70.3556	68.4255	66.3184	63.6958	61.3562	58.9247	58.4196	60.5225	62.6792	65.1761	67.8219	70.2568	(44)
Energy conte	111.4260	97.4370	101.9289	87.1964	82.5972	72.4549	70.6535	74.9395	77.2897	88.4434	96.6247	110.0052	(45)
Energy content (annual)										Total = Sum(45)m =		1070.9963	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	94.7121	82.8215	86.6396	74.1169	70.2076	61.5866	60.0554	63.6985	65.6963	75.1769	82.1310	93.5044	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	94.7121	82.8215	86.6396	74.1169	70.2076	61.5866	60.0554	63.6985	65.6963	75.1769	82.1310	93.5044	(64)
										Total per year (kWh/year) = Sum(64)m =		910.3469	(64)
12Total per year (kWh/year)												910	(64)
Electric shower(s)	54.1638	48.2604	52.6985	50.2896	51.2332	48.8715	50.5006	51.2332	50.2896	52.6985	51.7076	54.1638	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		616.1105	(64a)
Heat gains from water heating, kWh/month	37.2190	32.7705	34.8345	31.1016	30.3602	27.6145	27.6390	28.7329	28.9965	31.9689	33.4597	36.9171	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	118.2644	130.9356	118.2644	122.2065	118.2644	122.2065	118.2644	118.2644	122.2065	118.2644	122.2065	118.2644	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	234.3264	236.7580	230.6305	217.5858	201.1192	185.6429	175.3038	172.8722	178.9997	192.0444	208.5110	223.9873	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)	50.0255	48.7656	46.8206	43.1967	40.8067	38.3535	37.1492	38.6195	40.2729	42.9689	46.4717	49.6197	(72)
Total internal gains	464.4563	478.2991	457.5555	444.8290	422.0303	408.0430	392.5574	391.5962	403.3191	415.1177	439.0293	453.7114	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.0000	19.6403	0.3000	0.0000	0.7700	13.6107	(76)
West	8.4900	19.6403	0.3000	0.0000	0.7700	38.5183	(80)
East	7.6000	19.6403	0.3000	0.0000	0.7700	34.4804	(76)

Solar gains	86.6094	169.4264	279.0212	406.9358	498.7151	510.5236	486.0393	417.5006	324.5132	201.0387	107.9918	71.2234	(83)

Total gains	551.0658	647.7256	736.5767	851.7648	920.7454	918.5666	878.5967	809.0968	727.8323	616.1565	547.0211	524.9348	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.3107	20.3483	20.3853	20.5609	20.5941	20.7500	20.7500	20.7792	20.6897	20.5941	20.5270	20.4574	
alpha	2.3540	2.3566	2.3590	2.3707	2.3729	2.3833	2.3833	2.3853	2.3793	2.3729	2.3685	2.3638	
util living area	0.9521	0.9300	0.8934	0.8184	0.7116	0.5723	0.4496	0.4953	0.6882	0.8610	0.9325	0.9569	(86)
MIT	17.9934	18.3507	18.9111	19.6525	20.2709	20.6995	20.8790	20.8438	20.5036	19.6711	18.7101	17.9326	(87)
Th 2	19.9403	19.9420	19.9437	19.9518	19.9533	19.9603	19.9603	19.9616	19.9576	19.9533	19.9502	19.9470	(88)
util rest of house	0.9456	0.9206	0.8788	0.7928	0.6690	0.5054	0.3594	0.4045	0.6278	0.8356	0.9219	0.9510	(89)
MIT 2	17.1995	17.5515	18.1009	18.8189	19.3938	19.7696	19.9037	19.8841	19.6170	18.8539	17.9163	17.1438	(90)
Living area fraction										fLA = Living area / (4) =		0.2056	(91)
MIT	17.3627	17.7158	18.2674	18.9902	19.5741	19.9607	20.1042	20.0814	19.7992	19.0219	18.0795	17.3059	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.3627	17.7158	18.2674	18.9902	19.5741	19.9607	20.1042	20.0814	19.7992	19.0219	18.0795	17.3059	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9236	0.8945	0.8494	0.7650	0.6517	0.5054	0.3726	0.4157	0.6175	0.8075	0.8965	0.9304	(94)
Useful gains	508.9841	579.3716	625.6387	651.5923	600.0514	464.2360	327.3480	336.3579	449.4177	497.5398	490.3814	488.3771	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1342.1013	1314.3024	1204.5986	1024.0859	797.8752	539.1180	352.4118	369.7135	574.8297	853.3843	1116.1749	1336.8853	(97)
Space heating kWh	619.8392	493.8735	430.7461	268.1954	147.1809	0.0000	0.0000	0.0000	0.0000	264.7483	450.5713	631.2902	(98a)
Space heating requirement - total per year (kWh/year)												3306.4450	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	619.8392	493.8735	430.7461	268.1954	147.1809	0.0000	0.0000	0.0000	0.0000	264.7483	450.5713	631.2902	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3306.4450	
Space heating per m2											(98c) / (4) =	37.8052	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	945.3363	744.2009	763.2427	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7332	0.7948	0.7616	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	693.0782	591.5151	581.2933	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1027.4081	982.9876	904.0710	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	240.7176	291.2555	240.1466	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	60.1794	72.8139	60.0367	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												193.0299	(107)
Energy for space heating												37.8052	(99)
Energy for space cooling												2.2071	(108)
Total												40.0123	(109)
Fabric Energy Efficiency (DFEE)												40.0	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	43.7300	(1b)	x 2.5500	(2b) =	111.5115	(1b) - (3b)
First floor	43.7300	(1c)	x 2.8300	(2c) =	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		235.2674	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)

Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1275 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3775 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3209 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4091	0.4011	0.3931	0.3530	0.3450	0.3048	0.3048	0.2968	0.3209	0.3450	0.3610	0.3770	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		0.0000 (23c)

Effective ac	0.5837	0.5804	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type			19.0900	1.1450	21.8588			(27)
GF			43.7300	0.1300	5.6849			(28a)
Main	110.7742	21.2400	89.5342	0.1800	16.1162			(29a)
PIJ	43.7300		43.7300	0.1100	4.8103			(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.6201			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		85.8955 (35)
List of Thermal Bridges		

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.5100	0.0500	0.7255
E3 Sill	14.5100	0.0500	0.7255
E4 Jamb	29.8400	0.0500	1.4920
E5 Ground floor (normal)	20.5900	0.1600	3.2944
E10 Eaves (insulation at ceiling level)	14.6000	0.0600	0.8760
E12 Gable (insulation at ceiling level)	5.9900	0.0600	0.3594
E16 Corner (normal)	10.7600	0.0900	0.9684
E18 Party wall between dwellings	10.7600	0.0600	0.6456
P1 Party wall - Ground floor	5.9900	0.0800	0.4792
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.1200	0.7188
E6 Intermediate floor within a dwelling	20.5900	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.2848 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	60.9049 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.3170	45.0647	44.8173	43.6557	43.4383	42.4266	42.4266	42.2392	42.8163	43.4383	43.8780	44.3377	(38)
Heat transfer coeff	106.2219	105.9696	105.7223	104.5606	104.3433	103.3315	103.3315	103.1441	103.7212	104.3433	104.7830	105.2426	(39)
Average = Sum(39)m / 12 =												104.5596	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2145	1.2116	1.2088	1.1955	1.1930	1.1815	1.1815	1.1793	1.1859	1.1930	1.1981	1.2033	(40)
HLP (average)												1.1955	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.5893 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)
Hot water usage for other uses	41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)
Average daily hot water use (litres/day)												64.4873	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	70.3556	68.4255	66.3184	63.6958	61.3562	58.9247	58.4196	60.5225	62.6792	65.1761	67.8219	70.2568	(44)
Energy conte	111.4260	97.4370	101.9289	87.1964	82.5972	72.4549	70.6535	74.9395	77.2897	88.4434	96.6247	110.0052	(45)
Energy content (annual)										Total = Sum(45)m =		1070.9963	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	94.7121	82.8215	86.6396	74.1169	70.2076	61.5866	60.0554	63.6985	65.6963	75.1769	82.1310	93.5044	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	94.7121	82.8215	86.6396	74.1169	70.2076	61.5866	60.0554	63.6985	65.6963	75.1769	82.1310	93.5044	(64)
									Total per year (kWh/year) = Sum(64)m =			910.3469	(64)
12Total per year (kWh/year)												910	(64)

Electric shower(s)

	54.1638	48.2604	52.6985	50.2896	51.2332	48.8715	50.5006	51.2332	50.2896	52.6985	51.7076	54.1638 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												616.1105 (64a)
Heat gains from water heating, kWh/month												
	37.2190	32.7705	34.8345	31.1016	30.3602	27.6145	27.6390	28.7329	28.9965	31.9689	33.4597	36.9171 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	118.2644	130.9356	118.2644	122.2065	118.2644	122.2065	118.2644	118.2644	122.2065	118.2644	122.2065	118.2644	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	234.3264	236.7580	230.6305	217.5858	201.1192	185.6429	175.3038	172.8722	178.9997	192.0444	208.5110	223.9873	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)													
	50.0255	48.7656	46.8206	43.1967	40.8067	38.3535	37.1492	38.6195	40.2729	42.9689	46.4717	49.6197	(72)
Total internal gains													
	464.4563	478.2991	457.5555	444.8290	422.0303	408.0430	392.5574	391.5962	403.3191	415.1177	439.0293	453.7114	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.6000	19.6403	0.6300	0.7000	0.7700	63.6246	(76)
West	8.4900	19.6403	0.6300	0.7000	0.7700	50.9597	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	114.5843	224.1512	369.1451	538.3761	659.8001	675.4228	643.0300	552.3533	429.3310	265.9743	142.8731	94.2285	(83)
Total gains	579.0406	702.4503	826.7005	983.2051	1081.8304	1083.4658	1035.5874	943.9495	832.6501	681.0920	581.9024	547.9400	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000	(85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.6455	19.6923	19.7383	19.9576	19.9992	20.1950	20.1950	20.2317	20.1192	19.9992	19.9153	19.8283	
alpha	2.3097	2.3128	2.3159	2.3305	2.3333	2.3463	2.3463	2.3488	2.3413	2.3333	2.3277	2.3219	
util living area													
	0.9480	0.9202	0.8734	0.7821	0.6611	0.5180	0.4009	0.4474	0.6461	0.8407	0.9255	0.9536	(86)
MIT	17.9534	18.3617	18.9790	19.7571	20.3603	20.7480	20.9006	20.8687	20.5534	19.7150	18.7032	17.8894	(87)
Th 2	19.9084	19.9107	19.9130	19.9236	19.9256	19.9349	19.9349	19.9366	19.9313	19.9256	19.9215	19.9173	(88)
util rest of house													
	0.9409	0.9096	0.8565	0.7532	0.6157	0.4516	0.3155	0.3599	0.5831	0.8123	0.9138	0.9472	(89)
MIT 2	17.1400	17.5413	18.1435	18.8914	19.4438	19.7789	19.8899	19.8735	19.6314	18.8732	17.8904	17.0826	(90)
Living area fraction									fLA = Living area / (4) =			0.2056	(91)
MIT	17.3072	17.7100	18.3153	19.0693	19.6322	19.9782	20.0977	20.0781	19.8210	19.0463	18.0575	17.2484	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.3072	17.7100	18.3153	19.0693	19.6322	19.9782	20.0977	20.0781	19.8210	19.0463	18.0575	17.2484	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9174	0.8815	0.8256	0.7266	0.6021	0.4545	0.3292	0.3722	0.5759	0.7840	0.8868	0.9253	(94)
Useful gains	531.2217	619.2031	682.5330	714.4382	651.3609	492.4424	340.9147	351.3836	479.5377	533.9661	516.0422	506.9994	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1381.6513	1357.4659	1249.1362	1063.3119	827.6707	555.7328	361.4232	379.3746	593.3862	881.3100	1148.1613	1373.2531	(97)
Space heating kWh													
	632.7196	496.1126	421.5528	251.1891	131.1745	0.0000	0.0000	0.0000	0.0000	258.4239	455.1258	644.4928	(98a)
Space heating requirement - total per year (kWh/year)												3290.7910	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	632.7196	496.1126	421.5528	251.1891	131.1745	0.0000	0.0000	0.0000	0.0000	258.4239	455.1258	644.4928	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3290.7910	
Space heating per m2											(98c) / (4) =	37.6262	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	971.3160	764.6530	783.8953	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7763	0.8310	0.7988	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	754.0270	635.4170	626.2047	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1220.1474	1166.4832	1061.6911	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	335.6067	395.1133	324.0019	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	83.9017	98.7783	81.0005	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												263.6805	(107)

Energy for space heating	37.6262 (99)
Energy for space cooling	3.0149 (108)
Total	40.6411 (109)
Fabric Energy Efficiency (TFEE)	40.6 (109)

Full SAP Calculation Printout

Plot Reference	79841-07	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	2B3P (Semi)
Plot Address	Plot 7, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	83 B	**DER**	3.95	**TER**	11.67
Environmental	97 A	**% DER < TER**			66.15
CO_2 Emissions (t/year)	0.32	**DFEE**	40.01	**TFEE**	40.64
Compliance Check	See BREL	**% DFEE < TFEE**			1.55
% DPER < TPER	32.27	**DPER**	41.25	**TPER**	60.90

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	43.7300 (1b)	x	2.5500 (2b)	=	111.5115	(1b) - (3b)
First floor	43.7300 (1c)	x	2.8300 (2c)	=	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.2674	(5)

---

2. Ventilation rate

---

			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		3 * 10 =	30.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		30.0000 / (5) =	0.1275	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			4.0000	(17)
Infiltration rate			0.3275	(18)
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.2784	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3549	0.3480	0.3410	0.3062	0.2993	0.2645	0.2645	0.2575	0.2784	0.2993	0.3132	0.3271	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.6049	0.5980	0.5910	0.5562	0.5493	0.5145	0.5145	0.5075	0.5284	0.5493	0.5632	0.5771	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.4900	1.1450	13.1565			(27)
Glazed Doors			7.6000	1.1450	8.7023			(27)
GF			43.7300	0.1100	4.8103	75.0000	3279.7500	(28a)
Main	110.7742	21.2400	89.5342	0.1900	17.0115	9.0000	805.8078	(29a)
PIJ	43.7300		43.7300	0.0900	3.9357	9.0000	393.5700	(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.7663			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000	20.0000	644.6000	(32)
Timber			113.8200			9.0000	1024.3800	(32c)
Timber			20.4000			9.0000	183.6000	(32c)
FF			43.7300			18.0000	787.1400	(32d)
GF			43.7300			9.0000	393.5700	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7512.4178 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 85.8955 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.5100	0.0460	0.6675
E3 Sill	14.5100	0.0470	0.6820
E4 Jamb	29.8400	0.0530	1.5815
E5 Ground floor (normal)	20.5900	0.0680	1.4001
E10 Eaves (insulation at ceiling level)	14.6000	0.0910	1.3286
E12 Gable (insulation at ceiling level)	5.9900	0.0750	0.4492
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	5.9900	0.1160	0.6948
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.0460	0.2755
E6 Intermediate floor within a dwelling	20.5900	0.0540	1.1119

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2672 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.0334 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.9668	46.4264	45.8861	43.1844	42.6441	39.9424	39.9424	39.4020	41.0231	42.6441	43.7247	44.8054	(38)
Heat transfer coeff	106.0002	105.4599	104.9195	102.2178	101.6775	98.9758	98.9758	98.4355	100.0565	101.6775	102.7582	103.8389	(39)
Average = Sum(39)m / 12 =												102.0828	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2120	1.2058	1.1996	1.1687	1.1626	1.1317	1.1317	1.1255	1.1440	1.1626	1.1749	1.1873	(40)
HLP (average)												1.1672	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5893 (42)
Hot water usage for mixer showers

67.6343	66.6179	65.1368	62.3030	60.2117	57.8795	56.5538	58.0238	59.6350	62.1391	65.0338	67.3752	(42a)

Hot water usage for baths

29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)

Hot water usage for other uses

41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)

Average daily hot water use (litres/day) 126.8439 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.9899	135.0435	131.4552	125.9988	121.5679	116.8042	114.9735	118.5462	122.3142	127.3152	132.8557	137.6320	(44)
Energy conte	218.5423	192.3001	202.0418	172.4860	163.6537	143.6244	139.0504	146.7850	150.8257	172.7656	189.2773	215.4985	(45)
Energy content (annual)											Total = Sum(45)m =	2106.8508	
Distribution loss (46)m = 0.15 x (45)m	32.7813	28.8450	30.3063	25.8729	24.5481	21.5437	20.8576	22.0177	22.6239	25.9148	28.3916	32.3248	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(64)
										Total per year (kWh/year) = Sum(64)m =		2676.3968	(64)
12Total per year (kWh/year)												2676	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	111.3632	98.8927	105.8768	94.8012	93.1128	85.2047	84.9322	87.5039	87.5991	96.1425	100.3843	110.3512	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	118.2644	130.9356	118.2644	122.2065	118.2644	122.2065	118.2644	118.2644	122.2065	118.2644	122.2065	118.2644	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	234.3264	236.7580	230.6305	217.5858	201.1192	185.6429	175.3038	172.8722	178.9997	192.0444	208.5110	223.9873	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)	149.6818	147.1618	142.3075	131.6683	125.1516	118.3399	114.1562	117.6128	121.6655	129.2238	139.4227	148.3215	(72)
Total internal gains	564.1126	576.6954	553.0424	533.3007	506.3752	488.0294	469.5644	470.5894	484.7118	501.3726	531.9802	552.4132	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

East			3.0000		19.6403		0.3000		0.0000		0.7700		13.6107 (76)
West			8.4900		19.6403		0.3000		0.0000		0.7700		38.5183 (80)
East			7.6000		19.6403		0.3000		0.0000		0.7700		34.4804 (76)
Solar gains	86.6094	169.4264	279.0212	406.9358	498.7151	510.5236	486.0393	417.5006	324.5132	201.0387	107.9918	71.2234	(83)
Total gains	650.7220	746.1218	832.0636	940.2365	1005.0903	998.5530	955.6037	888.0900	809.2250	702.4113	639.9720	623.6366	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.6866	19.7875	19.8894	20.4151	20.5235	21.0838	21.0838	21.1995	20.8560	20.5235	20.3077	20.0964	
alpha	2.3124	2.3192	2.3260	2.3610	2.3682	2.4056	2.4056	2.4133	2.3904	2.3682	2.3538	2.3398	
util living area	0.9351	0.9109	0.8714	0.7915	0.6814	0.5358	0.4155	0.4552	0.6473	0.8296	0.9105	0.9402	(86)
Living	18.1081	18.4594	19.0087	19.7538	20.3388	20.7476	20.9014	20.8752	20.5746	19.7963	18.8657	18.0903	
Non living	17.2922	17.6387	18.1768	18.9054	19.4474	19.8162	19.9293	19.9187	19.6772	18.9652	18.0590	17.2873	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.5206	18.4594	19.0087	19.7538	20.3388	20.7476	20.9014	20.8752	20.5746	19.7963	18.8657	18.4973	(87)
Th 2	19.9104	19.9154	19.9203	19.9451	19.9501	19.9751	19.9751	19.9801	19.9650	19.9501	19.9401	19.9302	(88)
util rest of house	0.9266	0.8994	0.8543	0.7637	0.6374	0.4708	0.3309	0.3699	0.5859	0.8005	0.8971	0.9323	(89)
MIT 2	18.5710	17.6387	18.1768	18.9054	19.4474	19.8162	19.9293	19.9187	19.6772	18.9652	18.0590	17.6570	(90)
Living area fraction										fLA = Living area / (4) =		0.2056	(91)
MIT	18.7663	17.8074	18.3478	19.0798	19.6306	20.0077	20.1291	20.1153	19.8617	19.1360	18.2249	17.8297	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7663	17.8074	18.3478	19.0798	19.6306	20.0077	20.1291	20.1153	19.8617	19.1360	18.2249	17.8297	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9158	0.8703	0.8236	0.7372	0.6226	0.4730	0.3442	0.3819	0.5791	0.7733	0.8689	0.9121	(94)
Useful gains	595.9114	649.3608	685.3029	693.1332	625.7317	472.3015	328.9521	339.1532	468.6135	543.1759	556.0840	568.8159	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1533.4264	1361.2162	1243.0667	1040.5582	806.3674	535.2322	349.2998	365.7208	576.4916	867.9212	1143.1712	1415.2964	(97)
Space heating kWh	697.5112	478.3668	414.9762	250.1460	134.3930	0.0000	0.0000	0.0000	0.0000	241.6105	422.7028	629.7815	(98a)
Space heating requirement - total per year (kWh/year)												3269.4881	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	697.5112	478.3668	414.9762	250.1460	134.3930	0.0000	0.0000	0.0000	0.0000	241.6105	422.7028	629.7815	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3269.4881	
Space heating per m2											(98c) / (4) =	37.3827	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	286.3431 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	697.5112	478.3668	414.9762	250.1460	134.3930	0.0000	0.0000	0.0000	0.0000	241.6105	422.7028	629.7815	(98)
Space heating efficiency (main heating system 1)	286.3431	286.3431	286.3431	286.3431	286.3431	0.0000	0.0000	0.0000	0.0000	286.3431	286.3431	286.3431	(210)
Space heating fuel (main heating system)	243.5928	167.0607	144.9228	87.3589	46.9343	0.0000	0.0000	0.0000	0.0000	84.3780	147.6211	219.9395	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	93.6855	82.8316	87.8939	76.9723	74.4199	66.8421	65.7843	68.4991	69.3697	77.6181	82.8660	92.6172	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.3636	3.9413	4.3636	4.2228	4.3636	4.2228	4.3636	4.3636	4.2228	4.3636	4.2228	4.3636	(231)
Lighting	24.5730	19.7134	17.7497	13.0042	10.0448	8.2067	9.1632	11.9107	15.4708	20.2986	22.9272	25.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	1141.8080	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	284.9050	
Water heating fuel used	939.3997	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)		
mechanical ventilation fans (SFP = 0.1790)	51.3777	(230a)
Total electricity for the above, kWh/year	51.3777	(231)
Electricity for lighting (calculated in Appendix L)	198.3182	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2330.9037	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1141.8080	0.1549	176.9125	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	939.3997	0.1410	132.4256	(264)
Space and water heating			309.3381	(265)
Pumps, fans and electric keep-hot	51.3777	0.1387	7.1267	(267)
Energy for lighting	198.3182	0.1443	28.6234	(268)
Total CO2, kg/year			345.0882	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.9500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1141.8080	1.5736	1796.7338	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	939.3997	1.5213	1429.0647	(278)
Space and water heating			3225.7985	(279)
Pumps, fans and electric keep-hot	51.3777	1.5128	77.7242	(281)
Energy for lighting	198.3182	1.5338	304.1871	(282)
Total Primary energy kWh/year			3607.7098	(286)
Dwelling Primary energy Rate (DPER)			41.2500	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling							
Ground floor		43.7300 (1b)	x	2.5500 (2b)	=	111.5115	(1b) - (3b)
First floor		43.7300 (1c)	x	2.8300 (2c)	=	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.2674	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1275	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3775	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3209	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)

Adj infilt rate													
	0.4091	0.4011	0.3931	0.3530	0.3450	0.3048	0.3048	0.2968	0.3209	0.3450	0.3610	0.3770	(22b)
Effective ac	0.5837	0.5804	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711	(25)

---

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type			19.0900	1.1450	21.8588			(27)
GF			43.7300	0.1300	5.6849			(28a)
Main	110.7742	21.2400	89.5342	0.1800	16.1162			(29a)
PIJ	43.7300		43.7300	0.1100	4.8103			(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.6201			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 85.8955 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	14.5100	0.0500	0.7255	
E3 Sill	14.5100	0.0500	0.7255	
E4 Jamb	29.8400	0.0500	1.4920	
E5 Ground floor (normal)	20.5900	0.1600	3.2944	
E10 Eaves (insulation at ceiling level)	14.6000	0.0600	0.8760	
E12 Gable (insulation at ceiling level)	5.9900	0.0600	0.3594	
E16 Corner (normal)	10.7600	0.0900	0.9684	
E18 Party wall between dwellings	10.7600	0.0600	0.6456	
P1 Party wall - Ground floor	5.9900	0.0800	0.4792	
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.1200	0.7188	
E6 Intermediate floor within a dwelling	20.5900	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.2848	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	60.9049	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.3170	45.0647	44.8173	43.6557	43.4383	42.4266	42.4266	42.2392	42.8163	43.4383	43.8780	44.3377	(38)
Heat transfer coeff	106.2219	105.9696	105.7223	104.5606	104.3433	103.3315	103.3315	103.1441	103.7212	104.3433	104.7830	105.2426	(39)
Average = Sum(39)m / 12 =												104.5596	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2145	1.2116	1.2088	1.1955	1.1930	1.1815	1.1815	1.1793	1.1859	1.1930	1.1981	1.2033	(40)
HLP (average)												1.1955	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5893	(42)
Hot water usage for mixer showers													
	67.6343	66.6179	65.1368	62.3030	60.2117	57.8795	56.5538	58.0238	59.6350	62.1391	65.0338	67.3752	(42a)
Hot water usage for baths													
	29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)
Hot water usage for other uses													
	41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)
Average daily hot water use (litres/day)												126.8439	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	137.9899	135.0435	131.4552	125.9988	121.5679	116.8042	114.9735	118.5462	122.3142	127.3152	132.8557	137.6320	(44)
Energy conte	218.5423	192.3001	202.0418	172.4860	163.6537	143.6244	139.0504	146.7850	150.8257	172.7656	189.2773	215.4985	(45)
Energy content (annual)										Total = Sum(45)m =		2106.8508	
Distribution loss (46)m = 0.15 x (45)m													
	32.7813	28.8450	30.3063	25.8729	24.5481	21.5437	20.8576	22.0177	22.6239	25.9148	28.3916	32.3248	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6426	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8870	(55)
Total storage loss													
	27.4979	24.8369	27.4979	26.6109	27.4979	26.6109	27.4979	27.4979	26.6109	27.4979	26.6109	27.4979	(56)
If cylinder contains dedicated solar storage													
	27.4979	24.8369	27.4979	26.6109	27.4979	26.6109	27.4979	27.4979	26.6109	27.4979	26.6109	27.4979	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	269.3026	238.1481	252.8021	221.6090	214.4140	192.7473	189.8108	197.5453	199.9486	223.5259	238.4002	266.2588	(62)
WWHRS	-30.9196	-27.3455	-28.6347	-23.7106	-22.0975	-18.9090	-17.7241	-18.8478	-19.5639	-23.0637	-26.1284	-30.3470	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	238.3830	210.8026	224.1674	197.8983	192.3166	173.8384	172.0866	178.6975	180.3847	200.4622	212.2718	235.9118	(64)
										Total per year (kWh/year) = Sum(64)m =		2417.2209	(64)
12Total per year (kWh/year)												2417	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	113.2736	100.6182	107.7872	96.6499	95.0231	87.0534	86.8425	89.4143	89.4479	98.0528	102.2330	112.2615	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	118.2644	130.9356	118.2644	122.2065	118.2644	122.2065	118.2644	118.2644	122.2065	118.2644	122.2065	118.2644	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													

	234.3264	236.7580	230.6305	217.5858	201.1192	185.6429	175.3038	172.8722	178.9997	192.0444	208.5110	223.9873	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)													
	152.2494	149.7295	144.8752	134.2360	127.7193	120.9076	116.7239	120.1805	124.2332	131.7914	141.9903	150.8892	(72)
Total internal gains													
	569.6802	582.2631	558.6101	538.8684	511.9429	490.5970	472.1321	473.1571	487.2794	506.9403	537.5479	557.9809	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.6000	19.6403	0.6300	0.7000	0.7700	63.6246	(76)
West	8.4900	19.6403	0.6300	0.7000	0.7700	50.9597	(80)

Solar gains	114.5843	224.1512	369.1451	538.3761	659.8001	675.4228	643.0300	552.3533	429.3310	265.9743	142.8731	94.2285	(83)
Total gains	684.2645	806.4142	927.7552	1077.2444	1171.7429	1166.0198	1115.1621	1025.5104	916.6104	772.9145	680.4210	652.2094	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.6455	19.6923	19.7383	19.9576	19.9992	20.1950	20.1950	20.2317	20.1192	19.9992	19.9153	19.8283	
alpha	2.3097	2.3128	2.3159	2.3305	2.3333	2.3463	2.3463	2.3488	2.3413	2.3333	2.3277	2.3219	
util living area													
	0.9289	0.8983	0.8478	0.7537	0.6317	0.4908	0.3767	0.4187	0.6103	0.8075	0.9016	0.9353	(86)
MIT	18.1691	18.5559	19.1398	19.8649	20.4230	20.7759	20.9131	20.8863	20.6073	19.8443	18.8905	18.1080	(87)
Th 2	19.9084	19.9107	19.9130	19.9236	19.9256	19.9349	19.9349	19.9366	19.9313	19.9256	19.9215	19.9173	(88)
util rest of house													
	0.9197	0.8855	0.8286	0.7230	0.5857	0.4260	0.2952	0.3348	0.5469	0.7757	0.8870	0.9269	(89)
MIT 2	16.6258	17.1103	17.8364	18.7224	19.3724	19.7586	19.8850	19.8674	19.5973	18.7241	17.5456	16.5538	(90)
Living area fraction										fLA = Living area / (4) =		0.2056	(91)
MIT	16.9431	17.4075	18.1044	18.9573	19.5883	19.9677	20.0963	20.0768	19.8049	18.9544	17.8221	16.8733	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.9431	17.4075	18.1044	18.9573	19.5883	19.9677	20.0963	20.0768	19.8049	18.9544	17.8221	16.8733	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8842	0.8463	0.7887	0.6913	0.5699	0.4281	0.3080	0.3464	0.5387	0.7409	0.8488	0.8930	(94)
Useful gains	605.0532	682.4476	731.7367	744.6670	667.8221	499.1628	343.5218	355.2840	493.7427	572.6229	577.5182	582.4271	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1342.9696	1325.4119	1226.8417	1051.5951	823.0951	554.6541	361.2803	379.2433	591.7237	871.7217	1123.4926	1333.7762	(97)
Space heating kWh													
	549.0098	432.0720	368.3582	220.9882	115.5231	0.0000	0.0000	0.0000	0.0000	222.5295	393.1016	559.0037	(98a)
Space heating requirement - total per year (kWh/year)												2860.5862	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	549.0098	432.0720	368.3582	220.9882	115.5231	0.0000	0.0000	0.0000	0.0000	222.5295	393.1016	559.0037	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2860.5862	
Space heating per m2											(98c) / (4) =	32.7074	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	549.0098	432.0720	368.3582	220.9882	115.5231	0.0000	0.0000	0.0000	0.0000	222.5295	393.1016	559.0037	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	594.8102	468.1170	399.0879	239.4239	125.1605	0.0000	0.0000	0.0000	0.0000	241.0938	425.8955	605.6378	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	238.3830	210.8026	224.1674	197.8983	192.3166	173.8384	172.0866	178.6975	180.3847	200.4622	212.2718	235.9118	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.8681	85.6331	85.1661	84.3079	82.9551	79.8000	79.8000	79.8000	79.8000	84.2945	85.4219	85.9240	(217)
Fuel for water heating, kWh/month													
	277.6155	246.1694	263.2120	234.7329	231.8320	217.8426	215.6474	223.9317	226.0459	237.8116	248.4983	274.5586	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	24.5730	19.7134	17.7497	13.0042	10.0448	8.2067	9.1632	11.9107	15.4708	20.2986	22.9272	25.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-40.4681	-56.8289	-81.3729	-91.1293	-97.9537	-91.3009	-90.1428	-85.2277	-76.5407	-64.7751	-44.3982	-35.0109	(233a)

Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-23.5612	-49.4807	-98.1995	-147.2879	-194.5714	-195.4512	-193.1789	-163.6739	-120.0949	-70.7300	-31.4452	-18.6406 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3099.2266	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2897.8980	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	198.3182	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2161.4648	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4119.9781	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3099.2266	0.2100	650.8376	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2897.8980	0.2100	608.5586	(264)
Space and water heating			1259.3962	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	198.3182	0.1443	28.6234	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-855.1493	0.1347	-115.1661	
PV Unit electricity exported	-1306.3155	0.1259	-164.5086	
Total			-279.6747	(269)
Total CO2, kg/year			1020.2742	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.6700	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3099.2266	1.1300	3502.1261	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2897.8980	1.1300	3274.6247	(278)
Space and water heating			6776.7508	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	198.3182	1.5338	304.1871	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-855.1493	1.4977	-1280.7879	
PV Unit electricity exported	-1306.3155	0.4623	-603.8616	
Total			-1884.6496	(283)
Total Primary energy kWh/year			5326.3892	(286)
Target Primary Energy Rate (TPER)			60.9000	(287)

Full SAP Calculation Printout

Plot Reference	79841-07	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	2B3P (Semi)
Plot Address	Plot 7, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	83 B	**DER**	3.95	**TER**	11.67
Environmental	97 A	**% DER < TER**			66.15
CO_2 Emissions (t/year)	0.32	**DFEE**	40.01	**TFEE**	40.64
Compliance Check	See BREL	**% DFEE < TFEE**			1.55
% DPER < TPER	32.27	**DPER**	41.25	**TPER**	60.90

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	43.7300 (1b)	x	2.5500 (2b)	=	111.5115	(1b) - (3b)
First floor	43.7300 (1c)	x	2.8300 (2c)	=	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.2674	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1275	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3275	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2784	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3549	0.3480	0.3410	0.3062	0.2993	0.2645	0.2645	0.2575	0.2784	0.2993	0.3132	0.3271	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.6049	0.5980	0.5910	0.5562	0.5493	0.5145	0.5145	0.5075	0.5284	0.5493	0.5632	0.5771	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.4900	1.1450	13.1565			(27)
Glazed Doors			7.6000	1.1450	8.7023			(27)
GF			43.7300	0.1100	4.8103	75.0000	3279.7500	(28a)
Main	110.7742	21.2400	89.5342	0.1900	17.0115	9.0000	805.8078	(29a)
PIJ	43.7300		43.7300	0.0900	3.9357	9.0000	393.5700	(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.7663			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000	20.0000	644.6000	(32)
Timber			113.8200			9.0000	1024.3800	(32c)
Timber			20.4000			9.0000	183.6000	(32c)
FF			43.7300			18.0000	787.1400	(32d)
GF			43.7300			9.0000	393.5700	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7512.4178 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 85.8955 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.5100	0.0460	0.6675
E3 Sill	14.5100	0.0470	0.6820
E4 Jamb	29.8400	0.0530	1.5815
E5 Ground floor (normal)	20.5900	0.0680	1.4001
E10 Eaves (insulation at ceiling level)	14.6000	0.0910	1.3286
E12 Gable (insulation at ceiling level)	5.9900	0.0750	0.4492
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	5.9900	0.1160	0.6948
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.0460	0.2755
E6 Intermediate floor within a dwelling	20.5900	0.0540	1.1119

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2672 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.0334 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.9668	46.4264	45.8861	43.1844	42.6441	39.9424	39.9424	39.4020	41.0231	42.6441	43.7247	44.8054	(38)
Heat transfer coeff	106.0002	105.4599	104.9195	102.2178	101.6775	98.9758	98.9758	98.4355	100.0565	101.6775	102.7582	103.8389	(39)
Average = Sum(39)m / 12 =												102.0828	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2120	1.2058	1.1996	1.1687	1.1626	1.1317	1.1317	1.1255	1.1440	1.1626	1.1749	1.1873	(40)
HLP (average)												1.1672	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5893 (42)
Hot water usage for mixer showers

67.6343	66.6179	65.1368	62.3030	60.2117	57.8795	56.5538	58.0238	59.6350	62.1391	65.0338	67.3752	(42a)

Hot water usage for baths

29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)

Hot water usage for other uses

41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)

Average daily hot water use (litres/day) 126.8439 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.9899	135.0435	131.4552	125.9988	121.5679	116.8042	114.9735	118.5462	122.3142	127.3152	132.8557	137.6320	(44)
Energy conte	218.5423	192.3001	202.0418	172.4860	163.6537	143.6244	139.0504	146.7850	150.8257	172.7656	189.2773	215.4985	(45)
Energy content (annual)										Total = Sum(45)m =		2106.8508	
Distribution loss (46)m = 0.15 x (45)m	32.7813	28.8450	30.3063	25.8729	24.5481	21.5437	20.8576	22.0177	22.6239	25.9148	28.3916	32.3248	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(64)
										Total per year (kWh/year) = Sum(64)m =		2676.3968	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	111.3632	98.8927	105.8768	94.8012	93.1128	85.2047	84.9322	87.5039	87.5991	96.1425	100.3843	110.3512	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.0740	24.9351	20.2786	15.3522	11.4759	9.6885	10.4687	13.6077	18.2642	23.1905	27.0668	28.8543	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	349.7409	353.3701	344.2246	324.7549	300.1779	277.0790	261.6475	258.0183	267.1638	286.6335	311.2105	334.3094	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)	149.6818	147.1618	142.3075	131.6683	125.1516	118.3399	114.1562	117.6128	121.6655	129.2238	139.4227	148.3215	(72)
Total internal gains	632.4087	630.3790	611.7227	576.6874	541.7174	510.0193	491.1844	494.1507	512.0054	543.9598	582.6119	616.3971	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.0000	19.6403	0.3000	0.0000	0.7700	13.6107	(76)

West				8.4900	19.6403	0.3000	0.0000	0.7700				38.5183	(80)
East				7.6000	19.6403	0.3000	0.0000	0.7700				34.4804	(76)
Solar gains	86.6094	169.4264	279.0212	406.9358	498.7151	510.5236	486.0393	417.5006	324.5132	201.0387	107.9918	71.2234	(83)
Total gains	719.0181	799.8054	890.7439	983.6232	1040.4325	1020.5430	977.2237	911.6513	836.5186	744.9985	690.6037	687.6205	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.6866	19.7875	19.8894	20.4151	20.5235	21.0838	21.0838	21.1995	20.8560	20.5235	20.3077	20.0964	
alpha	2.3124	2.3192	2.3260	2.3610	2.3682	2.4056	2.4056	2.4133	2.3904	2.3682	2.3538	2.3398	
util living area	0.9221	0.8994	0.8565	0.7780	0.6688	0.5276	0.4079	0.4458	0.6349	0.8139	0.8977	0.9282	(86)
Living	18.2439	18.5585	19.1033	19.8070	20.3668	20.7562	20.9053	20.8808	20.5932	19.8561	18.9597	18.2208	
Non living	17.4239	17.7339	18.2659	18.9532	19.4704	19.8221	19.9313	19.9217	19.6910	19.0188	18.1487	17.4142	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.5901	18.5585	19.1033	19.8070	20.3668	20.7562	20.9053	20.8808	20.5932	19.8561	18.9597	18.6095	(87)
Th 2	19.9104	19.9154	19.9203	19.9451	19.9501	19.9751	19.9751	19.9801	19.9650	19.9501	19.9401	19.9302	(88)
util rest of house	0.9122	0.8867	0.8380	0.7492	0.6244	0.4629	0.3244	0.3617	0.5732	0.7832	0.8828	0.9190	(89)
MIT 2	18.6384	17.7339	18.2659	18.9532	19.4704	19.8221	19.9313	19.9217	19.6910	19.0188	18.1487	17.7661	(90)
Living area fraction									fLA = Living area / (4) =			0.2056	(91)
MIT	18.8341	17.9035	18.4380	19.1287	19.6546	20.0141	20.1315	20.1189	19.8765	19.1910	18.3154	17.9395	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8341	17.9035	18.4380	19.1287	19.6546	20.0141	20.1315	20.1189	19.8765	19.1910	18.3154	17.9395	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9005	0.8567	0.8072	0.7236	0.6107	0.4655	0.3377	0.3737	0.5674	0.7568	0.8537	0.8971	(94)
Useful gains	647.4596	685.2036	719.0477	711.7549	635.3708	475.0557	330.0172	340.7173	474.6623	563.7859	589.5519	616.8669	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1540.6142	1371.3424	1252.5307	1045.5591	808.8081	535.8682	349.5354	366.0694	577.9733	873.5081	1152.4766	1426.6951	(97)
Space heating kWh	664.5070	461.0852	396.9114	240.3390	129.0373	0.0000	0.0000	0.0000	0.0000	230.4333	405.3058	602.5122	(98a)
Space heating requirement - total per year (kWh/year)												3130.1313	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	664.5070	461.0852	396.9114	240.3390	129.0373	0.0000	0.0000	0.0000	0.0000	230.4333	405.3058	602.5122	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3130.1313	
Space heating per m2											(98c) / (4) =	35.7893	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												286.3431	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement	664.5070	461.0852	396.9114	240.3390	129.0373	0.0000	0.0000	0.0000	0.0000	230.4333	405.3058	602.5122	(98)
Space heating efficiency (main heating system 1)	286.3431	286.3431	286.3431	286.3431	286.3431	0.0000	0.0000	0.0000	0.0000	286.3431	286.3431	286.3431	(210)
Space heating fuel (main heating system)	232.0667	161.0255	138.6139	83.9339	45.0639	0.0000	0.0000	0.0000	0.0000	80.4745	141.5455	210.4162	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	93.6855	82.8316	87.8939	76.9723	74.4199	66.8421	65.7843	68.4991	69.3697	77.6181	82.8660	92.6172	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.3636	3.9413	4.3636	4.2228	4.3636	4.2228	4.3636	4.3636	4.2228	4.3636	4.2228	4.3636	(231)
Lighting	24.5730	19.7134	17.7497	13.0042	10.0448	8.2067	9.1632	11.9107	15.4708	20.2986	22.9272	25.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1093.1402	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	284.9050	
Water heating fuel used	939.3997	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)		
mechanical ventilation fans (SFP = 0.1790)	51.3777	(230a)
Total electricity for the above, kWh/year	51.3777	(231)
Electricity for lighting (calculated in Appendix L)	198.3182	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2282.2359	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1093.1402	16.4900	180.2588	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	939.3997	16.4900	154.9070	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	51.3777	16.4900	8.4722	(249)
Energy for lighting	198.3182	16.4900	32.7027	(250)
Additional standing charges			0.0000	(251)
Total energy cost			376.3407	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0228	(257)
SAP value		83.4201	
SAP rating (Section 12)		83	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1093.1402	0.1549	169.3656	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	939.3997	0.1410	132.4256	(264)
Space and water heating			301.7912	(265)
Pumps, fans and electric keep-hot	51.3777	0.1387	7.1267	(267)
Energy for lighting	198.3182	0.1443	28.6234	(268)
Total CO2, kg/year			337.5414	(272)
CO2 emissions per m2			3.8600	(273)
EI value			96.5853	
EI rating			97	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	43.7300	(1b)	x 2.5500	(2b) =	111.5115	(1b) - (3b)
First floor	43.7300	(1c)	x 2.8300	(2c) =	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		235.2674	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 30.0000 / (5) =	0.1275	(8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	4.0000	(17)
Infiltration rate	0.3275	(18)
Number of sides sheltered	2	(19)
Shelter factor (20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) =	0.2784	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.5000	4.4000	4.4000	4.0000	4.1000	3.5000	3.4000	3.4000	3.5000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1250	1.1000	1.1000	1.0000	1.0250	0.8750	0.8500	0.8500	0.8750	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.3132	0.3062	0.3062	0.2784	0.2853	0.2436	0.2366	0.2366	0.2436	0.2714	0.2714	0.2784	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
Effective ac	0.5632	0.5562	0.5562	0.5284	0.5353	0.5000	0.5000	0.5000	0.5000	0.5214	0.5214	0.5284	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.4900	1.1450	13.1565			(27)
Glazed Doors			7.6000	1.1450	8.7023			(27)
GF			43.7300	0.1100	4.8103	75.0000	3279.7500	(28a)
Main	110.7742	21.2400	89.5342	0.1900	17.0115	9.0000	805.8078	(29a)
PIJ	43.7300		43.7300	0.0900	3.9357	9.0000	393.5700	(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.7663			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000	20.0000	644.6000	(32)
Timber			113.8200			9.0000	1024.3800	(32c)
Timber			20.4000			9.0000	183.6000	(32c)
FF			43.7300			18.0000	787.1400	(32d)
GF			43.7300			9.0000	393.5700	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) =	7512.4178	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	85.8955	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.5100	0.0460	0.6675
E3 Sill	14.5100	0.0470	0.6820
E4 Jamb	29.8400	0.0530	1.5815
E5 Ground floor (normal)	20.5900	0.0680	1.4001
E10 Eaves (insulation at ceiling level)	14.6000	0.0910	1.3286
E12 Gable (insulation at ceiling level)	5.9900	0.0750	0.4492
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	5.9900	0.1160	0.6948
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.0460	0.2755
E6 Intermediate floor within a dwelling	20.5900	0.0540	1.1119

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2672	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	59.0334	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.7247	43.1844	43.1844	41.0231	41.5634	38.8191	38.8191	38.8191	38.8191	40.4827	40.4827	41.0231	(38)
Heat transfer coeff	102.7582	102.2178	102.2178	100.0565	100.5968	97.8526	97.8526	97.8526	97.8526	99.5162	99.5162	100.0565	(39)
Average = Sum(39)m / 12 =												99.8622	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1749	1.1687	1.1687	1.1440	1.1502	1.1188	1.1188	1.1188	1.1188	1.1378	1.1378	1.1440	(40)
HLP (average)												1.1418	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5893	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	67.6343	66.6179	65.1368	62.3030	60.2117	57.8795	56.5538	58.0238	59.6350	62.1391	65.0338	67.3752	(42a)
Hot water usage for baths	29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)
Hot water usage for other uses	41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)
Average daily hot water use (litres/day)												126.8439	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.9899	135.0435	131.4552	125.9988	121.5679	116.8042	114.9735	118.5462	122.3142	127.3152	132.8557	137.6320	(44)
Energy conte	218.5423	192.3001	202.0418	172.4860	163.6537	143.6244	139.0504	146.7850	150.8257	172.7656	189.2773	215.4985	(45)
Energy content (annual)										Total = Sum(45)m =		2106.8508	
Distribution loss (46)m = 0.15 x (45)m	32.7813	28.8450	30.3063	25.8729	24.5481	21.5437	20.8576	22.0177	22.6239	25.9148	28.3916	32.3248	(46)

Water storage loss (or HIU loss):		
Store volume	198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.5000	(48)
Temperature factor from Table 2b	0.5400	(49)
Enter (49) or (54) in (55)	0.8100	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)

PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(64)
									Total per year (kWh/year) = Sum(64)m =			2676.3968	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =				0.0000	(64a)
Heat gains from water heating, kWh/month													
	111.3632	98.8927	105.8768	94.8012	93.1128	85.2047	84.9322	87.5039	87.5991	96.1425	100.3843	110.3512	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.0740	24.9351	20.2786	15.3522	11.4759	9.6885	10.4687	13.6077	18.2642	23.1905	27.0668	28.8543	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	349.7409	353.3701	344.2246	324.7549	300.1779	277.0790	261.6475	258.0183	267.1638	286.6335	311.2105	334.3094	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)													
	149.6818	147.1618	142.3075	131.6683	125.1516	118.3399	114.1562	117.6128	121.6655	129.2238	139.4227	148.3215	(72)
Total internal gains													
	632.4087	630.3790	611.7227	576.6874	541.7174	510.0193	491.1844	494.1507	512.0054	543.9598	582.6119	616.3971	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.0000	17.3606	0.3000	0.0000	0.7700	12.0309	(76)
West	8.4900	17.3606	0.3000	0.0000	0.7700	34.0474	(80)
East	7.6000	17.3606	0.3000	0.0000	0.7700	30.4782	(76)

Solar gains	76.5565	153.6258	267.2216	395.8729	469.9406	495.0205	460.1381	390.7168	318.6765	194.8089	101.3691	67.7785	(83)
Total gains	708.9652	784.0048	878.9443	972.5604	1011.6580	1005.0398	951.3225	884.8675	830.6819	738.7687	683.9810	684.1756	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.3077	20.4151	20.4151	20.8560	20.7440	21.3258	21.3258	21.3258	21.3258	20.9693	20.9693	20.8560	
alpha	2.3538	2.3610	2.3610	2.3904	2.3829	2.4217	2.4217	2.4217	2.4217	2.3980	2.3980	2.3904	
util living area													
	0.9165	0.8929	0.8450	0.7561	0.6343	0.4800	0.3736	0.4143	0.6088	0.7960	0.8890	0.9223	(86)
Living	18.4903	18.7886	19.3104	19.9905	20.5077	20.8309	20.9325	20.9108	20.6639	20.0090	19.1686	18.4723	
Non living	17.6858	17.9793	18.4835	19.1404	19.6037	19.8885	19.9580	19.9466	19.7662	19.1769	18.3724	17.6843	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.7161	18.7886	19.3104	19.9905	20.5077	20.8309	20.9325	20.9108	20.6639	20.0090	19.1686	18.8258	(87)
Th 2	19.9401	19.9451	19.9451	19.9650	19.9600	19.9855	19.9855	19.9855	19.9855	19.9700	19.9700	19.9650	(88)
util rest of house													
	0.9056	0.8792	0.8249	0.7240	0.5836	0.4090	0.2856	0.3241	0.5438	0.7619	0.8726	0.9123	(89)
MIT 2	18.7869	17.9793	18.4835	19.1404	19.6037	19.8885	19.9580	19.9466	19.7662	19.1769	18.3724	18.0033	(90)
Living area fraction										fLA = Living area / (4) =		0.2056	(91)
MIT	18.9779	18.1456	18.6535	19.3152	19.7895	20.0822	20.1584	20.1448	19.9508	19.3480	18.5361	18.1724	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9779	18.1456	18.6535	19.3152	19.7895	20.0822	20.1584	20.1448	19.9508	19.3480	18.5361	18.1724	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8940	0.8496	0.7952	0.7012	0.5746	0.4162	0.3012	0.3390	0.5414	0.7378	0.8440	0.8904	(94)
Useful gains	633.7905	666.0991	698.9196	681.9735	581.3000	418.2543	286.5626	299.9722	449.7067	545.0560	577.3130	609.1797	(95)
Ext temp.	5.0000	5.6000	7.2000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.2000	7.7000	4.8000	(96)
Heat loss rate W													
	1436.3453	1282.3892	1170.7484	962.0629	713.1837	458.1691	299.2699	317.5112	533.3708	810.8551	1078.3641	1337.9949	(97)
Space heating kWh													
	597.1007	414.1470	351.0406	201.6644	98.1214	0.0000	0.0000	0.0000	0.0000	197.7545	360.7568	542.2385	(98a)
Space heating requirement - total per year (kWh/year)												2762.8240	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	597.1007	414.1470	351.0406	201.6644	98.1214	0.0000	0.0000	0.0000	0.0000	197.7545	360.7568	542.2385	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2762.8240	
Space heating per m2											(98c) / (4) =	31.5896	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	286.9197	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	597.1007	414.1470	351.0406	201.6644	98.1214	0.0000	0.0000	0.0000	0.0000	197.7545	360.7568	542.2385	(98)
Space heating efficiency (main heating system 1)	286.9197	286.9197	286.9197	286.9197	286.9197	0.0000	0.0000	0.0000	0.0000	286.9197	286.9197	286.9197	(210)
Space heating fuel (main heating system)	208.1073	144.3425	122.3480	70.2860	34.1982	0.0000	0.0000	0.0000	0.0000	68.9233	125.7344	188.9862	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	93.6855	82.8316	87.8939	76.9723	74.4199	66.8421	65.7843	68.4991	69.3697	77.6181	82.8660	92.6172	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.3636	3.9413	4.3636	4.2228	4.3636	4.2228	4.3636	4.3636	4.2228	4.3636	4.2228	4.3636	(231)
Lighting	24.5730	19.7134	17.7497	13.0042	10.0448	8.2067	9.1632	11.9107	15.4708	20.2986	22.9272	25.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	962.9259	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	284.9050	
Water heating fuel used	939.3997	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)		
mechanical ventilation fans (SFP = 0.1790)	51.3777	(230a)
Total electricity for the above, kWh/year	51.3777	(231)
Electricity for lighting (calculated in Appendix L)	198.3182	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2152.0216	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	962.9259	26.0000	250.3607	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	939.3997	26.0000	244.2439	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	51.3777	26.0000	13.3582	(249)
Energy for lighting	198.3182	26.0000	51.5627	(250)
Additional standing charges			0.0000	(251)
Total energy cost			559.5256	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	962.9259	0.1552	149.4648	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	939.3997	0.1410	132.4256	(264)
Space and water heating			281.8904	(265)
Pumps, fans and electric keep-hot	51.3777	0.1387	7.1267	(267)
Energy for lighting	198.3182	0.1443	28.6234	(268)
Total CO2, kg/year			317.6405	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	962.9259	1.5746	1516.2462	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	939.3997	1.5213	1429.0647	(278)
Space and water heating			2945.3109	(279)
Pumps, fans and electric keep-hot	51.3777	1.5128	77.7242	(281)
Energy for lighting	198.3182	1.5338	304.1871	(282)

Total Primary energy kWh/year 3327.2222 (286)

SAP 10 EPC IMPROVEMENTS

001

Current energy efficiency rating: B 83
Current environmental impact rating: A 97

N	Solar water heating		Recommended
U	Solar photovoltaic panels		Recommended
V2	Wind turbine		Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.4	-£ 49	-23 kg (7.3%)
U Solar photovoltaic panels	+ 8.3	-£ 259	-212 kg (71.9%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£49	0.27 kg/m²	B 85	A 97
Solar photovoltaic panels	£259	2.42 kg/m²	A 93	A 99
Total Savings	£308	2.69 kg/m²		

Potential energy efficiency rating: A 93
Potential environmental impact rating: A 99

Fuel prices for cost data on this page from database revision number 599 TEST (30 Sep 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, West Pennines (England)):

	Current	Potential	Saving
Electricity	£560	£510	£49
Space heating	£264	£287	-£23
Water heating	£244	£172	£72
Lighting	£52	£52	£0
Generated (PV)	-£0	-£259	£259
Total cost of fuels	£560	£251	£308
Total cost of uses	£560	£252	£308
Delivered energy	25 kWh/m²	4 kWh/m²	21 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.1 tonnes	0.2 tonnes
CO2 emissions per m²	4 kg/m²	1 kg/m²	3 kg/m²
Primary energy	38 kWh/m²	17 kWh/m²	21 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	43.7300	(1b)	x 2.5500	(2b) =	111.5115	(1b) - (3b)
First floor	43.7300	(1c)	x 2.8300	(2c) =	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		235.2674	(5)

---

2. Ventilation rate

---

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1275 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.3275 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2784 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)

Adj infilt rate

	0.3549	0.3480	0.3410	0.3062	0.2993	0.2645	0.2645	0.2575	0.2784	0.2993	0.3132	0.3271 (22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

Effective ac	0.6049	0.5980	0.5910	0.5562	0.5493	0.5145	0.5145	0.5075	0.5284	0.5493	0.5632	0.5771 (25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.4900	1.1450	13.1565			(27)
Glazed Doors			7.6000	1.1450	8.7023			(27)
GF			43.7300	0.1100	4.8103	75.0000	3279.7500	(28a)
Main	110.7742	21.2400	89.5342	0.1900	17.0115	9.0000	805.8078	(29a)
PIJ	43.7300		43.7300	0.0900	3.9357	9.0000	393.5700	(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.7663			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000	20.0000	644.6000	(32)
Timber			113.8200			9.0000	1024.3800	(32c)
Timber			20.4000			9.0000	183.6000	(32c)
FF			43.7300			18.0000	787.1400	(32d)
GF			43.7300			9.0000	393.5700	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7512.4178 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 85.8955 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.5100	0.0460	0.6675
E3 Sill	14.5100	0.0470	0.6820
E4 Jamb	29.8400	0.0530	1.5815
E5 Ground floor (normal)	20.5900	0.0680	1.4001
E10 Eaves (insulation at ceiling level)	14.6000	0.0910	1.3286
E12 Gable (insulation at ceiling level)	5.9900	0.0750	0.4492
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	5.9900	0.1160	0.6948
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.0460	0.2755
E6 Intermediate floor within a dwelling	20.5900	0.0540	1.1119

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2672 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 59.0334 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.9668	46.4264	45.8861	43.1844	42.6441	39.9424	39.9424	39.4020	41.0231	42.6441	43.7247	44.8054	(38)
Heat transfer coeff	106.0002	105.4599	104.9195	102.2178	101.6775	98.9758	98.9758	98.4355	100.0565	101.6775	102.7582	103.8389	(39)

Average = Sum(39)m / 12 = 102.0828

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2120	1.2058	1.1996	1.1687	1.1626	1.1317	1.1317	1.1255	1.1440	1.1626	1.1749	1.1873	(40)
HLP (average)												1.1672	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5893 (42)

Hot water usage for mixer showers

67.6343	66.6179	65.1368	62.3030	60.2117	57.8795	56.5538	58.0238	59.6350	62.1391	65.0338	67.3752	(42a)

Hot water usage for baths

29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)

Hot water usage for other uses

41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)

Average daily hot water use (litres/day) 126.8439 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.9899	135.0435	131.4552	125.9988	121.5679	116.8042	114.9735	118.5462	122.3142	127.3152	132.8557	137.6320	(44)
Energy conte	218.5423	192.3001	202.0418	172.4860	163.6537	143.6244	139.0504	146.7850	150.8257	172.7656	189.2773	215.4985	(45)
Energy content (annual)										Total = Sum(45)m =		2106.8508	
Distribution loss (46)m = 0.15 x (45)m	32.7813	28.8450	30.3063	25.8729	24.5481	21.5437	20.8576	22.0177	22.6239	25.9148	28.3916	32.3248	(46)

Water storage loss (or HIU loss):

Store volume 198.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.5000 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.8100 (55)

Total storage loss

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)

If cylinder contains dedicated solar storage

15.5986	14.0891	15.5986	15.0955	15.5986	15.0955	15.5986	15.5986	15.0955	15.5986	15.0955	15.5986	(57)
Primary loss 23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

257.4033	227.4004	239.5071	203.3399	189.7204	168.6252	164.8845	173.5496	183.0303	210.2309	226.8848	254.3595	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Aperture area of solar collector 3.0000 (H1)

Zero-loss collector efficiency 0.8000 (H2)

Collector linear heat loss coefficient 1.8000 (H3)

Collector 2nd order heat loss coefficient 0.0000 (H4)

Collector loop efficiency 0.9000 (H5)

Incidence angle modifier 1.0000 (H6)

Overshading factor 0.8000 (H8)

Overall heat loss coefficient of system 6.5000 (H10)

Heat loss coefficient of collector loop 3.9667 (H11)

Dedicated solar storage volume 75.0000 (H12)

If combined cylinder, total volume of cylinder 198.0000 (H13)

Effective solar volume 111.9000 (H14)

Reference volume 225.0000 (H15)

Storage tank correction coefficient												1.1908	(H16)
Heat delivered to hot water												648.7608	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												648.7608	
Solar input	-0.0000	-19.9033	-62.0018	-83.2548	-106.7311	-98.1676	-97.3555	-86.1278	-61.1731	-32.9118	-1.1339	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	257.4033	207.4971	177.5053	120.0851	82.9893	70.4575	67.5290	87.4217	121.8571	177.3191	225.7509	254.3595	(64)
									Total per year (kWh/year) = Sum(64)m =			1850.1749	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =				0.0000	(64a)
Heat gains from water heating, kWh/month													
	103.7541	92.0200	97.1511	82.0347	75.2682	67.7557	66.9015	70.2177	75.9132	87.4168	93.0207	102.7421	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.0740	24.9351	20.2786	15.3522	11.4759	9.6885	10.4687	13.6077	18.2642	23.1905	27.0668	28.8543	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	349.7409	353.3701	344.2246	324.7549	300.1779	277.0790	261.6475	258.0183	267.1638	286.6335	311.2105	334.3094	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)													
	139.4545	136.9345	130.5795	113.9371	101.1670	94.1051	89.9214	94.3786	105.4350	117.4957	129.1954	138.0942	(72)
Total internal gains													
	622.1814	620.1517	599.9946	558.9562	517.7328	485.7846	466.9497	470.9165	495.7749	532.2317	572.3847	606.1699	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.0000	19.6403	0.3000	0.0000	0.7700	13.6107	(76)
West	8.4900	19.6403	0.3000	0.0000	0.7700	38.5183	(80)
East	7.6000	19.6403	0.3000	0.0000	0.7700	34.4804	(76)

Solar gains	86.6094	169.4264	279.0212	406.9358	498.7151	510.5236	486.0393	417.5006	324.5132	201.0387	107.9918	71.2234	(83)
Total gains	708.7908	789.5782	879.0159	965.8920	1016.4479	996.3082	952.9890	888.4171	820.2882	733.2705	680.3765	677.3933	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.6866	19.7875	19.8894	20.4151	20.5235	21.0838	21.0838	21.1995	20.8560	20.5235	20.3077	20.0964	
alpha	2.3124	2.3192	2.3260	2.3610	2.3682	2.4056	2.4056	2.4133	2.3904	2.3682	2.3538	2.3398	
util living area													
	0.9241	0.9016	0.8595	0.7835	0.6773	0.5367	0.4164	0.4551	0.6422	0.8182	0.9003	0.9302	(86)
Living	18.2239	18.5399	19.0848	19.7856	20.3480	20.7467	20.9009	20.8752	20.5823	19.8400	18.9410	18.2002	
Non living	17.4046	17.7161	18.2485	18.9340	19.4549	19.8156	19.9291	19.9188	19.6829	19.0044	18.1309	17.3943	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.5799	18.5399	19.0848	19.7856	20.3480	20.7467	20.9009	20.8752	20.5823	19.8400	18.9410	18.5919	(87)
Th 2	19.9104	19.9154	19.9203	19.9451	19.9501	19.9751	19.9751	19.9801	19.9650	19.9501	19.9401	19.9302	(88)
util rest of house													
	0.9144	0.8892	0.8413	0.7551	0.6332	0.4716	0.3317	0.3698	0.5807	0.7879	0.8857	0.9212	(89)
MIT 2	18.6285	17.7161	18.2485	18.9340	19.4549	19.8156	19.9291	19.9188	19.6829	19.0044	18.1309	17.7490	(90)
Living area fraction										fLA = Living area / (4) =		0.2056	(91)
MIT	18.8241	17.8855	18.4204	19.1091	19.6385	20.0070	20.1288	20.1154	19.8678	19.1762	18.2975	17.9223	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8241	17.8855	18.4204	19.1091	19.6385	20.0070	20.1288	20.1154	19.8678	19.1762	18.2975	17.9223	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9028	0.8593	0.8105	0.7291	0.6187	0.4738	0.3450	0.3818	0.5743	0.7613	0.8568	0.8995	(94)
Useful gains	639.8952	678.4883	712.4428	704.2543	628.8844	472.0132	328.8191	339.1756	471.1064	558.2261	582.9166	609.3312	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1539.5586	1369.4450	1250.6806	1043.5482	807.1674	535.1655	349.2704	365.7258	577.1033	872.0041	1150.6318	1424.9053	(97)
Space heating kWh													
	669.3495	464.3229	400.4489	244.2916	132.6426	0.0000	0.0000	0.0000	0.0000	233.4508	408.7550	606.7871	(98a)
Space heating requirement - total per year (kWh/year)												3160.0485	
Solar heating kWh													
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	669.3495	464.3229	400.4489	244.2916	132.6426	0.0000	0.0000	0.0000	0.0000	233.4508	408.7550	606.7871	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3160.0485	
Space heating per m2											(98c) / (4) =	36.1314	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)

Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												286.3431	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	669.3495	464.3229	400.4489	244.2916	132.6426	0.0000	0.0000	0.0000	0.0000	233.4508	408.7550	606.7871	(98)
Space heating efficiency (main heating system 1)													
	286.3431	286.3431	286.3431	286.3431	286.3431	0.0000	0.0000	0.0000	0.0000	286.3431	286.3431	286.3431	(210)
Space heating fuel (main heating system)													
	233.7579	162.1562	139.8494	85.3143	46.3230	0.0000	0.0000	0.0000	0.0000	81.5284	142.7501	211.9091	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	257.4033	207.4971	177.5053	120.0851	82.9893	70.4575	67.5290	87.4217	121.8571	177.3191	225.7509	254.3595	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month													
	90.3471	72.8303	62.3033	42.1492	29.1288	24.7302	23.7023	30.6845	42.7711	62.2380	79.2372	89.2787	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.1581	10.0783	11.1581	10.7982	11.1581	10.7982	11.1581	11.1581	10.7982	11.1581	10.7982	11.1581	(231)
Lighting	24.5730	19.7134	17.7497	13.0042	10.0448	8.2067	9.1632	11.9107	15.4708	20.2986	22.9272	25.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-37.8592	-55.7876	-83.1360	-94.5943	-100.2805	-88.0622	-86.8110	-81.9151	-72.8247	-63.5837	-41.9951	-32.2301	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-12.2273	-27.7924	-59.2102	-96.1777	-135.4023	-143.6515	-141.8405	-117.8589	-83.6384	-43.2621	-17.4147	-9.6838	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1103.5883	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												284.9050	
Water heating fuel used												649.4007	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)													
mechanical ventilation fans (SFP = 0.1790)												51.3777	(230a)
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												131.3777	(231)
Electricity for lighting (calculated in Appendix L)												198.3182	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1727.2394	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												355.4454	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1103.5883	16.4900	181.9817	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	649.4007	16.4900	107.0862	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	51.3777	16.4900	8.4722	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	198.3182	16.4900	32.7027	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-839.0794	16.4900	-138.3642	
PV Unit electricity exported	-888.1600	5.5900	-49.6481	
Total			-188.0123	(252)
Total energy cost			155.4224	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4224	(257)
SAP value		93.1528	
SAP rating (Section 12)		93	(258)
SAP band		A	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	

Space heating - main system 1	1103.5883	0.1549	170.9434	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	649.4007	0.1463	95.0191	(264)
Space and water heating			265.9625	(265)
Pumps, fans and electric keep-hot	131.3777	0.1387	18.2237	(267)
Energy for lighting	198.3182	0.1443	28.6234	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-839.0794	0.1348	-113.0856	
PV Unit electricity exported	-888.1600	0.1233	-109.4795	
Total			-222.5651	(269)
Total CO2, kg/year			90.2445	(272)
CO2 emissions per m2			1.0300	(273)
EI value			99.0871	
EI rating			99	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	43.7300 (1b)	x	2.5500 (2b)	=	111.5115	(1b) - (3b)
First floor	43.7300 (1c)	x	2.8300 (2c)	=	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.2674	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1275	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3275	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2784	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.5000	4.4000	4.4000	4.0000	4.1000	3.5000	3.4000	3.4000	3.5000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1250	1.1000	1.1000	1.0000	1.0250	0.8750	0.8500	0.8500	0.8750	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.3132	0.3062	0.3062	0.2784	0.2853	0.2436	0.2366	0.2366	0.2436	0.2714	0.2714	0.2784	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
Effective ac	0.5632	0.5562	0.5562	0.5284	0.5353	0.5000	0.5000	0.5000	0.5000	0.5214	0.5214	0.5284	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.4900	1.1450	13.1565			(27)
Glazed Doors			7.6000	1.1450	8.7023			(27)
GF			43.7300	0.1100	4.8103	75.0000	3279.7500	(28a)
Main	110.7742	21.2400	89.5342	0.1900	17.0115	9.0000	805.8078	(29a)
PIJ	43.7300		43.7300	0.0900	3.9357	9.0000	393.5700	(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.7663			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000	20.0000	644.6000	(32)
Timber			113.8200			9.0000	1024.3800	(32c)
Timber			20.4000			9.0000	183.6000	(32c)
FF			43.7300			18.0000	787.1400	(32d)
GF			43.7300			9.0000	393.5700	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	7512.4178 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		85.8955 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.5100	0.0460	0.6675
E3 Sill	14.5100	0.0470	0.6820
E4 Jamb	29.8400	0.0530	1.5815

E5 Ground floor (normal)	20.5900	0.0680	1.4001	
E10 Eaves (insulation at ceiling level)	14.6000	0.0910	1.3286	
E12 Gable (insulation at ceiling level)	5.9900	0.0750	0.4492	
E16 Corner (normal)	10.7600	0.0460	0.4950	
E18 Party wall between dwellings	10.7600	0.0540	0.5810	
P1 Party wall - Ground floor	5.9900	0.1160	0.6948	
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.0460	0.2755	
E6 Intermediate floor within a dwelling	20.5900	0.0540	1.1119	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				9.2672 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	59.0334 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.7247	43.1844	43.1844	41.0231	41.5634	38.8191	38.8191	38.8191	38.8191	40.4827	40.4827	41.0231	(38)
Heat transfer coeff	102.7582	102.2178	102.2178	100.0565	100.5968	97.8526	97.8526	97.8526	97.8526	99.5162	99.5162	100.0565	(39)
Average = Sum(39)m / 12 =												99.8622	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1749	1.1687	1.1687	1.1440	1.1502	1.1188	1.1188	1.1188	1.1188	1.1378	1.1378	1.1440	(40)
HLP (average)												1.1418	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5893	(42)
Hot water usage for mixer showers	67.6343	66.6179	65.1368	62.3030	60.2117	57.8795	56.5538	58.0238	59.6350	62.1391	65.0338	67.3752	(42a)
Hot water usage for baths	29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)
Hot water usage for other uses	41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)
Average daily hot water use (litres/day)												126.8439	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.9899	135.0435	131.4552	125.9988	121.5679	116.8042	114.9735	118.5462	122.3142	127.3152	132.8557	137.6320	(44)
Energy conte	218.5423	192.3001	202.0418	172.4860	163.6537	143.6244	139.0504	146.7850	150.8257	172.7656	189.2773	215.4985	(45)
Energy content (annual)										Total = Sum(45)m =		2106.8508	
Distribution loss (46)m = 0.15 x (45)m	32.7813	28.8450	30.3063	25.8729	24.5481	21.5437	20.8576	22.0177	22.6239	25.9148	28.3916	32.3248	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage	15.5986	14.0891	15.5986	15.0955	15.5986	15.0955	15.5986	15.5986	15.0955	15.5986	15.0955	15.5986	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	257.4033	227.4004	239.5071	203.3399	189.7204	168.6252	164.8845	173.5496	183.0303	210.2309	226.8848	254.3595	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
If combined cylinder, total volume of cylinder												198.0000	(H13)
Effective solar volume												111.9000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.1908	(H16)
Heat delivered to hot water												615.9643	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												615.9643	
Solar input	-0.0000	-15.4930	-58.8525	-81.2359	-101.0942	-95.7775	-92.2407	-80.0212	-59.9473	-31.3019	-0.0000	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	257.4033	211.9073	180.6545	122.1040	88.6262	72.8477	72.6438	93.5284	123.0830	178.9290	226.8848	254.3595	(64)
										Total per year (kWh/year) = Sum(64)m =		1882.9715	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	103.7541	92.0200	97.1511	82.0347	75.2682	67.7557	66.9015	70.2177	75.9132	87.4168	93.0207	102.7421	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.0740	24.9351	20.2786	15.3522	11.4759	9.6885	10.4687	13.6077	18.2642	23.1905	27.0668	28.8543	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	349.7409	353.3701	344.2246	324.7549	300.1779	277.0790	261.6475	258.0183	267.1638	286.6335	311.2105	334.3094	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)	139.4545	136.9345	130.5795	113.9371	101.1670	94.1051	89.9214	94.3786	105.4350	117.4957	129.1954	138.0942	(72)
Total internal gains	622.1814	620.1517	599.9946	558.9562	517.7328	485.7846	466.9497	470.9165	495.7749	532.2317	572.3847	606.1699	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.0000	17.3606	0.3000	0.0000	0.7700	12.0309	(76)
West	8.4900	17.3606	0.3000	0.0000	0.7700	34.0474	(80)
East	7.6000	17.3606	0.3000	0.0000	0.7700	30.4782	(76)

Solar gains	76.5565	153.6258	267.2216	395.8729	469.9406	495.0205	460.1381	390.7168	318.6765	194.8089	101.3691	67.7785	(83)
Total gains	698.7379	773.7775	867.2162	954.8291	987.6734	980.8051	927.0878	861.6333	814.4514	727.0406	673.7537	673.9484	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.3077	20.4151	20.4151	20.8560	20.7440	21.3258	21.3258	21.3258	21.3258	20.9693	20.9693	20.8560	
alpha	2.3538	2.3610	2.3610	2.3904	2.3829	2.4217	2.4217	2.4217	2.4217	2.3980	2.3980	2.3904	
util living area	0.9187	0.8953	0.8483	0.7620	0.6433	0.4890	0.3820	0.4235	0.6163	0.8007	0.8919	0.9244	(86)
Living	18.4704	18.7703	19.2925	19.9707	20.4915	20.8237	20.9291	20.9063	20.6542	19.9938	19.1503	18.4519	
Non living	17.6666	17.9617	18.4667	19.1230	19.5910	19.8841	19.9566	19.9445	19.7593	19.1635	18.3550	17.6645	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.7060	18.7703	19.2925	19.9707	20.4915	20.8237	20.9291	20.9063	20.6542	19.9938	19.1503	18.8083	(87)
Th 2	19.9401	19.9451	19.9451	19.9650	19.9600	19.9855	19.9855	19.9855	19.9855	19.9700	19.9700	19.9650	(88)
util rest of house	0.9080	0.8818	0.8284	0.7303	0.5928	0.4174	0.2925	0.3319	0.5513	0.7670	0.8758	0.9147	(89)
MIT 2	18.7771	17.9617	18.4667	19.1230	19.5910	19.8841	19.9566	19.9445	19.7593	19.1635	18.3550	17.9863	(90)
Living area fraction										fLA = Living area / (4) =		0.2056	(91)
MIT	18.9680	18.1279	18.6365	19.2972	19.7761	20.0772	20.1565	20.1422	19.9433	19.3342	18.5185	18.1553	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9680	18.1279	18.6365	19.2972	19.7761	20.0772	20.1565	20.1422	19.9433	19.3342	18.5185	18.1553	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8965	0.8524	0.7986	0.7070	0.5830	0.4242	0.3082	0.3468	0.5484	0.7426	0.8473	0.8930	(94)
Useful gains	626.3989	659.5539	692.5971	675.1110	575.8256	416.0702	285.7220	298.8226	446.6244	539.8820	570.9000	601.8214	(95)
Ext temp.	5.0000	5.6000	7.2000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.2000	7.7000	4.8000	(96)
Heat loss rate W	1435.3314	1280.5755	1169.0114	960.2667	711.8345	457.6784	299.0858	317.2575	532.6373	809.4850	1076.6175	1336.2838	(97)
Space heating kWh	601.8458	417.3265	354.4522	205.3121	101.1906	0.0000	0.0000	0.0000	0.0000	200.5846	364.1166	546.4400	(98a)
Space heating requirement - total per year (kWh/year)												2791.2684	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	601.8458	417.3265	354.4522	205.3121	101.1906	0.0000	0.0000	0.0000	0.0000	200.5846	364.1166	546.4400	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2791.2684	
Space heating per m2											(98c) / (4) =	31.9148	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	286.9197	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	601.8458	417.3265	354.4522	205.3121	101.1906	0.0000	0.0000	0.0000	0.0000	200.5846	364.1166	546.4400	(98)
Space heating efficiency (main heating system 1)	286.9197	286.9197	286.9197	286.9197	286.9197	0.0000	0.0000	0.0000	0.0000	286.9197	286.9197	286.9197	(210)
Space heating fuel (main heating system)	209.7611	145.4506	123.5371	71.5573	35.2679	0.0000	0.0000	0.0000	0.0000	69.9097	126.9054	190.4505	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	257.4033	211.9073	180.6545	122.1040	88.6262	72.8477	72.6438	93.5284	123.0830	178.9290	226.8848	254.3595	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	90.3471	74.3782	63.4087	42.8578	31.1073	25.5691	25.4976	32.8279	43.2014	62.8030	79.6352	89.2787	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.1581	10.0783	11.1581	10.7982	11.1581	10.7982	11.1581	11.1581	10.7982	11.1581	10.7982	11.1581	(231)
Lighting	24.5730	19.7134	17.7497	13.0042	10.0448	8.2067	9.1632	11.9107	15.4708	20.2986	22.9272	25.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-33.8434	-51.2621	-79.8649	-91.8240	-95.8102	-86.8184	-84.6865	-79.2398	-72.0440	-61.6481	-39.6160	-30.7059	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)

Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-10.3961	-24.4711	-56.3878	-93.6973	-126.2287	-137.8255	-131.7428	-107.6652	-81.5336	-41.8206	-16.1093	-9.1502 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	972.8396 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	284.9050
Water heating fuel used	660.9121 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)	
mechanical ventilation fans (SFP = 0.1790)	51.3777 (230a)
pump for solar water heating	80.0000 (230g)
Total electricity for the above, kWh/year	131.3777 (231)
Electricity for lighting (calculated in Appendix L)	198.3182 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1644.3918 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	319.0558 (238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	972.8396	26.0000	252.9383	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	660.9121	26.0000	171.8371	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	51.3777	26.0000	13.3582	(249)
Pump for solar water heating	80.0000	26.0000	20.8000	(249)
Energy for lighting	198.3182	26.0000	51.5627	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-807.3634	26.0000	-209.9145	
PV Unit electricity exported	-837.0284	5.8100	-48.6313	
Total			-258.5458	(252)
Total energy cost			251.9505	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	972.8396	0.1552	150.9663	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	660.9121	0.1461	96.5278	(264)
Space and water heating			247.4941	(265)
Pumps, fans and electric keep-hot	131.3777	0.1387	18.2237	(267)
Energy for lighting	198.3182	0.1443	28.6234	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-807.3634	0.1345	-108.5694	
PV Unit electricity exported	-837.0284	0.1233	-103.1819	
Total			-211.7513	(269)
Total CO2, kg/year			82.5899	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	972.8396	1.5745	1531.7177	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	660.9121	1.5403	1017.9862	(278)
Space and water heating			2549.7039	(279)
Pumps, fans and electric keep-hot	131.3777	1.5128	198.7482	(281)
Energy for lighting	198.3182	1.5338	304.1871	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-807.3634	1.4970	-1208.6301	
PV Unit electricity exported	-837.0284	0.4524	-378.6692	
Total			-1587.2994	(283)
Total Primary energy kWh/year			1465.3399	(286)

Full SAP Calculation Printout

Plot Reference	79841-08	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	2B3P (Semi)
Plot Address	Plot 8, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	83 B	**DER**	3.95	**TER**	11.67
Environmental	97 A	**% DER < TER**			66.15
CO_2 Emissions (t/year)	0.32	**DFEE**	40.01	**TFEE**	40.64
Compliance Check	See BREL	**% DFEE < TFEE**			1.55
% DPER < TPER	32.27	**DPER**	41.25	**TPER**	60.90

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	43.7300 (1b)	x	2.5500 (2b)	=	111.5115	(1b) - (3b)
First floor	43.7300 (1c)	x	2.8300 (2c)	=	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.2674	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1275	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3275	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2784	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3549	0.3480	0.3410	0.3062	0.2993	0.2645	0.2645	0.2575	0.2784	0.2993	0.3132	0.3271	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.6049	0.5980	0.5910	0.5562	0.5493	0.5145	0.5145	0.5075	0.5284	0.5493	0.5632	0.5771	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.4900	1.1450	13.1565			(27)
Glazed Doors			7.6000	1.1450	8.7023			(27)
GF			43.7300	0.1100	4.8103	75.0000	3279.7500	(28a)
Main	110.7742	21.2400	89.5342	0.1900	17.0115	9.0000	805.8078	(29a)
PIJ	43.7300		43.7300	0.0900	3.9357	9.0000	393.5700	(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.7663			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000	20.0000	644.6000	(32)
Timber			113.8200			9.0000	1024.3800	(32c)
Timber			20.4000			9.0000	183.6000	(32c)
FF			43.7300			18.0000	787.1400	(32d)
GF			43.7300			9.0000	393.5700	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7512.4178 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 85.8955 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.5100	0.0460	0.6675
E3 Sill	14.5100	0.0470	0.6820
E4 Jamb	29.8400	0.0530	1.5815
E5 Ground floor (normal)	20.5900	0.0680	1.4001
E10 Eaves (insulation at ceiling level)	14.6000	0.0910	1.3286
E12 Gable (insulation at ceiling level)	5.9900	0.0750	0.4492
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	5.9900	0.1160	0.6948
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.0460	0.2755
E6 Intermediate floor within a dwelling	20.5900	0.0540	1.1119

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2672 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.0334 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.9668	46.4264	45.8861	43.1844	42.6441	39.9424	39.9424	39.4020	41.0231	42.6441	43.7247	44.8054	(38)
Heat transfer coeff	106.0002	105.4599	104.9195	102.2178	101.6775	98.9758	98.9758	98.4355	100.0565	101.6775	102.7582	103.8389	(39)
Average = Sum(39)m / 12 =												102.0828	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2120	1.2058	1.1996	1.1687	1.1626	1.1317	1.1317	1.1255	1.1440	1.1626	1.1749	1.1873	(40)
HLP (average)												1.1672	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5893 (42)
Hot water usage for mixer showers

67.6343	66.6179	65.1368	62.3030	60.2117	57.8795	56.5538	58.0238	59.6350	62.1391	65.0338	67.3752	(42a)

Hot water usage for baths

29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)

Hot water usage for other uses

41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)

Average daily hot water use (litres/day) 126.8439 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.9899	135.0435	131.4552	125.9988	121.5679	116.8042	114.9735	118.5462	122.3142	127.3152	132.8557	137.6320	(44)
Energy conte	218.5423	192.3001	202.0418	172.4860	163.6537	143.6244	139.0504	146.7850	150.8257	172.7656	189.2773	215.4985	(45)
Energy content (annual)											Total = Sum(45)m =	2106.8508	
Distribution loss (46)m = 0.15 x (45)m	32.7813	28.8450	30.3063	25.8729	24.5481	21.5437	20.8576	22.0177	22.6239	25.9148	28.3916	32.3248	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(64)
										Total per year (kWh/year) = Sum(64)m =		2676.3968	(64)
12Total per year (kWh/year)												2676	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	111.3632	98.8927	105.8768	94.8012	93.1128	85.2047	84.9322	87.5039	87.5991	96.1425	100.3843	110.3512	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	118.2644	130.9356	118.2644	122.2065	118.2644	122.2065	118.2644	118.2644	122.2065	118.2644	122.2065	118.2644	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	234.3264	236.7580	230.6305	217.5858	201.1192	185.6429	175.3038	172.8722	178.9997	192.0444	208.5110	223.9873	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)	149.6818	147.1618	142.3075	131.6683	125.1516	118.3399	114.1562	117.6128	121.6655	129.2238	139.4227	148.3215	(72)
Total internal gains	564.1126	576.6954	553.0424	533.3007	506.3752	488.0294	469.5644	470.5894	484.7118	501.3726	531.9802	552.4132	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

East			3.0000		19.6403		0.3000		0.0000		0.7700		13.6107 (76)
West			8.4900		19.6403		0.3000		0.0000		0.7700		38.5183 (80)
East			7.6000		19.6403		0.3000		0.0000		0.7700		34.4804 (76)
Solar gains	86.6094	169.4264	279.0212	406.9358	498.7151	510.5236	486.0393	417.5006	324.5132	201.0387	107.9918	71.2234	(83)
Total gains	650.7220	746.1218	832.0636	940.2365	1005.0903	998.5530	955.6037	888.0900	809.2250	702.4113	639.9720	623.6366	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.6866	19.7875	19.8894	20.4151	20.5235	21.0838	21.0838	21.1995	20.8560	20.5235	20.3077	20.0964	
alpha	2.3124	2.3192	2.3260	2.3610	2.3682	2.4056	2.4056	2.4133	2.3904	2.3682	2.3538	2.3398	
util living area	0.9351	0.9109	0.8714	0.7915	0.6814	0.5358	0.4155	0.4552	0.6473	0.8296	0.9105	0.9402	(86)
Living	18.1081	18.4594	19.0087	19.7538	20.3388	20.7476	20.9014	20.8752	20.5746	19.7963	18.8657	18.0903	
Non living	17.2922	17.6387	18.1768	18.9054	19.4474	19.8162	19.9293	19.9187	19.6772	18.9652	18.0590	17.2873	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.5206	18.4594	19.0087	19.7538	20.3388	20.7476	20.9014	20.8752	20.5746	19.7963	18.8657	18.4973	(87)
Th 2	19.9104	19.9154	19.9203	19.9451	19.9501	19.9751	19.9751	19.9801	19.9650	19.9501	19.9401	19.9302	(88)
util rest of house	0.9266	0.8994	0.8543	0.7637	0.6374	0.4708	0.3309	0.3699	0.5859	0.8005	0.8971	0.9323	(89)
MIT 2	18.5710	17.6387	18.1768	18.9054	19.4474	19.8162	19.9293	19.9187	19.6772	18.9652	18.0590	17.6570	(90)
Living area fraction										fLA = Living area / (4) =		0.2056	(91)
MIT	18.7663	17.8074	18.3478	19.0798	19.6306	20.0077	20.1291	20.1153	19.8617	19.1360	18.2249	17.8297	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7663	17.8074	18.3478	19.0798	19.6306	20.0077	20.1291	20.1153	19.8617	19.1360	18.2249	17.8297	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9158	0.8703	0.8236	0.7372	0.6226	0.4730	0.3442	0.3819	0.5791	0.7733	0.8689	0.9121	(94)
Useful gains	595.9114	649.3608	685.3029	693.1332	625.7317	472.3015	328.9521	339.1532	468.6135	543.1759	556.0840	568.8159	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1533.4264	1361.2162	1243.0667	1040.5582	806.3674	535.2322	349.2998	365.7208	576.4916	867.9212	1143.1712	1415.2964	(97)
Space heating kWh	697.5112	478.3668	414.9762	250.1460	134.3930	0.0000	0.0000	0.0000	0.0000	241.6105	422.7028	629.7815	(98a)
Space heating requirement - total per year (kWh/year)												3269.4881	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	697.5112	478.3668	414.9762	250.1460	134.3930	0.0000	0.0000	0.0000	0.0000	241.6105	422.7028	629.7815	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3269.4881	
Space heating per m2											(98c) / (4) =	37.3827	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	286.3431 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	697.5112	478.3668	414.9762	250.1460	134.3930	0.0000	0.0000	0.0000	0.0000	241.6105	422.7028	629.7815	(98)
Space heating efficiency (main heating system 1)	286.3431	286.3431	286.3431	286.3431	286.3431	0.0000	0.0000	0.0000	0.0000	286.3431	286.3431	286.3431	(210)
Space heating fuel (main heating system)	243.5928	167.0607	144.9228	87.3589	46.9343	0.0000	0.0000	0.0000	0.0000	84.3780	147.6211	219.9395	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	93.6855	82.8316	87.8939	76.9723	74.4199	66.8421	65.7843	68.4991	69.3697	77.6181	82.8660	92.6172	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.3636	3.9413	4.3636	4.2228	4.3636	4.2228	4.3636	4.3636	4.2228	4.3636	4.2228	4.3636	(231)
Lighting	24.5730	19.7134	17.7497	13.0042	10.0448	8.2067	9.1632	11.9107	15.4708	20.2986	22.9272	25.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	1141.8080	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	284.9050	
Water heating fuel used	939.3997	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)		
mechanical ventilation fans (SFP = 0.1790)	51.3777	(230a)
Total electricity for the above, kWh/year	51.3777	(231)
Electricity for lighting (calculated in Appendix L)	198.3182	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2330.9037	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1141.8080	0.1549	176.9125	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	939.3997	0.1410	132.4256	(264)
Space and water heating			309.3381	(265)
Pumps, fans and electric keep-hot	51.3777	0.1387	7.1267	(267)
Energy for lighting	198.3182	0.1443	28.6234	(268)
Total CO2, kg/year			345.0882	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.9500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1141.8080	1.5736	1796.7338	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	939.3997	1.5213	1429.0647	(278)
Space and water heating			3225.7985	(279)
Pumps, fans and electric keep-hot	51.3777	1.5128	77.7242	(281)
Energy for lighting	198.3182	1.5338	304.1871	(282)
Total Primary energy kWh/year			3607.7098	(286)
Dwelling Primary energy Rate (DPER)			41.2500	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling							
Ground floor		43.7300 (1b)	x	2.5500 (2b)	=	111.5115	(1b) - (3b)
First floor		43.7300 (1c)	x	2.8300 (2c)	=	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.2674	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1275	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3775	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3209	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)

Adj infilt rate													
	0.4091	0.4011	0.3931	0.3530	0.3450	0.3048	0.3048	0.2968	0.3209	0.3450	0.3610	0.3770	(22b)
Effective ac	0.5837	0.5804	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711	(25)

---

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type			19.0900	1.1450	21.8588			(27)
GF			43.7300	0.1300	5.6849			(28a)
Main	110.7742	21.2400	89.5342	0.1800	16.1162			(29a)
PIJ	43.7300		43.7300	0.1100	4.8103			(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.6201			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 85.8955 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	14.5100	0.0500	0.7255	
E3 Sill	14.5100	0.0500	0.7255	
E4 Jamb	29.8400	0.0500	1.4920	
E5 Ground floor (normal)	20.5900	0.1600	3.2944	
E10 Eaves (insulation at ceiling level)	14.6000	0.0600	0.8760	
E12 Gable (insulation at ceiling level)	5.9900	0.0600	0.3594	
E16 Corner (normal)	10.7600	0.0900	0.9684	
E18 Party wall between dwellings	10.7600	0.0600	0.6456	
P1 Party wall - Ground floor	5.9900	0.0800	0.4792	
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.1200	0.7188	
E6 Intermediate floor within a dwelling	20.5900	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.2848	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	60.9049	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.3170	45.0647	44.8173	43.6557	43.4383	42.4266	42.4266	42.2392	42.8163	43.4383	43.8780	44.3377	(38)
Heat transfer coeff	106.2219	105.9696	105.7223	104.5606	104.3433	103.3315	103.3315	103.1441	103.7212	104.3433	104.7830	105.2426	(39)
Average = Sum(39)m / 12 =												104.5596	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2145	1.2116	1.2088	1.1955	1.1930	1.1815	1.1815	1.1793	1.1859	1.1930	1.1981	1.2033	(40)
HLP (average)												1.1955	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5893	(42)
Hot water usage for mixer showers													
	67.6343	66.6179	65.1368	62.3030	60.2117	57.8795	56.5538	58.0238	59.6350	62.1391	65.0338	67.3752	(42a)
Hot water usage for baths													
	29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)
Hot water usage for other uses													
	41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)
Average daily hot water use (litres/day)												126.8439	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	137.9899	135.0435	131.4552	125.9988	121.5679	116.8042	114.9735	118.5462	122.3142	127.3152	132.8557	137.6320	(44)
Energy conte	218.5423	192.3001	202.0418	172.4860	163.6537	143.6244	139.0504	146.7850	150.8257	172.7656	189.2773	215.4985	(45)
Energy content (annual)										Total = Sum(45)m =		2106.8508	
Distribution loss (46)m = 0.15 x (45)m													
	32.7813	28.8450	30.3063	25.8729	24.5481	21.5437	20.8576	22.0177	22.6239	25.9148	28.3916	32.3248	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6426	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8870	(55)
Total storage loss													
	27.4979	24.8369	27.4979	26.6109	27.4979	26.6109	27.4979	27.4979	26.6109	27.4979	26.6109	27.4979	(56)
If cylinder contains dedicated solar storage													
	27.4979	24.8369	27.4979	26.6109	27.4979	26.6109	27.4979	27.4979	26.6109	27.4979	26.6109	27.4979	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	269.3026	238.1481	252.8021	221.6090	214.4140	192.7473	189.8108	197.5453	199.9486	223.5259	238.4002	266.2588	(62)
WWHRS	-30.9196	-27.3455	-28.6347	-23.7106	-22.0975	-18.9090	-17.7241	-18.8478	-19.5639	-23.0637	-26.1284	-30.3470	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	238.3830	210.8026	224.1674	197.8983	192.3166	173.8384	172.0866	178.6975	180.3847	200.4622	212.2718	235.9118	(64)
										Total per year (kWh/year) = Sum(64)m =		2417.2209	(64)
12Total per year (kWh/year)												2417	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	113.2736	100.6182	107.7872	96.6499	95.0231	87.0534	86.8425	89.4143	89.4479	98.0528	102.2330	112.2615	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	118.2644	130.9356	118.2644	122.2065	118.2644	122.2065	118.2644	118.2644	122.2065	118.2644	122.2065	118.2644	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													

	234.3264	236.7580	230.6305	217.5858	201.1192	185.6429	175.3038	172.8722	178.9997	192.0444	208.5110	223.9873	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)													
	152.2494	149.7295	144.8752	134.2360	127.7193	120.9076	116.7239	120.1805	124.2332	131.7914	141.9903	150.8892	(72)
Total internal gains													
	569.6802	582.2631	558.6101	538.8684	511.9429	490.5970	472.1321	473.1571	487.2794	506.9403	537.5479	557.9809	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.6000	19.6403	0.6300	0.7000	0.7700	63.6246	(76)
West	8.4900	19.6403	0.6300	0.7000	0.7700	50.9597	(80)

Solar gains	114.5843	224.1512	369.1451	538.3761	659.8001	675.4228	643.0300	552.3533	429.3310	265.9743	142.8731	94.2285	(83)
Total gains	684.2645	806.4142	927.7552	1077.2444	1171.7429	1166.0198	1115.1621	1025.5104	916.6104	772.9145	680.4210	652.2094	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.6455	19.6923	19.7383	19.9576	19.9992	20.1950	20.1950	20.2317	20.1192	19.9992	19.9153	19.8283	
alpha	2.3097	2.3128	2.3159	2.3305	2.3333	2.3463	2.3463	2.3488	2.3413	2.3333	2.3277	2.3219	
util living area													
	0.9289	0.8983	0.8478	0.7537	0.6317	0.4908	0.3767	0.4187	0.6103	0.8075	0.9016	0.9353	(86)
MIT	18.1691	18.5559	19.1398	19.8649	20.4230	20.7759	20.9131	20.8863	20.6073	19.8443	18.8905	18.1080	(87)
Th 2	19.9084	19.9107	19.9130	19.9236	19.9256	19.9349	19.9349	19.9366	19.9313	19.9256	19.9215	19.9173	(88)
util rest of house													
	0.9197	0.8855	0.8286	0.7230	0.5857	0.4260	0.2952	0.3348	0.5469	0.7757	0.8870	0.9269	(89)
MIT 2	16.6258	17.1103	17.8364	18.7224	19.3724	19.7586	19.8850	19.8674	19.5973	18.7241	17.5456	16.5538	(90)
Living area fraction										fLA = Living area / (4) =		0.2056	(91)
MIT	16.9431	17.4075	18.1044	18.9573	19.5883	19.9677	20.0963	20.0768	19.8049	18.9544	17.8221	16.8733	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.9431	17.4075	18.1044	18.9573	19.5883	19.9677	20.0963	20.0768	19.8049	18.9544	17.8221	16.8733	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8842	0.8463	0.7887	0.6913	0.5699	0.4281	0.3080	0.3464	0.5387	0.7409	0.8488	0.8930	(94)
Useful gains	605.0532	682.4476	731.7367	744.6670	667.8221	499.1628	343.5218	355.2840	493.7427	572.6229	577.5182	582.4271	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1342.9696	1325.4119	1226.8417	1051.5951	823.0951	554.6541	361.2803	379.2433	591.7237	871.7217	1123.4926	1333.7762	(97)
Space heating kWh													
	549.0098	432.0720	368.3582	220.9882	115.5231	0.0000	0.0000	0.0000	0.0000	222.5295	393.1016	559.0037	(98a)
Space heating requirement - total per year (kWh/year)												2860.5862	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	549.0098	432.0720	368.3582	220.9882	115.5231	0.0000	0.0000	0.0000	0.0000	222.5295	393.1016	559.0037	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2860.5862	
Space heating per m2											(98c) / (4) =	32.7074	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	549.0098	432.0720	368.3582	220.9882	115.5231	0.0000	0.0000	0.0000	0.0000	222.5295	393.1016	559.0037	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	594.8102	468.1170	399.0879	239.4239	125.1605	0.0000	0.0000	0.0000	0.0000	241.0938	425.8955	605.6378	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	238.3830	210.8026	224.1674	197.8983	192.3166	173.8384	172.0866	178.6975	180.3847	200.4622	212.2718	235.9118	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.8681	85.6331	85.1661	84.3079	82.9551	79.8000	79.8000	79.8000	79.8000	84.2945	85.4219	85.9240	(217)
Fuel for water heating, kWh/month													
	277.6155	246.1694	263.2120	234.7329	231.8320	217.8426	215.6474	223.9317	226.0459	237.8116	248.4983	274.5586	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	24.5730	19.7134	17.7497	13.0042	10.0448	8.2067	9.1632	11.9107	15.4708	20.2986	22.9272	25.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-40.4681	-56.8289	-81.3729	-91.1293	-97.9537	-91.3009	-90.1428	-85.2277	-76.5407	-64.7751	-44.3982	-35.0109	(233a)

Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-23.5612	-49.4807	-98.1995	-147.2879	-194.5714	-195.4512	-193.1789	-163.6739	-120.0949	-70.7300	-31.4452	-18.6406 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3099.2266	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2897.8980	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	198.3182	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2161.4648	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4119.9781	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3099.2266	0.2100	650.8376	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2897.8980	0.2100	608.5586	(264)
Space and water heating			1259.3962	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	198.3182	0.1443	28.6234	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-855.1493	0.1347	-115.1661	
PV Unit electricity exported	-1306.3155	0.1259	-164.5086	
Total			-279.6747	(269)
Total CO2, kg/year			1020.2742	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.6700	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3099.2266	1.1300	3502.1261	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2897.8980	1.1300	3274.6247	(278)
Space and water heating			6776.7508	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	198.3182	1.5338	304.1871	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-855.1493	1.4977	-1280.7879	
PV Unit electricity exported	-1306.3155	0.4623	-603.8616	
Total			-1884.6496	(283)
Total Primary energy kWh/year			5326.3892	(286)
Target Primary Energy Rate (TPER)			60.9000	(287)

Full SAP Calculation Printout

Plot Reference	79841-08	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	2B3P (Semi)
Plot Address	Plot 8, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	83 B	**DER**	3.95	**TER**	11.67
Environmental	97 A	**% DER < TER**			66.15
CO_2 Emissions (t/year)	0.32	**DFEE**	40.01	**TFEE**	40.64
Compliance Check	See BREL	**% DFEE < TFEE**			1.55
% DPER < TPER	32.27	**DPER**	41.25	**TPER**	60.90

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	43.7300 (1b)	x	2.5500 (2b)	=	111.5115	(1b) - (3b)
First floor	43.7300 (1c)	x	2.8300 (2c)	=	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.2674	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1275	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3275	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2784	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3549	0.3480	0.3410	0.3062	0.2993	0.2645	0.2645	0.2575	0.2784	0.2993	0.3132	0.3271	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5630	0.5605	0.5581	0.5469	0.5448	0.5350	0.5350	0.5332	0.5387	0.5448	0.5490	0.5535	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.4900	1.1450	13.1565			(27)
Glazed Doors			7.6000	1.1450	8.7023			(27)
GF			43.7300	0.1100	4.8103	75.0000	3279.7500	(28a)
Main	110.7742	21.2400	89.5342	0.1900	17.0115	9.0000	805.8078	(29a)
PIJ	43.7300		43.7300	0.0900	3.9357	9.0000	393.5700	(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.7663			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000	20.0000	644.6000	(32)
Timber			113.8200			9.0000	1024.3800	(32c)
Timber			20.4000			9.0000	183.6000	(32c)
FF			43.7300			18.0000	787.1400	(32d)
GF			43.7300			9.0000	393.5700	(32e)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			7512.4178	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							85.8955	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.5100	0.0460	0.6675
E3 Sill	14.5100	0.0470	0.6820
E4 Jamb	29.8400	0.0530	1.5815
E5 Ground floor (normal)	20.5900	0.0680	1.4001
E10 Eaves (insulation at ceiling level)	14.6000	0.0910	1.3286
E12 Gable (insulation at ceiling level)	5.9900	0.0750	0.4492
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	5.9900	0.1160	0.6948
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.0460	0.2755
E6 Intermediate floor within a dwelling	20.5900	0.0540	1.1119

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2672 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.0334 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.7098	43.5198	43.3337	42.4594	42.2958	41.5343	41.5343	41.3932	41.8276	42.2958	42.6267	42.9727	(38)
Heat transfer coeff	102.7432	102.5533	102.3671	101.4928	101.3292	100.5677	100.5677	100.4267	100.8610	101.3292	101.6601	102.0061	(39)
Average = Sum(39)m / 12 =												101.4920	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1747	1.1726	1.1704	1.1604	1.1586	1.1499	1.1499	1.1483	1.1532	1.1586	1.1624	1.1663	(40)
HLP (average)												1.1604	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5893 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)
Hot water usage for other uses	41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)
Average daily hot water use (litres/day)												64.4873	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	70.3556	68.4255	66.3184	63.6958	61.3562	58.9247	58.4196	60.5225	62.6792	65.1761	67.8219	70.2568	(44)
Energy conte	111.4260	97.4370	101.9289	87.1964	82.5972	72.4549	70.6535	74.9395	77.2897	88.4434	96.6247	110.0052	(45)
Energy content (annual)										Total = Sum(45)m =		1070.9963	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	94.7121	82.8215	86.6396	74.1169	70.2076	61.5866	60.0554	63.6985	65.6963	75.1769	82.1310	93.5044	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	94.7121	82.8215	86.6396	74.1169	70.2076	61.5866	60.0554	63.6985	65.6963	75.1769	82.1310	93.5044	(64)
										Total per year (kWh/year) = Sum(64)m =		910.3469	(64)
12Total per year (kWh/year)												910	(64)
Electric shower(s)	54.1638	48.2604	52.6985	50.2896	51.2332	48.8715	50.5006	51.2332	50.2896	52.6985	51.7076	54.1638	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		616.1105	(64a)
Heat gains from water heating, kWh/month	37.2190	32.7705	34.8345	31.1016	30.3602	27.6145	27.6390	28.7329	28.9965	31.9689	33.4597	36.9171	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	118.2644	130.9356	118.2644	122.2065	118.2644	122.2065	118.2644	118.2644	122.2065	118.2644	122.2065	118.2644	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	234.3264	236.7580	230.6305	217.5858	201.1192	185.6429	175.3038	172.8722	178.9997	192.0444	208.5110	223.9873	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)	50.0255	48.7656	46.8206	43.1967	40.8067	38.3535	37.1492	38.6195	40.2729	42.9689	46.4717	49.6197	(72)
Total internal gains	464.4563	478.2991	457.5555	444.8290	422.0303	408.0430	392.5574	391.5962	403.3191	415.1177	439.0293	453.7114	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.0000	19.6403	0.3000	0.0000	0.7700	13.6107	(76)
West	8.4900	19.6403	0.3000	0.0000	0.7700	38.5183	(80)
East	7.6000	19.6403	0.3000	0.0000	0.7700	34.4804	(76)

Solar gains	86.6094	169.4264	279.0212	406.9358	498.7151	510.5236	486.0393	417.5006	324.5132	201.0387	107.9918	71.2234	(83)

Total gains	551.0658	647.7256	736.5767	851.7648	920.7454	918.5666	878.5967	809.0968	727.8323	616.1565	547.0211	524.9348	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.3107	20.3483	20.3853	20.5609	20.5941	20.7500	20.7500	20.7792	20.6897	20.5941	20.5270	20.4574	
alpha	2.3540	2.3566	2.3590	2.3707	2.3729	2.3833	2.3833	2.3853	2.3793	2.3729	2.3685	2.3638	
util living area	0.9521	0.9300	0.8934	0.8184	0.7116	0.5723	0.4496	0.4953	0.6882	0.8610	0.9325	0.9569	(86)
MIT	17.9934	18.3507	18.9111	19.6525	20.2709	20.6995	20.8790	20.8438	20.5036	19.6711	18.7101	17.9326	(87)
Th 2	19.9403	19.9420	19.9437	19.9518	19.9533	19.9603	19.9603	19.9616	19.9576	19.9533	19.9502	19.9470	(88)
util rest of house	0.9456	0.9206	0.8788	0.7928	0.6690	0.5054	0.3594	0.4045	0.6278	0.8356	0.9219	0.9510	(89)
MIT 2	17.1995	17.5515	18.1009	18.8189	19.3938	19.7696	19.9037	19.8841	19.6170	18.8539	17.9163	17.1438	(90)
Living area fraction										fLA = Living area / (4) =		0.2056	(91)
MIT	17.3627	17.7158	18.2674	18.9902	19.5741	19.9607	20.1042	20.0814	19.7992	19.0219	18.0795	17.3059	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.3627	17.7158	18.2674	18.9902	19.5741	19.9607	20.1042	20.0814	19.7992	19.0219	18.0795	17.3059	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9236	0.8945	0.8494	0.7650	0.6517	0.5054	0.3726	0.4157	0.6175	0.8075	0.8965	0.9304	(94)
Useful gains	508.9841	579.3716	625.6387	651.5923	600.0514	464.2360	327.3480	336.3579	449.4177	497.5398	490.3814	488.3771	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1342.1013	1314.3024	1204.5986	1024.0859	797.8752	539.1180	352.4118	369.7135	574.8297	853.3843	1116.1749	1336.8853	(97)
Space heating kWh	619.8392	493.8735	430.7461	268.1954	147.1809	0.0000	0.0000	0.0000	0.0000	264.7483	450.5713	631.2902	(98a)
Space heating requirement - total per year (kWh/year)												3306.4450	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	619.8392	493.8735	430.7461	268.1954	147.1809	0.0000	0.0000	0.0000	0.0000	264.7483	450.5713	631.2902	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3306.4450	
Space heating per m2											(98c) / (4) =	37.8052	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	945.3363	744.2009	763.2427	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7332	0.7948	0.7616	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	693.0782	591.5151	581.2933	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1027.4081	982.9876	904.0710	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	240.7176	291.2555	240.1466	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	60.1794	72.8139	60.0367	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												193.0299	(107)
Energy for space heating												37.8052	(99)
Energy for space cooling												2.2071	(108)
Total												40.0123	(109)
Fabric Energy Efficiency (DFEE)												40.0	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	43.7300	(1b)	x 2.5500	(2b) =	111.5115	(1b) - (3b)
First floor	43.7300	(1c)	x 2.8300	(2c) =	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		235.2674	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)

Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1275 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3775 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3209 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4091	0.4011	0.3931	0.3530	0.3450	0.3048	0.3048	0.2968	0.3209	0.3450	0.3610	0.3770	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		0.0000 (23c)

Effective ac	0.5837	0.5804	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type			19.0900	1.1450	21.8588			(27)
GF			43.7300	0.1300	5.6849			(28a)
Main	110.7742	21.2400	89.5342	0.1800	16.1162			(29a)
PIJ	43.7300		43.7300	0.1100	4.8103			(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.6201			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		85.8955 (35)
List of Thermal Bridges		

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.5100	0.0500	0.7255
E3 Sill	14.5100	0.0500	0.7255
E4 Jamb	29.8400	0.0500	1.4920
E5 Ground floor (normal)	20.5900	0.1600	3.2944
E10 Eaves (insulation at ceiling level)	14.6000	0.0600	0.8760
E12 Gable (insulation at ceiling level)	5.9900	0.0600	0.3594
E16 Corner (normal)	10.7600	0.0900	0.9684
E18 Party wall between dwellings	10.7600	0.0600	0.6456
P1 Party wall - Ground floor	5.9900	0.0800	0.4792
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.1200	0.7188
E6 Intermediate floor within a dwelling	20.5900	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.2848 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	60.9049 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.3170	45.0647	44.8173	43.6557	43.4383	42.4266	42.4266	42.2392	42.8163	43.4383	43.8780	44.3377	(38)
Heat transfer coeff	106.2219	105.9696	105.7223	104.5606	104.3433	103.3315	103.3315	103.1441	103.7212	104.3433	104.7830	105.2426	(39)
Average = Sum(39)m / 12 =												104.5596	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2145	1.2116	1.2088	1.1955	1.1930	1.1815	1.1815	1.1793	1.1859	1.1930	1.1981	1.2033	(40)
HLP (average)												1.1955	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.5893 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)
Hot water usage for other uses	41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)
Average daily hot water use (litres/day)												64.4873	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	70.3556	68.4255	66.3184	63.6958	61.3562	58.9247	58.4196	60.5225	62.6792	65.1761	67.8219	70.2568	(44)
Energy conte	111.4260	97.4370	101.9289	87.1964	82.5972	72.4549	70.6535	74.9395	77.2897	88.4434	96.6247	110.0052	(45)
Energy content (annual)										Total = Sum(45)m =		1070.9963	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	94.7121	82.8215	86.6396	74.1169	70.2076	61.5866	60.0554	63.6985	65.6963	75.1769	82.1310	93.5044	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	94.7121	82.8215	86.6396	74.1169	70.2076	61.5866	60.0554	63.6985	65.6963	75.1769	82.1310	93.5044	(64)
									Total per year (kWh/year) = Sum(64)m =			910.3469	(64)
12Total per year (kWh/year)												910	(64)

Electric shower(s)

	54.1638	48.2604	52.6985	50.2896	51.2332	48.8715	50.5006	51.2332	50.2896	52.6985	51.7076	54.1638 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												616.1105 (64a)
Heat gains from water heating, kWh/month												
	37.2190	32.7705	34.8345	31.1016	30.3602	27.6145	27.6390	28.7329	28.9965	31.9689	33.4597	36.9171 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	118.2644	130.9356	118.2644	122.2065	118.2644	122.2065	118.2644	118.2644	122.2065	118.2644	122.2065	118.2644	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	234.3264	236.7580	230.6305	217.5858	201.1192	185.6429	175.3038	172.8722	178.9997	192.0444	208.5110	223.9873	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)													
	50.0255	48.7656	46.8206	43.1967	40.8067	38.3535	37.1492	38.6195	40.2729	42.9689	46.4717	49.6197	(72)
Total internal gains													
	464.4563	478.2991	457.5555	444.8290	422.0303	408.0430	392.5574	391.5962	403.3191	415.1177	439.0293	453.7114	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.6000	19.6403	0.6300	0.7000	0.7700	63.6246	(76)
West	8.4900	19.6403	0.6300	0.7000	0.7700	50.9597	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	114.5843	224.1512	369.1451	538.3761	659.8001	675.4228	643.0300	552.3533	429.3310	265.9743	142.8731	94.2285	(83)
Total gains	579.0406	702.4503	826.7005	983.2051	1081.8304	1083.4658	1035.5874	943.9495	832.6501	681.0920	581.9024	547.9400	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000	(85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.6455	19.6923	19.7383	19.9576	19.9992	20.1950	20.1950	20.2317	20.1192	19.9992	19.9153	19.8283	
alpha	2.3097	2.3128	2.3159	2.3305	2.3333	2.3463	2.3463	2.3488	2.3413	2.3333	2.3277	2.3219	
util living area													
	0.9480	0.9202	0.8734	0.7821	0.6611	0.5180	0.4009	0.4474	0.6461	0.8407	0.9255	0.9536	(86)
MIT	17.9534	18.3617	18.9790	19.7571	20.3603	20.7480	20.9006	20.8687	20.5534	19.7150	18.7032	17.8894	(87)
Th 2	19.9084	19.9107	19.9130	19.9236	19.9256	19.9349	19.9349	19.9366	19.9313	19.9256	19.9215	19.9173	(88)
util rest of house													
	0.9409	0.9096	0.8565	0.7532	0.6157	0.4516	0.3155	0.3599	0.5831	0.8123	0.9138	0.9472	(89)
MIT 2	17.1400	17.5413	18.1435	18.8914	19.4438	19.7789	19.8899	19.8735	19.6314	18.8732	17.8904	17.0826	(90)
Living area fraction									fLA = Living area / (4) =			0.2056	(91)
MIT	17.3072	17.7100	18.3153	19.0693	19.6322	19.9782	20.0977	20.0781	19.8210	19.0463	18.0575	17.2484	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.3072	17.7100	18.3153	19.0693	19.6322	19.9782	20.0977	20.0781	19.8210	19.0463	18.0575	17.2484	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9174	0.8815	0.8256	0.7266	0.6021	0.4545	0.3292	0.3722	0.5759	0.7840	0.8868	0.9253	(94)
Useful gains	531.2217	619.2031	682.5330	714.4382	651.3609	492.4424	340.9147	351.3836	479.5377	533.9661	516.0422	506.9994	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1381.6513	1357.4659	1249.1362	1063.3119	827.6707	555.7328	361.4232	379.3746	593.3862	881.3100	1148.1613	1373.2531	(97)
Space heating kWh													
	632.7196	496.1126	421.5528	251.1891	131.1745	0.0000	0.0000	0.0000	0.0000	258.4239	455.1258	644.4928	(98a)
Space heating requirement - total per year (kWh/year)												3290.7910	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	632.7196	496.1126	421.5528	251.1891	131.1745	0.0000	0.0000	0.0000	0.0000	258.4239	455.1258	644.4928	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3290.7910	
Space heating per m2											(98c) / (4) =	37.6262	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	971.3160	764.6530	783.8953	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7763	0.8310	0.7988	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	754.0270	635.4170	626.2047	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1220.1474	1166.4832	1061.6911	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	335.6067	395.1133	324.0019	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	83.9017	98.7783	81.0005	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												263.6805	(107)

Energy for space heating	37.6262 (99)
Energy for space cooling	3.0149 (108)
Total	40.6411 (109)
Fabric Energy Efficiency (TFEE)	40.6 (109)

Full SAP Calculation Printout

Plot Reference	79841-08	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	2B3P (Semi)
Plot Address	Plot 8, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	83 B	**DER**	3.95	**TER**	11.67
Environmental	97 A	**% DER < TER**			66.15
CO_2 Emissions (t/year)	0.32	**DFEE**	40.01	**TFEE**	40.64
Compliance Check	See BREL	**% DFEE < TFEE**			1.55
% DPER < TPER	32.27	**DPER**	41.25	**TPER**	60.90

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	43.7300 (1b)	x	2.5500 (2b)	=	111.5115	(1b) - (3b)
First floor	43.7300 (1c)	x	2.8300 (2c)	=	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.2674	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1275	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3275	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2784	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3549	0.3480	0.3410	0.3062	0.2993	0.2645	0.2645	0.2575	0.2784	0.2993	0.3132	0.3271	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.6049	0.5980	0.5910	0.5562	0.5493	0.5145	0.5145	0.5075	0.5284	0.5493	0.5632	0.5771	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.4900	1.1450	13.1565			(27)
Glazed Doors			7.6000	1.1450	8.7023			(27)
GF			43.7300	0.1100	4.8103	75.0000	3279.7500	(28a)
Main	110.7742	21.2400	89.5342	0.1900	17.0115	9.0000	805.8078	(29a)
PIJ	43.7300		43.7300	0.0900	3.9357	9.0000	393.5700	(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.7663			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000	20.0000	644.6000	(32)
Timber			113.8200			9.0000	1024.3800	(32c)
Timber			20.4000			9.0000	183.6000	(32c)
FF			43.7300			18.0000	787.1400	(32d)
GF			43.7300			9.0000	393.5700	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7512.4178 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 85.8955 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.5100	0.0460	0.6675
E3 Sill	14.5100	0.0470	0.6820
E4 Jamb	29.8400	0.0530	1.5815
E5 Ground floor (normal)	20.5900	0.0680	1.4001
E10 Eaves (insulation at ceiling level)	14.6000	0.0910	1.3286
E12 Gable (insulation at ceiling level)	5.9900	0.0750	0.4492
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	5.9900	0.1160	0.6948
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.0460	0.2755
E6 Intermediate floor within a dwelling	20.5900	0.0540	1.1119

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2672 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.0334 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.9668	46.4264	45.8861	43.1844	42.6441	39.9424	39.9424	39.4020	41.0231	42.6441	43.7247	44.8054	(38)
Heat transfer coeff	106.0002	105.4599	104.9195	102.2178	101.6775	98.9758	98.9758	98.4355	100.0565	101.6775	102.7582	103.8389	(39)
Average = Sum(39)m / 12 =												102.0828	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2120	1.2058	1.1996	1.1687	1.1626	1.1317	1.1317	1.1255	1.1440	1.1626	1.1749	1.1873	(40)
HLP (average)												1.1672	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5893 (42)
Hot water usage for mixer showers

67.6343	66.6179	65.1368	62.3030	60.2117	57.8795	56.5538	58.0238	59.6350	62.1391	65.0338	67.3752	(42a)

Hot water usage for baths

29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)

Hot water usage for other uses

41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)

Average daily hot water use (litres/day) 126.8439 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.9899	135.0435	131.4552	125.9988	121.5679	116.8042	114.9735	118.5462	122.3142	127.3152	132.8557	137.6320	(44)
Energy conte	218.5423	192.3001	202.0418	172.4860	163.6537	143.6244	139.0504	146.7850	150.8257	172.7656	189.2773	215.4985	(45)
Energy content (annual)											Total = Sum(45)m =	2106.8508	
Distribution loss (46)m = 0.15 x (45)m	32.7813	28.8450	30.3063	25.8729	24.5481	21.5437	20.8576	22.0177	22.6239	25.9148	28.3916	32.3248	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(64)
										Total per year (kWh/year) = Sum(64)m =		2676.3968	(64)
12Total per year (kWh/year)												2676	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	111.3632	98.8927	105.8768	94.8012	93.1128	85.2047	84.9322	87.5039	87.5991	96.1425	100.3843	110.3512	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	118.2644	130.9356	118.2644	122.2065	118.2644	122.2065	118.2644	118.2644	122.2065	118.2644	122.2065	118.2644	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	234.3264	236.7580	230.6305	217.5858	201.1192	185.6429	175.3038	172.8722	178.9997	192.0444	208.5110	223.9873	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)	149.6818	147.1618	142.3075	131.6683	125.1516	118.3399	114.1562	117.6128	121.6655	129.2238	139.4227	148.3215	(72)
Total internal gains	564.1126	576.6954	553.0424	533.3007	506.3752	488.0294	469.5644	470.5894	484.7118	501.3726	531.9802	552.4132	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

East			3.0000		19.6403		0.3000		0.0000		0.7700		13.6107 (76)
West			8.4900		19.6403		0.3000		0.0000		0.7700		38.5183 (80)
East			7.6000		19.6403		0.3000		0.0000		0.7700		34.4804 (76)
Solar gains	86.6094	169.4264	279.0212	406.9358	498.7151	510.5236	486.0393	417.5006	324.5132	201.0387	107.9918	71.2234	(83)
Total gains	650.7220	746.1218	832.0636	940.2365	1005.0903	998.5530	955.6037	888.0900	809.2250	702.4113	639.9720	623.6366	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.6866	19.7875	19.8894	20.4151	20.5235	21.0838	21.0838	21.1995	20.8560	20.5235	20.3077	20.0964	
alpha	2.3124	2.3192	2.3260	2.3610	2.3682	2.4056	2.4056	2.4133	2.3904	2.3682	2.3538	2.3398	
util living area	0.9351	0.9109	0.8714	0.7915	0.6814	0.5358	0.4155	0.4552	0.6473	0.8296	0.9105	0.9402	(86)
Living	18.1081	18.4594	19.0087	19.7538	20.3388	20.7476	20.9014	20.8752	20.5746	19.7963	18.8657	18.0903	
Non living	17.2922	17.6387	18.1768	18.9054	19.4474	19.8162	19.9293	19.9187	19.6772	18.9652	18.0590	17.2873	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.5206	18.4594	19.0087	19.7538	20.3388	20.7476	20.9014	20.8752	20.5746	19.7963	18.8657	18.4973	(87)
Th 2	19.9104	19.9154	19.9203	19.9451	19.9501	19.9751	19.9751	19.9801	19.9650	19.9501	19.9401	19.9302	(88)
util rest of house	0.9266	0.8994	0.8543	0.7637	0.6374	0.4708	0.3309	0.3699	0.5859	0.8005	0.8971	0.9323	(89)
MIT 2	18.5710	17.6387	18.1768	18.9054	19.4474	19.8162	19.9293	19.9187	19.6772	18.9652	18.0590	17.6570	(90)
Living area fraction										fLA = Living area / (4) =		0.2056	(91)
MIT	18.7663	17.8074	18.3478	19.0798	19.6306	20.0077	20.1291	20.1153	19.8617	19.1360	18.2249	17.8297	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7663	17.8074	18.3478	19.0798	19.6306	20.0077	20.1291	20.1153	19.8617	19.1360	18.2249	17.8297	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9158	0.8703	0.8236	0.7372	0.6226	0.4730	0.3442	0.3819	0.5791	0.7733	0.8689	0.9121	(94)
Useful gains	595.9114	649.3608	685.3029	693.1332	625.7317	472.3015	328.9521	339.1532	468.6135	543.1759	556.0840	568.8159	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1533.4264	1361.2162	1243.0667	1040.5582	806.3674	535.2322	349.2998	365.7208	576.4916	867.9212	1143.1712	1415.2964	(97)
Space heating kWh	697.5112	478.3668	414.9762	250.1460	134.3930	0.0000	0.0000	0.0000	0.0000	241.6105	422.7028	629.7815	(98a)
Space heating requirement - total per year (kWh/year)												3269.4881	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	697.5112	478.3668	414.9762	250.1460	134.3930	0.0000	0.0000	0.0000	0.0000	241.6105	422.7028	629.7815	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3269.4881	
Space heating per m2											(98c) / (4) =	37.3827	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	286.3431 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	697.5112	478.3668	414.9762	250.1460	134.3930	0.0000	0.0000	0.0000	0.0000	241.6105	422.7028	629.7815	(98)
Space heating efficiency (main heating system 1)	286.3431	286.3431	286.3431	286.3431	286.3431	0.0000	0.0000	0.0000	0.0000	286.3431	286.3431	286.3431	(210)
Space heating fuel (main heating system)	243.5928	167.0607	144.9228	87.3589	46.9343	0.0000	0.0000	0.0000	0.0000	84.3780	147.6211	219.9395	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	93.6855	82.8316	87.8939	76.9723	74.4199	66.8421	65.7843	68.4991	69.3697	77.6181	82.8660	92.6172	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.3636	3.9413	4.3636	4.2228	4.3636	4.2228	4.3636	4.3636	4.2228	4.3636	4.2228	4.3636	(231)
Lighting	24.5730	19.7134	17.7497	13.0042	10.0448	8.2067	9.1632	11.9107	15.4708	20.2986	22.9272	25.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	1141.8080	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	284.9050	
Water heating fuel used	939.3997	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)		
mechanical ventilation fans (SFP = 0.1790)	51.3777	(230a)
Total electricity for the above, kWh/year	51.3777	(231)
Electricity for lighting (calculated in Appendix L)	198.3182	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2330.9037	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1141.8080	0.1549	176.9125	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	939.3997	0.1410	132.4256	(264)
Space and water heating			309.3381	(265)
Pumps, fans and electric keep-hot	51.3777	0.1387	7.1267	(267)
Energy for lighting	198.3182	0.1443	28.6234	(268)
Total CO2, kg/year			345.0882	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.9500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1141.8080	1.5736	1796.7338	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	939.3997	1.5213	1429.0647	(278)
Space and water heating			3225.7985	(279)
Pumps, fans and electric keep-hot	51.3777	1.5128	77.7242	(281)
Energy for lighting	198.3182	1.5338	304.1871	(282)
Total Primary energy kWh/year			3607.7098	(286)
Dwelling Primary energy Rate (DPER)			41.2500	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling							
Ground floor		43.7300 (1b)	x	2.5500 (2b)	=	111.5115	(1b) - (3b)
First floor		43.7300 (1c)	x	2.8300 (2c)	=	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.2674	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1275	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3775	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3209	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)

Adj infilt rate													
	0.4091	0.4011	0.3931	0.3530	0.3450	0.3048	0.3048	0.2968	0.3209	0.3450	0.3610	0.3770	(22b)
Effective ac	0.5837	0.5804	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711	(25)

---

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type			19.0900	1.1450	21.8588			(27)
GF			43.7300	0.1300	5.6849			(28a)
Main	110.7742	21.2400	89.5342	0.1800	16.1162			(29a)
PIJ	43.7300		43.7300	0.1100	4.8103			(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.6201			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 85.8955 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	14.5100	0.0500	0.7255	
E3 Sill	14.5100	0.0500	0.7255	
E4 Jamb	29.8400	0.0500	1.4920	
E5 Ground floor (normal)	20.5900	0.1600	3.2944	
E10 Eaves (insulation at ceiling level)	14.6000	0.0600	0.8760	
E12 Gable (insulation at ceiling level)	5.9900	0.0600	0.3594	
E16 Corner (normal)	10.7600	0.0900	0.9684	
E18 Party wall between dwellings	10.7600	0.0600	0.6456	
P1 Party wall - Ground floor	5.9900	0.0800	0.4792	
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.1200	0.7188	
E6 Intermediate floor within a dwelling	20.5900	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.2848	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	60.9049	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.3170	45.0647	44.8173	43.6557	43.4383	42.4266	42.4266	42.2392	42.8163	43.4383	43.8780	44.3377	(38)
Heat transfer coeff	106.2219	105.9696	105.7223	104.5606	104.3433	103.3315	103.3315	103.1441	103.7212	104.3433	104.7830	105.2426	(39)
Average = Sum(39)m / 12 =												104.5596	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2145	1.2116	1.2088	1.1955	1.1930	1.1815	1.1815	1.1793	1.1859	1.1930	1.1981	1.2033	(40)
HLP (average)												1.1955	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5893	(42)
Hot water usage for mixer showers													
	67.6343	66.6179	65.1368	62.3030	60.2117	57.8795	56.5538	58.0238	59.6350	62.1391	65.0338	67.3752	(42a)
Hot water usage for baths													
	29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)
Hot water usage for other uses													
	41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)
Average daily hot water use (litres/day)												126.8439	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	137.9899	135.0435	131.4552	125.9988	121.5679	116.8042	114.9735	118.5462	122.3142	127.3152	132.8557	137.6320	(44)
Energy conte	218.5423	192.3001	202.0418	172.4860	163.6537	143.6244	139.0504	146.7850	150.8257	172.7656	189.2773	215.4985	(45)
Energy content (annual)										Total = Sum(45)m =		2106.8508	
Distribution loss (46)m = 0.15 x (45)m													
	32.7813	28.8450	30.3063	25.8729	24.5481	21.5437	20.8576	22.0177	22.6239	25.9148	28.3916	32.3248	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6426	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8870	(55)
Total storage loss													
	27.4979	24.8369	27.4979	26.6109	27.4979	26.6109	27.4979	27.4979	26.6109	27.4979	26.6109	27.4979	(56)
If cylinder contains dedicated solar storage													
	27.4979	24.8369	27.4979	26.6109	27.4979	26.6109	27.4979	27.4979	26.6109	27.4979	26.6109	27.4979	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	269.3026	238.1481	252.8021	221.6090	214.4140	192.7473	189.8108	197.5453	199.9486	223.5259	238.4002	266.2588	(62)
WWHRS	-30.9196	-27.3455	-28.6347	-23.7106	-22.0975	-18.9090	-17.7241	-18.8478	-19.5639	-23.0637	-26.1284	-30.3470	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	238.3830	210.8026	224.1674	197.8983	192.3166	173.8384	172.0866	178.6975	180.3847	200.4622	212.2718	235.9118	(64)
										Total per year (kWh/year) = Sum(64)m =		2417.2209	(64)
12Total per year (kWh/year)												2417	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	113.2736	100.6182	107.7872	96.6499	95.0231	87.0534	86.8425	89.4143	89.4479	98.0528	102.2330	112.2615	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	129.4667	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	118.2644	130.9356	118.2644	122.2065	118.2644	122.2065	118.2644	118.2644	122.2065	118.2644	122.2065	118.2644	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													

	234.3264	236.7580	230.6305	217.5858	201.1192	185.6429	175.3038	172.8722	178.9997	192.0444	208.5110	223.9873	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	35.9467	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)													
	152.2494	149.7295	144.8752	134.2360	127.7193	120.9076	116.7239	120.1805	124.2332	131.7914	141.9903	150.8892	(72)
Total internal gains													
	569.6802	582.2631	558.6101	538.8684	511.9429	490.5970	472.1321	473.1571	487.2794	506.9403	537.5479	557.9809	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.6000	19.6403	0.6300	0.7000	0.7700	63.6246	(76)
West	8.4900	19.6403	0.6300	0.7000	0.7700	50.9597	(80)

Solar gains	114.5843	224.1512	369.1451	538.3761	659.8001	675.4228	643.0300	552.3533	429.3310	265.9743	142.8731	94.2285	(83)
Total gains	684.2645	806.4142	927.7552	1077.2444	1171.7429	1166.0198	1115.1621	1025.5104	916.6104	772.9145	680.4210	652.2094	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.6455	19.6923	19.7383	19.9576	19.9992	20.1950	20.1950	20.2317	20.1192	19.9992	19.9153	19.8283	
alpha	2.3097	2.3128	2.3159	2.3305	2.3333	2.3463	2.3463	2.3488	2.3413	2.3333	2.3277	2.3219	
util living area													
	0.9289	0.8983	0.8478	0.7537	0.6317	0.4908	0.3767	0.4187	0.6103	0.8075	0.9016	0.9353	(86)
MIT	18.1691	18.5559	19.1398	19.8649	20.4230	20.7759	20.9131	20.8863	20.6073	19.8443	18.8905	18.1080	(87)
Th 2	19.9084	19.9107	19.9130	19.9236	19.9256	19.9349	19.9349	19.9366	19.9313	19.9256	19.9215	19.9173	(88)
util rest of house													
	0.9197	0.8855	0.8286	0.7230	0.5857	0.4260	0.2952	0.3348	0.5469	0.7757	0.8870	0.9269	(89)
MIT 2	16.6258	17.1103	17.8364	18.7224	19.3724	19.7586	19.8850	19.8674	19.5973	18.7241	17.5456	16.5538	(90)
Living area fraction										fLA = Living area / (4) =		0.2056	(91)
MIT	16.9431	17.4075	18.1044	18.9573	19.5883	19.9677	20.0963	20.0768	19.8049	18.9544	17.8221	16.8733	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.9431	17.4075	18.1044	18.9573	19.5883	19.9677	20.0963	20.0768	19.8049	18.9544	17.8221	16.8733	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8842	0.8463	0.7887	0.6913	0.5699	0.4281	0.3080	0.3464	0.5387	0.7409	0.8488	0.8930	(94)
Useful gains	605.0532	682.4476	731.7367	744.6670	667.8221	499.1628	343.5218	355.2840	493.7427	572.6229	577.5182	582.4271	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1342.9696	1325.4119	1226.8417	1051.5951	823.0951	554.6541	361.2803	379.2433	591.7237	871.7217	1123.4926	1333.7762	(97)
Space heating kWh													
	549.0098	432.0720	368.3582	220.9882	115.5231	0.0000	0.0000	0.0000	0.0000	222.5295	393.1016	559.0037	(98a)
Space heating requirement - total per year (kWh/year)												2860.5862	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	549.0098	432.0720	368.3582	220.9882	115.5231	0.0000	0.0000	0.0000	0.0000	222.5295	393.1016	559.0037	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2860.5862	
Space heating per m2											(98c) / (4) =	32.7074	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	549.0098	432.0720	368.3582	220.9882	115.5231	0.0000	0.0000	0.0000	0.0000	222.5295	393.1016	559.0037	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	594.8102	468.1170	399.0879	239.4239	125.1605	0.0000	0.0000	0.0000	0.0000	241.0938	425.8955	605.6378	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	238.3830	210.8026	224.1674	197.8983	192.3166	173.8384	172.0866	178.6975	180.3847	200.4622	212.2718	235.9118	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.8681	85.6331	85.1661	84.3079	82.9551	79.8000	79.8000	79.8000	79.8000	84.2945	85.4219	85.9240	(217)
Fuel for water heating, kWh/month													
	277.6155	246.1694	263.2120	234.7329	231.8320	217.8426	215.6474	223.9317	226.0459	237.8116	248.4983	274.5586	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	24.5730	19.7134	17.7497	13.0042	10.0448	8.2067	9.1632	11.9107	15.4708	20.2986	22.9272	25.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-40.4681	-56.8289	-81.3729	-91.1293	-97.9537	-91.3009	-90.1428	-85.2277	-76.5407	-64.7751	-44.3982	-35.0109	(233a)

Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-23.5612	-49.4807	-98.1995	-147.2879	-194.5714	-195.4512	-193.1789	-163.6739	-120.0949	-70.7300	-31.4452	-18.6406 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3099.2266	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2897.8980	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	198.3182	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2161.4648	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4119.9781	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3099.2266	0.2100	650.8376	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2897.8980	0.2100	608.5586	(264)
Space and water heating			1259.3962	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	198.3182	0.1443	28.6234	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-855.1493	0.1347	-115.1661	
PV Unit electricity exported	-1306.3155	0.1259	-164.5086	
Total			-279.6747	(269)
Total CO2, kg/year			1020.2742	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.6700	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3099.2266	1.1300	3502.1261	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2897.8980	1.1300	3274.6247	(278)
Space and water heating			6776.7508	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	198.3182	1.5338	304.1871	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-855.1493	1.4977	-1280.7879	
PV Unit electricity exported	-1306.3155	0.4623	-603.8616	
Total			-1884.6496	(283)
Total Primary energy kWh/year			5326.3892	(286)
Target Primary Energy Rate (TPER)			60.9000	(287)

Full SAP Calculation Printout

Plot Reference	79841-08	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	2B3P (Semi)
Plot Address	Plot 8, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	83 B	**DER**	3.95	**TER**	11.67
Environmental	97 A	**% DER < TER**			66.15
CO_2 Emissions (t/year)	0.32	**DFEE**	40.01	**TFEE**	40.64
Compliance Check	See BREL	**% DFEE < TFEE**			1.55
% DPER < TPER	32.27	**DPER**	41.25	**TPER**	60.90

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	43.7300 (1b)	x	2.5500 (2b)	=	111.5115	(1b) - (3b)
First floor	43.7300 (1c)	x	2.8300 (2c)	=	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.2674	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1275	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3275	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2784	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3549	0.3480	0.3410	0.3062	0.2993	0.2645	0.2645	0.2575	0.2784	0.2993	0.3132	0.3271	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

Effective ac	0.6049	0.5980	0.5910	0.5562	0.5493	0.5145	0.5145	0.5075	0.5284	0.5493	0.5632	0.5771	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.4900	1.1450	13.1565			(27)
Glazed Doors			7.6000	1.1450	8.7023			(27)
GF			43.7300	0.1100	4.8103	75.0000	3279.7500	(28a)
Main	110.7742	21.2400	89.5342	0.1900	17.0115	9.0000	805.8078	(29a)
PIJ	43.7300		43.7300	0.0900	3.9357	9.0000	393.5700	(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.7663			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000	20.0000	644.6000	(32)
Timber			113.8200			9.0000	1024.3800	(32c)
Timber			20.4000			9.0000	183.6000	(32c)
FF			43.7300			18.0000	787.1400	(32d)
GF			43.7300			9.0000	393.5700	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7512.4178 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 85.8955 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.5100	0.0460	0.6675
E3 Sill	14.5100	0.0470	0.6820
E4 Jamb	29.8400	0.0530	1.5815
E5 Ground floor (normal)	20.5900	0.0680	1.4001
E10 Eaves (insulation at ceiling level)	14.6000	0.0910	1.3286
E12 Gable (insulation at ceiling level)	5.9900	0.0750	0.4492
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	5.9900	0.1160	0.6948
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.0460	0.2755
E6 Intermediate floor within a dwelling	20.5900	0.0540	1.1119

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2672 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.0334 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.9668	46.4264	45.8861	43.1844	42.6441	39.9424	39.9424	39.4020	41.0231	42.6441	43.7247	44.8054	(38)
Heat transfer coeff	106.0002	105.4599	104.9195	102.2178	101.6775	98.9758	98.9758	98.4355	100.0565	101.6775	102.7582	103.8389	(39)
Average = Sum(39)m / 12 =												102.0828	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2120	1.2058	1.1996	1.1687	1.1626	1.1317	1.1317	1.1255	1.1440	1.1626	1.1749	1.1873	(40)
HLP (average)												1.1672	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5893 (42)
Hot water usage for mixer showers

67.6343	66.6179	65.1368	62.3030	60.2117	57.8795	56.5538	58.0238	59.6350	62.1391	65.0338	67.3752	(42a)

Hot water usage for baths

29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)

Hot water usage for other uses

41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)

Average daily hot water use (litres/day) 126.8439 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.9899	135.0435	131.4552	125.9988	121.5679	116.8042	114.9735	118.5462	122.3142	127.3152	132.8557	137.6320	(44)
Energy conte	218.5423	192.3001	202.0418	172.4860	163.6537	143.6244	139.0504	146.7850	150.8257	172.7656	189.2773	215.4985	(45)
Energy content (annual)										Total = Sum(45)m =		2106.8508	
Distribution loss (46)m = 0.15 x (45)m	32.7813	28.8450	30.3063	25.8729	24.5481	21.5437	20.8576	22.0177	22.6239	25.9148	28.3916	32.3248	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(64)
										Total per year (kWh/year) = Sum(64)m =		2676.3968	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	111.3632	98.8927	105.8768	94.8012	93.1128	85.2047	84.9322	87.5039	87.5991	96.1425	100.3843	110.3512	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.0740	24.9351	20.2786	15.3522	11.4759	9.6885	10.4687	13.6077	18.2642	23.1905	27.0668	28.8543	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	349.7409	353.3701	344.2246	324.7549	300.1779	277.0790	261.6475	258.0183	267.1638	286.6335	311.2105	334.3094	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)	149.6818	147.1618	142.3075	131.6683	125.1516	118.3399	114.1562	117.6128	121.6655	129.2238	139.4227	148.3215	(72)
Total internal gains	632.4087	630.3790	611.7227	576.6874	541.7174	510.0193	491.1844	494.1507	512.0054	543.9598	582.6119	616.3971	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.0000	19.6403	0.3000	0.0000	0.7700	13.6107	(76)

West				8.4900	19.6403	0.3000	0.0000	0.7700				38.5183	(80)
East				7.6000	19.6403	0.3000	0.0000	0.7700				34.4804	(76)
Solar gains	86.6094	169.4264	279.0212	406.9358	498.7151	510.5236	486.0393	417.5006	324.5132	201.0387	107.9918	71.2234	(83)
Total gains	719.0181	799.8054	890.7439	983.6232	1040.4325	1020.5430	977.2237	911.6513	836.5186	744.9985	690.6037	687.6205	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.6866	19.7875	19.8894	20.4151	20.5235	21.0838	21.0838	21.1995	20.8560	20.5235	20.3077	20.0964	
alpha	2.3124	2.3192	2.3260	2.3610	2.3682	2.4056	2.4056	2.4133	2.3904	2.3682	2.3538	2.3398	
util living area	0.9221	0.8994	0.8565	0.7780	0.6688	0.5276	0.4079	0.4458	0.6349	0.8139	0.8977	0.9282	(86)
Living	18.2439	18.5585	19.1033	19.8070	20.3668	20.7562	20.9053	20.8808	20.5932	19.8561	18.9597	18.2208	
Non living	17.4239	17.7339	18.2659	18.9532	19.4704	19.8221	19.9313	19.9217	19.6910	19.0188	18.1487	17.4142	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.5901	18.5585	19.1033	19.8070	20.3668	20.7562	20.9053	20.8808	20.5932	19.8561	18.9597	18.6095	(87)
Th 2	19.9104	19.9154	19.9203	19.9451	19.9501	19.9751	19.9751	19.9801	19.9650	19.9501	19.9401	19.9302	(88)
util rest of house	0.9122	0.8867	0.8380	0.7492	0.6244	0.4629	0.3244	0.3617	0.5732	0.7832	0.8828	0.9190	(89)
MIT 2	18.6384	17.7339	18.2659	18.9532	19.4704	19.8221	19.9313	19.9217	19.6910	19.0188	18.1487	17.7661	(90)
Living area fraction									fLA = Living area / (4) =			0.2056	(91)
MIT	18.8341	17.9035	18.4380	19.1287	19.6546	20.0141	20.1315	20.1189	19.8765	19.1910	18.3154	17.9395	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8341	17.9035	18.4380	19.1287	19.6546	20.0141	20.1315	20.1189	19.8765	19.1910	18.3154	17.9395	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9005	0.8567	0.8072	0.7236	0.6107	0.4655	0.3377	0.3737	0.5674	0.7568	0.8537	0.8971	(94)
Useful gains	647.4596	685.2036	719.0477	711.7549	635.3708	475.0557	330.0172	340.7173	474.6623	563.7859	589.5519	616.8669	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1540.6142	1371.3424	1252.5307	1045.5591	808.8081	535.8682	349.5354	366.0694	577.9733	873.5081	1152.4766	1426.6951	(97)
Space heating kWh	664.5070	461.0852	396.9114	240.3390	129.0373	0.0000	0.0000	0.0000	0.0000	230.4333	405.3058	602.5122	(98a)
Space heating requirement - total per year (kWh/year)												3130.1313	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	664.5070	461.0852	396.9114	240.3390	129.0373	0.0000	0.0000	0.0000	0.0000	230.4333	405.3058	602.5122	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3130.1313	
Space heating per m2											(98c) / (4) =	35.7893	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												286.3431	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement	664.5070	461.0852	396.9114	240.3390	129.0373	0.0000	0.0000	0.0000	0.0000	230.4333	405.3058	602.5122	(98)
Space heating efficiency (main heating system 1)	286.3431	286.3431	286.3431	286.3431	286.3431	0.0000	0.0000	0.0000	0.0000	286.3431	286.3431	286.3431	(210)
Space heating fuel (main heating system)	232.0667	161.0255	138.6139	83.9339	45.0639	0.0000	0.0000	0.0000	0.0000	80.4745	141.5455	210.4162	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	93.6855	82.8316	87.8939	76.9723	74.4199	66.8421	65.7843	68.4991	69.3697	77.6181	82.8660	92.6172	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.3636	3.9413	4.3636	4.2228	4.3636	4.2228	4.3636	4.3636	4.2228	4.3636	4.2228	4.3636	(231)
Lighting	24.5730	19.7134	17.7497	13.0042	10.0448	8.2067	9.1632	11.9107	15.4708	20.2986	22.9272	25.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1093.1402	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	284.9050	
Water heating fuel used	939.3997	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)		
mechanical ventilation fans (SFP = 0.1790)	51.3777	(230a)
Total electricity for the above, kWh/year	51.3777	(231)
Electricity for lighting (calculated in Appendix L)	198.3182	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2282.2359	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1093.1402	16.4900	180.2588	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	939.3997	16.4900	154.9070	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	51.3777	16.4900	8.4722	(249)
Energy for lighting	198.3182	16.4900	32.7027	(250)
Additional standing charges			0.0000	(251)
Total energy cost			376.3407	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0228	(257)
SAP value		83.4201	
SAP rating (Section 12)		83	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1093.1402	0.1549	169.3656	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	939.3997	0.1410	132.4256	(264)
Space and water heating			301.7912	(265)
Pumps, fans and electric keep-hot	51.3777	0.1387	7.1267	(267)
Energy for lighting	198.3182	0.1443	28.6234	(268)
Total CO2, kg/year			337.5414	(272)
CO2 emissions per m2			3.8600	(273)
EI value			96.5853	
EI rating			97	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	43.7300	(1b)	x 2.5500	(2b) =	111.5115	(1b) - (3b)
First floor	43.7300	(1c)	x 2.8300	(2c) =	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		235.2674	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 30.0000 / (5) =	0.1275	(8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	4.0000	(17)
Infiltration rate	0.3275	(18)
Number of sides sheltered	2	(19)
Shelter factor (20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) =	0.2784	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.5000	4.4000	4.4000	4.0000	4.1000	3.5000	3.4000	3.4000	3.5000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1250	1.1000	1.1000	1.0000	1.0250	0.8750	0.8500	0.8500	0.8750	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.3132	0.3062	0.3062	0.2784	0.2853	0.2436	0.2366	0.2366	0.2436	0.2714	0.2714	0.2784	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
Effective ac	0.5632	0.5562	0.5562	0.5284	0.5353	0.5000	0.5000	0.5000	0.5000	0.5214	0.5214	0.5284	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.4900	1.1450	13.1565			(27)
Glazed Doors			7.6000	1.1450	8.7023			(27)
GF			43.7300	0.1100	4.8103	75.0000	3279.7500	(28a)
Main	110.7742	21.2400	89.5342	0.1900	17.0115	9.0000	805.8078	(29a)
PIJ	43.7300		43.7300	0.0900	3.9357	9.0000	393.5700	(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.7663			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000	20.0000	644.6000	(32)
Timber			113.8200			9.0000	1024.3800	(32c)
Timber			20.4000			9.0000	183.6000	(32c)
FF			43.7300			18.0000	787.1400	(32d)
GF			43.7300			9.0000	393.5700	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) =	7512.4178	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	85.8955	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.5100	0.0460	0.6675
E3 Sill	14.5100	0.0470	0.6820
E4 Jamb	29.8400	0.0530	1.5815
E5 Ground floor (normal)	20.5900	0.0680	1.4001
E10 Eaves (insulation at ceiling level)	14.6000	0.0910	1.3286
E12 Gable (insulation at ceiling level)	5.9900	0.0750	0.4492
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	5.9900	0.1160	0.6948
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.0460	0.2755
E6 Intermediate floor within a dwelling	20.5900	0.0540	1.1119

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2672	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	59.0334	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.7247	43.1844	43.1844	41.0231	41.5634	38.8191	38.8191	38.8191	38.8191	40.4827	40.4827	41.0231	(38)
Heat transfer coeff	102.7582	102.2178	102.2178	100.0565	100.5968	97.8526	97.8526	97.8526	97.8526	99.5162	99.5162	100.0565	(39)
Average = Sum(39)m / 12 =												99.8622	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1749	1.1687	1.1687	1.1440	1.1502	1.1188	1.1188	1.1188	1.1188	1.1378	1.1378	1.1440	(40)
HLP (average)												1.1418	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5893	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	67.6343	66.6179	65.1368	62.3030	60.2117	57.8795	56.5538	58.0238	59.6350	62.1391	65.0338	67.3752	(42a)
Hot water usage for baths	29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)
Hot water usage for other uses	41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)
Average daily hot water use (litres/day)												126.8439	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.9899	135.0435	131.4552	125.9988	121.5679	116.8042	114.9735	118.5462	122.3142	127.3152	132.8557	137.6320	(44)
Energy conte	218.5423	192.3001	202.0418	172.4860	163.6537	143.6244	139.0504	146.7850	150.8257	172.7656	189.2773	215.4985	(45)
Energy content (annual)										Total = Sum(45)m =		2106.8508	
Distribution loss (46)m = 0.15 x (45)m	32.7813	28.8450	30.3063	25.8729	24.5481	21.5437	20.8576	22.0177	22.6239	25.9148	28.3916	32.3248	(46)

Water storage loss (or HIU loss):		
Store volume	198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.5000	(48)
Temperature factor from Table 2b	0.5400	(49)
Enter (49) or (54) in (55)	0.8100	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)

PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(64)
									Total per year (kWh/year) = Sum(64)m =			2676.3968	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =				0.0000	(64a)
Heat gains from water heating, kWh/month													
	111.3632	98.8927	105.8768	94.8012	93.1128	85.2047	84.9322	87.5039	87.5991	96.1425	100.3843	110.3512	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.0740	24.9351	20.2786	15.3522	11.4759	9.6885	10.4687	13.6077	18.2642	23.1905	27.0668	28.8543	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	349.7409	353.3701	344.2246	324.7549	300.1779	277.0790	261.6475	258.0183	267.1638	286.6335	311.2105	334.3094	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)													
	149.6818	147.1618	142.3075	131.6683	125.1516	118.3399	114.1562	117.6128	121.6655	129.2238	139.4227	148.3215	(72)
Total internal gains													
	632.4087	630.3790	611.7227	576.6874	541.7174	510.0193	491.1844	494.1507	512.0054	543.9598	582.6119	616.3971	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.0000	17.3606	0.3000	0.0000	0.7700	12.0309	(76)
West	8.4900	17.3606	0.3000	0.0000	0.7700	34.0474	(80)
East	7.6000	17.3606	0.3000	0.0000	0.7700	30.4782	(76)

Solar gains	76.5565	153.6258	267.2216	395.8729	469.9406	495.0205	460.1381	390.7168	318.6765	194.8089	101.3691	67.7785	(83)
Total gains	708.9652	784.0048	878.9443	972.5604	1011.6580	1005.0398	951.3225	884.8675	830.6819	738.7687	683.9810	684.1756	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.3077	20.4151	20.4151	20.8560	20.7440	21.3258	21.3258	21.3258	21.3258	20.9693	20.9693	20.8560	
alpha	2.3538	2.3610	2.3610	2.3904	2.3829	2.4217	2.4217	2.4217	2.4217	2.3980	2.3980	2.3904	
util living area													
	0.9165	0.8929	0.8450	0.7561	0.6343	0.4800	0.3736	0.4143	0.6088	0.7960	0.8890	0.9223	(86)
Living	18.4903	18.7886	19.3104	19.9905	20.5077	20.8309	20.9325	20.9108	20.6639	20.0090	19.1686	18.4723	
Non living	17.6858	17.9793	18.4835	19.1404	19.6037	19.8885	19.9580	19.9466	19.7662	19.1769	18.3724	17.6843	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.7161	18.7886	19.3104	19.9905	20.5077	20.8309	20.9325	20.9108	20.6639	20.0090	19.1686	18.8258	(87)
Th 2	19.9401	19.9451	19.9451	19.9650	19.9600	19.9855	19.9855	19.9855	19.9855	19.9700	19.9700	19.9650	(88)
util rest of house													
	0.9056	0.8792	0.8249	0.7240	0.5836	0.4090	0.2856	0.3241	0.5438	0.7619	0.8726	0.9123	(89)
MIT 2	18.7869	17.9793	18.4835	19.1404	19.6037	19.8885	19.9580	19.9466	19.7662	19.1769	18.3724	18.0033	(90)
Living area fraction										fLA = Living area / (4) =		0.2056	(91)
MIT	18.9779	18.1456	18.6535	19.3152	19.7895	20.0822	20.1584	20.1448	19.9508	19.3480	18.5361	18.1724	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9779	18.1456	18.6535	19.3152	19.7895	20.0822	20.1584	20.1448	19.9508	19.3480	18.5361	18.1724	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8940	0.8496	0.7952	0.7012	0.5746	0.4162	0.3012	0.3390	0.5414	0.7378	0.8440	0.8904	(94)
Useful gains	633.7905	666.0991	698.9196	681.9735	581.3000	418.2543	286.5626	299.9722	449.7067	545.0560	577.3130	609.1797	(95)
Ext temp.	5.0000	5.6000	7.2000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.2000	7.7000	4.8000	(96)
Heat loss rate W													
	1436.3453	1282.3892	1170.7484	962.0629	713.1837	458.1691	299.2699	317.5112	533.3708	810.8551	1078.3641	1337.9949	(97)
Space heating kWh													
	597.1007	414.1470	351.0406	201.6644	98.1214	0.0000	0.0000	0.0000	0.0000	197.7545	360.7568	542.2385	(98a)
Space heating requirement - total per year (kWh/year)												2762.8240	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	597.1007	414.1470	351.0406	201.6644	98.1214	0.0000	0.0000	0.0000	0.0000	197.7545	360.7568	542.2385	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2762.8240	
Space heating per m2											(98c) / (4) =	31.5896	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	286.9197	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	597.1007	414.1470	351.0406	201.6644	98.1214	0.0000	0.0000	0.0000	0.0000	197.7545	360.7568	542.2385	(98)
Space heating efficiency (main heating system 1)	286.9197	286.9197	286.9197	286.9197	286.9197	0.0000	0.0000	0.0000	0.0000	286.9197	286.9197	286.9197	(210)
Space heating fuel (main heating system)	208.1073	144.3425	122.3480	70.2860	34.1982	0.0000	0.0000	0.0000	0.0000	68.9233	125.7344	188.9862	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	266.9147	235.9913	250.4142	219.2980	212.0261	190.4364	187.4228	195.1574	197.6377	221.1380	236.0893	263.8709	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	93.6855	82.8316	87.8939	76.9723	74.4199	66.8421	65.7843	68.4991	69.3697	77.6181	82.8660	92.6172	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.3636	3.9413	4.3636	4.2228	4.3636	4.2228	4.3636	4.3636	4.2228	4.3636	4.2228	4.3636	(231)
Lighting	24.5730	19.7134	17.7497	13.0042	10.0448	8.2067	9.1632	11.9107	15.4708	20.2986	22.9272	25.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	962.9259	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	284.9050	
Water heating fuel used	939.3997	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)		
mechanical ventilation fans (SFP = 0.1790)	51.3777	(230a)
Total electricity for the above, kWh/year	51.3777	(231)
Electricity for lighting (calculated in Appendix L)	198.3182	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2152.0216	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	962.9259	26.0000	250.3607	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	939.3997	26.0000	244.2439	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	51.3777	26.0000	13.3582	(249)
Energy for lighting	198.3182	26.0000	51.5627	(250)
Additional standing charges			0.0000	(251)
Total energy cost			559.5256	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	962.9259	0.1552	149.4648	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	939.3997	0.1410	132.4256	(264)
Space and water heating			281.8904	(265)
Pumps, fans and electric keep-hot	51.3777	0.1387	7.1267	(267)
Energy for lighting	198.3182	0.1443	28.6234	(268)
Total CO2, kg/year			317.6405	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	962.9259	1.5746	1516.2462	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	939.3997	1.5213	1429.0647	(278)
Space and water heating			2945.3109	(279)
Pumps, fans and electric keep-hot	51.3777	1.5128	77.7242	(281)
Energy for lighting	198.3182	1.5338	304.1871	(282)

Total Primary energy kWh/year 3327.2222 (286)

SAP 10 EPC IMPROVEMENTS

001

Current energy efficiency rating: B 83
Current environmental impact rating: A 97

N	Solar water heating		Recommended
U	Solar photovoltaic panels		Recommended
V2	Wind turbine		Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.4	-£ 49	-23 kg (7.3%)
U Solar photovoltaic panels	+ 8.3	-£ 259	-212 kg (71.9%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£49	0.27 kg/m²	B 85	A 97
Solar photovoltaic panels	£259	2.42 kg/m²	A 93	A 99
Total Savings	£308	2.69 kg/m²		

Potential energy efficiency rating: A 93
Potential environmental impact rating: A 99

Fuel prices for cost data on this page from database revision number 599 TEST (30 Sep 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, West Pennines (England)):

	Current	Potential	Saving
Electricity	£560	£510	£49
Space heating	£264	£287	-£23
Water heating	£244	£172	£72
Lighting	£52	£52	£0
Generated (PV)	-£0	-£259	£259
Total cost of fuels	£560	£251	£308
Total cost of uses	£560	£252	£308
Delivered energy	25 kWh/m²	4 kWh/m²	21 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.1 tonnes	0.2 tonnes
CO2 emissions per m²	4 kg/m²	1 kg/m²	3 kg/m²
Primary energy	38 kWh/m²	17 kWh/m²	21 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	43.7300	(1b)	x 2.5500	(2b) =	111.5115	(1b) - (3b)
First floor	43.7300	(1c)	x 2.8300	(2c) =	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		235.2674	(5)

---

2. Ventilation rate

---

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1275 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.3275 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2784 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)

Adj infilt rate

	0.3549	0.3480	0.3410	0.3062	0.2993	0.2645	0.2645	0.2575	0.2784	0.2993	0.3132	0.3271 (22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

Effective ac	0.6049	0.5980	0.5910	0.5562	0.5493	0.5145	0.5145	0.5075	0.5284	0.5493	0.5632	0.5771 (25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.4900	1.1450	13.1565			(27)
Glazed Doors			7.6000	1.1450	8.7023			(27)
GF			43.7300	0.1100	4.8103	75.0000	3279.7500	(28a)
Main	110.7742	21.2400	89.5342	0.1900	17.0115	9.0000	805.8078	(29a)
PIJ	43.7300		43.7300	0.0900	3.9357	9.0000	393.5700	(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.7663			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000	20.0000	644.6000	(32)
Timber			113.8200			9.0000	1024.3800	(32c)
Timber			20.4000			9.0000	183.6000	(32c)
FF			43.7300			18.0000	787.1400	(32d)
GF			43.7300			9.0000	393.5700	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7512.4178 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 85.8955 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.5100	0.0460	0.6675
E3 Sill	14.5100	0.0470	0.6820
E4 Jamb	29.8400	0.0530	1.5815
E5 Ground floor (normal)	20.5900	0.0680	1.4001
E10 Eaves (insulation at ceiling level)	14.6000	0.0910	1.3286
E12 Gable (insulation at ceiling level)	5.9900	0.0750	0.4492
E16 Corner (normal)	10.7600	0.0460	0.4950
E18 Party wall between dwellings	10.7600	0.0540	0.5810
P1 Party wall - Ground floor	5.9900	0.1160	0.6948
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.0460	0.2755
E6 Intermediate floor within a dwelling	20.5900	0.0540	1.1119

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2672 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 59.0334 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.9668	46.4264	45.8861	43.1844	42.6441	39.9424	39.9424	39.4020	41.0231	42.6441	43.7247	44.8054	(38)
Heat transfer coeff	106.0002	105.4599	104.9195	102.2178	101.6775	98.9758	98.9758	98.4355	100.0565	101.6775	102.7582	103.8389	(39)

Average = Sum(39)m / 12 = 102.0828

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2120	1.2058	1.1996	1.1687	1.1626	1.1317	1.1317	1.1255	1.1440	1.1626	1.1749	1.1873	(40)
HLP (average)												1.1672	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5893 (42)

Hot water usage for mixer showers

67.6343	66.6179	65.1368	62.3030	60.2117	57.8795	56.5538	58.0238	59.6350	62.1391	65.0338	67.3752	(42a)

Hot water usage for baths

29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)

Hot water usage for other uses

41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)

Average daily hot water use (litres/day) 126.8439 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.9899	135.0435	131.4552	125.9988	121.5679	116.8042	114.9735	118.5462	122.3142	127.3152	132.8557	137.6320	(44)
Energy conte	218.5423	192.3001	202.0418	172.4860	163.6537	143.6244	139.0504	146.7850	150.8257	172.7656	189.2773	215.4985	(45)
Energy content (annual)										Total = Sum(45)m =		2106.8508	
Distribution loss (46)m = 0.15 x (45)m	32.7813	28.8450	30.3063	25.8729	24.5481	21.5437	20.8576	22.0177	22.6239	25.9148	28.3916	32.3248	(46)

Water storage loss (or HIU loss):

Store volume 198.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.5000 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.8100 (55)

Total storage loss

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)

If cylinder contains dedicated solar storage

15.5986	14.0891	15.5986	15.0955	15.5986	15.0955	15.5986	15.5986	15.0955	15.5986	15.0955	15.5986	(57)
Primary loss 23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

257.4033	227.4004	239.5071	203.3399	189.7204	168.6252	164.8845	173.5496	183.0303	210.2309	226.8848	254.3595	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Aperture area of solar collector 3.0000 (H1)

Zero-loss collector efficiency 0.8000 (H2)

Collector linear heat loss coefficient 1.8000 (H3)

Collector 2nd order heat loss coefficient 0.0000 (H4)

Collector loop efficiency 0.9000 (H5)

Incidence angle modifier 1.0000 (H6)

Overshading factor 0.8000 (H8)

Overall heat loss coefficient of system 6.5000 (H10)

Heat loss coefficient of collector loop 3.9667 (H11)

Dedicated solar storage volume 75.0000 (H12)

If combined cylinder, total volume of cylinder 198.0000 (H13)

Effective solar volume 111.9000 (H14)

Reference volume 225.0000 (H15)

Storage tank correction coefficient												1.1908	(H16)
Heat delivered to hot water												648.7608	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												648.7608	
Solar input	-0.0000	-19.9033	-62.0018	-83.2548	-106.7311	-98.1676	-97.3555	-86.1278	-61.1731	-32.9118	-1.1339	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	257.4033	207.4971	177.5053	120.0851	82.9893	70.4575	67.5290	87.4217	121.8571	177.3191	225.7509	254.3595	(64)
									Total per year (kWh/year) = Sum(64)m =			1850.1749	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =				0.0000	(64a)
Heat gains from water heating, kWh/month													
	103.7541	92.0200	97.1511	82.0347	75.2682	67.7557	66.9015	70.2177	75.9132	87.4168	93.0207	102.7421	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.0740	24.9351	20.2786	15.3522	11.4759	9.6885	10.4687	13.6077	18.2642	23.1905	27.0668	28.8543	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	349.7409	353.3701	344.2246	324.7549	300.1779	277.0790	261.6475	258.0183	267.1638	286.6335	311.2105	334.3094	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)													
	139.4545	136.9345	130.5795	113.9371	101.1670	94.1051	89.9214	94.3786	105.4350	117.4957	129.1954	138.0942	(72)
Total internal gains													
	622.1814	620.1517	599.9946	558.9562	517.7328	485.7846	466.9497	470.9165	495.7749	532.2317	572.3847	606.1699	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.0000	19.6403	0.3000	0.0000	0.7700	13.6107	(76)
West	8.4900	19.6403	0.3000	0.0000	0.7700	38.5183	(80)
East	7.6000	19.6403	0.3000	0.0000	0.7700	34.4804	(76)

Solar gains	86.6094	169.4264	279.0212	406.9358	498.7151	510.5236	486.0393	417.5006	324.5132	201.0387	107.9918	71.2234	(83)
Total gains	708.7908	789.5782	879.0159	965.8920	1016.4479	996.3082	952.9890	888.4171	820.2882	733.2705	680.3765	677.3933	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.6866	19.7875	19.8894	20.4151	20.5235	21.0838	21.0838	21.1995	20.8560	20.5235	20.3077	20.0964	
alpha	2.3124	2.3192	2.3260	2.3610	2.3682	2.4056	2.4056	2.4133	2.3904	2.3682	2.3538	2.3398	
util living area													
	0.9241	0.9016	0.8595	0.7835	0.6773	0.5367	0.4164	0.4551	0.6422	0.8182	0.9003	0.9302	(86)
Living	18.2239	18.5399	19.0848	19.7856	20.3480	20.7467	20.9009	20.8752	20.5823	19.8400	18.9410	18.2002	
Non living	17.4046	17.7161	18.2485	18.9340	19.4549	19.8156	19.9291	19.9188	19.6829	19.0044	18.1309	17.3943	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.5799	18.5399	19.0848	19.7856	20.3480	20.7467	20.9009	20.8752	20.5823	19.8400	18.9410	18.5919	(87)
Th 2	19.9104	19.9154	19.9203	19.9451	19.9501	19.9751	19.9751	19.9801	19.9650	19.9501	19.9401	19.9302	(88)
util rest of house													
	0.9144	0.8892	0.8413	0.7551	0.6332	0.4716	0.3317	0.3698	0.5807	0.7879	0.8857	0.9212	(89)
MIT 2	18.6285	17.7161	18.2485	18.9340	19.4549	19.8156	19.9291	19.9188	19.6829	19.0044	18.1309	17.7490	(90)
Living area fraction										fLA = Living area / (4) =		0.2056	(91)
MIT	18.8241	17.8855	18.4204	19.1091	19.6385	20.0070	20.1288	20.1154	19.8678	19.1762	18.2975	17.9223	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8241	17.8855	18.4204	19.1091	19.6385	20.0070	20.1288	20.1154	19.8678	19.1762	18.2975	17.9223	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9028	0.8593	0.8105	0.7291	0.6187	0.4738	0.3450	0.3818	0.5743	0.7613	0.8568	0.8995	(94)
Useful gains	639.8952	678.4883	712.4428	704.2543	628.8844	472.0132	328.8191	339.1756	471.1064	558.2261	582.9166	609.3312	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1539.5586	1369.4450	1250.6806	1043.5482	807.1674	535.1655	349.2704	365.7258	577.1033	872.0041	1150.6318	1424.9053	(97)
Space heating kWh													
	669.3495	464.3229	400.4489	244.2916	132.6426	0.0000	0.0000	0.0000	0.0000	233.4508	408.7550	606.7871	(98a)
Space heating requirement - total per year (kWh/year)												3160.0485	
Solar heating kWh													
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	669.3495	464.3229	400.4489	244.2916	132.6426	0.0000	0.0000	0.0000	0.0000	233.4508	408.7550	606.7871	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3160.0485	
Space heating per m2											(98c) / (4) =	36.1314	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)

Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												286.3431	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	669.3495	464.3229	400.4489	244.2916	132.6426	0.0000	0.0000	0.0000	0.0000	233.4508	408.7550	606.7871	(98)
Space heating efficiency (main heating system 1)													
	286.3431	286.3431	286.3431	286.3431	286.3431	0.0000	0.0000	0.0000	0.0000	286.3431	286.3431	286.3431	(210)
Space heating fuel (main heating system)													
	233.7579	162.1562	139.8494	85.3143	46.3230	0.0000	0.0000	0.0000	0.0000	81.5284	142.7501	211.9091	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	257.4033	207.4971	177.5053	120.0851	82.9893	70.4575	67.5290	87.4217	121.8571	177.3191	225.7509	254.3595	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month													
	90.3471	72.8303	62.3033	42.1492	29.1288	24.7302	23.7023	30.6845	42.7711	62.2380	79.2372	89.2787	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.1581	10.0783	11.1581	10.7982	11.1581	10.7982	11.1581	11.1581	10.7982	11.1581	10.7982	11.1581	(231)
Lighting	24.5730	19.7134	17.7497	13.0042	10.0448	8.2067	9.1632	11.9107	15.4708	20.2986	22.9272	25.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-37.8592	-55.7876	-83.1360	-94.5943	-100.2805	-88.0622	-86.8110	-81.9151	-72.8247	-63.5837	-41.9951	-32.2301	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-12.2273	-27.7924	-59.2102	-96.1777	-135.4023	-143.6515	-141.8405	-117.8589	-83.6384	-43.2621	-17.4147	-9.6838	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1103.5883	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												284.9050	
Water heating fuel used												649.4007	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)													
mechanical ventilation fans (SFP = 0.1790)												51.3777	(230a)
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												131.3777	(231)
Electricity for lighting (calculated in Appendix L)												198.3182	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1727.2394	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												355.4454	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1103.5883	16.4900	181.9817	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	649.4007	16.4900	107.0862	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	51.3777	16.4900	8.4722	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	198.3182	16.4900	32.7027	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-839.0794	16.4900	-138.3642	
PV Unit electricity exported	-888.1600	5.5900	-49.6481	
Total			-188.0123	(252)
Total energy cost			155.4224	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4224	(257)
SAP value		93.1528	
SAP rating (Section 12)		93	(258)
SAP band		A	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	

Space heating - main system 1	1103.5883	0.1549	170.9434	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	649.4007	0.1463	95.0191	(264)
Space and water heating			265.9625	(265)
Pumps, fans and electric keep-hot	131.3777	0.1387	18.2237	(267)
Energy for lighting	198.3182	0.1443	28.6234	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-839.0794	0.1348	-113.0856	
PV Unit electricity exported	-888.1600	0.1233	-109.4795	
Total			-222.5651	(269)
Total CO2, kg/year			90.2445	(272)
CO2 emissions per m2			1.0300	(273)
EI value			99.0871	
EI rating			99	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	43.7300 (1b)	x	2.5500 (2b)	=	111.5115	(1b) - (3b)
First floor	43.7300 (1c)	x	2.8300 (2c)	=	123.7559	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.2674	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1275	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3275	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2784	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.5000	4.4000	4.4000	4.0000	4.1000	3.5000	3.4000	3.4000	3.5000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1250	1.1000	1.1000	1.0000	1.0250	0.8750	0.8500	0.8500	0.8750	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.3132	0.3062	0.3062	0.2784	0.2853	0.2436	0.2366	0.2366	0.2436	0.2714	0.2714	0.2784	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
Effective ac	0.5632	0.5562	0.5562	0.5284	0.5353	0.5000	0.5000	0.5000	0.5000	0.5214	0.5214	0.5284	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			2.1500	1.0000	2.1500			(26)
Window			11.4900	1.1450	13.1565			(27)
Glazed Doors			7.6000	1.1450	8.7023			(27)
GF			43.7300	0.1100	4.8103	75.0000	3279.7500	(28a)
Main	110.7742	21.2400	89.5342	0.1900	17.0115	9.0000	805.8078	(29a)
PIJ	43.7300		43.7300	0.0900	3.9357	9.0000	393.5700	(30)
Total net area of external elements Aum(A, m2)			198.2342					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.7663			(33)
Main dwelling								
Party Wall			32.2300	0.0000	0.0000	20.0000	644.6000	(32)
Timber			113.8200			9.0000	1024.3800	(32c)
Timber			20.4000			9.0000	183.6000	(32c)
FF			43.7300			18.0000	787.1400	(32d)
GF			43.7300			9.0000	393.5700	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	7512.4178 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		85.8955 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.5100	0.0460	0.6675
E3 Sill	14.5100	0.0470	0.6820
E4 Jamb	29.8400	0.0530	1.5815

E5 Ground floor (normal)	20.5900	0.0680	1.4001	
E10 Eaves (insulation at ceiling level)	14.6000	0.0910	1.3286	
E12 Gable (insulation at ceiling level)	5.9900	0.0750	0.4492	
E16 Corner (normal)	10.7600	0.0460	0.4950	
E18 Party wall between dwellings	10.7600	0.0540	0.5810	
P1 Party wall - Ground floor	5.9900	0.1160	0.6948	
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.0460	0.2755	
E6 Intermediate floor within a dwelling	20.5900	0.0540	1.1119	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				9.2672 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	59.0334 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.7247	43.1844	43.1844	41.0231	41.5634	38.8191	38.8191	38.8191	38.8191	40.4827	40.4827	41.0231	(38)
Heat transfer coeff	102.7582	102.2178	102.2178	100.0565	100.5968	97.8526	97.8526	97.8526	97.8526	99.5162	99.5162	100.0565	(39)
Average = Sum(39)m / 12 =												99.8622	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1749	1.1687	1.1687	1.1440	1.1502	1.1188	1.1188	1.1188	1.1188	1.1378	1.1378	1.1440	(40)
HLP (average)												1.1418	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5893	(42)
Hot water usage for mixer showers	67.6343	66.6179	65.1368	62.3030	60.2117	57.8795	56.5538	58.0238	59.6350	62.1391	65.0338	67.3752	(42a)
Hot water usage for baths	29.2082	28.7744	28.1636	27.0373	26.1939	25.2587	24.7536	25.3602	26.0206	27.0213	28.1708	29.1095	(42b)
Hot water usage for other uses	41.1474	39.6511	38.1548	36.6586	35.1623	33.6660	33.6660	35.1623	36.6586	38.1548	39.6511	41.1474	(42c)
Average daily hot water use (litres/day)												126.8439	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.9899	135.0435	131.4552	125.9988	121.5679	116.8042	114.9735	118.5462	122.3142	127.3152	132.8557	137.6320	(44)
Energy conte	218.5423	192.3001	202.0418	172.4860	163.6537	143.6244	139.0504	146.7850	150.8257	172.7656	189.2773	215.4985	(45)
Energy content (annual)										Total = Sum(45)m =		2106.8508	
Distribution loss (46)m = 0.15 x (45)m	32.7813	28.8450	30.3063	25.8729	24.5481	21.5437	20.8576	22.0177	22.6239	25.9148	28.3916	32.3248	(46)
Water storage loss (or HIU loss):													
Store volume												198.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage	15.5986	14.0891	15.5986	15.0955	15.5986	15.0955	15.5986	15.5986	15.0955	15.5986	15.0955	15.5986	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	257.4033	227.4004	239.5071	203.3399	189.7204	168.6252	164.8845	173.5496	183.0303	210.2309	226.8848	254.3595	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
If combined cylinder, total volume of cylinder												198.0000	(H13)
Effective solar volume												111.9000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.1908	(H16)
Heat delivered to hot water												615.9643	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												615.9643	
Solar input	-0.0000	-15.4930	-58.8525	-81.2359	-101.0942	-95.7775	-92.2407	-80.0212	-59.9473	-31.3019	-0.0000	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	257.4033	211.9073	180.6545	122.1040	88.6262	72.8477	72.6438	93.5284	123.0830	178.9290	226.8848	254.3595	(64)
										Total per year (kWh/year) = Sum(64)m =		1882.9715	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	103.7541	92.0200	97.1511	82.0347	75.2682	67.7557	66.9015	70.2177	75.9132	87.4168	93.0207	102.7421	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	155.3600	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.0740	24.9351	20.2786	15.3522	11.4759	9.6885	10.4687	13.6077	18.2642	23.1905	27.0668	28.8543	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	349.7409	353.3701	344.2246	324.7549	300.1779	277.0790	261.6475	258.0183	267.1638	286.6335	311.2105	334.3094	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	53.1253	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	-103.5733	(71)
Water heating gains (Table 5)	139.4545	136.9345	130.5795	113.9371	101.1670	94.1051	89.9214	94.3786	105.4350	117.4957	129.1954	138.0942	(72)
Total internal gains	622.1814	620.1517	599.9946	558.9562	517.7328	485.7846	466.9497	470.9165	495.7749	532.2317	572.3847	606.1699	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.0000	17.3606	0.3000	0.0000	0.7700	12.0309	(76)
West	8.4900	17.3606	0.3000	0.0000	0.7700	34.0474	(80)
East	7.6000	17.3606	0.3000	0.0000	0.7700	30.4782	(76)

Solar gains	76.5565	153.6258	267.2216	395.8729	469.9406	495.0205	460.1381	390.7168	318.6765	194.8089	101.3691	67.7785	(83)
Total gains	698.7379	773.7775	867.2162	954.8291	987.6734	980.8051	927.0878	861.6333	814.4514	727.0406	673.7537	673.9484	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.3077	20.4151	20.4151	20.8560	20.7440	21.3258	21.3258	21.3258	21.3258	20.9693	20.9693	20.8560	
alpha	2.3538	2.3610	2.3610	2.3904	2.3829	2.4217	2.4217	2.4217	2.4217	2.3980	2.3980	2.3904	
util living area	0.9187	0.8953	0.8483	0.7620	0.6433	0.4890	0.3820	0.4235	0.6163	0.8007	0.8919	0.9244	(86)
Living	18.4704	18.7703	19.2925	19.9707	20.4915	20.8237	20.9291	20.9063	20.6542	19.9938	19.1503	18.4519	
Non living	17.6666	17.9617	18.4667	19.1230	19.5910	19.8841	19.9566	19.9445	19.7593	19.1635	18.3550	17.6645	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.7060	18.7703	19.2925	19.9707	20.4915	20.8237	20.9291	20.9063	20.6542	19.9938	19.1503	18.8083	(87)
Th 2	19.9401	19.9451	19.9451	19.9650	19.9600	19.9855	19.9855	19.9855	19.9855	19.9700	19.9700	19.9650	(88)
util rest of house	0.9080	0.8818	0.8284	0.7303	0.5928	0.4174	0.2925	0.3319	0.5513	0.7670	0.8758	0.9147	(89)
MIT 2	18.7771	17.9617	18.4667	19.1230	19.5910	19.8841	19.9566	19.9445	19.7593	19.1635	18.3550	17.9863	(90)
Living area fraction										fLA = Living area / (4) =		0.2056	(91)
MIT	18.9680	18.1279	18.6365	19.2972	19.7761	20.0772	20.1565	20.1422	19.9433	19.3342	18.5185	18.1553	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9680	18.1279	18.6365	19.2972	19.7761	20.0772	20.1565	20.1422	19.9433	19.3342	18.5185	18.1553	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8965	0.8524	0.7986	0.7070	0.5830	0.4242	0.3082	0.3468	0.5484	0.7426	0.8473	0.8930	(94)
Useful gains	626.3989	659.5539	692.5971	675.1110	575.8256	416.0702	285.7220	298.8226	446.6244	539.8820	570.9000	601.8214	(95)
Ext temp.	5.0000	5.6000	7.2000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.2000	7.7000	4.8000	(96)
Heat loss rate W	1435.3314	1280.5755	1169.0114	960.2667	711.8345	457.6784	299.0858	317.2575	532.6373	809.4850	1076.6175	1336.2838	(97)
Space heating kWh	601.8458	417.3265	354.4522	205.3121	101.1906	0.0000	0.0000	0.0000	0.0000	200.5846	364.1166	546.4400	(98a)
Space heating requirement - total per year (kWh/year)												2791.2684	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	601.8458	417.3265	354.4522	205.3121	101.1906	0.0000	0.0000	0.0000	0.0000	200.5846	364.1166	546.4400	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2791.2684	
Space heating per m2											(98c) / (4) =	31.9148	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	286.9197	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	601.8458	417.3265	354.4522	205.3121	101.1906	0.0000	0.0000	0.0000	0.0000	200.5846	364.1166	546.4400	(98)
Space heating efficiency (main heating system 1)	286.9197	286.9197	286.9197	286.9197	286.9197	0.0000	0.0000	0.0000	0.0000	286.9197	286.9197	286.9197	(210)
Space heating fuel (main heating system)	209.7611	145.4506	123.5371	71.5573	35.2679	0.0000	0.0000	0.0000	0.0000	69.9097	126.9054	190.4505	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	257.4033	211.9073	180.6545	122.1040	88.6262	72.8477	72.6438	93.5284	123.0830	178.9290	226.8848	254.3595	(64)
Efficiency of water heater												284.9050	(216)
(217)m	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	284.9050	(217)
Fuel for water heating, kWh/month	90.3471	74.3782	63.4087	42.8578	31.1073	25.5691	25.4976	32.8279	43.2014	62.8030	79.6352	89.2787	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.1581	10.0783	11.1581	10.7982	11.1581	10.7982	11.1581	11.1581	10.7982	11.1581	10.7982	11.1581	(231)
Lighting	24.5730	19.7134	17.7497	13.0042	10.0448	8.2067	9.1632	11.9107	15.4708	20.2986	22.9272	25.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-33.8434	-51.2621	-79.8649	-91.8240	-95.8102	-86.8184	-84.6865	-79.2398	-72.0440	-61.6481	-39.6160	-30.7059	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)

Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-10.3961	-24.4711	-56.3878	-93.6973	-126.2287	-137.8255	-131.7428	-107.6652	-81.5336	-41.8206	-16.1093	-9.1502 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	972.8396 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	284.9050
Water heating fuel used	660.9121 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)	
mechanical ventilation fans (SFP = 0.1790)	51.3777 (230a)
pump for solar water heating	80.0000 (230g)
Total electricity for the above, kWh/year	131.3777 (231)
Electricity for lighting (calculated in Appendix L)	198.3182 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1644.3918 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	319.0558 (238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	972.8396	26.0000	252.9383	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	660.9121	26.0000	171.8371	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	51.3777	26.0000	13.3582	(249)
Pump for solar water heating	80.0000	26.0000	20.8000	(249)
Energy for lighting	198.3182	26.0000	51.5627	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-807.3634	26.0000	-209.9145	
PV Unit electricity exported	-837.0284	5.8100	-48.6313	
Total			-258.5458	(252)
Total energy cost			251.9505	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	972.8396	0.1552	150.9663	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	660.9121	0.1461	96.5278	(264)
Space and water heating			247.4941	(265)
Pumps, fans and electric keep-hot	131.3777	0.1387	18.2237	(267)
Energy for lighting	198.3182	0.1443	28.6234	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-807.3634	0.1345	-108.5694	
PV Unit electricity exported	-837.0284	0.1233	-103.1819	
Total			-211.7513	(269)
Total CO2, kg/year			82.5899	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	972.8396	1.5745	1531.7177	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	660.9121	1.5403	1017.9862	(278)
Space and water heating			2549.7039	(279)
Pumps, fans and electric keep-hot	131.3777	1.5128	198.7482	(281)
Energy for lighting	198.3182	1.5338	304.1871	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-807.3634	1.4970	-1208.6301	
PV Unit electricity exported	-837.0284	0.4524	-378.6692	
Total			-1587.2994	(283)
Total Primary energy kWh/year			1465.3399	(286)

Predicted Energy Assessment

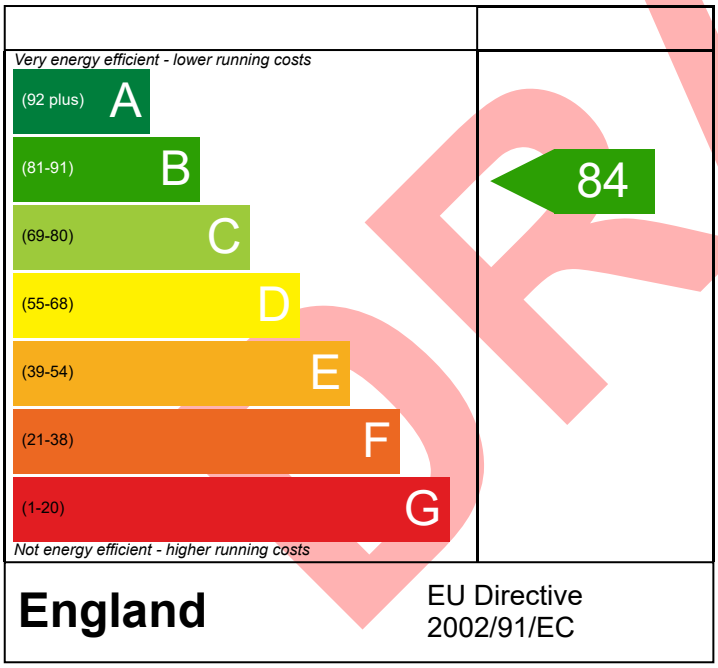
Plot 1, Amberley Drive, Wythenshawe , MANCHESTER, M23 2RH

Dwelling type:	House, Semi-Detached
Date of assessment:	27/10/2026
SAP Version:	10.2
Produced by:	Daniel Goddard
Total floor area:	95.14 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

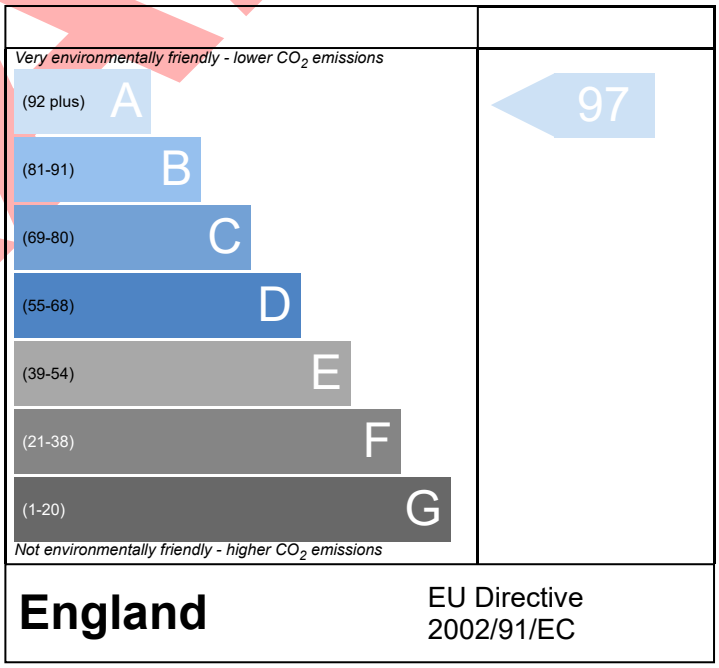
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Predicted Energy Assessment

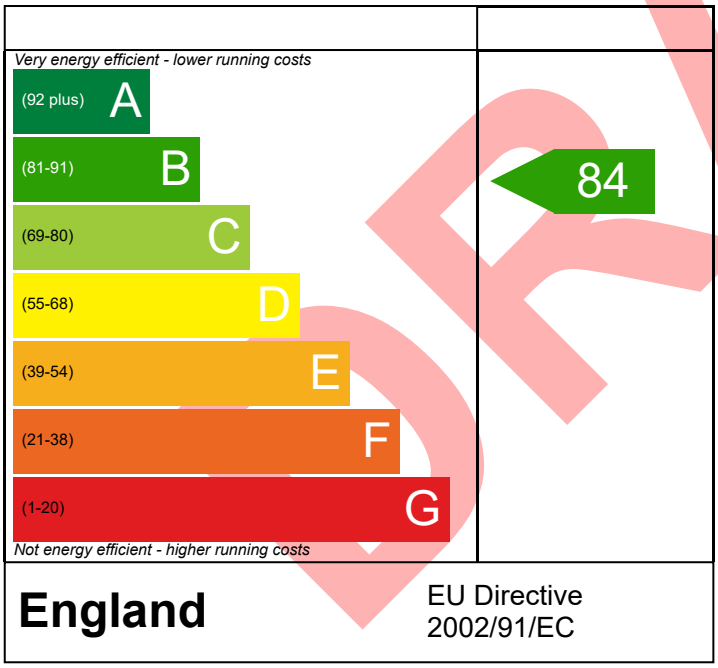
Plot 2, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH

Dwelling type:	House, Semi-Detached
Date of assessment:	27/10/2026
SAP Version:	10.2
Produced by:	Daniel Goddard
Total floor area:	95.14 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

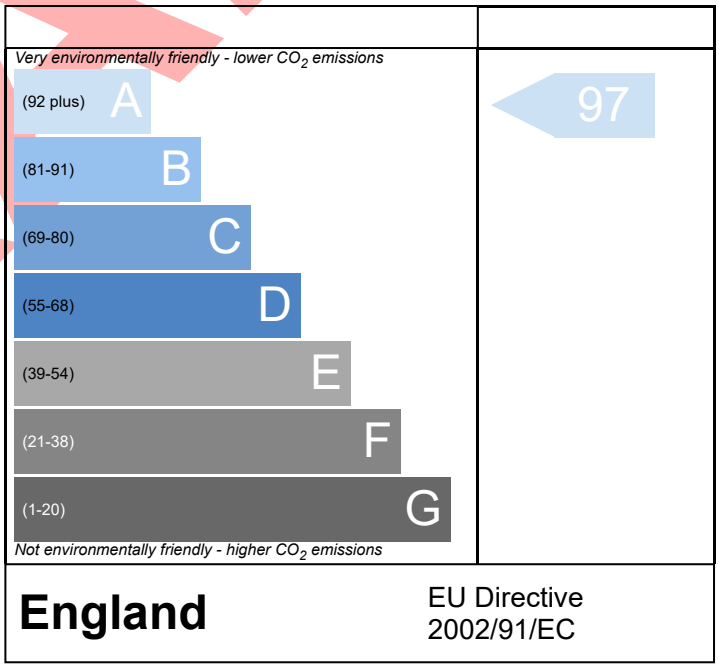
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Predicted Energy Assessment

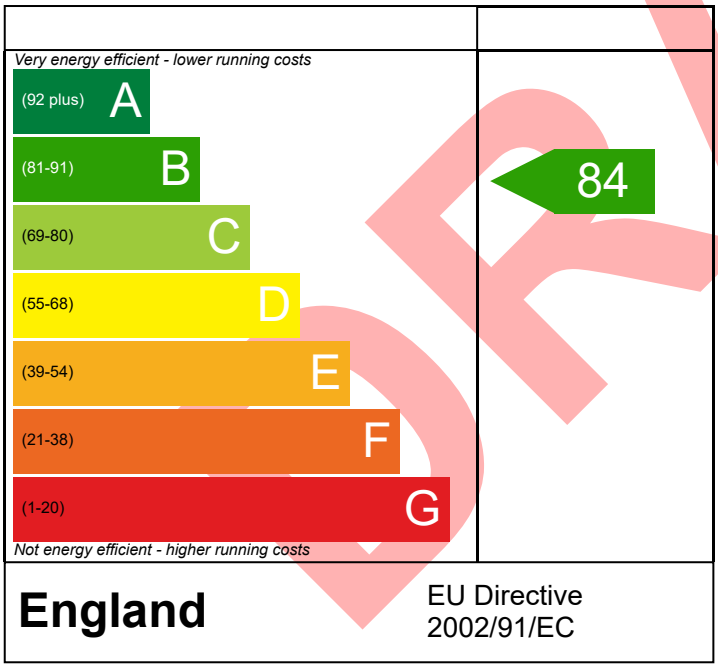
Plot 3, Amberley Drive, Wythenshawe , MANCHESTER, M23 2RH

Dwelling type:	House, Semi-Detached
Date of assessment:	27/10/2026
SAP Version:	10.2
Produced by:	Daniel Goddard
Total floor area:	95.14 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

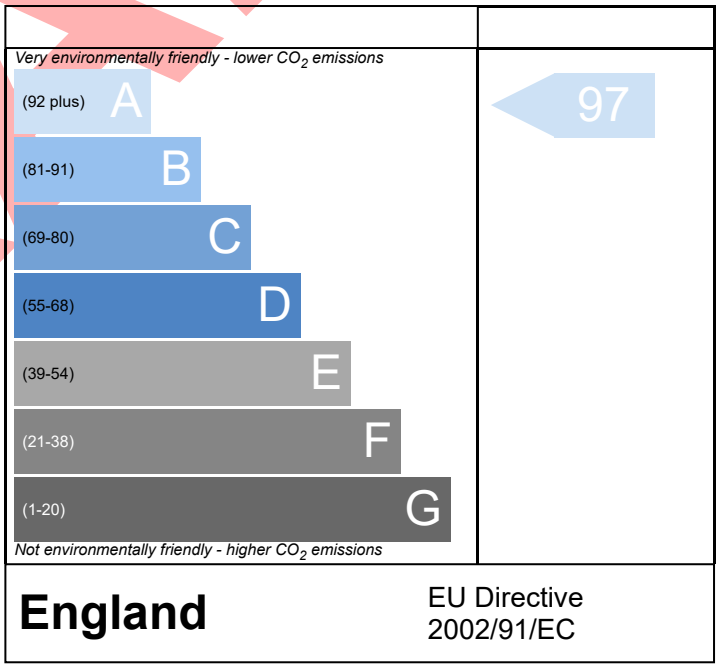
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Predicted Energy Assessment

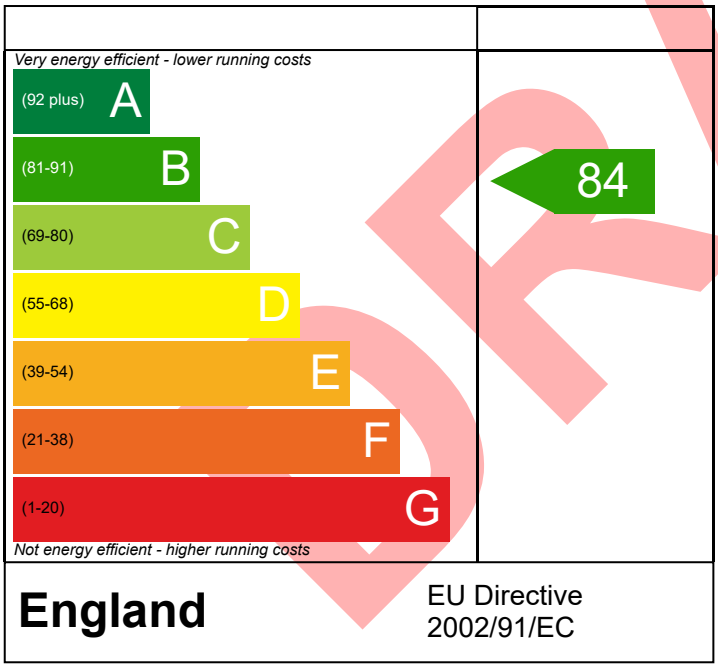
Plot 4, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH

Dwelling type:	House, Semi-Detached
Date of assessment:	27/10/2026
SAP Version:	10.2
Produced by:	Daniel Goddard
Total floor area:	95.14 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

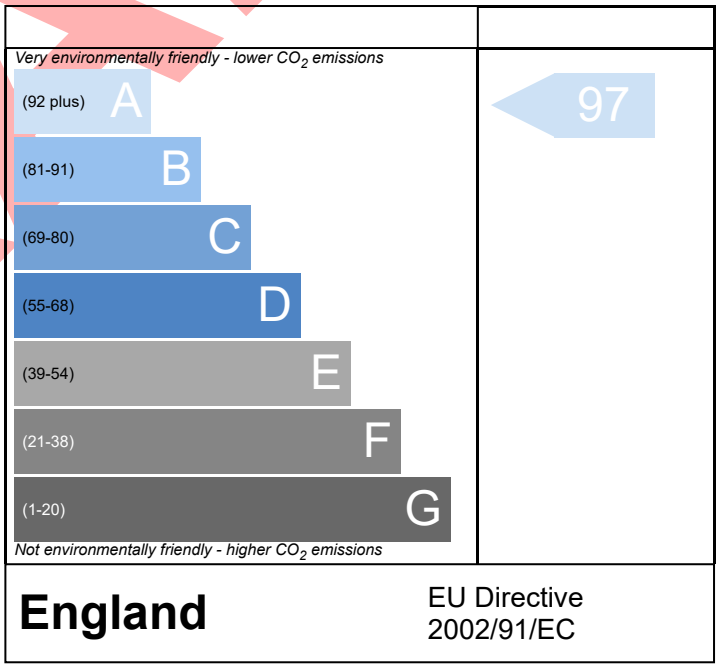
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Predicted Energy Assessment

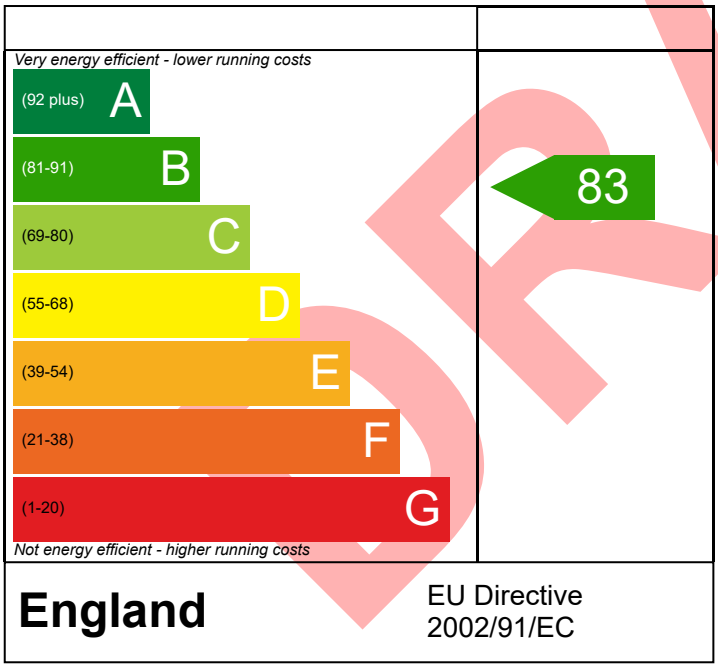
Plot 5, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH

Dwelling type:	House, Semi-Detached
Date of assessment:	27/10/2026
SAP Version:	10.2
Produced by:	Daniel Goddard
Total floor area:	87.46 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

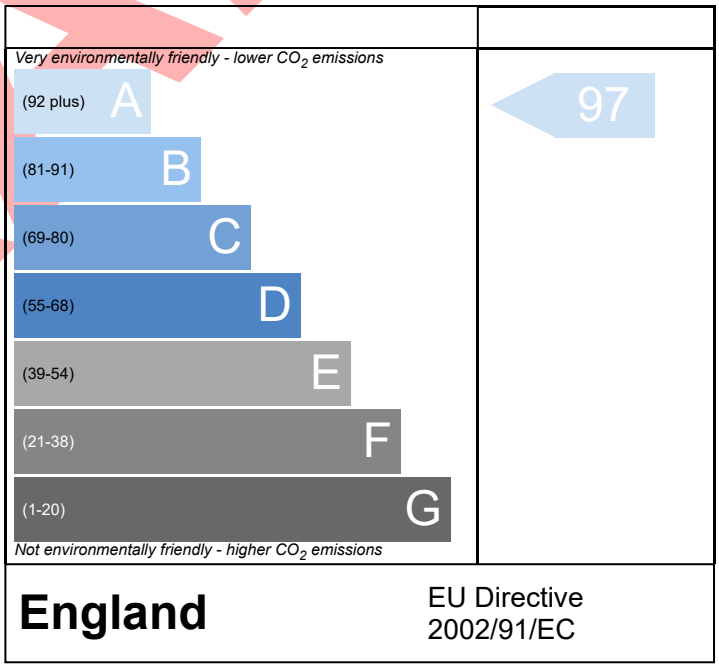
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Predicted Energy Assessment

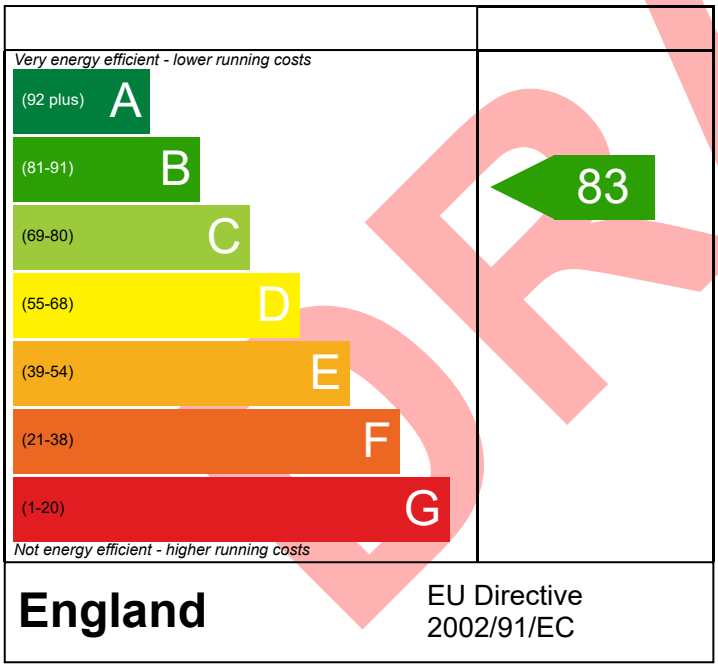
Plot 6, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH

Dwelling type:	House, Semi-Detached
Date of assessment:	27/10/2026
SAP Version:	10.2
Produced by:	Daniel Goddard
Total floor area:	87.46 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

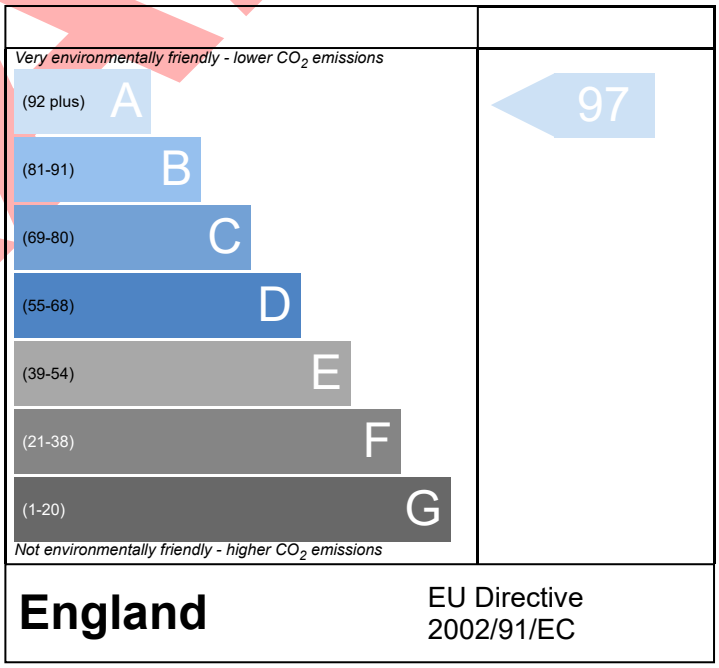
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Predicted Energy Assessment

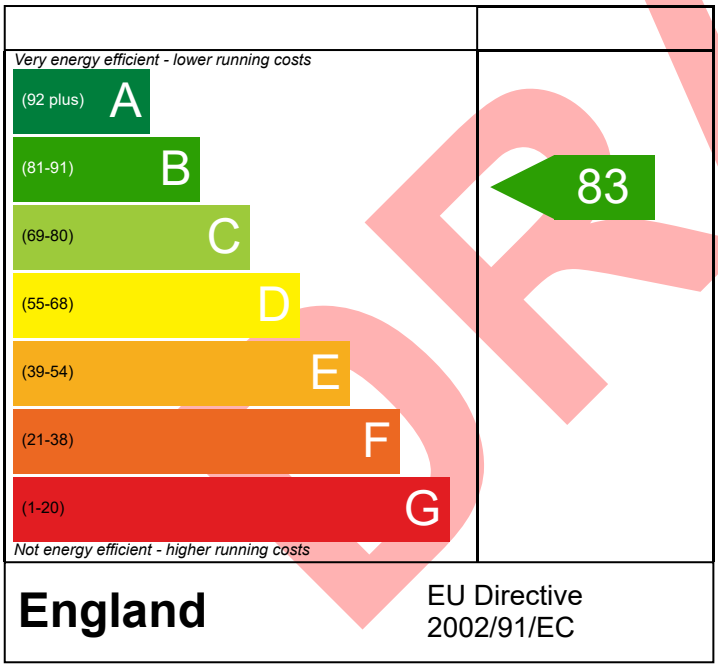
Plot 7, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH

Dwelling type:	House, Semi-Detached
Date of assessment:	27/10/2026
SAP Version:	10.2
Produced by:	Daniel Goddard
Total floor area:	87.46 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

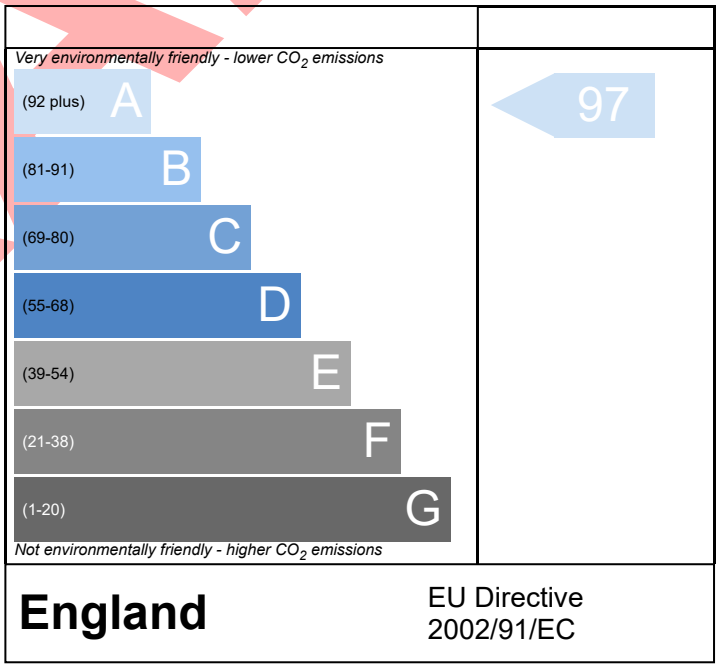
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Predicted Energy Assessment

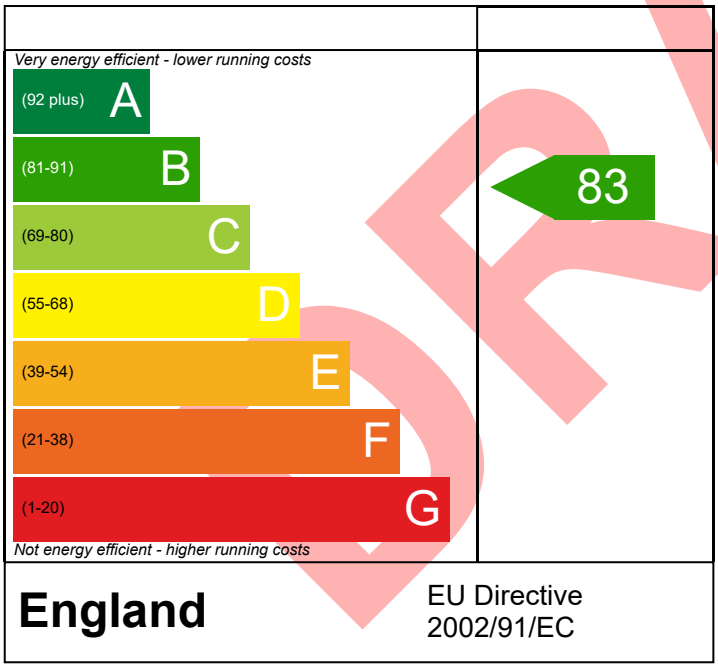
Plot 8, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH

Dwelling type:	House, Semi-Detached
Date of assessment:	27/10/2026
SAP Version:	10.2
Produced by:	Daniel Goddard
Total floor area:	87.46 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

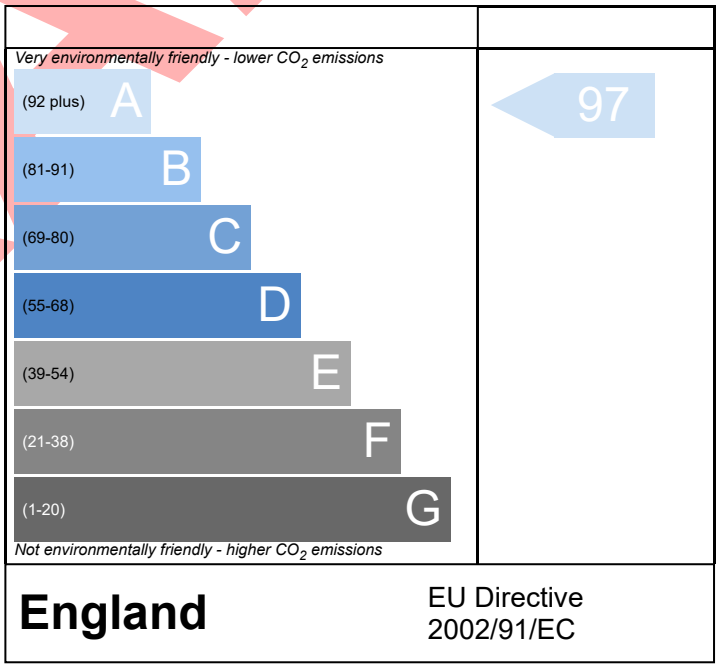
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Thermal Bridging

Plot Reference	79841-01	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	Semi-Detached House
Plot Address	Plot 1, Amberley Drive, Wythenshawe , MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	84 B	**DER**	3.80	**TER**	11.13
Environmental	97 A	**% DER < TER**			65.86
CO_2 Emissions (t/year)	0.33	**DFEE**	38.63	**TFEE**	39.28
Compliance Check	See BREL	**% DFEE < TFEE**			1.65
% DPER < TPER	31.59	**DPER**	39.74	**TPER**	58.09

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.046	12.26	0.56	To Be Confirmed
External wall	E3 Sill	Independently assessed	0.047	12.26	0.58	To Be Confirmed
External wall	E4 Jamb	Independently assessed	0.053	37.20	1.97	To Be Confirmed
External wall	E5 Ground floor (normal)	Independently assessed	0.068	21.53	1.46	To Be Confirmed
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.091	15.32	1.39	To Be Confirmed
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.075	6.21	0.47	To Be Confirmed
External wall	E16 Corner (normal)	Independently assessed	0.046	10.76	0.49	To Be Confirmed
External wall	E18 Party wall between dwellings	Independently assessed	0.054	10.76	0.58	To Be Confirmed
Party wall	P1 Party wall - Ground floor	Independently assessed	0.116	6.21	0.72	To Be Confirmed
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.046	6.21	0.29	To Be Confirmed
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.054	21.53	1.16	To Be Confirmed

Total: 160.25 W/mK:

Y-Value: W/m²K:

Thermal Bridging

Plot Reference	79841-02	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	Semi-Detached House
Plot Address	Plot 2, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	84 B	**DER**	3.80	**TER**	11.13
Environmental	97 A	**% DER < TER**			65.86
CO_2 Emissions (t/year)	0.33	**DFEE**	38.63	**TFEE**	39.28
Compliance Check	See BREL	**% DFEE < TFEE**			1.65
% DPER < TPER	31.59	**DPER**	39.74	**TPER**	58.09

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.046	12.26	0.56	To Be Confirmed
External wall	E3 Sill	Independently assessed	0.047	12.26	0.58	To Be Confirmed
External wall	E4 Jamb	Independently assessed	0.053	37.20	1.97	To Be Confirmed
External wall	E5 Ground floor (normal)	Independently assessed	0.068	21.53	1.46	To Be Confirmed
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.091	15.32	1.39	To Be Confirmed
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.075	6.21	0.47	To Be Confirmed
External wall	E16 Corner (normal)	Independently assessed	0.046	10.76	0.49	To Be Confirmed
External wall	E18 Party wall between dwellings	Independently assessed	0.054	10.76	0.58	To Be Confirmed
Party wall	P1 Party wall - Ground floor	Independently assessed	0.116	6.21	0.72	To Be Confirmed
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.046	6.21	0.29	To Be Confirmed
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.054	21.53	1.16	To Be Confirmed

Total: 160.25 W/mK:

Y-Value: W/m²K:

Thermal Bridging

Plot Reference	79841-03	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	Semi-Detached House
Plot Address	Plot 3, Amberley Drive, Wythenshawe , MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	84 B	**DER**	3.80	**TER**	11.13
Environmental	97 A	**% DER < TER**			65.86
CO_2 Emissions (t/year)	0.33	**DFEE**	38.63	**TFEE**	39.28
Compliance Check	See BREL	**% DFEE < TFEE**			1.65
% DPER < TPER	31.59	**DPER**	39.74	**TPER**	58.09

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.046	12.26	0.56	To Be Confirmed
External wall	E3 Sill	Independently assessed	0.047	12.26	0.58	To Be Confirmed
External wall	E4 Jamb	Independently assessed	0.053	37.20	1.97	To Be Confirmed
External wall	E5 Ground floor (normal)	Independently assessed	0.068	21.53	1.46	To Be Confirmed
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.091	15.32	1.39	To Be Confirmed
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.075	6.21	0.47	To Be Confirmed
External wall	E16 Corner (normal)	Independently assessed	0.046	10.76	0.49	To Be Confirmed
External wall	E18 Party wall between dwellings	Independently assessed	0.054	10.76	0.58	To Be Confirmed
Party wall	P1 Party wall - Ground floor	Independently assessed	0.116	6.21	0.72	To Be Confirmed
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.046	6.21	0.29	To Be Confirmed
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.054	21.53	1.16	To Be Confirmed

Total: 160.25 W/mK:

Y-Value: W/m²K:

Thermal Bridging

Plot Reference	79841-04	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	Semi-Detached House
Plot Address	Plot 4, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	84 B	**DER**	3.80	**TER**	11.13
Environmental	97 A	**% DER < TER**			65.86
CO_2 Emissions (t/year)	0.33	**DFEE**	38.63	**TFEE**	39.28
Compliance Check	See BREL	**% DFEE < TFEE**			1.65
% DPER < TPER	31.59	**DPER**	39.74	**TPER**	58.09

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.046	12.26	0.56	To Be Confirmed
External wall	E3 Sill	Independently assessed	0.047	12.26	0.58	To Be Confirmed
External wall	E4 Jamb	Independently assessed	0.053	37.20	1.97	To Be Confirmed
External wall	E5 Ground floor (normal)	Independently assessed	0.068	21.53	1.46	To Be Confirmed
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.091	15.32	1.39	To Be Confirmed
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.075	6.21	0.47	To Be Confirmed
External wall	E16 Corner (normal)	Independently assessed	0.046	10.76	0.49	To Be Confirmed
External wall	E18 Party wall between dwellings	Independently assessed	0.054	10.76	0.58	To Be Confirmed
Party wall	P1 Party wall - Ground floor	Independently assessed	0.116	6.21	0.72	To Be Confirmed
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.046	6.21	0.29	To Be Confirmed
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.054	21.53	1.16	To Be Confirmed

Total: 160.25 W/mK:

Y-Value: W/m²K:

Thermal Bridging

Plot Reference	79841-05	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	Semi-Detached House
Plot Address	Plot 5, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	83 B	**DER**	3.95	**TER**	11.67
Environmental	97 A	**% DER < TER**			66.15
CO_2 Emissions (t/year)	0.32	**DFEE**	40.01	**TFEE**	40.64
Compliance Check	See BREL	**% DFEE < TFEE**			1.55
% DPER < TPER	32.27	**DPER**	41.25	**TPER**	60.90

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.046	14.51	0.67	To Be Confirmed
External wall	E3 Sill	Independently assessed	0.047	14.51	0.68	To Be Confirmed
External wall	E4 Jamb	Independently assessed	0.053	29.84	1.58	To Be Confirmed
External wall	E5 Ground floor (normal)	Independently assessed	0.068	20.59	1.40	To Be Confirmed
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.091	14.60	1.33	To Be Confirmed
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.075	5.99	0.45	To Be Confirmed
External wall	E16 Corner (normal)	Independently assessed	0.046	10.76	0.49	To Be Confirmed
External wall	E18 Party wall between dwellings	Independently assessed	0.054	10.76	0.58	To Be Confirmed
Party wall	P1 Party wall - Ground floor	Independently assessed	0.116	5.99	0.69	To Be Confirmed
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.046	5.99	0.28	To Be Confirmed
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.054	20.59	1.11	To Be Confirmed

Total: 154.13 W/mK:

Y-Value: W/m²K:

Thermal Bridging

Plot Reference	79841-06	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	Semi-Detached House
Plot Address	Plot 6, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	83 B	**DER**	3.95	**TER**	11.67
Environmental	97 A	**% DER < TER**			66.15
CO_2 Emissions (t/year)	0.32	**DFEE**	40.01	**TFEE**	40.64
Compliance Check	See BREL	**% DFEE < TFEE**			1.55
% DPER < TPER	32.27	**DPER**	41.25	**TPER**	60.90

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.046	14.51	0.67	To Be Confirmed
External wall	E3 Sill	Independently assessed	0.047	14.51	0.68	To Be Confirmed
External wall	E4 Jamb	Independently assessed	0.053	29.84	1.58	To Be Confirmed
External wall	E5 Ground floor (normal)	Independently assessed	0.068	20.59	1.40	To Be Confirmed
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.091	14.60	1.33	To Be Confirmed
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.075	5.99	0.45	To Be Confirmed
External wall	E16 Corner (normal)	Independently assessed	0.046	10.76	0.49	To Be Confirmed
External wall	E18 Party wall between dwellings	Independently assessed	0.054	10.76	0.58	To Be Confirmed
Party wall	P1 Party wall - Ground floor	Independently assessed	0.116	5.99	0.69	To Be Confirmed
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.046	5.99	0.28	To Be Confirmed
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.054	20.59	1.11	To Be Confirmed

Total: 154.13 W/mK:

Y-Value: W/m²K:

Thermal Bridging

Plot Reference	79841-07	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	Semi-Detached House
Plot Address	Plot 7, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	83 B	**DER**	3.95	**TER**	11.67
Environmental	97 A	**% DER < TER**			66.15
CO_2 Emissions (t/year)	0.32	**DFEE**	40.01	**TFEE**	40.64
Compliance Check	See BREL	**% DFEE < TFEE**			1.55
% DPER < TPER	32.27	**DPER**	41.25	**TPER**	60.90

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.046	14.51	0.67	To Be Confirmed
External wall	E3 Sill	Independently assessed	0.047	14.51	0.68	To Be Confirmed
External wall	E4 Jamb	Independently assessed	0.053	29.84	1.58	To Be Confirmed
External wall	E5 Ground floor (normal)	Independently assessed	0.068	20.59	1.40	To Be Confirmed
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.091	14.60	1.33	To Be Confirmed
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.075	5.99	0.45	To Be Confirmed
External wall	E16 Corner (normal)	Independently assessed	0.046	10.76	0.49	To Be Confirmed
External wall	E18 Party wall between dwellings	Independently assessed	0.054	10.76	0.58	To Be Confirmed
Party wall	P1 Party wall - Ground floor	Independently assessed	0.116	5.99	0.69	To Be Confirmed
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.046	5.99	0.28	To Be Confirmed
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.054	20.59	1.11	To Be Confirmed

Total: 154.13 W/mK:

Y-Value: W/m²K:

Thermal Bridging

Plot Reference	79841-08	**Issued on Date**	27/10/2026
Assessment Reference	001	**Plot Type Ref**	Semi-Detached House
Plot Address	Plot 8, Amberley Drive, Wythenshawe, MANCHESTER, M23 2RH	**SAP Version**	10.2

SAP Rating	83 B	**DER**	3.95	**TER**	11.67
Environmental	97 A	**% DER < TER**			66.15
CO_2 Emissions (t/year)	0.32	**DFEE**	40.01	**TFEE**	40.64
Compliance Check	See BREL	**% DFEE < TFEE**			1.55
% DPER < TPER	32.27	**DPER**	41.25	**TPER**	60.90

Assessor Details	Mr. Daniel Goddard	**Assessor ID**	CP52-0001
Client	John Southworth, -		

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.046	14.51	0.67	To Be Confirmed
External wall	E3 Sill	Independently assessed	0.047	14.51	0.68	To Be Confirmed
External wall	E4 Jamb	Independently assessed	0.053	29.84	1.58	To Be Confirmed
External wall	E5 Ground floor (normal)	Independently assessed	0.068	20.59	1.40	To Be Confirmed
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.091	14.60	1.33	To Be Confirmed
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.075	5.99	0.45	To Be Confirmed
External wall	E16 Corner (normal)	Independently assessed	0.046	10.76	0.49	To Be Confirmed
External wall	E18 Party wall between dwellings	Independently assessed	0.054	10.76	0.58	To Be Confirmed
Party wall	P1 Party wall - Ground floor	Independently assessed	0.116	5.99	0.69	To Be Confirmed
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.046	5.99	0.28	To Be Confirmed
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.054	20.59	1.11	To Be Confirmed

Total: 154.13 W/mK:

Y-Value: W/m²K: