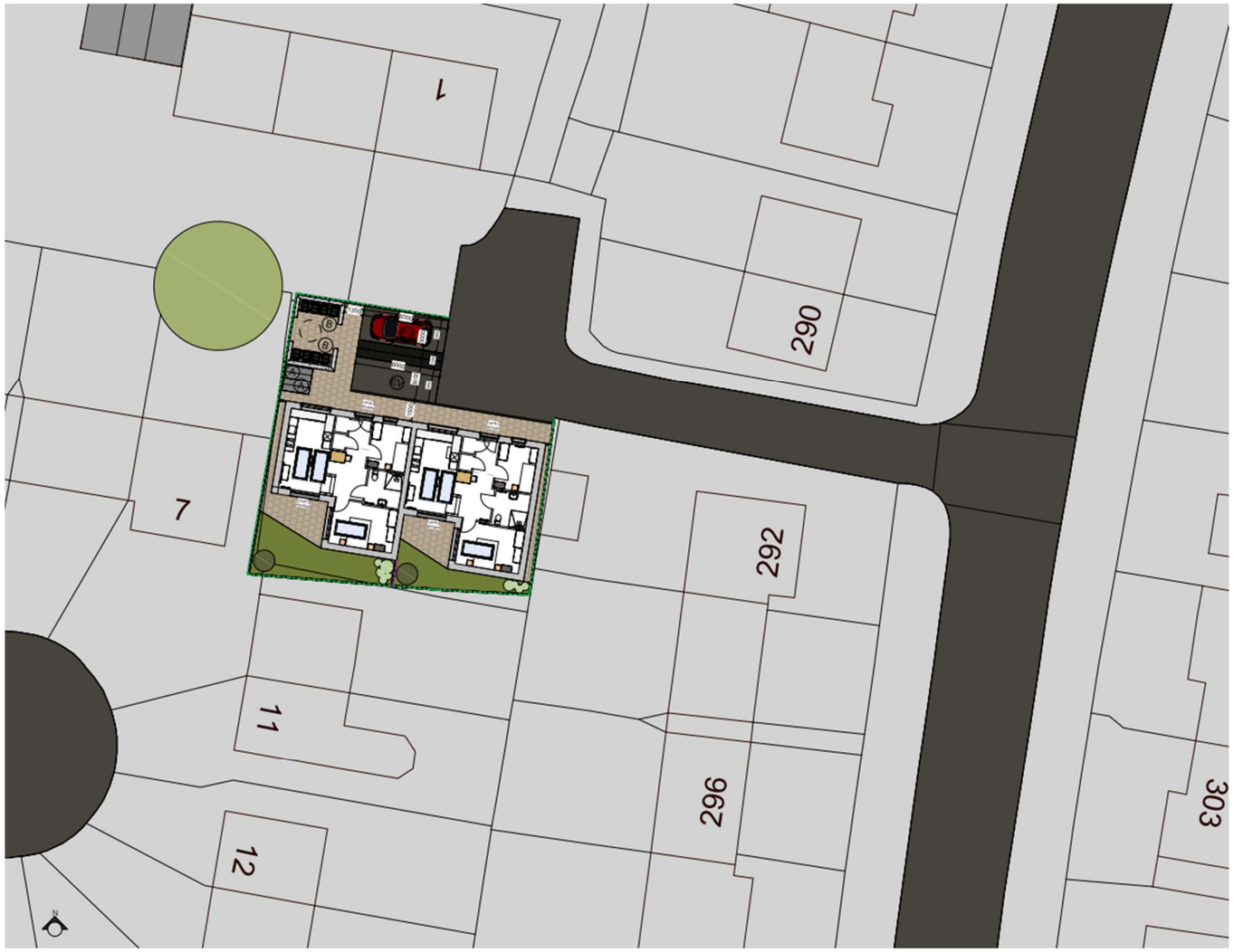
Proposed Residential Development at Minden Close, Burnage

Energy Statement

44534



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Prepared by:	Signature	Date
Edward Ainsworth		30/07/2026

Revision Record			
Rev	Date	By	Summary of Changes
-	30.07.26	EA	-

1 EXECUTIVE SUMMARY

An Energy and Sustainability Statement has been prepared for a proposed residential development comprising of two bungalows on the land at Minden Close. At this preliminary stage, both dwellings are identical in construction, orientation and services and therefore a representative SAP assessment has been undertaken. The structure and philosophy of the report have been based upon utilising best practice methodology and adheres to the "Be Lean, Be Clean and Be Green" hierarchy as follows:

Energy Efficient Measures (Be Lean – Use Less Energy)

To maximise the energy efficiency of the development and reduce the energy demand, the development will benefit from the following:

- High specification building fabric.
- U values that improve on Part L1A standard values.
- Low air leakage rates.
- Dedicated LED energy-efficient light fittings within all areas.

Energy Efficient Systems (Be Clean – Supply Energy Efficiently)

- Hot Water provided via high efficiency systems via main heating ASHP (Air Source Heat Pump).
- High efficiency dMEV (Decentralized Mechanical Ventilation) assumed.
- High-efficiency heating to proposed units.

Renewable Technologies (Be Green – Use Renewable Energy)

The following renewable technologies have been evaluated as part of this report:

- Air Source Heat Pump



Figure 1: Existing Site Location Plan



Figure 2: Proposed Site layout

2 INTRODUCTION

2.1 PROJECT SCOPE

Complete Sustainability Solutions have been commissioned to prepare an Energy and Sustainability Statement to assist with the planning submission for the proposed scheme.

The purpose of this Energy Statement is to model the proposed development using SAP software, establish baseline regulated carbon emissions, and apply the energy hierarchy to minimise operational energy demand and associated carbon emissions, thereby demonstrating compliance with Manchester planning policy and Approved Document Part L.

2.2 DEVELOPMENT DESCRIPTION

The project comprises a residential development of 2 no. bungalows, located at Minden Close, Burnage, Manchester.



Figure 3: Proposed Site layout

3 ARCHITECTURAL DRAWINGS OF ASSESSED UNITS



Figure 4: Proposed Site plan and location of site.

3.1 Site Plan and Location





4 POLICY CONTEXT

This section reviews the national and local planning policies relevant to the proposed residential development at Minden Close, Burnage, Manchester. The proposed development has been designed in accordance with the National Planning Policy Framework (NPPF), the Manchester Core Strategy (as updated following the adoption of Places for Everyone in 2024), and current Building Regulations Approved Document Part L. The proposals follow the recognised energy hierarchy of Be Lean, Be Clean and Be Green to minimise operational energy demand and carbon emissions.

4.1 National Planning Policy Framework (NPPF)

Achieving sustainable development means that the planning system has three overarching objectives, which are interdependent and need to be pursued in mutually supportive ways (so that opportunities can be taken to secure net gains across each of the different objectives):

a) an economic objective – to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure.

b) a social objective – to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering a well-designed and safe built environment, with accessible services and open spaces that reflect current and future needs and support communities' health, social and cultural well-being.

c) an environmental objective – to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.

4.1.1 Section 14. Meeting the Challenge of Climate Change, Flooding and Coastal Change

(**164**) – New development should be planned for in ways that:

a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through incorporating green infrastructure and sustainable drainage systems; and

b) help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings in plans should reflect the Government's policy for national technical standards.

(**165**) – To help increase the use and supply of renewable and low carbon energy and heat, plans should:

a) provide a positive strategy for energy from these sources, that maximises the potential for suitable development, and their future re-powering and life extension, while ensuring that adverse impacts are addressed appropriately (including cumulative landscape and visual impacts);

b) consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and

c) identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for colocating potential heat customers and suppliers.

(**166**) – In determining planning applications, local planning authorities should expect new development to:

a) comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and

b) take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

(**168**) – When determining planning applications for all forms of renewable and low carbon energy developments and their associated infrastructure, local planning authorities should:

a) not require applicants to demonstrate the overall need for renewable or low carbon energy, and give significant weight to the benefits associated with renewable and low carbon energy generation and the proposal's contribution to a net zero future;

b) recognise that small-scale and community-led projects provide a valuable contribution to cutting greenhouse gas emissions;

c) in the case of applications for the repowering and life-extension of existing renewable sites, give significant weight to the benefits of utilising an established site.

(**169**) – Once suitable areas for renewable and low carbon energy have been identified in plans, local planning authorities should expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas

4.2 Manchester Local Planning Policy

The application site lies within Manchester City Council and is therefore assessed against the Manchester Local Plan. The Manchester Core Strategy (2012), together with the Places for Everyone Joint Development Plan adopted in 2024, provides the strategic planning framework for sustainable development within the city. Policies relating to reducing carbon emissions and promoting low carbon development have been updated through Places for Everyone and should be read alongside the Core Strategy.

4.2.1 Core Strategy Policy EN4 – Reducing CO_2 Emissions by Enabling Low and Zero Carbon Development

Policy EN4 promotes the reduction of carbon emissions through the application of the energy hierarchy. Development proposals should:

- Minimise energy demand through high standards of fabric efficiency;
- Maximise energy efficiency through efficient building services;
- Incorporate low and zero carbon technologies where feasible;
- Minimise operational carbon emissions over the lifetime of the development.

The proposed development adopts a fabric-first approach with enhanced insulation standards, improved airtightness and low-carbon heating provided by Air Source Heat Pumps in accordance with these objectives.

4.2.2 Places for Everyone (2024)

Places for Everyone Joint Development Plan (2024) - Places for Everyone Policy JP-S2 replaces elements of the former Core Strategy energy policies and promotes development that minimises operational carbon emissions through energy efficiency, renewable and low-carbon energy technologies and consideration of heat network opportunities. The proposed development has been designed in accordance with the energy hierarchy and includes high-performance building fabric together with Air Source Heat Pumps as the primary heating system.

5 Design Criteria

This section presents the SAP assessment of the proposed development against the requirements of Approved Document Part L 2021. The assessment establishes the baseline regulated carbon emissions before applying the energy hierarchy to develop a low-carbon specification that complies with national and local planning policy.

Full SAP calculations will be carried out at detailed design to ensure compliance with the National Planning Policy Framework, Manchester Local Plan policies and Building Regulations Approved Document Part L. If any amendments to the design are required, these will be incorporated at this point and calculations updated to ensure compliance.

5.1 Preview and implement the Energy Hierarchy: Be Lean – Be Clean – Be Green

The Energy Hierarchy is a classification of energy options, prioritised to assist progress towards a more sustainable energy system. The energy hierarchy uses a step-by-step process:

- Step 1 - Be lean – Use less energy.
- Step 2 - Be Clean – Use energy efficiently
- Step 3 - Be Green – Utilise renewable technology

5.2 Be Lean – Use Less Energy

The proposed development adopts a fabric-first approach to minimise operational energy demand. Enhanced insulation standards, improved airtightness and high-performance glazing have been incorporated to reduce heat loss and improve energy efficiency beyond the minimum standards required by Approved Document Part L 2021.

Table 1 demonstrates that the proposed building fabric exceeds the minimum thermal performance requirements of Approved Document Part L 2021, contributing to lower regulated carbon emissions than the Part L notional dwelling.

Table 1: Summary of Proposed Be Lean Measures

Element	Building Fabric	
	L1A Minimum Requirement U Values (W/m²K)	Proposed Dwelling U Values (W/m²K)
Ground Floor	0.18	0.09
External Wall	0.26	0.17
Pitch Roof	0.16	0.09
Windows	1.60	1.20 G-value = 0.63
Roof Windows	2.20	1.20 G-value = 0.63
External Doors	1.60	1.10
Air Permeability	8	4.00

Table 2: Additional Be Lean Measures

Be Lean
Low Air Leakage Rates
Dedicated LED low energy efficient light fitting within all areas
Lighting controls to all applicable areas

Beyond the fabric-first approach, the next stage is to look at possible be lean measures that can be introduced across the site to minimise energy demand. In table 2 we have identified the practical measures to be introduced.

5.3 Be Clean – Supply Energy Efficiently

Within this section of the energy hierarchy, we see an emphasis being placed upon ensuring the regulated energy demands of the development are met as efficiently as possible.

The proposed houses will be served by an Air Source Heat Pump (Logic Air 5kW) providing both space heating and hot water, ensuring an efficient solution for the development. In this instance, there are no existing district heat network within a practical connection distance of the proposed development (see Appendix B)

The next stage is to look at possible be clean measures that can be introduced to proposed dwelling on site. Below we have identified the practical measures to be introduced:

Table 3: Be Clean Measures

Be Clean
Hot water provided by high efficiency systems
Heating via high efficiency systems
Highly efficient dMEV

5.4 Be Green – Utilise Renewable Energy

The final phase of the report is to ascertain if the development will benefit from renewable/low carbon technologies and the following renewable/low carbon technologies will be analysed for this development.

- Solar Thermal
- Solar PV
- CHP
- **Air Source Heat Pump**
- Ground Source Heat Pump

See Appendix A for detailed summary and suitability matrix of Be Green technologies.

Table 4: Summary of Be Green Measures

Be Green
We have reviewed the renewable options available to this site and have included the following: • ASHP units (assumed Logic Air 5kW) across site to reduce site-wide carbon emissions.

Following an assessment of the available technologies, Air Source Heat Pumps have been identified as the most appropriate low-carbon heating solution for the proposed development.

6 Summary of Results

6.1 Summary of Results – The Energy Hierarchy

Table 5 summarises the performance of the proposed development against the Part L 2021 notional dwelling, demonstrating the reductions in regulated carbon emissions achieved through the application of the energy hierarchy.

It can be concluded that CO_2 emissions of predicted energy use of the development will be less than the baseline (notional building) as the DER/BER (Dwelling or Building Emissions Rate) will be lower than the TER (Target Emissions Rate), as detailed in the table below.

Table 5: Summary of Results - Demonstrating energy & emissions reductions at Minden Close

	Carbon Dioxide Emissions for Residential building (Kg CO_2 / year)	Percentage improvement on Part L1A	Dwelling Emission Rate Kg CO_2/yr/m2
Part L 2021 Baseline/Target Emissions Rate	840	-	12.75
Part L 2021 Be lean	550	26.58	8.37
Part L 2021 Be clean	420	43.16	6.48
Part L 2021 Be green	320	57.32	4.93
		57.32	

The development has been assessed using SAP 10 in accordance with Part L 2021 and achieves a 57.32% improvement over the Part L 2021 notional building. Part L 2021 represents an uplift from Part L 2013, targeting an approximate 30% reduction in regulated CO_2 emissions at a national level.

7 CONCLUSION

This report is based upon a review of the proposals and a thorough analysis of relevant national and local planning policy requirements. Both the National Planning Policy Framework (NPPF) and Manchester Local Plan.

The development will follow the Be Lean, Be Clean, Be Green Energy Hierarchy to evidence this, as follows:

Energy Efficient Measures (Be Lean – Use Less Energy)

To maximise the energy efficiency of the development and reduce the energy demand, the development will benefit from a high specification of building fabric with U values that will improve on Part L1A 2021 standard values.

Energy Efficient Measures (Be Clean – Supply Energy Efficiently)

All developments will utilise electricity as the primary energy source for space heating and domestic hot water and be provided with a high level of user control including local and central temperature controls.

Renewable Technologies (Be Green – Use Renewable Energy)

All The following renewable technologies have been evaluated as part of this report.

- Solar Thermal
- Solar PV
- Combined Heat and Power (CHP)
- **Air Source Heat Pump**
- Ground Source Heat Pump

In conclusion, SAP calculations undertaken for the representative dwelling demonstrate a 57.32% reduction in regulated carbon emissions compared with the Part L 2021 notional dwelling. This is achieved through the adoption of a fabric-first approach together with Air Source Heat Pumps as the primary low-carbon heating technology. The proposed development therefore complies with the energy hierarchy promoted by the National Planning Policy Framework, Manchester Core Strategy Policy EN4 and the Places for Everyone Joint Development Plan.

The contents of this report outline how the following policies relevant to the scheme are met:

- **<u>Manchester Core Strategy Policy EN4 – Reducing CO_2 Emissions by Enabling Low and Zero Carbon Development</u>**

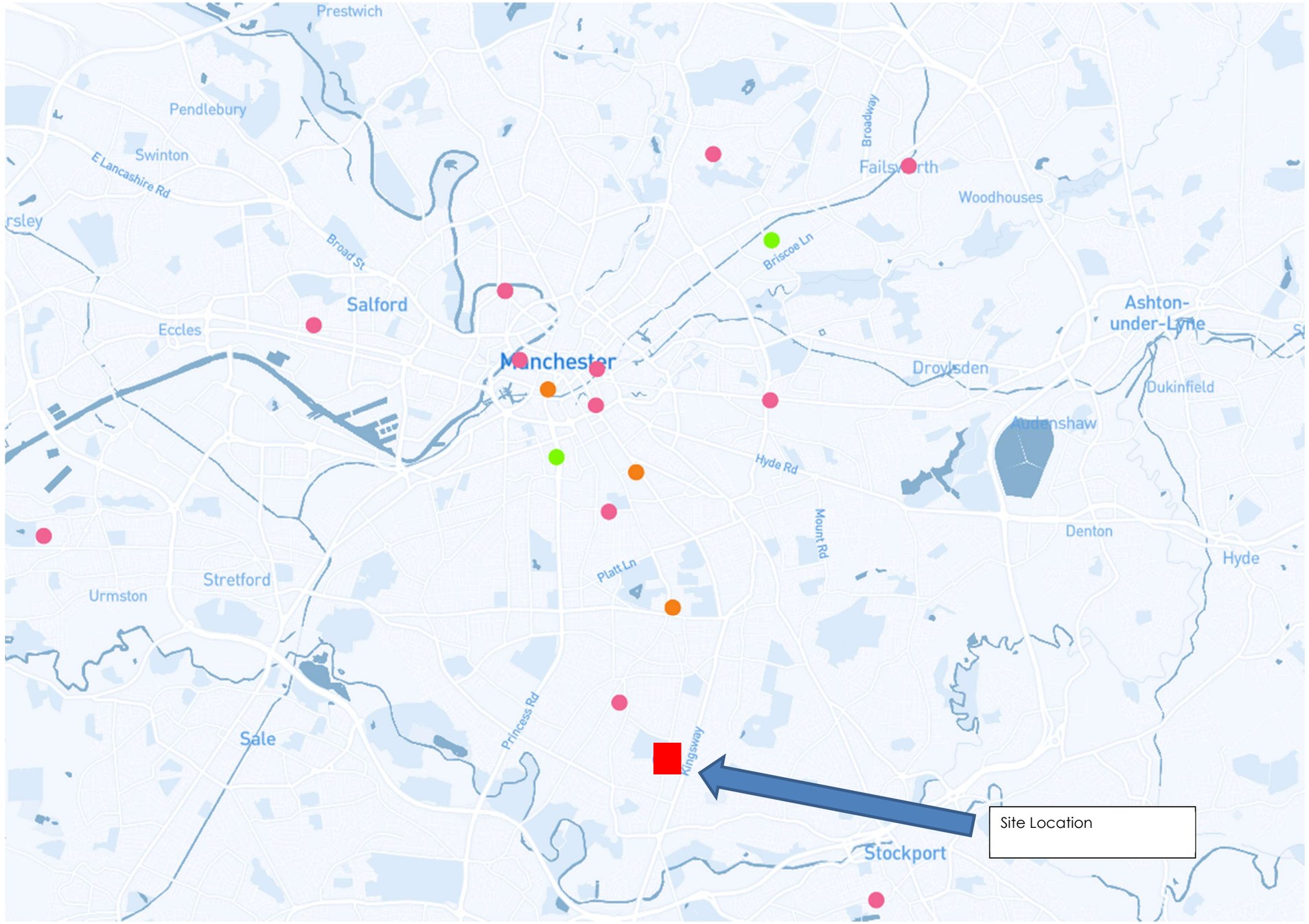
  <u>How is this policy achieved?</u>
  Policy EN4 seeks to minimise operational carbon emissions through energy-efficient design, improved building fabric and the incorporation of appropriate low-carbon technologies. The proposed development has been designed in accordance with the recognised Be Lean, Be Clean and Be Green energy hierarchy.

  The design adopts a fabric-first approach, incorporating enhanced insulation standards, improved airtightness and energy-efficient building services to reduce operational energy demand. Low-carbon heating is provided by Air Source Heat Pumps (ASHPs), which supply space heating and domestic hot water. SAP calculations demonstrate that the proposed specification achieves a significant reduction in regulated carbon emissions compared with the Part L 2021 notional dwelling, ensuring compliance with Manchester Core Strategy Policy EN4.

APPENDIX A – RENEWABLE TECHNOLOGIES MATRIX

Technology	Description	Pros	Cons	Project Suitability	Included in Proposed Scheme?
Solar Thermal	Solar thermal hot water collectors are panels or evacuated tubes which are typically located on the roof of the buildings. The collectors harness the sun's energy to warm domestic hot water	• Reduced fuel bills and carbon footprint • Low maintenance • Proven technology	• Only compatible with boilers that have hot water storage • Need south facing roofs to optimise efficiency • Carbon saved is low comparative to the savings offered by PV	Solar thermal HW is not deemed suitable for this development due to the nature of the scheme in particular the level of hot water demand thus making the suitability of a system unfeasible.	
Solar PV	Solar Photovoltaic (PV) panels work by converting energy from the sun into electricity. This can then be used with the development to offset electrical usage.	• Reduced bills and carbon footprint • Benefit from the feed in tariff • Proven technology • Relatively maintenance free	• PV panels lose efficiency over their lifetime	The scheme already incorporates Air Source Heat Pumps as the primary low-carbon heating technology. Whilst Solar PV could provide additional reductions in electricity demand, the proposed energy strategy has been developed around a fabric-first approach combined with ASHPs.	
Combined Heat & Power (CHP)	CHP is a technology which develops heat and power from the same energy source, typically mains gas. The CHP engine is fed by mains gas which then drives an alternator to provide electricity. CHP is highly energy efficient as the heat and electricity are produced on site, therefore reducing transmission losses. Typical efficiencies are 50% for the heat and 35% for the electric.	• Reduced fuel bills and carbon footprints • Eligible for the feed in tariff. • Proven technology which is in use in many schemes in the UK • Suited to large developments	• Not a true renewable technology • Heating and electricity demand must remain fairly stable to ensure CHP is running at optimum efficiency • Requires a centralised/district heating network • Noise. / Capital intensive	The total size and nature of the development does not lend itself to CHP. It would add to the capital costs of the development making the development not financially viable. For these reasons, CHP has been discounted	
Air Source Heat Pump	Air source heat pumps extract heat from the external air which can be used to heat radiators/underfloor heating and hot water within a dwelling. ASHP can still extract heat from air as cold as -15 degrees centigrade. ASHP are particularly useful on sites where gas is not available. There are two forms of ASHP – air to air and air to water.	• Can offer lower heating bills and reduce carbon footprints (when compared to electric systems) • Relatively maintenance free • Offers high efficiencies • Can offer heating and cooling depending on system chosen (air to air)	• Requires space to locate the external condenser unit. The unit requires lots of space around it to ensure adequate air flow. • Requires the use of underfloor heating or large radiators due to low grade heat. • Noise issues	Air source heat pumps have been included on this development due to the lower emissions associated with this technology.	☑
Ground Source Heat Pump	Ground source heat pumps (GSHP) work in a similar way to air source heat pumps, however they extract heat from the ground. A ground loop is buried within the garden, and a mixture of water and refrigerant is circulated along the loop. The heat from the ground is then absorbed within the fluid and then passes through a heat exchanger within the GSHP. Ground loops can be laid horizontally at depths or 1-2m or vertically at depths of up to 100m.	• Can offer lower heating bills and reduce carbon footprints (when compared to electric systems). • Relatively maintenance free • Offers high efficiencies	• High capital costs • Requires space for boreholes or trenches to locate ground loops • Requires the use of under floor heating or large radiators due to low grade heat	Ground source heat pumps have been discounted on this development predominantly due to the nature of the development and the lower emissions associated with an air source heat pump.	

APPENDIX B – EXISTING AND PROPOSED LOCAL HEAT NETWORKS



APPENDIX C – SAP CALCULATIONS SUMMARY

Full SAP Calculation Printout

Plot Reference	Plot 1	Issued on Date	04/08/2026
Assessment Reference	Be Green	Plot Type Ref	
Plot Address		SAP Version	10.2

SAP Rating	81 B	DER	4.93	TER	11.55
Environmental	96 A	% DER < TER			57.32
CO_2 Emissions (t/year)	0.32	DFEE	47.65	TFEE	50.50
Compliance Check	See BREL	% DFEE < TFEE			5.64
% DPER < TPER	15.58	DPER	52.14	TPER	61.77

Assessor Details	Mr. Andrew Graves	Assessor ID	K720-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	63.2200	(1b)	x 2.6000	(2b) =	164.3720	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.2200					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	164.3720	(5)

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2. Ventilation rate

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		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	0 * 10 =	0.0000	(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) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(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) =	0.1700	(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	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Balanced mechanical ventilation with heat recovery

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)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		81.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3117	0.3075	0.3033	0.2820	0.2777	0.2565	0.2565	0.2522	0.2650	0.2777	0.2863	0.2947	(25)

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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			1.9700	1.1000	2.1670			(26)
Windows			16.3100	1.1450	18.6756			(27)
Rooflight			6.8000	1.1450	7.7863			(27a)
Heatloss Floor 1			63.2200	0.0900	5.6898	110.0000	6954.2000	(28a)
External Wall 1	76.4400	18.2800	58.1600	0.1500	8.7240	110.0000	6397.6000	(29a)
External Roof 1	63.2200	6.8000	56.4200	0.0900	5.0778	9.0000	507.7800	(30)
Total net area of external elements Aum(A, m2)			202.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.1204			(33)
Main dwelling								
Party Wall 1			14.6600	0.0000	0.0000	110.0000	1612.6000	(32)
Internal Wall 1			55.0000			9.0000	495.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	15967.1800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		252.5653 (35)
List of Thermal Bridges		

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	10.5000	0.2300	2.4150	
E3 Sill	9.5600	0.0190	0.1816	
E4 Jamb	24.3000	0.0160	0.3888	
E5 Ground floor (normal)	29.6200	0.0940	2.7843	
R11 Upstands or kerbs of rooflights	19.3800	0.2400	4.6512	
E14 Flat roof	29.6200	0.1600	4.7392	
E16 Corner (normal)	7.8000	0.0510	0.3978	
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0700	-0.1820	
E18 Party wall between dwellings	5.2000	0.0400	0.2080	
P1 Party wall - Ground floor	5.6100	0.0680	0.3815	
P4 Party wall - Roof (insulation at ceiling level)	5.6100	0.0910	0.5105	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			16.4759	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	64.5963	(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	16.9102	16.6796	16.4491	15.2965	15.0659	13.9133	13.9133	13.6827	14.3743	15.0659	15.5270	15.9881	(38)
Heat transfer coeff	81.5065	81.2760	81.0455	79.8928	79.6623	78.5096	78.5096	78.2791	78.9707	79.6623	80.1233	80.5844	(39)
Average = Sum(39)m / 12 =												79.8352	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2893	1.2856	1.2820	1.2637	1.2601	1.2418	1.2418	1.2382	1.2491	1.2601	1.2674	1.2747	(40)
HLP (average)												1.2628	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0711	(42)
Hot water usage for mixer showers	75.6831	74.5457	72.8883	69.7172	67.3771	64.7673	63.2839	64.9288	66.7318	69.5339	72.7731	75.3931	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	35.8397	34.5365	33.2332	31.9299	30.6267	29.3234	29.3234	30.6267	31.9299	33.2332	34.5365	35.8397	(42c)
Average daily hot water use (litres/day)												102.3588	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5228	109.0822	106.1215	101.6472	98.0037	94.0907	92.6074	95.5554	98.6617	102.7671	107.3095	111.2328	(44)
Energy conte	176.6248	155.3315	163.1048	139.1499	131.9319	115.6955	112.0006	118.3176	121.6598	139.4540	152.8821	174.1637	(45)
Energy content (annual)										Total = Sum(45)m =		1700.3162	
Distribution loss (46)m = 0.15 x (45)m	26.4937	23.2997	24.4657	20.8725	19.7898	17.3543	16.8001	17.7476	18.2490	20.9181	22.9323	26.1246	(46)
Water storage loss (or HIU loss):													
Store volume												201.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8694	(55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(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	226.8386	200.6859	213.3186	187.7439	182.1457	164.2895	162.2144	168.5314	170.2538	189.6678	201.4761	224.3775	(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	226.8386	200.6859	213.3186	187.7439	182.1457	164.2895	162.2144	168.5314	170.2538	189.6678	201.4761	224.3775	(64)
										Total per year (kWh/year) = Sum(64)m =		2291.5432	(64)
12Total per year (kWh/year)												2292	(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	98.8988	87.9313	94.4034	85.1425	84.0384	77.3440	77.4112	79.5116	79.3271	86.5395	89.7085	98.0805	(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	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	91.2880	101.0689	91.2880	94.3310	91.2880	94.3310	91.2880	91.2880	94.3310	91.2880	94.3310	91.2880	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	180.9887	182.8668	178.1341	168.0586	155.3402	143.3866	135.4009	133.5228	138.2556	148.3310	161.0495	173.0030	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	(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)	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	(71)
Water heating gains (Table 5)	132.9285	130.8501	126.8863	118.2535	112.9548	107.4222	104.0474	106.8705	110.1765	116.3165	124.5951	131.8286	(72)
Total internal gains	459.2711	468.8517	450.3743	434.7090	413.6489	399.2057	384.8022	385.7472	396.8289	410.0015	434.0415	450.1855	(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	
North	7.2800	10.6334	0.6300	0.7000	0.7700	23.6578	(74)
South	4.2800	46.7521	0.6300	0.7000	0.7700	61.1528	(78)
West	4.7500	19.6403	0.6300	0.7000	0.7700	28.5110	(80)

South				6.8000		34.8864		0.6300		0.7000		1.0000			94.1556 (82)
Solar gains	207.4773	383.3013	594.2628	837.6852	1019.4685	1044.7842	993.9032	855.2885	679.1423	443.3786	254.1856	173.7590 (83)	
Total gains	666.7484	852.1530	1044.6371	1272.3942	1433.1175	1443.9899	1378.7054	1241.0357	1075.9712	853.3801	688.2271	623.9445 (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	54.4168	54.5712	54.7264	55.5160	55.6766	56.4941	56.4941	56.6604	56.1642	55.6766	55.3563	55.0395	
alpha	4.6278	4.6381	4.6484	4.7011	4.7118	4.7663	4.7663	4.7774	4.7443	4.7118	4.6904	4.6693	
util living area	0.9809	0.9476	0.8677	0.6964	0.5055	0.3465	0.2503	0.2896	0.4963	0.8125	0.9573	0.9853	(86)
Living	19.8398	20.1774	20.5586	20.8671	20.9730	20.9965	20.9994	20.9989	20.9820	20.7772	20.2508	19.7844	
Non living	18.5498	18.9676	19.4170	19.7559	19.8538	19.8850	19.8865	19.8892	19.8713	19.6827	19.0763	18.4886	
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	20.4065	20.1774	20.5586	20.8671	20.9730	20.9965	20.9994	20.9989	20.9820	20.7772	20.2508	19.9544	(87)
Th 2	19.8493	19.8521	19.8550	19.8694	19.8722	19.8867	19.8867	19.8896	19.8809	19.8722	19.8665	19.8607	(88)
util rest of house	0.9751	0.9334	0.8372	0.6466	0.4482	0.2869	0.1871	0.2200	0.4201	0.7606	0.9430	0.9808	(89)
MIT 2	19.3312	18.9676	19.4170	19.7559	19.8538	19.8850	19.8865	19.8892	19.8713	19.6827	19.0763	18.7359	(90)
Living area fraction										fLA = Living area / (4) =		0.4875	(91)
MIT	19.8554	19.5574	19.9735	20.2976	20.3994	20.4268	20.4291	20.4302	20.4128	20.2163	19.6489	19.3299	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8554	19.5574	19.9735	20.2976	20.3994	20.4268	20.4291	20.4302	20.4128	20.2163	19.6489	19.3299	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9751	0.9291	0.8407	0.6661	0.4753	0.3159	0.2179	0.2539	0.4568	0.7777	0.9397	0.9781	(94)
Useful gains	650.1523	791.7245	878.2149	847.5020	681.1599	456.1569	300.4525	315.1396	491.4845	663.6327	646.7382	610.2943	(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	1267.8668	1191.2967	1091.9688	910.5837	693.0150	457.4635	300.6179	315.4786	498.5238	766.0536	1005.4567	1219.2356	(97)
Space heating kWh	459.5796	268.5125	159.0329	45.4189	8.8202	0.0000	0.0000	0.0000	0.0000	76.2012	258.2773	453.0523	(98a)
Space heating requirement - total per year (kWh/year)												1728.8949	
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	459.5796	268.5125	159.0329	45.4189	8.8202	0.0000	0.0000	0.0000	0.0000	76.2012	258.2773	453.0523	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1728.8949	
Space heating per m2											(98c) / (4) =	27.3473	(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 %) 308.7478 (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	459.5796	268.5125	159.0329	45.4189	8.8202	0.0000	0.0000	0.0000	0.0000	76.2012	258.2773	453.0523	(98)
Space heating efficiency (main heating system 1)	308.7478	308.7478	308.7478	308.7478	308.7478	0.0000	0.0000	0.0000	0.0000	308.7478	308.7478	308.7478	(210)
Space heating fuel (main heating system)	148.8528	86.9682	51.5090	14.7107	2.8568	0.0000	0.0000	0.0000	0.0000	24.6807	83.6532	146.7387	(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	226.8386	200.6859	213.3186	187.7439	182.1457	164.2895	162.2144	168.5314	170.2538	189.6678	201.4761	224.3775	(64)
Efficiency of water heater												176.2057	(216)
(217)m	176.2057	176.2057	176.2057	176.2057	176.2057	176.2057	176.2057	176.2057	176.2057	176.2057	176.2057	176.2057	(217)
Fuel for water heating, kWh/month	128.7351	113.8930	121.0623	106.5481	103.3710	93.2373	92.0597	95.6447	96.6222	107.6400	114.3414	127.3384	(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	11.4964	10.3838	11.4964	11.1255	11.4964	11.1255	11.4964	11.4964	11.1255	11.4964	11.1255	11.4964	(231)
Lighting	18.3073	14.6868	13.2238	9.6883	7.4835	6.1141	6.8267	8.8737	11.5260	15.1227	17.0811	18.8161	(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												559.9700	(211)
Space heating fuel - main system 2												0.0000	(213)

Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	176.2057	
Water heating fuel used	1300.4931	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6750)		
mechanical ventilation fans (SFP = 0.6750)	135.3603	(230a)
Total electricity for the above, kWh/year	135.3603	(231)
Electricity for lighting (calculated in Appendix L)	147.7501	(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	2143.5735	(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	559.9700	0.1579	88.4461	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1300.4931	0.1409	183.1785	(264)
Space and water heating			271.6247	(265)
Pumps, fans and electric keep-hot	135.3603	0.1387	18.7761	(267)
Energy for lighting	147.7501	0.1443	21.3249	(268)
Total CO2, kg/year			311.7257	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.9300	(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	559.9700	1.5846	887.3442	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1300.4931	1.5208	1977.8179	(278)
Space and water heating			2865.1621	(279)
Pumps, fans and electric keep-hot	135.3603	1.5128	204.7731	(281)
Energy for lighting	147.7501	1.5338	226.6241	(282)
Total Primary energy kWh/year			3296.5593	(286)
Dwelling Primary energy Rate (DPER)			52.1400	(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	63.2200 (1b)	x	2.6000 (2b)	=	164.3720	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.2200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	164.3720	(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	2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1217	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3717	(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) =	0.3159	(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	0.4028	0.3949	0.3870	0.3475	0.3396	0.3001	0.3001	0.2922	0.3159	0.3396	0.3554	0.3712	(22b)
Effective ac	0.5811	0.5780	0.5749	0.5604	0.5577	0.5450	0.5450	0.5427	0.5499	0.5577	0.5632	0.5689	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
TER Opaque door			1.9700	1.0000	1.9700			(26)
TER Opening Type			9.7600	1.1450	11.1756			(27)
TER Roof Light			4.0700	1.5918	8.2298			(27a)
Heatloss Floor 1			63.2200	0.1300	8.2186			(28a)
External Wall 1	76.4400	11.7300	64.7100	0.1800	11.6478			(29a)
External Roof 1	63.2200	4.0700	59.1500	0.1100	6.5065			(30)
Total net area of external elements Aum(A, m2)			202.8800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	47.7483			(33)
Main dwelling								
Party Wall 1			14.6600	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 252.5653 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	10.5000	0.0500	0.5250	
E3 Sill	9.5600	0.0500	0.4780	
E4 Jamb	24.3000	0.0500	1.2150	
E5 Ground floor (normal)	29.6200	0.1600	4.7392	
R11 Upstands or kerbs of rooflights	19.3800	0.0800	1.5504	
E14 Flat roof	29.6200	0.0800	2.3696	
E16 Corner (normal)	7.8000	0.0900	0.7020	
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0900	-0.2340	
E18 Party wall between dwellings	5.2000	0.0600	0.3120	
P1 Party wall - Ground floor	5.6100	0.0800	0.4488	
P4 Party wall - Roof (insulation at ceiling level)	5.6100	0.1200	0.6732	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.7792 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 60.5275 (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	31.5218	31.3510	31.1835	30.3968	30.2496	29.5644	29.5644	29.4375	29.8283	30.2496	30.5473	30.8586	(38)
Heat transfer coeff	92.0493	91.8784	91.7109	90.9242	90.7770	90.0918	90.0918	89.9649	90.3558	90.7770	91.0748	91.3861	(39)

Average = Sum(39)m / 12 = 90.9235

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4560	1.4533	1.4507	1.4382	1.4359	1.4251	1.4251	1.4230	1.4292	1.4359	1.4406	1.4455	(40)
HLP (average)												1.4382	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0711 (42)

Hot water usage for mixer showers

75.6831	74.5457	72.8883	69.7172	67.3771	64.7673	63.2839	64.9288	66.7318	69.5339	72.7731	75.3931	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

35.8397	34.5365	33.2332	31.9299	30.6267	29.3234	29.3234	30.6267	31.9299	33.2332	34.5365	35.8397	(42c)

Average daily hot water use (litres/day) 102.3588 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5228	109.0822	106.1215	101.6472	98.0037	94.0907	92.6074	95.5554	98.6617	102.7671	107.3095	111.2328	(44)
Energy conte	176.6248	155.3315	163.1048	139.1499	131.9319	115.6955	112.0006	118.3176	121.6598	139.4540	152.8821	174.1637	(45)
Energy content (annual)										Total = Sum(45)m =		1700.3162	
Distribution loss (46)m = 0.15 x (45)m	26.4937	23.2997	24.4657	20.8725	19.7898	17.3543	16.8001	17.7476	18.2490	20.9181	22.9323	26.1246	(46)

Water storage loss (or HIU loss):

Store volume 201.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.6575 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.8950 (55)

Total storage loss

27.7463	25.0612	27.7463	26.8513	27.7463	26.8513	27.7463	27.7463	26.8513	27.7463	26.8513	27.7463	(56)

If cylinder contains dedicated solar storage

27.7463	25.0612	27.7463	26.8513	27.7463	26.8513	27.7463	27.7463	26.8513	27.7463	26.8513	27.7463	(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

227.6336	201.4039	214.1136	188.5132	182.9406	165.0588	163.0093	169.3263	171.0231	190.4627	202.2454	225.1724	(62)
WWHRS -34.5991	-30.5998	-32.0423	-26.5323	-24.7271	-21.1592	-19.8334	-21.0908	-21.8921	-25.8084	-29.2378	-33.9584	(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

193.0344	170.8042	182.0713	161.9809	158.2135	143.8996	143.1759	148.2355	149.1310	164.6543	173.0076	191.2140	(64)
								Total per year (kWh/year) = Sum(64)m =			1979.4222	(64)

12Total per year (kWh/year) 1979 (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

99.5347	88.5057	95.0393	85.7580	84.6743	77.9594	78.0472	80.1476	79.9425	87.1754	90.3239	98.7164	(65)

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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	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	91.2880	101.0689	91.2880	94.3310	91.2880	94.3310	91.2880	91.2880	94.3310	91.2880	94.3310	91.2880	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	180.9887	182.8668	178.1341	168.0586	155.3402	143.3866	135.4009	133.5228	138.2556	148.3310	161.0495	173.0030	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	(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)													
	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	(71)
Water heating gains (Table 5)													
	133.7833	131.7048	127.7410	119.1083	113.8096	108.2769	104.9021	107.7253	111.0313	117.1713	125.4499	132.6834	(72)
Total internal gains													
	463.1259	472.7064	454.2290	438.5638	417.5037	400.0604	385.6570	386.6020	397.6837	413.8562	437.8962	454.0403	(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	
North	4.3600	10.6334	0.6300	0.7000	0.7700	14.1687	(74)
South	2.5600	46.7521	0.6300	0.7000	0.7700	36.5774	(78)
West	2.8400	19.6403	0.6300	0.7000	0.7700	17.0466	(80)
South	4.0700	34.8864	0.6300	0.7000	1.0000	56.3549	(82)

Solar gains	124.1476	229.3586	355.6032	501.2826	610.0796	625.2359	594.7842	511.8224	406.4000	265.3101	152.0969	103.9713	(83)
Total gains	587.2735	702.0650	809.8322	939.8464	1027.5833	1025.2964	980.4412	898.4244	804.0837	679.1663	589.9932	558.0115	(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	48.1843	48.2739	48.3620	48.7805	48.8596	49.2312	49.2312	49.3006	49.0874	48.8596	48.6998	48.5340	
alpha	4.2123	4.2183	4.2241	4.2520	4.2573	4.2821	4.2821	4.2867	4.2725	4.2573	4.2467	4.2356	
util living area													
	0.9892	0.9769	0.9480	0.8675	0.7230	0.5404	0.3993	0.4515	0.6958	0.9161	0.9787	0.9912	(86)
MIT	19.4758	19.7348	20.1033	20.5445	20.8380	20.9639	20.9921	20.9869	20.8976	20.4852	19.8998	19.4317	(87)
Th 2	19.7206	19.7227	19.7247	19.7342	19.7359	19.7442	19.7442	19.7457	19.7410	19.7359	19.7323	19.7286	(88)
util rest of house													
	0.9856	0.9694	0.9313	0.8281	0.6525	0.4436	0.2879	0.3330	0.5975	0.8810	0.9705	0.9883	(89)
MIT 2	18.0014	18.3287	18.7859	19.3100	19.6150	19.7265	19.7421	19.7419	19.6809	19.2619	18.5473	17.9509	(90)
Living area fraction										fLA = Living area / (4) =		0.4875	(91)
MIT	18.7202	19.0142	19.4281	19.9118	20.2112	20.3297	20.3515	20.3488	20.2740	19.8582	19.2066	18.6728	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7202	19.0142	19.4281	19.9118	20.2112	20.3297	20.3515	20.3488	20.2740	19.8582	19.2066	18.6728	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9818	0.9641	0.9267	0.8343	0.6806	0.4899	0.3424	0.3909	0.6416	0.8850	0.9661	0.9849	(94)
Useful gains	576.5684	676.8460	750.4313	784.1139	699.3221	502.2601	335.6555	351.2025	515.9357	601.0749	569.9681	549.5792	(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													
	1327.3660	1296.7887	1185.6488	1001.2402	772.6217	516.2018	337.9798	355.2570	557.8607	840.4356	1102.6100	1322.6144	(97)
Space heating kWh													
	558.5934	416.6015	323.8018	156.3310	54.5349	0.0000	0.0000	0.0000	0.0000	178.0844	383.5022	575.1382	(98a)
Space heating requirement - total per year (kWh/year)												2646.5873	
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													
	558.5934	416.6015	323.8018	156.3310	54.5349	0.0000	0.0000	0.0000	0.0000	178.0844	383.5022	575.1382	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2646.5873	
Space heating per m2											(98c) / (4) =	41.8631	(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													
	558.5934	416.6015	323.8018	156.3310	54.5349	0.0000	0.0000	0.0000	0.0000	178.0844	383.5022	575.1382	(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)													
	605.1933	451.3559	350.8145	169.3727	59.0844	0.0000	0.0000	0.0000	0.0000	192.9408	415.4953	623.1183	(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													
	193.0344	170.8042	182.0713	161.9809	158.2135	143.8996	143.1759	148.2355	149.1310	164.6543	173.0076	191.2140	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.3003	85.9803	85.3360	83.9802	81.9285	79.8000	79.8000	79.8000	79.8000	84.2360	85.7920	86.3695	(217)
Fuel for water heating, kWh/month													
	223.6775	198.6550	213.3580	192.8798	193.1116	180.3254	179.4185	185.7588	186.8809	195.4679	201.6594	221.3906	(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	18.9678	15.2167	13.7010	10.0379	7.7536	6.3347	7.0731	9.1938	11.9419	15.6684	17.6974	19.4950	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-49.4928	-65.3855	-88.1850	-92.9041	-95.3001	-87.3413	-86.2873	-83.7679	-78.7250	-71.6863	-52.8412	-43.3292	(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	-43.0738	-88.3051	-171.4210	-251.7733	-327.6003	-327.2132	-323.3080	-276.0664	-205.5491	-124.2121	-56.8048	-34.2342	(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	2867.3752	(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	2372.5833	(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)	153.0814	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3124.8069	(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	2354.2331	(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	2867.3752	0.2100	602.1488	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2372.5833	0.2100	498.2425	(264)
Space and water heating			1100.3913	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	153.0814	0.1443	22.0944	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-895.2457	0.1360	-121.7225	
PV Unit electricity exported	-2229.5612	0.1266	-282.1998	
Total			-403.9223	(269)
Total CO2, kg/year			730.4926	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.5500	(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	2867.3752	1.1300	3240.1340	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2372.5833	1.1300	2681.0192	(278)
Space and water heating			5921.1532	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	153.0814	1.5338	234.8014	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-895.2457	1.5026	-1345.1785	
PV Unit electricity exported	-2229.5612	0.4646	-1035.9349	
Total			-2381.1134	(283)
Total Primary energy kWh/year			3904.9419	(286)
Target Primary Energy Rate (TPER)			61.7700	(287)

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

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling							
Ground floor		63.2200	(1b)	x 2.6000	(2b) =	164.3720	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.2200						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		164.3720	(5)

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2. Ventilation rate

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	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	2 * 10 =	20.0000 (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) =	20.0000 / (5) =	0.1217	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3217	(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) =	0.2734	(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	0.3486	0.3418	0.3349	0.3008	0.2939	0.2598	0.2598	0.2529	0.2734	0.2939	0.3076	0.3213	(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	0.5608	0.5584	0.5561	0.5452	0.5432	0.5337	0.5337	0.5320	0.5374	0.5432	0.5473	0.5516	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Door			1.9700	1.1000	2.1670			(26)
Windows			16.3100	1.1450	18.6756			(27)
Rooflight			6.8000	1.1450	7.7863			(27a)
Heatloss Floor 1			63.2200	0.0900	5.6898	110.0000	6954.2000	(28a)
External Wall 1	76.4400	18.2800	58.1600	0.1500	8.7240	110.0000	6397.6000	(29a)
External Roof 1	63.2200	6.8000	56.4200	0.0900	5.0778	9.0000	507.7800	(30)
Total net area of external elements Aum(A, m2)			202.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.1204			(33)
Main dwelling								
Party Wall 1			14.6600	0.0000	0.0000	110.0000	1612.6000	(32)
Internal Wall 1			55.0000			9.0000	495.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	15967.1800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		252.5653 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.5000	0.2300	2.4150
E3 Sill	9.5600	0.0190	0.1816
E4 Jamb	24.3000	0.0160	0.3888
E5 Ground floor (normal)	29.6200	0.0940	2.7843
R11 Upstands or kerbs of rooflights	19.3800	0.2400	4.6512
E14 Flat roof	29.6200	0.1600	4.7392
E16 Corner (normal)	7.8000	0.0510	0.3978
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0700	-0.1820
E18 Party wall between dwellings	5.2000	0.0400	0.2080
P1 Party wall - Ground floor	5.6100	0.0680	0.3815
P4 Party wall - Roof (insulation at ceiling level)	5.6100	0.0910	0.5105

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		16.4759 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	64.5963 (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	30.4175	30.2895	30.1641	29.5748	29.4645	28.9513	28.9513	28.8563	29.1490	29.4645	29.6876	29.9208	(38)
Heat transfer coeff	95.0139	94.8859	94.7604	94.1711	94.0609	93.5476	93.5476	93.4526	93.7453	94.0609	94.2839	94.5171	(39)
Average = Sum(39)m / 12 =												94.1706	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5029	1.5009	1.4989	1.4896	1.4878	1.4797	1.4797	1.4782	1.4828	1.4878	1.4914	1.4951	(40)
HLP (average)												1.4896	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.0711 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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

25.4713	25.0930	24.5603	23.5781	22.8426	22.0271	21.5866	22.1156	22.6915	23.5642	24.5666	25.3852	(42b)

Hot water usage for other uses

35.8397	34.5365	33.2332	31.9299	30.6267	29.3234	29.3234	30.6267	31.9299	33.2332	34.5365	35.8397	(42c)

Average daily hot water use (litres/day)	56.1975 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	61.3110	59.6295	57.7935	55.5080	53.4693	51.3505	50.9100	52.7422	54.6215	56.7974	59.1031	61.2249	(44)
Energy conte	97.1016	84.9115	88.8264	75.9877	71.9799	63.1414	61.5712	65.3059	67.3537	77.0735	84.2031	95.8634	(45)
Energy content (annual)										Total = Sum(45)m =		933.3196	

Distribution loss (46)m = 0.15 x (45)m

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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

82.5364	72.1748	75.5025	64.5895	61.1829	53.6702	52.3356	55.5100	57.2507	65.5125	71.5727	81.4839	(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													
	82.5364	72.1748	75.5025	64.5895	61.1829	53.6702	52.3356	55.5100	57.2507	65.5125	71.5727	81.4839	(64)
											Total per year (kWh/year) = Sum(64)m =	793.3216	(64)
12Total per year (kWh/year)												793	(64)
Electric shower(s)													
	47.2047	42.0598	45.9277	43.8282	44.6506	42.5924	44.0121	44.6506	43.8282	45.9277	45.0640	47.2047	(64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	536.9506	(64a)
Heat gains from water heating, kWh/month													
	32.4353	28.5586	30.3575	27.1044	26.4584	24.0656	24.0869	25.0402	25.2697	27.8600	29.1592	32.1721	(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	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	91.2880	101.0689	91.2880	94.3310	91.2880	94.3310	91.2880	91.2880	94.3310	91.2880	94.3310	91.2880	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	180.9887	182.8668	178.1341	168.0586	155.3402	143.3866	135.4009	133.5228	138.2556	148.3310	161.0495	173.0030	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	(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)													
	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	(71)
Water heating gains (Table 5)													
	43.5958	42.4980	40.8031	37.6450	35.5624	33.4245	32.3749	33.6561	35.0968	37.4463	40.4989	43.2421	(72)
Total internal gains													
	369.9384	380.4996	364.2911	354.1005	336.2565	325.2080	313.1297	312.5329	321.7493	331.1312	349.9452	361.5991	(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	
North	7.2800	10.6334	0.6300	0.7000	0.7700	23.6578	(74)
South	4.2800	46.7521	0.6300	0.7000	0.7700	61.1528	(78)
West	4.7500	19.6403	0.6300	0.7000	0.7700	28.5110	(80)
South	6.8000	34.8864	0.6300	0.7000	1.0000	94.1556	(82)

Solar gains	207.4773	383.3013	594.2628	837.6852	1019.4685	1044.7842	993.9032	855.2885	679.1423	443.3786	254.1856	173.7590	(83)
Total gains	577.4157	763.8009	958.5540	1191.7857	1355.7250	1369.9922	1307.0330	1167.8214	1000.8915	774.5099	604.1308	535.3581	(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	46.6809	46.7438	46.8057	47.0986	47.1538	47.4125	47.4125	47.4607	47.3125	47.1538	47.0423	46.9262	
alpha	4.1121	4.1163	4.1204	4.1399	4.1436	4.1608	4.1608	4.1640	4.1542	4.1436	4.1362	4.1284	
util living area													
	0.9900	0.9703	0.9185	0.7870	0.6036	0.4290	0.3132	0.3645	0.6046	0.8868	0.9777	0.9925	(86)
MIT	19.3950	19.7559	20.2191	20.6805	20.9105	20.9827	20.9963	20.9932	20.9338	20.5381	19.8595	19.3272	(87)
Th 2	19.6853	19.6868	19.6883	19.6953	19.6966	19.7027	19.7027	19.7039	19.7004	19.6966	19.6940	19.6912	(88)
util rest of house													
	0.9866	0.9610	0.8949	0.7367	0.5322	0.3456	0.2217	0.2636	0.5068	0.8435	0.9690	0.9900	(89)
MIT 2	18.2747	18.6286	19.0682	19.4757	19.6481	19.6966	19.7021	19.7025	19.6722	19.3759	18.7403	18.2121	(90)
Living area fraction											fLA = Living area / (4) =	0.4875	(91)
MIT	18.8208	19.1782	19.6292	20.0631	20.2635	20.3236	20.3330	20.3317	20.2873	19.9425	19.2859	18.7557	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8208	19.1782	19.6292	20.0631	20.2635	20.3236	20.3330	20.3317	20.2873	19.9425	19.2859	18.7557	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9836	0.9565	0.8936	0.7519	0.5642	0.3860	0.2664	0.3129	0.5526	0.8528	0.9655	0.9875	(94)
Useful gains	567.9628	730.5380	856.5931	896.0985	764.9008	528.8310	348.1599	365.3830	553.1222	660.5327	583.2999	528.6623	(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													
	1379.6813	1354.7964	1244.1309	1051.2381	805.4930	535.4252	349.2157	367.4296	580.0271	878.7596	1148.9331	1375.7667	(97)
Space heating kWh													
	603.9185	419.5017	288.3281	111.7005	30.2006	0.0000	0.0000	0.0000	0.0000	162.3608	407.2559	630.2457	(98a)
Space heating requirement - total per year (kWh/year)												2653.5119	
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													
	603.9185	419.5017	288.3281	111.7005	30.2006	0.0000	0.0000	0.0000	0.0000	162.3608	407.2559	630.2457	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2653.5119	
Space heating per m2											(98c) / (4) =	41.9727	(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	879.3478	692.2526	710.2397	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9495	0.9727	0.9576	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	834.9010	673.3748	680.1305	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1473.9558	1406.8345	1258.9920	0.0000	0.0000	0.0000	0.0000	(103)

Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	460.1194	545.6940	430.6730	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	115.0299	136.4235	107.6682	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												359.1216	(107)
Energy for space heating												41.9727	(99)
Energy for space cooling												5.6805	(108)
Total												47.6532	(109)
Fabric Energy Efficiency (DFEE)												47.7	(109)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	63.2200	(1b)	x 2.6000	(2b) =	164.3720	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.2200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	164.3720	(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	2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1217	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3717	(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) =	0.3159	(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													
	0.4028	0.3949	0.3870	0.3475	0.3396	0.3001	0.3001	0.2922	0.3159	0.3396	0.3554	0.3712	(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	0.5811	0.5780	0.5749	0.5604	0.5577	0.5450	0.5450	0.5427	0.5499	0.5577	0.5632	0.5689	(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								
TER Opaque door			1.9700	1.0000	1.9700			(26)
TER Opening Type			9.7600	1.1450	11.1756			(27)
TER Roof Light			4.0700	1.5918	8.2298			(27a)
Heatloss Floor 1			63.2200	0.1300	8.2186			(28a)
External Wall 1	76.4400	11.7300	64.7100	0.1800	11.6478			(29a)
External Roof 1	63.2200	4.0700	59.1500	0.1100	6.5065			(30)
Total net area of external elements Aum(A, m2)			202.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.7483			(33)
Main dwelling								
Party Wall 1			14.6600	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							252.5653	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.5000	0.0500	0.5250
E3 Sill	9.5600	0.0500	0.4780
E4 Jamb	24.3000	0.0500	1.2150
E5 Ground floor (normal)	29.6200	0.1600	4.7392
R11 Upstands or kerbs of rooflights	19.3800	0.0800	1.5504
E14 Flat roof	29.6200	0.0800	2.3696
E16 Corner (normal)	7.8000	0.0900	0.7020
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0900	-0.2340
E18 Party wall between dwellings	5.2000	0.0600	0.3120
P1 Party wall - Ground floor	5.6100	0.0800	0.4488
P4 Party wall - Roof (insulation at ceiling level)	5.6100	0.1200	0.6732

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		12.7792	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	60.5275	(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	31.5218	31.3510	31.1835	30.3968	30.2496	29.5644	29.5644	29.4375	29.8283	30.2496	30.5473	30.8586	(38)
Heat transfer coeff	92.0493	91.8784	91.7109	90.9242	90.7770	90.0918	90.0918	89.9649	90.3558	90.7770	91.0748	91.3861	(39)
Average = Sum(39)m / 12 =												90.9235	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4560	1.4533	1.4507	1.4382	1.4359	1.4251	1.4251	1.4230	1.4292	1.4359	1.4406	1.4455	(40)
HLP (average)												1.4382	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0711 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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

25.4713	25.0930	24.5603	23.5781	22.8426	22.0271	21.5866	22.1156	22.6915	23.5642	24.5666	25.3852	(42b)

Hot water usage for other uses

35.8397	34.5365	33.2332	31.9299	30.6267	29.3234	29.3234	30.6267	31.9299	33.2332	34.5365	35.8397	(42c)

Average daily hot water use (litres/day) 56.1975 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	61.3110	59.6295	57.7935	55.5080	53.4693	51.3505	50.9100	52.7422	54.6215	56.7974	59.1031	61.2249	(44)
Energy conte	97.1016	84.9115	88.8264	75.9877	71.9799	63.1414	61.5712	65.3059	67.3537	77.0735	84.2031	95.8634	(45)
Energy content (annual)										Total = Sum(45)m =		933.3196	

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

82.5364	72.1748	75.5025	64.5895	61.1829	53.6702	52.3356	55.5100	57.2507	65.5125	71.5727	81.4839	(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

82.5364	72.1748	75.5025	64.5895	61.1829	53.6702	52.3356	55.5100	57.2507	65.5125	71.5727	81.4839	(64)
									Total per year (kWh/year) = Sum(64)m =		793.3216	(64)
12Total per year (kWh/year)											793	(64)

Electric shower(s)

47.2047	42.0598	45.9277	43.8282	44.6506	42.5924	44.0121	44.6506	43.8282	45.9277	45.0640	47.2047	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	536.9506	(64a)

Heat gains from water heating, kWh/month

32.4353	28.5586	30.3575	27.1044	26.4584	24.0656	24.0869	25.0402	25.2697	27.8600	29.1592	32.1721	(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	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	91.2880	101.0689	91.2880	94.3310	91.2880	94.3310	91.2880	91.2880	94.3310	91.2880	94.3310	91.2880	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	180.9887	182.8668	178.1341	168.0586	155.3402	143.3866	135.4009	133.5228	138.2556	148.3310	161.0495	173.0030	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	(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)	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	(71)
Water heating gains (Table 5)	43.5958	42.4980	40.8031	37.6450	35.5624	33.4245	32.3749	33.6561	35.0968	37.4463	40.4989	43.2421	(72)
Total internal gains	369.9384	380.4996	364.2911	354.1005	336.2565	325.2080	313.1297	312.5329	321.7493	331.1312	349.9452	361.5991	(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	
North	4.3600	10.6334	0.6300	0.7000	0.7700	14.1687	(74)
South	2.5600	46.7521	0.6300	0.7000	0.7700	36.5774	(78)
West	2.8400	19.6403	0.6300	0.7000	0.7700	17.0466	(80)
South	4.0700	34.8864	0.6300	0.7000	1.0000	56.3549	(82)

Solar gains	124.1476	229.3586	355.6032	501.2826	610.0796	625.2359	594.7842	511.8224	406.4000	265.3101	152.0969	103.9713	(83)
Total gains	494.0860	609.8582	719.8943	855.3831	946.3361	950.4439	907.9139	824.3553	728.1493	596.4413	502.0421	465.5703	(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	48.1843	48.2739	48.3620	48.7805	48.8596	49.2312	49.2312	49.3006	49.0874	48.8596	48.6998	48.5340	
alpha	4.2123	4.2183	4.2241	4.2520	4.2573	4.2821	4.2821	4.2867	4.2725	4.2573	4.2467	4.2356	
util living area	0.9943	0.9859	0.9642	0.8959	0.7609	0.5764	0.4294	0.4886	0.7427	0.9428	0.9880	0.9955	(86)
MIT	19.3329	19.5999	19.9859	20.4663	20.8015	20.9540	20.9896	20.9823	20.8677	20.3894	19.7696	19.2886	(87)

Th 2	19.7206	19.7227	19.7247	19.7342	19.7359	19.7442	19.7442	19.7457	19.7410	19.7359	19.7323	19.7286	(88)
util rest of house	0.9923	0.9811	0.9520	0.8620	0.6926	0.4758	0.3105	0.3620	0.6460	0.9162	0.9831	0.9940	(89)
MIT 2	18.2397	18.5051	18.8831	19.3381	19.6175	19.7262	19.7420	19.7416	19.6781	19.2835	18.6825	18.2016	(90)
Living area fraction									fLA = Living area / (4) =			0.4875	(91)
MIT	18.7726	19.0389	19.4207	19.8881	20.1947	20.3247	20.3502	20.3465	20.2580	19.8226	19.2125	18.7316	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7726	19.0389	19.4207	19.8881	20.1947	20.3247	20.3502	20.3465	20.2580	19.8226	19.2125	18.7316	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9903	0.9777	0.9484	0.8667	0.7191	0.5238	0.3687	0.4240	0.6888	0.9184	0.9804	0.9923	(94)
Useful gains	489.2941	596.2703	682.7228	741.3807	680.5357	497.8296	334.7693	349.5161	501.5441	547.7606	492.2202	461.9874	(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	1332.1957	1299.0553	1184.9725	999.0870	771.1227	515.7528	337.8642	355.0431	556.4115	837.2016	1103.1436	1327.9817	(97)
Space heating kWh	627.1187	472.2715	373.6737	185.5486	67.3967	0.0000	0.0000	0.0000	0.0000	215.3441	439.8649	644.2998	(98a)
Space heating requirement - total per year (kWh/year)												3025.5181	
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	627.1187	472.2715	373.6737	185.5486	67.3967	0.0000	0.0000	0.0000	0.0000	215.3441	439.8649	644.2998	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3025.5181	
Space heating per m2											(98c) / (4) =	47.8570	(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	846.8633	666.6796	683.7336	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8780	0.9285	0.8998	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	743.5633	619.0050	615.2419	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1021.1366	976.0167	887.9603	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	199.8528	265.6167	202.9025	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	49.9632	66.4042	50.7256	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												167.0930	(107)
Energy for space heating												47.8570	(99)
Energy for space cooling												2.6430	(108)
Total												50.5000	(109)
Fabric Energy Efficiency (TFEE)												50.5	(109)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	63.2200	(1b)	x 2.6000	(2b) =	164.3720	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.2200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		164.3720	(5)

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2. Ventilation rate

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	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	0 * 10 =	0.0000 (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) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.2000 (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) =	0.1700 (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													
	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Balanced mechanical ventilation with heat recovery

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)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 81.0000 (23c)

Effective ac	0.3117	0.3075	0.3033	0.2820	0.2777	0.2565	0.2565	0.2522	0.2650	0.2777	0.2863	0.2947	(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			1.9700	1.1000	2.1670			(26)
Windows			16.3100	1.1450	18.6756			(27)
Rooflight			6.8000	1.1450	7.7863			(27a)
Heatloss Floor 1			63.2200	0.0900	5.6898	110.0000	6954.2000	(28a)
External Wall 1	76.4400	18.2800	58.1600	0.1500	8.7240	110.0000	6397.6000	(29a)
External Roof 1	63.2200	6.8000	56.4200	0.0900	5.0778	9.0000	507.7800	(30)
Total net area of external elements Aum(A, m2)			202.8800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.1204			(33)
Main dwelling								
Party Wall 1			14.6600	0.0000	0.0000	110.0000	1612.6000	(32)
Internal Wall 1			55.0000			9.0000	495.0000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 15967.1800 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 252.5653 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.5000	0.2300	2.4150
E3 Sill	9.5600	0.0190	0.1816
E4 Jamb	24.3000	0.0160	0.3888
E5 Ground floor (normal)	29.6200	0.0940	2.7843
R11 Upstands or kerbs of rooflights	19.3800	0.2400	4.6512
E14 Flat roof	29.6200	0.1600	4.7392
E16 Corner (normal)	7.8000	0.0510	0.3978
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0700	-0.1820
E18 Party wall between dwellings	5.2000	0.0400	0.2080
P1 Party wall - Ground floor	5.6100	0.0680	0.3815
P4 Party wall - Roof (insulation at ceiling level)	5.6100	0.0910	0.5105

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.4759 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 64.5963 (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	16.9102	16.6796	16.4491	15.2965	15.0659	13.9133	13.9133	13.6827	14.3743	15.0659	15.5270	15.9881	(38)
Heat transfer coeff	81.5065	81.2760	81.0455	79.8928	79.6623	78.5096	78.5096	78.2791	78.9707	79.6623	80.1233	80.5844	(39)

Average = Sum(39)m / 12 = 79.8352

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2893	1.2856	1.2820	1.2637	1.2601	1.2418	1.2418	1.2382	1.2491	1.2601	1.2674	1.2747	(40)
HLP (average)												1.2628	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0711 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
75.6831	74.5457	72.8883	69.7172	67.3771	64.7673	63.2839	64.9288	66.7318	69.5339	72.7731	75.3931	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

35.8397	34.5365	33.2332	31.9299	30.6267	29.3234	29.3234	30.6267	31.9299	33.2332	34.5365	35.8397	(42c)

Average daily hot water use (litres/day) 102.3588 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	111.5228	109.0822	106.1215	101.6472	98.0037	94.0907	92.6074	95.5554	98.6617	102.7671	107.3095	111.2328	(44)
Energy conte	176.6248	155.3315	163.1048	139.1499	131.9319	115.6955	112.0006	118.3176	121.6598	139.4540	152.8821	174.1637	(45)
Energy content (annual)										Total = Sum(45)m =		1700.3162	
Distribution loss (46)m = 0.15 x (45)m													
	26.4937	23.2997	24.4657	20.8725	19.7898	17.3543	16.8001	17.7476	18.2490	20.9181	22.9323	26.1246	(46)
Water storage loss (or HIU loss):													
Store volume												201.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8694	(55)
Total storage loss													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(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													
	226.8386	200.6859	213.3186	187.7439	182.1457	164.2895	162.2144	168.5314	170.2538	189.6678	201.4761	224.3775	(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													
	226.8386	200.6859	213.3186	187.7439	182.1457	164.2895	162.2144	168.5314	170.2538	189.6678	201.4761	224.3775	(64)
										Total per year (kWh/year) = Sum(64)m =		2291.5432	(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													
	98.8988	87.9313	94.4034	85.1425	84.0384	77.3440	77.4112	79.5116	79.3271	86.5395	89.7085	98.0805	(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	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.9156	18.5770	15.1078	11.4376	8.5497	7.2181	7.7994	10.1379	13.6071	17.2773	20.1652	21.4969	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	270.1324	272.9355	265.8717	250.8338	231.8510	214.0099	202.0909	199.2878	206.3516	221.3896	240.3723	258.2135	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	(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)													
	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	(71)
Water heating gains (Table 5)													
	132.9285	130.8501	126.8863	118.2535	112.9548	107.4222	104.0474	106.8705	110.1765	116.3165	124.5951	131.8286	(72)
Total internal gains													
	514.8951	513.2813	498.7845	471.4435	444.2742	419.5687	404.8563	407.2148	421.0538	445.9020	476.0513	502.4575	(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	
North	7.2800	10.6334	0.6300	0.7000	0.7700	23.6578	(74)
South	4.2800	46.7521	0.6300	0.7000	0.7700	61.1528	(78)
West	4.7500	19.6403	0.6300	0.7000	0.7700	28.5110	(80)
South	6.8000	34.8864	0.6300	0.7000	1.0000	94.1556	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	207.4773	383.3013	594.2628	837.6852	1019.4685	1044.7842	993.9032	855.2885	679.1423	443.3786	254.1856	173.7590	(83)
Total gains	722.3723	896.5825	1093.0473	1309.1287	1463.7427	1464.3530	1398.7595	1262.5033	1100.1961	889.2807	730.2369	676.2165	(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	54.4168	54.5712	54.7264	55.5160	55.6766	56.4941	56.4941	56.6604	56.1642	55.6766	55.3563	55.0395	
alpha	4.6278	4.6381	4.6484	4.7011	4.7118	4.7663	4.7663	4.7774	4.7443	4.7118	4.6904	4.6693	
util living area													
	0.9743	0.9381	0.8514	0.6820	0.4958	0.3417	0.2467	0.2847	0.4862	0.7945	0.9477	0.9800	(86)
Living	19.9214	20.2326	20.5983	20.8782	20.9751	20.9967	20.9995	20.9989	20.9835	20.7989	20.3055	19.8632	
Non living	18.6512	19.0334	19.4602	19.7660	19.8553	19.8851	19.8865	19.8893	19.8721	19.7033	19.1414	18.5872	
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	20.4483	20.2326	20.5983	20.8782	20.9751	20.9967	20.9995	20.9989	20.9835	20.7989	20.3055	20.0222	(87)
Th 2	19.8493	19.8521	19.8550	19.8694	19.8722	19.8867	19.8867	19.8896	19.8809	19.8722	19.8665	19.8607	(88)
util rest of house													
	0.9667	0.9220	0.8189	0.6321	0.4393	0.2829	0.1844	0.2163	0.4112	0.7408	0.9310	0.9740	(89)
MIT 2	19.3717	19.0334	19.4602	19.7660	19.8553	19.8851	19.8865	19.8893	19.8721	19.7033	19.1414	18.8167	(90)
Living area fraction										fLA = Living area / (4) =		0.4875	(91)
MIT	19.8965	19.6180	20.0150	20.3082	20.4012	20.4270	20.4291	20.4302	20.4139	20.2374	19.7089	19.4044	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8965	19.6180	20.0150	20.3082	20.4012	20.4270	20.4291	20.4302	20.4139	20.2374	19.7089	19.4044	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9671	0.9181	0.8238	0.6521	0.4661	0.3116	0.2148	0.2496	0.4473	0.7594	0.9282	0.9711	(94)
Useful gains	698.5769	823.1721	900.4713	853.6300	682.2240	456.2452	300.4647	315.1686	492.1639	675.3117	677.8118	656.6574	(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													
	1271.2163	1196.2221	1095.3309	911.4332	693.1561	457.4753	300.6197	315.4827	498.6142	767.7356	1010.2688	1225.2368	(97)
Space heating kWh													
	426.0437	250.6896	144.9756	41.6183	8.1335	0.0000	0.0000	0.0000	0.0000	68.7634	239.3691	423.0231	(98a)
Space heating requirement - total per year (kWh/year)												1602.6163	
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													
	426.0437	250.6896	144.9756	41.6183	8.1335	0.0000	0.0000	0.0000	0.0000	68.7634	239.3691	423.0231	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1602.6163	
Space heating per m2											(98c) / (4) =	25.3498	(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 %)	308.7478	(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													
	426.0437	250.6896	144.9756	41.6183	8.1335	0.0000	0.0000	0.0000	0.0000	68.7634	239.3691	423.0231	(98)
Space heating efficiency (main heating system 1)													
	308.7478	308.7478	308.7478	308.7478	308.7478	0.0000	0.0000	0.0000	0.0000	308.7478	308.7478	308.7478	(210)
Space heating fuel (main heating system)													
	137.9908	81.1956	46.9560	13.4797	2.6344	0.0000	0.0000	0.0000	0.0000	22.2717	77.5290	137.0125	(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
226.8386 200.6859 213.3186 187.7439 182.1457 164.2895 162.2144 168.5314 170.2538 189.6678 201.4761 224.3775 (64)
Efficiency of water heater 176.2057 (216)
(217)m 176.2057 176.2057 176.2057 176.2057 176.2057 176.2057 176.2057 176.2057 176.2057 176.2057 176.2057 176.2057 (217)
Fuel for water heating, kWh/month
128.7351 113.8930 121.0623 106.5481 103.3710 93.2373 92.0597 95.6447 96.6222 107.6400 114.3414 127.3384 (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 11.4964 10.3838 11.4964 11.1255 11.4964 11.1255 11.4964 11.4964 11.1255 11.4964 11.1255 11.4964 (231)
Lighting 18.3073 14.6868 13.2238 9.6883 7.4835 6.1141 6.8267 8.8737 11.5260 15.1227 17.0811 18.8161 (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 1 519.0697 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 176.2057
Water heating fuel used 1300.4931 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6750)
mechanical ventilation fans (SFP = 0.6750) 135.3603 (230a)
Total electricity for the above, kWh/year 135.3603 (231)
Electricity for lighting (calculated in Appendix L) 147.7501 (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 2102.6733 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	519.0697	16.4900	85.5946	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1300.4931	16.4900	214.4513	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	135.3603	16.4900	22.3209	(249)
Energy for lighting	147.7501	16.4900	24.3640	(250)
Additional standing charges			0.0000	(251)
Total energy cost			346.7308	(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] = 1.1534 (257)
SAP value 81.3031
SAP rating (Section 12) 81 (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	519.0697	0.1580	82.0123	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1300.4931	0.1409	183.1785	(264)
Space and water heating			265.1908	(265)
Pumps, fans and electric keep-hot	135.3603	0.1387	18.7761	(267)
Energy for lighting	147.7501	0.1443	21.3249	(268)
Total CO2, kg/year			305.2919	(272)
CO2 emissions per m2			4.8300	(273)
EI value			96.2198	
EI rating			96	(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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	63.2200	(1b)	x 2.6000	(2b) =	164.3720	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.2200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	164.3720	(5)

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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	0 * 10 =	0.0000	(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) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(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) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.2210	0.2210	0.2125	0.1870	0.1827	0.1658	0.1573	0.1573	0.1742	0.1955	0.2040	0.1998	(22b)

Balanced mechanical ventilation with heat recovery

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)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3160	0.3160	0.3075	0.2820	0.2777	0.2607	0.2522	0.2522	0.2692	0.2905	0.2990	0.2947	(25)

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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			1.9700	1.1000	2.1670			(26)
Windows			16.3100	1.1450	18.6756			(27)
Rooflight			6.8000	1.1450	7.7863			(27a)
Heatloss Floor 1			63.2200	0.0900	5.6898	110.0000	6954.2000	(28a)
External Wall 1	76.4400	18.2800	58.1600	0.1500	8.7240	110.0000	6397.6000	(29a)
External Roof 1	63.2200	6.8000	56.4200	0.0900	5.0778	9.0000	507.7800	(30)
Total net area of external elements Aum(A, m2)			202.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.1204			(33)
Main dwelling								
Party Wall 1			14.6600	0.0000	0.0000	110.0000	1612.6000	(32)
Internal Wall 1			55.0000			9.0000	495.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	15967.1800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		252.5653 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.5000	0.2300	2.4150
E3 Sill	9.5600	0.0190	0.1816
E4 Jamb	24.3000	0.0160	0.3888
E5 Ground floor (normal)	29.6200	0.0940	2.7843
R11 Upstands or kerbs of rooflights	19.3800	0.2400	4.6512
E14 Flat roof	29.6200	0.1600	4.7392
E16 Corner (normal)	7.8000	0.0510	0.3978
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0700	-0.1820
E18 Party wall between dwellings	5.2000	0.0400	0.2080
P1 Party wall - Ground floor	5.6100	0.0680	0.3815
P4 Party wall - Roof (insulation at ceiling level)	5.6100	0.0910	0.5105

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		16.4759 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	64.5963 (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	17.1407	17.1407	16.6796	15.2965	15.0659	14.1438	13.6827	13.6827	14.6049	15.7575	16.2186	15.9881	(38)
Heat transfer coeff	81.7371	81.7371	81.2760	79.8928	79.6623	78.7401	78.2791	78.2791	79.2012	80.3539	80.8149	80.5844	(39)
Average = Sum(39)m / 12 =												80.0465	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2929	1.2929	1.2856	1.2637	1.2601	1.2455	1.2382	1.2382	1.2528	1.2710	1.2783	1.2747	(40)
HLP (average)												1.2662	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0711 (42)

Hot water usage for mixer showers
75.6831 74.5457 72.8883 69.7172 67.3771 64.7673 63.2839 64.9288 66.7318 69.5339 72.7731 75.3931 (42a)
Hot water usage for baths
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42b)
Hot water usage for other uses
35.8397 34.5365 33.2332 31.9299 30.6267 29.3234 29.3234 30.6267 31.9299 33.2332 34.5365 35.8397 (42c)
Average daily hot water use (litres/day) 102.3588 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5228	109.0822	106.1215	101.6472	98.0037	94.0907	92.6074	95.5554	98.6617	102.7671	107.3095	111.2328	(44)
Energy conte	176.6248	155.3315	163.1048	139.1499	131.9319	115.6955	112.0006	118.3176	121.6598	139.4540	152.8821	174.1637	(45)
Energy content (annual)										Total = Sum(45)m =		1700.3162	
Distribution loss (46)m = 0.15 x (45)m													
	26.4937	23.2997	24.4657	20.8725	19.7898	17.3543	16.8001	17.7476	18.2490	20.9181	22.9323	26.1246	(46)
Water storage loss (or HIU loss):													
Store volume												201.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8694	(55)
Total storage loss													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(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													
	226.8386	200.6859	213.3186	187.7439	182.1457	164.2895	162.2144	168.5314	170.2538	189.6678	201.4761	224.3775	(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													
	226.8386	200.6859	213.3186	187.7439	182.1457	164.2895	162.2144	168.5314	170.2538	189.6678	201.4761	224.3775	(64)
										Total per year (kWh/year) = Sum(64)m =		2291.5432	(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)
Heat gains from water heating, kWh/month													
	98.8988	87.9313	94.4034	85.1425	84.0384	77.3440	77.4112	79.5116	79.3271	86.5395	89.7085	98.0805	(65)

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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	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.9156	18.5770	15.1078	11.4376	8.5497	7.2181	7.7994	10.1379	13.6071	17.2773	20.1652	21.4969	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	270.1324	272.9355	265.8717	250.8338	231.8510	214.0099	202.0909	199.2878	206.3516	221.3896	240.3723	258.2135	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	(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)													
	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	(71)
Water heating gains (Table 5)													
	132.9285	130.8501	126.8863	118.2535	112.9548	107.4222	104.0474	106.8705	110.1765	116.3165	124.5951	131.8286	(72)
Total internal gains													
	514.8951	513.2813	498.7845	471.4435	444.2742	419.5687	404.8563	407.2148	421.0538	445.9020	476.0513	502.4575	(73)

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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	
North	7.2800	9.5462	0.6300	0.7000	0.7700	21.2390	(74)
South	4.2800	42.7195	0.6300	0.7000	0.7700	55.8782	(78)
West	4.7500	17.5237	0.6300	0.7000	0.7700	25.4385	(80)
South	6.8000	31.1868	0.6300	0.7000	1.0000	84.1708	(82)

Solar gains	186.7264	367.6620	595.2049	883.7008	1067.1843	1064.4337	1024.5339	855.4025	674.2843	422.5207	234.9927	159.9995	(83)
Total gains	701.6215	880.9433	1093.9894	1355.1444	1511.4585	1484.0024	1429.3902	1262.6173	1095.3381	868.4227	711.0440	662.4571	(84)

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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	54.2634	54.2634	54.5712	55.5160	55.6766	56.3287	56.6604	56.6604	56.0008	55.1974	54.8825	55.0395	
alpha	4.6176	4.6176	4.6381	4.7011	4.7118	4.7552	4.7774	4.7774	4.7334	4.6798	4.6588	4.6693	
util living area													
	0.9789	0.9487	0.8732	0.7046	0.5285	0.4102	0.3329	0.3819	0.5715	0.8418	0.9582	0.9835	(86)
Living	19.8344	20.1322	20.5134	20.8487	20.9641	20.9910	20.9972	20.9948	20.9613	20.7087	20.2070	19.7785	
Non living	18.5400	18.9063	19.3600	19.7354	19.8458	19.8786	19.8883	19.8872	19.8531	19.6019	19.0148	18.4803	
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	20.4037	20.1322	20.5134	20.8487	20.9641	20.9910	20.9972	20.9948	20.9613	20.7087	20.2070	19.9494	(87)
Th 2	19.8464	19.8464	19.8521	19.8694	19.8722	19.8838	19.8896	19.8896	19.8780	19.8636	19.8579	19.8607	(88)
util rest of house													
	0.9727	0.9352	0.8453	0.6589	0.4752	0.3530	0.2728	0.3147	0.5011	0.7977	0.9448	0.9786	(89)
MIT 2	19.3256	18.9063	19.3600	19.7354	19.8458	19.8786	19.8883	19.8872	19.8531	19.6019	19.0148	18.7290	(90)
Living area fraction										fLA = Living area / (4) =		0.4875	(91)
MIT	19.8512	19.5039	19.9223	20.2782	20.3910	20.4209	20.4289	20.4272	20.3934	20.1414	19.5960	19.3239	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8512	19.5039	19.9223	20.2782	20.3910	20.4209	20.4289	20.4272	20.3934	20.1414	19.5960	19.3239	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9727	0.9305	0.8472	0.6760	0.5000	0.3807	0.3021	0.3474	0.5341	0.8095	0.9410	0.9757	(94)
Useful gains	682.4979	819.7172	926.7983	916.0616	755.7206	564.8952	431.7950	438.6129	584.9978	702.9455	669.1203	646.3823	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	1303.8021	1242.7215	1164.0571	988.9264	772.0067	568.5718	432.7980	440.4911	601.4032	839.0107	1050.2734	1259.0465	(97)
Space heating kWh	462.2504	284.2589	176.5205	52.4626	12.1169	0.0000	0.0000	0.0000	0.0000	101.2325	274.4302	455.8221	(98a)
Space heating requirement - total per year (kWh/year)												1819.0941	
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	462.2504	284.2589	176.5205	52.4626	12.1169	0.0000	0.0000	0.0000	0.0000	101.2325	274.4302	455.8221	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1819.0941	
Space heating per m2											(98c) / (4) =	28.7740	(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 %)	308.7012	(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	462.2504	284.2589	176.5205	52.4626	12.1169	0.0000	0.0000	0.0000	0.0000	101.2325	274.4302	455.8221	(98)
Space heating efficiency (main heating system 1)	308.7012	308.7012	308.7012	308.7012	308.7012	0.0000	0.0000	0.0000	0.0000	308.7012	308.7012	308.7012	(210)
Space heating fuel (main heating system)	149.7404	92.0822	57.1817	16.9946	3.9251	0.0000	0.0000	0.0000	0.0000	32.7930	88.8983	147.6580	(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	226.8386	200.6859	213.3186	187.7439	182.1457	164.2895	162.2144	168.5314	170.2538	189.6678	201.4761	224.3775	(64)
Efficiency of water heater												176.1896	(216)
(217)m	176.1896	176.1896	176.1896	176.1896	176.1896	176.1896	176.1896	176.1896	176.1896	176.1896	176.1896	176.1896	(217)
Fuel for water heating, kWh/month	128.7469	113.9034	121.0734	106.5579	103.3805	93.2459	92.0681	95.6535	96.6310	107.6498	114.3519	127.3500	(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	11.4964	10.3838	11.4964	11.1255	11.4964	11.1255	11.4964	11.4964	11.1255	11.4964	11.1255	11.4964	(231)
Lighting	18.3073	14.6868	13.2238	9.6883	7.4835	6.1141	6.8267	8.8737	11.5260	15.1227	17.0811	18.8161	(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	589.2734	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	176.1896	
Water heating fuel used	1300.6123	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6750)		
mechanical ventilation fans (SFP = 0.6750)	135.3603	(230a)
Total electricity for the above, kWh/year	135.3603	(231)
Electricity for lighting (calculated in Appendix L)	147.7501	(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	2172.9961	(238)

10a. Fuel costs - using BEDF prices (596)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	589.2734	27.6700	163.0519	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1300.6123	27.6700	359.8794	(247)
Energy for instantaneous electric shower(s)	0.0000	27.6700	0.0000	(247a)
Pumps, fans and electric keep-hot	135.3603	27.6700	37.4542	(249)
Energy for lighting	147.7501	27.6700	40.8825	(250)
Additional standing charges			0.0000	(251)
Total energy cost			601.2680	(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	589.2734	0.1575	92.7897	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1300.6123	0.1409	183.1953	(264)
Space and water heating			275.9851	(265)
Pumps, fans and electric keep-hot	135.3603	0.1387	18.7761	(267)
Energy for lighting	147.7501	0.1443	21.3249	(268)
Total CO2, kg/year			316.0861	(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	589.2734	1.5829	932.7381	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1300.6123	1.5208	1977.9992	(278)
Space and water heating			2910.7373	(279)
Pumps, fans and electric keep-hot	135.3603	1.5128	204.7731	(281)
Energy for lighting	147.7501	1.5338	226.6241	(282)
Total Primary energy kWh/year			3342.1345	(286)

SAP 10 EPC IMPROVEMENTS

Be Green

Current energy efficiency rating: B 81
Current environmental impact rating: A 96

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	+ 2.6	-£ 81	-36 kg (11.5%)
U Solar photovoltaic panels	+ 9.8	-£ 272	-224 kg (79.9%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£81	0.58 kg/m²	B 84	A 97
Solar photovoltaic panels	£272	3.54 kg/m²	A 94	A 99
Total Savings	£353	4.11 kg/m²		

Potential energy efficiency rating: A 94
Potential environmental impact rating: A 99

Fuel prices for cost data on this page from database revision number 596 TEST (30 Jun 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£601	£520	£81
Space heating	£201	£223	-£22
Water heating	£360	£256	£104
Lighting	£41	£41	£0
Generated (PV)	-£0	-£272	£272
Total cost of fuels	£601	£248	£353
Total cost of uses	£602	£248	£354
Delivered energy	34 kWh/m²	2 kWh/m²	32 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.1 tonnes	0.3 tonnes
CO2 emissions per m²	5 kg/m²	1 kg/m²	4 kg/m²
Primary energy	53 kWh/m²	21 kWh/m²	32 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	63.2200	(1b)	x 2.6000	(2b) =	164.3720	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.2200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	164.3720	(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	0 * 10 =	0.0000	(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) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(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) =	0.1700	(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	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Balanced mechanical ventilation with heat recovery

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)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3117	0.3075	0.3033	0.2820	0.2777	0.2565	0.2565	0.2522	0.2650	0.2777	0.2863	0.2947	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Door			1.9700	1.1000	2.1670			(26)
Windows			16.3100	1.1450	18.6756			(27)
Rooflight			6.8000	1.1450	7.7863			(27a)
Heatloss Floor 1			63.2200	0.0900	5.6898	110.0000	6954.2000	(28a)
External Wall 1	76.4400	18.2800	58.1600	0.1500	8.7240	110.0000	6397.6000	(29a)
External Roof 1	63.2200	6.8000	56.4200	0.0900	5.0778	9.0000	507.7800	(30)
Total net area of external elements Aum(A, m2)			202.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.1204			(33)
Main dwelling								
Party Wall 1			14.6600	0.0000	0.0000	110.0000	1612.6000	(32)
Internal Wall 1			55.0000			9.0000	495.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 15967.1800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	252.5653 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.5000	0.2300	2.4150
E3 Sill	9.5600	0.0190	0.1816
E4 Jamb	24.3000	0.0160	0.3888
E5 Ground floor (normal)	29.6200	0.0940	2.7843
R11 Upstands or kerbs of rooflights	19.3800	0.2400	4.6512
E14 Flat roof	29.6200	0.1600	4.7392
E16 Corner (normal)	7.8000	0.0510	0.3978
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0700	-0.1820
E18 Party wall between dwellings	5.2000	0.0400	0.2080
P1 Party wall - Ground floor	5.6100	0.0680	0.3815
P4 Party wall - Roof (insulation at ceiling level)	5.6100	0.0910	0.5105

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	16.4759 (36)
Point Thermal bridges (36a) =	0.0000
Total fabric heat loss (33) + (36) + (36a) =	64.5963 (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	16.9102	16.6796	16.4491	15.2965	15.0659	13.9133	13.9133	13.6827	14.3743	15.0659	15.5270	15.9881	(38)
Heat transfer coeff	81.5065	81.2760	81.0455	79.8928	79.6623	78.5096	78.5096	78.2791	78.9707	79.6623	80.1233	80.5844	(39)
Average = Sum(39)m / 12 =												79.8352	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2893	1.2856	1.2820	1.2637	1.2601	1.2418	1.2418	1.2382	1.2491	1.2601	1.2674	1.2747	(40)
HLP (average)												1.2628	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0711 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
75.6831	74.5457	72.8883	69.7172	67.3771	64.7673	63.2839	64.9288	66.7318	69.5339	72.7731	75.3931	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

35.8397	34.5365	33.2332	31.9299	30.6267	29.3234	29.3234	30.6267	31.9299	33.2332	34.5365	35.8397	(42c)

Average daily hot water use (litres/day)	102.3588 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5228	109.0822	106.1215	101.6472	98.0037	94.0907	92.6074	95.5554	98.6617	102.7671	107.3095	111.2328	(44)
Energy conte	176.6248	155.3315	163.1048	139.1499	131.9319	115.6955	112.0006	118.3176	121.6598	139.4540	152.8821	174.1637	(45)
Energy content (annual)										Total = Sum(45)m =		1700.3162	
Distribution loss (46)m = 0.15 x (45)m													
	26.4937	23.2997	24.4657	20.8725	19.7898	17.3543	16.8001	17.7476	18.2490	20.9181	22.9323	26.1246	(46)

Water storage loss (or HIU loss):

Store volume												201.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8694	(55)
Total storage loss													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(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													
	226.8386	200.6859	211.9229	180.9903	169.3514	151.6828	149.1874	156.4350	164.8509	188.2720	201.4761	224.3775	(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)
Effective solar volume												75.0000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.3161	(H16)
Heat delivered to hot water												594.6003	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												594.6003	
Solar input	-0.0000	-16.2555	-56.9758	-77.1223	-98.9628	-90.9278	-90.1208	-79.7111	-56.0370	-28.4873	-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													
	226.8386	184.4305	154.9471	103.8680	70.3885	60.7550	59.0666	76.7239	108.8139	159.7847	201.4761	224.3775	(64)
									Total per year (kWh/year) = Sum(64)m =			1631.4705	(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													
	98.8988	87.9313	93.2868	79.7397	73.8029	67.2586	66.9897	69.8345	75.0048	85.4229	89.7085	98.0805	(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	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.9156	18.5770	15.1078	11.4376	8.5497	7.2181	7.7994	10.1379	13.6071	17.2773	20.1652	21.4969	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	270.1324	272.9355	265.8717	250.8338	231.8510	214.0099	202.0909	199.2878	206.3516	221.3896	240.3723	258.2135	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	(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)													
	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	(71)
Water heating gains (Table 5)													
	132.9285	130.8501	125.3855	110.7495	99.1975	93.4147	90.0399	93.8636	104.1733	114.8157	124.5951	131.8286	(72)
Total internal gains													
	514.8951	513.2813	497.2837	463.9395	430.5169	405.5613	390.8488	394.2079	415.0506	444.4012	476.0513	502.4575	(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	
North	7.2800	10.6334	0.6300	0.7000	0.7700	23.6578	(74)
South	4.2800	46.7521	0.6300	0.7000	0.7700	61.1528	(78)
West	4.7500	19.6403	0.6300	0.7000	0.7700	28.5110	(80)
South	6.8000	34.8864	0.6300	0.7000	1.0000	94.1556	(82)

Solar gains	207.4773	383.3013	594.2628	837.6852	1019.4685	1044.7842	993.9032	855.2885	679.1423	443.3786	254.1856	173.7590	(83)
Total gains	722.3723	896.5825	1091.5465	1301.6247	1449.9854	1450.3455	1384.7520	1249.4964	1094.1929	887.7799	730.2369	676.2165	(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	54.4168	54.5712	54.7264	55.5160	55.6766	56.4941	56.4941	56.6604	56.1642	55.6766	55.3563	55.0395	
alpha	4.6278	4.6381	4.6484	4.7011	4.7118	4.7663	4.7663	4.7774	4.7443	4.7118	4.6904	4.6693	
util living area													
	0.9743	0.9381	0.8519	0.6849	0.5001	0.3450	0.2492	0.2876	0.4887	0.7953	0.9477	0.9800	(86)
Living	19.9214	20.2326	20.5971	20.8760	20.9742	20.9965	20.9994	20.9989	20.9831	20.7980	20.3055	19.8632	
Non living	18.6512	19.0334	19.4589	19.7640	19.8546	19.8850	19.8865	19.8892	19.8719	19.7025	19.1414	18.5872	
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	20.4483	20.2326	20.5971	20.8760	20.9742	20.9965	20.9994	20.9989	20.9831	20.7980	20.3055	20.0222	(87)
Th 2	19.8493	19.8521	19.8550	19.8694	19.8722	19.8867	19.8867	19.8896	19.8809	19.8722	19.8665	19.8607	(88)
util rest of house													
	0.9667	0.9220	0.8195	0.6350	0.4432	0.2857	0.1863	0.2185	0.4134	0.7416	0.9310	0.9740	(89)
MIT 2	19.3717	19.0334	19.4589	19.7640	19.8546	19.8850	19.8865	19.8892	19.8719	19.7025	19.1414	18.8167	(90)
Living area fraction										fLA = Living area / (4) =		0.4875	(91)
MIT	19.8965	19.6180	20.0138	20.3061	20.4004	20.4269	20.4291	20.4302	20.4136	20.2365	19.7089	19.4044	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8965	19.6180	20.0138	20.3061	20.4004	20.4269	20.4291	20.4302	20.4136	20.2365	19.7089	19.4044	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9671	0.9181	0.8243	0.6549	0.4702	0.3145	0.2170	0.2522	0.4496	0.7602	0.9282	0.9711	(94)
Useful gains	698.5769	823.1721	899.8092	852.4249	681.7584	456.1852	300.4563	315.1514	492.0019	674.8469	677.8118	656.6574	(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	1271.2163	1196.2221	1095.2313	911.2665	693.0944	457.4672	300.6185	315.4802	498.5927	767.6689	1010.2688	1225.2368	(97)
Space heating kWh	426.0437	250.6896	145.3940	42.3659	8.4340	0.0000	0.0000	0.0000	0.0000	69.0595	239.3691	423.0231	(98a)
Space heating requirement - total per year (kWh/year)												1604.3790	
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	426.0437	250.6896	145.3940	42.3659	8.4340	0.0000	0.0000	0.0000	0.0000	69.0595	239.3691	423.0231	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1604.3790	
Space heating per m2											(98c) / (4) =	25.3777	(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 %)	308.7478	(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	426.0437	250.6896	145.3940	42.3659	8.4340	0.0000	0.0000	0.0000	0.0000	69.0595	239.3691	423.0231	(98)
Space heating efficiency (main heating system 1)	308.7478	308.7478	308.7478	308.7478	308.7478	0.0000	0.0000	0.0000	0.0000	308.7478	308.7478	308.7478	(210)
Space heating fuel (main heating system)	137.9908	81.1956	47.0915	13.7219	2.7317	0.0000	0.0000	0.0000	0.0000	22.3676	77.5290	137.0125	(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	226.8386	184.4305	154.9471	103.8680	70.3885	60.7550	59.0666	76.7239	108.8139	159.7847	201.4761	224.3775	(64)
Efficiency of water heater												176.2057	(216)
(217)m	176.2057	176.2057	176.2057	176.2057	176.2057	176.2057	176.2057	176.2057	176.2057	176.2057	176.2057	176.2057	(217)
Fuel for water heating, kWh/month	128.7351	104.6677	87.9353	58.9470	39.9468	34.4796	33.5214	43.5422	61.7539	90.6808	114.3414	127.3384	(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	18.2909	16.5208	18.2909	17.7009	18.2909	17.7009	18.2909	18.2909	17.7009	18.2909	17.7009	18.2909	(231)
Lighting	18.3073	14.6868	13.2238	9.6883	7.4835	6.1141	6.8267	8.8737	11.5260	15.1227	17.0811	18.8161	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-36.7211	-53.1530	-76.4906	-84.0580	-88.3162	-82.3467	-81.2908	-77.7175	-70.3571	-59.8688	-40.6266	-31.4749	(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	-13.3655	-30.4270	-65.8557	-106.7140	-147.3666	-149.3670	-147.3607	-122.0565	-86.1060	-46.9771	-18.7832	-10.4389	(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	519.6406	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	176.2057	
Water heating fuel used	925.8896	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6750)		
mechanical ventilation fans (SFP = 0.6750)	135.3603	(230a)
pump for solar water heating	80.0000	(230g)
Total electricity for the above, kWh/year	215.3603	(231)
Electricity for lighting (calculated in Appendix L)	147.7501	(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	81.4013	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	519.6406	16.4900	85.6887	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	925.8896	16.4900	152.6792	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	135.3603	16.4900	22.3209	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	147.7501	16.4900	24.3640	(250)

Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-782.4213	16.4900	-129.0213	
PV Unit electricity exported	-944.8181	5.5900	-52.8153	
Total			-181.8366	(252)
Total energy cost			116.4083	(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] =	0.3872	(257)
SAP value		93.7229	
SAP rating (Section 12)		94	(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	519.6406	0.1580	82.0935	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	925.8896	0.1464	135.5106	(264)
Space and water heating			217.6041	(265)
Pumps, fans and electric keep-hot	215.3603	0.1387	29.8731	(267)
Energy for lighting	147.7501	0.1443	21.3249	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-782.4213	0.1348	-105.4711	
PV Unit electricity exported	-944.8181	0.1240	-117.1897	
Total			-222.6608	(269)
Total CO2, kg/year			46.1414	(272)
CO2 emissions per m2			0.7300	(273)
EI value			99.4287	
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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	63.2200 (1b)	x	2.6000 (2b)	=	164.3720	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 63.2200						
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	164.3720	(5)

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2. Ventilation rate

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		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	0 * 10 =	0.0000	(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) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(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) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.2210	0.2210	0.2125	0.1870	0.1827	0.1658	0.1573	0.1573	0.1742	0.1955	0.2040	0.1998	(22b)

Balanced mechanical ventilation with heat recovery	
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)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.0000 (23c)

Effective ac	0.3160	0.3160	0.3075	0.2820	0.2777	0.2607	0.2522	0.2522	0.2692	0.2905	0.2990	0.2947	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Door			1.9700	1.1000	2.1670			(26)
Windows			16.3100	1.1450	18.6756			(27)
Rooflight			6.8000	1.1450	7.7863			(27a)
Heatloss Floor 1			63.2200	0.0900	5.6898	110.0000	6954.2000	(28a)
External Wall 1	76.4400	18.2800	58.1600	0.1500	8.7240	110.0000	6397.6000	(29a)
External Roof 1	63.2200	6.8000	56.4200	0.0900	5.0778	9.0000	507.7800	(30)
Total net area of external elements Aum(A, m2)			202.8800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.1204			(33)
Main dwelling								
Party Wall 1			14.6600	0.0000	0.0000	110.0000	1612.6000	(32)
Internal Wall 1			55.0000			9.0000	495.0000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 15967.1800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 252.5653 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.5000	0.2300	2.4150
E3 Sill	9.5600	0.0190	0.1816
E4 Jamb	24.3000	0.0160	0.3888
E5 Ground floor (normal)	29.6200	0.0940	2.7843
R11 Upstands or kerbs of rooflights	19.3800	0.2400	4.6512
E14 Flat roof	29.6200	0.1600	4.7392
E16 Corner (normal)	7.8000	0.0510	0.3978
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0700	-0.1820
E18 Party wall between dwellings	5.2000	0.0400	0.2080
P1 Party wall - Ground floor	5.6100	0.0680	0.3815
P4 Party wall - Roof (insulation at ceiling level)	5.6100	0.0910	0.5105

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.4759 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 64.5963 (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	17.1407	17.1407	16.6796	15.2965	15.0659	14.1438	13.6827	13.6827	14.6049	15.7575	16.2186	15.9881	(38)
Heat transfer coeff	81.7371	81.7371	81.2760	79.8928	79.6623	78.7401	78.2791	78.2791	79.2012	80.3539	80.8149	80.5844	(39)
Average = Sum(39)m / 12 =												80.0465	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2929	1.2929	1.2856	1.2637	1.2601	1.2455	1.2382	1.2382	1.2528	1.2710	1.2783	1.2747	(40)
HLP (average)												1.2662	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0711 (42)
Hot water usage for mixer showers

75.6831	74.5457	72.8883	69.7172	67.3771	64.7673	63.2839	64.9288	66.7318	69.5339	72.7731	75.3931	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

35.8397	34.5365	33.2332	31.9299	30.6267	29.3234	29.3234	30.6267	31.9299	33.2332	34.5365	35.8397	(42c)

Average daily hot water use (litres/day) 102.3588 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5228	109.0822	106.1215	101.6472	98.0037	94.0907	92.6074	95.5554	98.6617	102.7671	107.3095	111.2328	(44)
Energy conte	176.6248	155.3315	163.1048	139.1499	131.9319	115.6955	112.0006	118.3176	121.6598	139.4540	152.8821	174.1637	(45)
Energy content (annual)										Total = Sum(45)m =		1700.3162	
Distribution loss (46)m = 0.15 x (45)m	26.4937	23.2997	24.4657	20.8725	19.7898	17.3543	16.8001	17.7476	18.2490	20.9181	22.9323	26.1246	(46)

Water storage loss (or HIU loss):
Store volume 201.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.6100 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.8694 (55)
Total storage loss

26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)

If cylinder contains dedicated solar storage

26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(57)
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)
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)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

226.8386	200.6859	211.9229	180.9903	169.3514	151.6828	149.1874	156.4350	164.8509	188.2720	201.4761	224.3775	(62)
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)
-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)

WWHRS
PV diverter

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)
Effective solar volume	75.0000 (H14)
Reference volume	225.0000 (H15)
Storage tank correction coefficient	1.3161 (H16)
Heat delivered to hot water	593.6204 (H24)
Heat delivered to space heating	0.0000 (H29)
Solar input	593.6204

-0.0000	-13.3806	-56.1028	-81.5943	-102.9856	-91.5034	-91.5136	-78.2144	-54.1659	-24.1597	-0.0000	-0.0000	(63c)
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)

Solar input
FGHRS
Output from w/h

226.8386	187.3053	155.8201	99.3960	66.3658	60.1794	57.6738	78.2206	110.6851	164.1123	201.4761	224.3775	(64)

Total per year (kWh/year) = Sum(64)m = 1632.4505 (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

98.8988	87.9313	93.2868	79.7397	73.8029	67.2586	66.9897	69.8345	75.0048	85.4229	89.7085	98.0805	(65)

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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	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.9156	18.5770	15.1078	11.4376	8.5497	7.2181	7.7994	10.1379	13.6071	17.2773	20.1652	21.4969	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	270.1324	272.9355	265.8717	250.8338	231.8510	214.0099	202.0909	199.2878	206.3516	221.3896	240.3723	258.2135	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	(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)													
	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	(71)
Water heating gains (Table 5)													
	132.9285	130.8501	125.3855	110.7495	99.1975	93.4147	90.0399	93.8636	104.1733	114.8157	124.5951	131.8286	(72)
Total internal gains													
	514.8951	513.2813	497.2837	463.9395	430.5169	405.5613	390.8488	394.2079	415.0506	444.4012	476.0513	502.4575	(73)

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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	
North	7.2800	9.5462	0.6300	0.7000	0.7700	21.2390	(74)
South	4.2800	42.7195	0.6300	0.7000	0.7700	55.8782	(78)
West	4.7500	17.5237	0.6300	0.7000	0.7700	25.4385	(80)
South	6.8000	31.1868	0.6300	0.7000	1.0000	84.1708	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	186.7264	367.6620	595.2049	883.7008	1067.1843	1064.4337	1024.5339	855.4025	674.2843	422.5207	234.9927	159.9995	(83)
Total gains	701.6215	880.9433	1092.4886	1347.6404	1497.7012	1469.9950	1415.3827	1249.6104	1089.3349	866.9219	711.0440	662.4571	(84)

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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	54.2634	54.2634	54.5712	55.5160	55.6766	56.3287	56.6604	56.6604	56.0008	55.1974	54.8825	55.0395	
alpha	4.6176	4.6176	4.6381	4.7011	4.7118	4.7552	4.7774	4.7774	4.7334	4.6798	4.6588	4.6693	
util living area													
	0.9789	0.9487	0.8736	0.7074	0.5328	0.4139	0.3361	0.3858	0.5742	0.8425	0.9582	0.9835	(86)
Living	19.8344	20.1322	20.5120	20.8462	20.9629	20.9906	20.9971	20.9946	20.9605	20.7076	20.2070	19.7785	
Non living	18.5400	18.9063	19.3585	19.7330	19.8449	19.8783	19.8883	19.8871	19.8526	19.6007	19.0148	18.4803	
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	20.4037	20.1322	20.5120	20.8462	20.9629	20.9906	20.9971	20.9946	20.9605	20.7076	20.2070	19.9494	(87)
Th 2	19.8464	19.8464	19.8521	19.8694	19.8722	19.8838	19.8896	19.8896	19.8780	19.8636	19.8579	19.8607	(88)
util rest of house													
	0.9727	0.9352	0.8458	0.6617	0.4792	0.3563	0.2755	0.3179	0.5036	0.7985	0.9448	0.9786	(89)
MIT 2	19.3256	18.9063	19.3585	19.7330	19.8449	19.8783	19.8883	19.8871	19.8526	19.6007	19.0148	18.7290	(90)
Living area fraction										fLA = Living area / (4) =		0.4875	(91)
MIT	19.8512	19.5039	19.9209	20.2757	20.3899	20.4206	20.4288	20.4270	20.3927	20.1403	19.5960	19.3239	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8512	19.5039	19.9209	20.2757	20.3899	20.4206	20.4288	20.4270	20.3927	20.1403	19.5960	19.3239	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9727	0.9305	0.8477	0.6787	0.5042	0.3842	0.3050	0.3509	0.5367	0.8101	0.9410	0.9757	(94)
Useful gains	682.4979	819.7172	926.0540	914.6483	755.0692	564.7260	431.7445	438.5157	584.6163	702.3329	669.1203	646.3823	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	1303.8021	1242.7215	1163.9435	988.7291	771.9200	568.5496	432.7912	440.4781	601.3522	838.9201	1050.2734	1259.0465	(97)
Space heating kWh													
	462.2504	284.2589	176.9898	53.3381	12.5371	0.0000	0.0000	0.0000	0.0000	101.6208	274.4302	455.8221	(98a)
Space heating requirement - total per year (kWh/year)												1821.2474	
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													
	462.2504	284.2589	176.9898	53.3381	12.5371	0.0000	0.0000	0.0000	0.0000	101.6208	274.4302	455.8221	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1821.2474	
Space heating per m2											(98c) / (4) =	28.8081	(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 %)	308.7012	(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													
	462.2504	284.2589	176.9898	53.3381	12.5371	0.0000	0.0000	0.0000	0.0000	101.6208	274.4302	455.8221	(98)
Space heating efficiency (main heating system 1)													
	308.7012	308.7012	308.7012	308.7012	308.7012	0.0000	0.0000	0.0000	0.0000	308.7012	308.7012	308.7012	(210)
Space heating fuel (main heating system)													
	149.7404	92.0822	57.3337	17.2782	4.0612	0.0000	0.0000	0.0000	0.0000	32.9188	88.8983	147.6580	(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													
	226.8386	187.3053	155.8201	99.3960	66.3658	60.1794	57.6738	78.2206	110.6851	164.1123	201.4761	224.3775	(64)
Efficiency of water heater												176.1896	(216)
(217)m	176.1896	176.1896	176.1896	176.1896	176.1896	176.1896	176.1896	176.1896	176.1896	176.1896	176.1896	176.1896	(217)
Fuel for water heating, kWh/month													
	128.7469	106.3090	88.4389	56.4142	37.6672	34.1561	32.7339	44.3957	62.8216	93.1453	114.3519	127.3500	(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	18.2909	16.5208	18.2909	17.7009	18.2909	17.7009	18.2909	18.2909	17.7009	18.2909	17.7009	18.2909	(231)
Lighting	18.3073	14.6868	13.2238	9.6883	7.4835	6.1141	6.8267	8.8737	11.5260	15.1227	17.0811	18.8161	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-33.6932	-51.8279	-77.3121	-86.9126	-90.2553	-83.0919	-82.3828	-77.9455	-70.2433	-58.5353	-38.3103	-29.3998	(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	-11.3688	-28.3629	-65.4322	-114.7431	-157.0128	-153.5025	-153.8435	-122.2868	-85.3464	-43.3466	-16.6041	-9.1764	(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	589.9709	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	176.1896	
Water heating fuel used	926.5307	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6750)		
mechanical ventilation fans (SFP = 0.6750)	135.3603	(230a)
pump for solar water heating	80.0000	(230g)
Total electricity for the above, kWh/year	215.3603	(231)
Electricity for lighting (calculated in Appendix L)	147.7501	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1740.9362	(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	138.6759	(238)

10a. Fuel costs - using BEDF prices (596)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	589.9709	27.6700	163.2449	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	926.5307	27.6700	256.3711	(247)
Energy for instantaneous electric shower(s)	0.0000	27.6700	0.0000	(247a)
Pumps, fans and electric keep-hot	135.3603	27.6700	37.4542	(249)
Pump for solar water heating	80.0000	27.6700	22.1360	(249)
Energy for lighting	147.7501	27.6700	40.8825	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-779.9101	27.6700	-215.8011	
PV Unit electricity exported	-961.0262	5.8100	-55.8356	
Total			-271.6367	(252)
Total energy cost			248.4519	(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	589.9709	0.1574	92.8886	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	926.5307	0.1464	135.6273	(264)
Space and water heating			228.5160	(265)
Pumps, fans and electric keep-hot	215.3603	0.1387	29.8731	(267)
Energy for lighting	147.7501	0.1443	21.3249	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-779.9101	0.1345	-104.9083	
PV Unit electricity exported	-961.0262	0.1235	-118.6595	
Total			-223.5679	(269)
Total CO2, kg/year			56.1461	(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	589.9709	1.5828	933.8020	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	926.5307	1.5415	1428.2534	(278)
Space and water heating			2362.0554	(279)
Pumps, fans and electric keep-hot	215.3603	1.5128	325.7971	(281)

Energy for lighting	147.7501	1.5338	226.6241 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-779.9101	1.4972	-1167.6463
PV Unit electricity exported	-961.0262	0.4532	-435.5172
Total			-1603.1634 (283)
Total Primary energy kWh/year			1311.3131 (286)

Full SAP Calculation Printout

Plot Reference	Plot 1	**Issued on Date**	04/08/2026
Assessment Reference	Be Clean	**Plot Type Ref**	
Plot Address		**SAP Version**	10.2

SAP Rating	77 C	**DER**	6.48	**TER**	11.40
Environmental	95 A	**% DER < TER**			43.16
CO_2 Emissions (t/year)	0.42	**DFEE**	47.65	**TFEE**	50.50
Compliance Check	See BREL	**% DFEE < TFEE**			5.64
% DPER < TPER	-9.06	**DPER**	66.46	**TPER**	60.94

Assessor Details	Mr. Andrew Graves	**Assessor ID**	K720-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	63.2200	(1b)	x 2.6000	(2b) =	164.3720	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.2200					
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	164.3720	(5)

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2. Ventilation rate

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		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	0 * 10 =	0.0000	(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) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(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) =	0.1700	(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	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Balanced mechanical ventilation with heat recovery

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)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3117	0.3075	0.3033	0.2820	0.2777	0.2565	0.2565	0.2522	0.2650	0.2777	0.2863	0.2947	(25)

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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			1.9700	1.1000	2.1670			(26)
Windows			16.3100	1.1450	18.6756			(27)
Rooflight			6.8000	1.1450	7.7863			(27a)
Heatloss Floor 1			63.2200	0.0900	5.6898	110.0000	6954.2000	(28a)
External Wall 1	76.4400	18.2800	58.1600	0.1500	8.7240	110.0000	6397.6000	(29a)
External Roof 1	63.2200	6.8000	56.4200	0.0900	5.0778	9.0000	507.7800	(30)
Total net area of external elements Aum(A, m2)			202.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.1204			(33)
Main dwelling								
Party Wall 1			14.6600	0.0000	0.0000	110.0000	1612.6000	(32)
Internal Wall 1			55.0000			9.0000	495.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 15967.1800	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	252.5653	(35)
List of Thermal Bridges		

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	10.5000	0.2300	2.4150	
E3 Sill	9.5600	0.0190	0.1816	
E4 Jamb	24.3000	0.0160	0.3888	
E5 Ground floor (normal)	29.6200	0.0940	2.7843	
R11 Upstands or kerbs of rooflights	19.3800	0.2400	4.6512	
E14 Flat roof	29.6200	0.1600	4.7392	
E16 Corner (normal)	7.8000	0.0510	0.3978	
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0700	-0.1820	
E18 Party wall between dwellings	5.2000	0.0400	0.2080	
P1 Party wall - Ground floor	5.6100	0.0680	0.3815	
P4 Party wall - Roof (insulation at ceiling level)	5.6100	0.0910	0.5105	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			16.4759	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	64.5963	(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	16.9102	16.6796	16.4491	15.2965	15.0659	13.9133	13.9133	13.6827	14.3743	15.0659	15.5270	15.9881	(38)
Heat transfer coeff	81.5065	81.2760	81.0455	79.8928	79.6623	78.5096	78.5096	78.2791	78.9707	79.6623	80.1233	80.5844	(39)
Average = Sum(39)m / 12 =												79.8352	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2893	1.2856	1.2820	1.2637	1.2601	1.2418	1.2418	1.2382	1.2491	1.2601	1.2674	1.2747	(40)
HLP (average)												1.2628	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0711	(42)
Hot water usage for mixer showers	75.6831	74.5457	72.8883	69.7172	67.3771	64.7673	63.2839	64.9288	66.7318	69.5339	72.7731	75.3931	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	35.8397	34.5365	33.2332	31.9299	30.6267	29.3234	29.3234	30.6267	31.9299	33.2332	34.5365	35.8397	(42c)
Average daily hot water use (litres/day)												102.3588	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5228	109.0822	106.1215	101.6472	98.0037	94.0907	92.6074	95.5554	98.6617	102.7671	107.3095	111.2328	(44)
Energy conte	176.6248	155.3315	163.1048	139.1499	131.9319	115.6955	112.0006	118.3176	121.6598	139.4540	152.8821	174.1637	(45)
Energy content (annual)										Total = Sum(45)m =		1700.3162	
Distribution loss (46)m = 0.15 x (45)m	26.4937	23.2997	24.4657	20.8725	19.7898	17.3543	16.8001	17.7476	18.2490	20.9181	22.9323	26.1246	(46)
Water storage loss (or HIU loss):													
Store volume												201.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8694	(55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(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	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(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	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(64)
										Total per year (kWh/year) = Sum(64)m =		2017.6472	(64)
12Total per year (kWh/year)												2018	(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	58.7278	51.6477	54.2324	46.2673	43.8673	38.4688	37.2402	39.3406	40.4519	46.3684	50.8333	57.9094	(65)

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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	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	91.2880	101.0689	91.2880	94.3310	91.2880	94.3310	91.2880	91.2880	94.3310	91.2880	94.3310	91.2880	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	180.9887	182.8668	178.1341	168.0586	155.3402	143.3866	135.4009	133.5228	138.2556	148.3310	161.0495	173.0030	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	(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)	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	(71)
Water heating gains (Table 5)	78.9352	76.8567	72.8929	64.2602	58.9615	53.4288	50.0540	52.8772	56.1832	62.3232	70.6018	77.8353	(72)
Total internal gains	405.2778	414.8583	396.3809	380.7157	359.6556	345.2123	330.8089	331.7539	342.8356	356.0081	380.0481	396.1922	(73)

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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	
North	7.2800	10.6334	0.6300	0.7000	0.7700	23.6578	(74)
South	4.2800	46.7521	0.6300	0.7000	0.7700	61.1528	(78)
West	4.7500	19.6403	0.6300	0.7000	0.7700	28.5110	(80)

South			6.8000		34.8864		0.6300		0.7000		1.0000		94.1556 (82)
Solar gains	207.4773	383.3013	594.2628	837.6852	1019.4685	1044.7842	993.9032	855.2885	679.1423	443.3786	254.1856	173.7590 (83)	
Total gains	612.7550	798.1596	990.6438	1218.4008	1379.1241	1389.9966	1324.7121	1187.0424	1021.9779	799.3868	634.2337	569.9512 (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	54.4168	54.5712	54.7264	55.5160	55.6766	56.4941	56.4941	56.6604	56.1642	55.6766	55.3563	55.0395	
alpha	4.6278	4.6381	4.6484	4.7011	4.7118	4.7663	4.7663	4.7774	4.7443	4.7118	4.6904	4.6693	
util living area	0.9862	0.9580	0.8853	0.7180	0.5235	0.3597	0.2604	0.3026	0.5202	0.8393	0.9680	0.9897	(86)
MIT	19.7582	20.1071	20.5102	20.8486	20.9688	20.9958	20.9993	20.9986	20.9781	20.7402	20.1769	19.7010	(87)
Th 2	19.8493	19.8521	19.8550	19.8694	19.8722	19.8867	19.8867	19.8896	19.8809	19.8722	19.8665	19.8607	(88)
util rest of house	0.9818	0.9461	0.8573	0.6686	0.4647	0.2979	0.1947	0.2300	0.4412	0.7908	0.9568	0.9865	(89)
MIT 2	18.4476	18.8829	19.3637	19.7389	19.8508	19.8847	19.8865	19.8892	19.8691	19.6469	18.9871	18.3837	(90)
Living area fraction									fLA = Living area / (4) =			0.4875	(91)
MIT	19.0865	19.4797	19.9227	20.2799	20.3958	20.4264	20.4290	20.4300	20.4097	20.1799	19.5671	19.0259	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0865	19.4797	19.9227	20.2799	20.3958	20.4264	20.4290	20.4300	20.4097	20.1799	19.5671	19.0259	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9780	0.9415	0.8592	0.6873	0.4924	0.3280	0.2268	0.2654	0.4792	0.8053	0.9531	0.9832	(94)
Useful gains	599.2927	751.4499	851.1278	837.3764	679.0177	455.8893	300.4146	315.0536	489.6919	643.7146	604.4916	560.4009	(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	1205.1988	1184.9777	1087.8453	909.1714	692.7303	457.4277	300.6124	315.4663	498.2848	763.1564	998.9073	1194.7329	(97)
Space heating kWh	450.7941	291.3307	176.1178	51.6924	10.2022	0.0000	0.0000	0.0000	0.0000	88.8647	283.9793	471.9430	(98a)
Space heating requirement - total per year (kWh/year)												1824.9242	
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	450.7941	291.3307	176.1178	51.6924	10.2022	0.0000	0.0000	0.0000	0.0000	88.8647	283.9793	471.9430	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1824.9242	
Space heating per m2										(98c) / (4) =		28.8662	(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)
Fraction of main heating from main system 2	0.0000 (203)
Fraction of total heating from main system 1	1.0000 (204)
Fraction of total heating from main system 2	0.0000 (205)
Efficiency of main space heating system 1 (in %)	100.0000 (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	450.7941	291.3307	176.1178	51.6924	10.2022	0.0000	0.0000	0.0000	0.0000	88.8647	283.9793	471.9430	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	450.7941	291.3307	176.1178	51.6924	10.2022	0.0000	0.0000	0.0000	0.0000	88.8647	283.9793	471.9430	(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)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(64)
Efficiency of water heater												348.7264	(216)
(217)m	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	(217)
Fuel for water heating, kWh/month	58.3771	51.5231	54.5001	47.3815	45.5610	40.6558	39.8456	41.6570	42.3661	47.7180	51.3193	57.6713	(219)
Space cooling fuel requirement	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	11.4964	10.3838	11.4964	11.1255	11.4964	11.1255	11.4964	11.4964	11.1255	11.4964	11.1255	11.4964	(231)
Lighting	18.3073	14.6868	13.2238	9.6883	7.4835	6.1141	6.8267	8.8737	11.5260	15.1227	17.0811	18.8161	(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												1824.9242	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)

Efficiency of water heater	348.7264	
Water heating fuel used	578.5760	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6750)		
mechanical ventilation fans (SFP = 0.6750)	135.3603	(230a)
Total electricity for the above, kWh/year	135.3603	(231)
Electricity for lighting (calculated in Appendix L)	147.7501	(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	2686.6107	(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	1824.9242	0.1576	287.6703	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	578.5760	0.1411	81.6624	(264)
Space and water heating			369.3326	(265)
Pumps, fans and electric keep-hot	135.3603	0.1387	18.7761	(267)
Energy for lighting	147.7501	0.1443	21.3249	(268)
Total CO2, kg/year			409.4337	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			6.4800	(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	1824.9242	1.5835	2889.7635	(275)
Space heating - main system 2	0.0000	0.0000	0.0000	(276)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	578.5760	1.5219	880.5409	(278)
Space and water heating			3770.3044	(279)
Pumps, fans and electric keep-hot	135.3603	1.5128	204.7731	(281)
Energy for lighting	147.7501	1.5338	226.6241	(282)
Total Primary energy kWh/year			4201.7016	(286)
Dwelling Primary energy Rate (DPER)			66.4600	(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	63.2200	(1b)	x 2.6000	(2b) =	164.3720	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.2200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		164.3720	(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	2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1217	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3717	(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) =	0.3159	(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	0.4028	0.3949	0.3870	0.3475	0.3396	0.3001	0.3001	0.2922	0.3159	0.3396	0.3554	0.3712	(22b)

Effective ac	0.5811	0.5780	0.5749	0.5604	0.5577	0.5450	0.5450	0.5427	0.5499	0.5577	0.5632	0.5689	(25)

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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			1.9700	1.0000	1.9700			(26)
TER Opening Type			9.7600	1.1450	11.1756			(27)
TER Roof Light			4.0700	1.5918	8.2298			(27a)
Heatloss Floor 1			63.2200	0.1300	8.2186			(28a)
External Wall 1	76.4400	11.7300	64.7100	0.1800	11.6478			(29a)
External Roof 1	63.2200	4.0700	59.1500	0.1100	6.5065			(30)
Total net area of external elements Aum(A, m2)			202.8800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	47.7483			(33)
Main dwelling								
Party Wall 1			14.6600	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	252.5653	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.5000	0.0500	0.5250
E3 Sill	9.5600	0.0500	0.4780
E4 Jamb	24.3000	0.0500	1.2150
E5 Ground floor (normal)	29.6200	0.1600	4.7392
R11 Upstands or kerbs of rooflights	19.3800	0.0800	1.5504
E14 Flat roof	29.6200	0.0800	2.3696
E16 Corner (normal)	7.8000	0.0900	0.7020
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0900	-0.2340
E18 Party wall between dwellings	5.2000	0.0600	0.3120
P1 Party wall - Ground floor	5.6100	0.0800	0.4488
P4 Party wall - Roof (insulation at ceiling level)	5.6100	0.1200	0.6732

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.7792	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	60.5275	(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	31.5218	31.3510	31.1835	30.3968	30.2496	29.5644	29.5644	29.4375	29.8283	30.2496	30.5473	30.8586	(38)
Heat transfer coeff	92.0493	91.8784	91.7109	90.9242	90.7770	90.0918	90.0918	89.9649	90.3558	90.7770	91.0748	91.3861	(39)
Average = Sum(39)m / 12 =												90.9235	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4560	1.4533	1.4507	1.4382	1.4359	1.4251	1.4251	1.4230	1.4292	1.4359	1.4406	1.4455	(40)
HLP (average)												1.4382	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0711	(42)

Hot water usage for mixer showers

	75.6831	74.5457	72.8883	69.7172	67.3771	64.7673	63.2839	64.9288	66.7318	69.5339	72.7731	75.3931	(42a)

Hot water usage for baths

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

	35.8397	34.5365	33.2332	31.9299	30.6267	29.3234	29.3234	30.6267	31.9299	33.2332	34.5365	35.8397	(42c)

Average daily hot water use (litres/day)	102.3588 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5228	109.0822	106.1215	101.6472	98.0037	94.0907	92.6074	95.5554	98.6617	102.7671	107.3095	111.2328	(44)
Energy conte	176.6248	155.3315	163.1048	139.1499	131.9319	115.6955	112.0006	118.3176	121.6598	139.4540	152.8821	174.1637	(45)
Energy content (annual)										Total = Sum(45)m =		1700.3162	
Distribution loss (46)m = 0.15 x (45)m	26.4937	23.2997	24.4657	20.8725	19.7898	17.3543	16.8001	17.7476	18.2490	20.9181	22.9323	26.1246	(46)

Water storage loss (or HIU loss):	
Store volume	150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.3938 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.7527 (55)

Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(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	223.2197	197.4173	209.6997	184.2417	178.5268	160.7874	158.5955	164.9125	166.7516	186.0489	197.9739	220.7586	(62)
WWHRS	-34.5991	-30.5998	-32.0423	-26.5323	-24.7271	-21.1592	-19.8334	-21.0908	-21.8921	-25.8084	-29.2378	-33.9584	(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	188.6206	166.8175	177.6574	157.7095	153.7996	139.6282	138.7621	143.8217	144.8595	160.2405	168.7362	186.8002	(64)
									Total per year (kWh/year) = Sum(64)m =			1927.4529	(64)
12Total per year (kWh/year)												1927	(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	96.0037	85.3163	91.5083	82.3408	81.1433	74.5422	74.5161	76.6165	76.5254	83.6444	86.9068	95.1854	(65)

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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	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	91.2880	101.0689	91.2880	94.3310	91.2880	94.3310	91.2880	91.2880	94.3310	91.2880	94.3310	91.2880	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	180.9887	182.8668	178.1341	168.0586	155.3402	143.3866	135.4009	133.5228	138.2556	148.3310	161.0495	173.0030	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	(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)													
	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	(71)
Water heating gains (Table 5)													
	129.0372	126.9588	122.9950	114.3622	109.0635	103.5309	100.1561	102.9792	106.2852	112.4252	120.7039	127.9373	(72)
Total internal gains													
	458.3798	467.9604	449.4830	433.8177	412.7576	395.3144	380.9109	381.8560	392.9376	409.1102	433.1502	449.2942	(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	
North	4.3600	10.6334	0.6300	0.7000	0.7700	14.1687	(74)
South	2.5600	46.7521	0.6300	0.7000	0.7700	36.5774	(78)
West	2.8400	19.6403	0.6300	0.7000	0.7700	17.0466	(80)
South	4.0700	34.8864	0.6300	0.7000	1.0000	56.3549	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	124.1476	229.3586	355.6032	501.2826	610.0796	625.2359	594.7842	511.8224	406.4000	265.3101	152.0969	103.9713	(83)
Total gains	582.5274	697.3190	805.0862	935.1003	1022.8372	1020.5503	975.6951	893.6784	799.3377	674.4203	585.2471	553.2655	(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	48.1843	48.2739	48.3620	48.7805	48.8596	49.2312	49.2312	49.3006	49.0874	48.8596	48.6998	48.5340	
alpha	4.2123	4.2183	4.2241	4.2520	4.2573	4.2821	4.2821	4.2867	4.2725	4.2573	4.2467	4.2356	
util living area													
	0.9895	0.9774	0.9489	0.8691	0.7252	0.5426	0.4011	0.4537	0.6987	0.9177	0.9793	0.9915	(86)
MIT	19.4686	19.7280	20.0973	20.5404	20.8361	20.9633	20.9920	20.9866	20.8960	20.4800	19.8929	19.4245	(87)
Th 2	19.7206	19.7227	19.7247	19.7342	19.7359	19.7442	19.7442	19.7457	19.7410	19.7359	19.7323	19.7286	(88)
util rest of house													
	0.9860	0.9701	0.9325	0.8301	0.6548	0.4455	0.2893	0.3347	0.6004	0.8831	0.9713	0.9886	(89)
MIT 2	17.9923	18.3202	18.7788	19.3056	19.6134	19.7262	19.7421	19.7418	19.6798	19.2562	18.5388	17.9417	(90)
Living area fraction										fLA = Living area / (4) =		0.4875	(91)
MIT	18.7120	19.0065	19.4216	19.9076	20.2094	20.3293	20.3514	20.3487	20.2727	19.8528	19.1989	18.6646	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7120	19.0065	19.4216	19.9076	20.2094	20.3293	20.3514	20.3487	20.2727	19.8528	19.1989	18.6646	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9822	0.9648	0.9278	0.8361	0.6827	0.4919	0.3440	0.3929	0.6444	0.8869	0.9669	0.9853	(94)
Useful gains	572.1855	672.7755	746.9460	781.7917	698.2860	502.0047	335.6048	351.1093	515.1235	598.1590	565.8657	545.1392	(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													
	1326.6150	1296.0866	1185.0476	1000.8551	772.4618	516.1641	337.9718	355.2427	557.7376	839.9443	1101.9082	1321.8594	(97)
Space heating kWh													
	561.2955	418.8651	325.9476	157.7257	55.1869	0.0000	0.0000	0.0000	0.0000	179.8883	385.9506	577.8798	(98a)
Space heating requirement - total per year (kWh/year)												2662.7394	
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													
	561.2955	418.8651	325.9476	157.7257	55.1869	0.0000	0.0000	0.0000	0.0000	179.8883	385.9506	577.8798	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2662.7394	
Space heating per m2											(98c) / (4) =	42.1186	(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													
	561.2955	418.8651	325.9476	157.7257	55.1869	0.0000	0.0000	0.0000	0.0000	179.8883	385.9506	577.8798	(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)													
	608.1208	453.8083	353.1393	170.8837	59.7907	0.0000	0.0000	0.0000	0.0000	194.8952	418.1480	626.0887	(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													
	188.6206	166.8175	177.6574	157.7095	153.7996	139.6282	138.7621	143.8217	144.8595	160.2405	168.7362	186.8002	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.3505	86.0362	85.4022	84.0600	81.9945	79.8000	79.8000	79.8000	79.8000	84.3198	85.8545	86.4191	(217)
Fuel for water heating, kWh/month													
	218.4361	193.8921	208.0245	187.6153	187.5732	174.9727	173.8873	180.2277	181.5282	190.0390	196.5374	216.1562	(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	18.9678	15.2167	13.7010	10.0379	7.7536	6.3347	7.0731	9.1938	11.9419	15.6684	17.6974	19.4950	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233a)m	-49.4928	-65.3855	-88.1850	-92.9041	-95.3001	-87.3413	-86.2873	-83.7679	-78.7250	-71.6863	-52.8412	-43.3292	(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	-43.0738	-88.3051	-171.4210	-251.7733	-327.6003	-327.2132	-323.3080	-276.0664	-205.5491	-124.2121	-56.8048	-34.2342	(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	2884.8748	(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	2308.8897	(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)	153.0814	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3124.8069	(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	2308.0390	(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	2884.8748	0.2100	605.8237	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2308.8897	0.2100	484.8668	(264)
Space and water heating			1090.6905	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	153.0814	0.1443	22.0944	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-895.2457	0.1360	-121.7225	
PV Unit electricity exported	-2229.5612	0.1266	-282.1998	
Total			-403.9223	(269)
Total CO2, kg/year			720.7919	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.4000	(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	2884.8748	1.1300	3259.9085	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2308.8897	1.1300	2609.0453	(278)
Space and water heating			5868.9539	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	153.0814	1.5338	234.8014	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-895.2457	1.5026	-1345.1785	
PV Unit electricity exported	-2229.5612	0.4646	-1035.9349	
Total			-2381.1134	(283)
Total Primary energy kWh/year			3852.7426	(286)
Target Primary Energy Rate (TPER)			60.9400	(287)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	63.2200	(1b)	x 2.6000	(2b)	= 164.3720	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.2200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)		= 164.3720	(5)

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2. Ventilation rate

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	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	2 * 10 =	20.0000 (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) =	20.0000 / (5) =	0.1217	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3217	(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) =	0.2734	(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	0.3486	0.3418	0.3349	0.3008	0.2939	0.2598	0.2598	0.2529	0.2734	0.2939	0.3076	0.3213	(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	0.5608	0.5584	0.5561	0.5452	0.5432	0.5337	0.5337	0.5320	0.5374	0.5432	0.5473	0.5516	(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			1.9700	1.1000	2.1670			(26)
Windows			16.3100	1.1450	18.6756			(27)
Rooflight			6.8000	1.1450	7.7863			(27a)
Heatloss Floor 1			63.2200	0.0900	5.6898	110.0000	6954.2000	(28a)
External Wall 1	76.4400	18.2800	58.1600	0.1500	8.7240	110.0000	6397.6000	(29a)
External Roof 1	63.2200	6.8000	56.4200	0.0900	5.0778	9.0000	507.7800	(30)
Total net area of external elements Aum(A, m2)			202.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.1204			(33)
Main dwelling								
Party Wall 1			14.6600	0.0000	0.0000	110.0000	1612.6000	(32)
Internal Wall 1			55.0000			9.0000	495.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	15967.1800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		252.5653 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.5000	0.2300	2.4150
E3 Sill	9.5600	0.0190	0.1816
E4 Jamb	24.3000	0.0160	0.3888
E5 Ground floor (normal)	29.6200	0.0940	2.7843
R11 Upstands or kerbs of rooflights	19.3800	0.2400	4.6512
E14 Flat roof	29.6200	0.1600	4.7392
E16 Corner (normal)	7.8000	0.0510	0.3978
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0700	-0.1820
E18 Party wall between dwellings	5.2000	0.0400	0.2080
P1 Party wall - Ground floor	5.6100	0.0680	0.3815
P4 Party wall - Roof (insulation at ceiling level)	5.6100	0.0910	0.5105

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		16.4759 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	64.5963 (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	30.4175	30.2895	30.1641	29.5748	29.4645	28.9513	28.9513	28.8563	29.1490	29.4645	29.6876	29.9208	(38)
Heat transfer coeff	95.0139	94.8859	94.7604	94.1711	94.0609	93.5476	93.5476	93.4526	93.7453	94.0609	94.2839	94.5171	(39)
Average = Sum(39)m / 12 =												94.1706	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5029	1.5009	1.4989	1.4896	1.4878	1.4797	1.4797	1.4782	1.4828	1.4878	1.4914	1.4951	(40)
HLP (average)												1.4896	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.0711 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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

25.4713	25.0930	24.5603	23.5781	22.8426	22.0271	21.5866	22.1156	22.6915	23.5642	24.5666	25.3852	(42b)

Hot water usage for other uses

35.8397	34.5365	33.2332	31.9299	30.6267	29.3234	29.3234	30.6267	31.9299	33.2332	34.5365	35.8397	(42c)

Average daily hot water use (litres/day)		56.1975 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	61.3110	59.6295	57.7935	55.5080	53.4693	51.3505	50.9100	52.7422	54.6215	56.7974	59.1031	61.2249	(44)
Energy conte	97.1016	84.9115	88.8264	75.9877	71.9799	63.1414	61.5712	65.3059	67.3537	77.0735	84.2031	95.8634	(45)

Energy content (annual)	Total = Sum(45)m =	933.3196

Distribution loss (46)m = 0.15 x (45)m

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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

82.5364	72.1748	75.5025	64.5895	61.1829	53.6702	52.3356	55.5100	57.2507	65.5125	71.5727	81.4839	(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													
	82.5364	72.1748	75.5025	64.5895	61.1829	53.6702	52.3356	55.5100	57.2507	65.5125	71.5727	81.4839	(64)
										Total per year (kWh/year) = Sum(64)m =		793.3216	(64)
12Total per year (kWh/year)												793	(64)
Electric shower(s)													
	47.2047	42.0598	45.9277	43.8282	44.6506	42.5924	44.0121	44.6506	43.8282	45.9277	45.0640	47.2047	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						536.9506	(64a)
Heat gains from water heating, kWh/month													
	32.4353	28.5586	30.3575	27.1044	26.4584	24.0656	24.0869	25.0402	25.2697	27.8600	29.1592	32.1721	(65)

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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	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	91.2880	101.0689	91.2880	94.3310	91.2880	94.3310	91.2880	91.2880	94.3310	91.2880	94.3310	91.2880	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	180.9887	182.8668	178.1341	168.0586	155.3402	143.3866	135.4009	133.5228	138.2556	148.3310	161.0495	173.0030	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	(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)													
	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	(71)
Water heating gains (Table 5)													
	43.5958	42.4980	40.8031	37.6450	35.5624	33.4245	32.3749	33.6561	35.0968	37.4463	40.4989	43.2421	(72)
Total internal gains													
	369.9384	380.4996	364.2911	354.1005	336.2565	325.2080	313.1297	312.5329	321.7493	331.1312	349.9452	361.5991	(73)

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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	
North	7.2800	10.6334	0.6300	0.7000	0.7700	23.6578	(74)
South	4.2800	46.7521	0.6300	0.7000	0.7700	61.1528	(78)
West	4.7500	19.6403	0.6300	0.7000	0.7700	28.5110	(80)
South	6.8000	34.8864	0.6300	0.7000	1.0000	94.1556	(82)

Solar gains	207.4773	383.3013	594.2628	837.6852	1019.4685	1044.7842	993.9032	855.2885	679.1423	443.3786	254.1856	173.7590	(83)
Total gains	577.4157	763.8009	958.5540	1191.7857	1355.7250	1369.9922	1307.0330	1167.8214	1000.8915	774.5099	604.1308	535.3581	(84)

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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	46.6809	46.7438	46.8057	47.0986	47.1538	47.4125	47.4125	47.4607	47.3125	47.1538	47.0423	46.9262	
alpha	4.1121	4.1163	4.1204	4.1399	4.1436	4.1608	4.1608	4.1640	4.1542	4.1436	4.1362	4.1284	
util living area													
	0.9900	0.9703	0.9185	0.7870	0.6036	0.4290	0.3132	0.3645	0.6046	0.8868	0.9777	0.9925	(86)
MIT	19.3950	19.7559	20.2191	20.6805	20.9105	20.9827	20.9963	20.9932	20.9338	20.5381	19.8595	19.3272	(87)
Th 2	19.6853	19.6868	19.6883	19.6953	19.6966	19.7027	19.7027	19.7039	19.7004	19.6966	19.6940	19.6912	(88)
util rest of house													
	0.9866	0.9610	0.8949	0.7367	0.5322	0.3456	0.2217	0.2636	0.5068	0.8435	0.9690	0.9900	(89)
MIT 2	18.2747	18.6286	19.0682	19.4757	19.6481	19.6966	19.7021	19.7025	19.6722	19.3759	18.7403	18.2121	(90)
Living area fraction										fLA = Living area / (4) =		0.4875	(91)
MIT	18.8208	19.1782	19.6292	20.0631	20.2635	20.3236	20.3330	20.3317	20.2873	19.9425	19.2859	18.7557	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8208	19.1782	19.6292	20.0631	20.2635	20.3236	20.3330	20.3317	20.2873	19.9425	19.2859	18.7557	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9836	0.9565	0.8936	0.7519	0.5642	0.3860	0.2664	0.3129	0.5526	0.8528	0.9655	0.9875	(94)
Useful gains	567.9628	730.5380	856.5931	896.0985	764.9008	528.8310	348.1599	365.3830	553.1222	660.5327	583.2999	528.6623	(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													
	1379.6813	1354.7964	1244.1309	1051.2381	805.4930	535.4252	349.2157	367.4296	580.0271	878.7596	1148.9331	1375.7667	(97)
Space heating kWh													
	603.9185	419.5017	288.3281	111.7005	30.2006	0.0000	0.0000	0.0000	0.0000	162.3608	407.2559	630.2457	(98a)
Space heating requirement - total per year (kWh/year)												2653.5119	
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													
	603.9185	419.5017	288.3281	111.7005	30.2006	0.0000	0.0000	0.0000	0.0000	162.3608	407.2559	630.2457	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2653.5119	
Space heating per m2											(98c) / (4) =	41.9727	(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	879.3478	692.2526	710.2397	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9495	0.9727	0.9576	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	834.9010	673.3748	680.1305	0.0000	0.0000	0.0000	0.0000	(102)

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1473.9558	1406.8345	1258.9920	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	460.1194	545.6940	430.6730	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	115.0299	136.4235	107.6682	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												359.1216	(107)
Energy for space heating												41.9727	(99)
Energy for space cooling												5.6805	(108)
Total												47.6532	(109)
Fabric Energy Efficiency (DFEE)												47.7	(109)

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

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1. Overall dwelling characteristics

	Area		Storey height		Volume	
Main dwelling	(m2)		(m)		(m3)	
Ground floor	63.2200	(1b)	x 2.6000	(2b) =	164.3720	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.2200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		164.3720	(5)

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2. Ventilation rate

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		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	2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1217	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3717	(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) =	0.3159	(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	0.4028	0.3949	0.3870	0.3475	0.3396	0.3001	0.3001	0.2922	0.3159	0.3396	0.3554	0.3712	(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	0.5811	0.5780	0.5749	0.5604	0.5577	0.5450	0.5450	0.5427	0.5499	0.5577	0.5632	0.5689	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
TER Opaque door			1.9700	1.0000	1.9700			(26)
TER Opening Type			9.7600	1.1450	11.1756			(27)
TER Roof Light			4.0700	1.5918	8.2298			(27a)
Heatloss Floor 1			63.2200	0.1300	8.2186			(28a)
External Wall 1	76.4400	11.7300	64.7100	0.1800	11.6478			(29a)
External Roof 1	63.2200	4.0700	59.1500	0.1100	6.5065			(30)
Total net area of external elements Aum(A, m2)			202.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.7483			(33)
Main dwelling								
Party Wall 1			14.6600	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	252.5653	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.5000	0.0500	0.5250
E3 Sill	9.5600	0.0500	0.4780
E4 Jamb	24.3000	0.0500	1.2150
E5 Ground floor (normal)	29.6200	0.1600	4.7392
R11 Upstands or kerbs of rooflights	19.3800	0.0800	1.5504
E14 Flat roof	29.6200	0.0800	2.3696
E16 Corner (normal)	7.8000	0.0900	0.7020
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0900	-0.2340
E18 Party wall between dwellings	5.2000	0.0600	0.3120
P1 Party wall - Ground floor	5.6100	0.0800	0.4488
P4 Party wall - Roof (insulation at ceiling level)	5.6100	0.1200	0.6732

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.7792	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	60.5275	(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	31.5218	31.3510	31.1835	30.3968	30.2496	29.5644	29.5644	29.4375	29.8283	30.2496	30.5473	30.8586	(38)
Heat transfer coeff	92.0493	91.8784	91.7109	90.9242	90.7770	90.0918	90.0918	89.9649	90.3558	90.7770	91.0748	91.3861	(39)
Average = Sum(39)m / 12 =												90.9235	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4560	1.4533	1.4507	1.4382	1.4359	1.4251	1.4251	1.4230	1.4292	1.4359	1.4406	1.4455	(40)
HLP (average)												1.4382	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0711 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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

25.4713	25.0930	24.5603	23.5781	22.8426	22.0271	21.5866	22.1156	22.6915	23.5642	24.5666	25.3852	(42b)

Hot water usage for other uses

35.8397	34.5365	33.2332	31.9299	30.6267	29.3234	29.3234	30.6267	31.9299	33.2332	34.5365	35.8397	(42c)

Average daily hot water use (litres/day) 56.1975 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	61.3110	59.6295	57.7935	55.5080	53.4693	51.3505	50.9100	52.7422	54.6215	56.7974	59.1031	61.2249	(44)
Energy conte	97.1016	84.9115	88.8264	75.9877	71.9799	63.1414	61.5712	65.3059	67.3537	77.0735	84.2031	95.8634	(45)
Energy content (annual)										Total = Sum(45)m =		933.3196	

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

82.5364	72.1748	75.5025	64.5895	61.1829	53.6702	52.3356	55.5100	57.2507	65.5125	71.5727	81.4839	(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

82.5364	72.1748	75.5025	64.5895	61.1829	53.6702	52.3356	55.5100	57.2507	65.5125	71.5727	81.4839	(64)
								Total per year (kWh/year) = Sum(64)m =			793.3216	(64)
12Total per year (kWh/year)											793	(64)

Electric shower(s)

47.2047	42.0598	45.9277	43.8282	44.6506	42.5924	44.0121	44.6506	43.8282	45.9277	45.0640	47.2047	(64a)
				Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =							536.9506	(64a)

Heat gains from water heating, kWh/month

32.4353	28.5586	30.3575	27.1044	26.4584	24.0656	24.0869	25.0402	25.2697	27.8600	29.1592	32.1721	(65)

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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	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	91.2880	101.0689	91.2880	94.3310	91.2880	94.3310	91.2880	91.2880	94.3310	91.2880	94.3310	91.2880	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	180.9887	182.8668	178.1341	168.0586	155.3402	143.3866	135.4009	133.5228	138.2556	148.3310	161.0495	173.0030	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	(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)	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	(71)
Water heating gains (Table 5)	43.5958	42.4980	40.8031	37.6450	35.5624	33.4245	32.3749	33.6561	35.0968	37.4463	40.4989	43.2421	(72)
Total internal gains	369.9384	380.4996	364.2911	354.1005	336.2565	325.2080	313.1297	312.5329	321.7493	331.1312	349.9452	361.5991	(73)

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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	
North	4.3600	10.6334	0.6300	0.7000	0.7700	14.1687	(74)
South	2.5600	46.7521	0.6300	0.7000	0.7700	36.5774	(78)
West	2.8400	19.6403	0.6300	0.7000	0.7700	17.0466	(80)
South	4.0700	34.8864	0.6300	0.7000	1.0000	56.3549	(82)

Solar gains	124.1476	229.3586	355.6032	501.2826	610.0796	625.2359	594.7842	511.8224	406.4000	265.3101	152.0969	103.9713	(83)
Total gains	494.0860	609.8582	719.8943	855.3831	946.3361	950.4439	907.9139	824.3553	728.1493	596.4413	502.0421	465.5703	(84)

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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	48.1843	48.2739	48.3620	48.7805	48.8596	49.2312	49.2312	49.3006	49.0874	48.8596	48.6998	48.5340	
alpha	4.2123	4.2183	4.2241	4.2520	4.2573	4.2821	4.2821	4.2867	4.2725	4.2573	4.2467	4.2356	
util living area	0.9943	0.9859	0.9642	0.8959	0.7609	0.5764	0.4294	0.4886	0.7427	0.9428	0.9880	0.9955	(86)

MIT	19.3329	19.5999	19.9859	20.4663	20.8015	20.9540	20.9896	20.9823	20.8677	20.3894	19.7696	19.2886	(87)
Th 2	19.7206	19.7227	19.7247	19.7342	19.7359	19.7442	19.7442	19.7457	19.7410	19.7359	19.7323	19.7286	(88)
util rest of house													
	0.9923	0.9811	0.9520	0.8620	0.6926	0.4758	0.3105	0.3620	0.6460	0.9162	0.9831	0.9940	(89)
MIT 2	18.2397	18.5051	18.8831	19.3381	19.6175	19.7262	19.7420	19.7416	19.6781	19.2835	18.6825	18.2016	(90)
Living area fraction										fLA = Living area / (4) =		0.4875	(91)
MIT	18.7726	19.0389	19.4207	19.8881	20.1947	20.3247	20.3502	20.3465	20.2580	19.8226	19.2125	18.7316	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7726	19.0389	19.4207	19.8881	20.1947	20.3247	20.3502	20.3465	20.2580	19.8226	19.2125	18.7316	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9903	0.9777	0.9484	0.8667	0.7191	0.5238	0.3687	0.4240	0.6888	0.9184	0.9804	0.9923	(94)
Useful gains	489.2941	596.2703	682.7228	741.3807	680.5357	497.8296	334.7693	349.5161	501.5441	547.7606	492.2202	461.9874	(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													
	1332.1957	1299.0553	1184.9725	999.0870	771.1227	515.7528	337.8642	355.0431	556.4115	837.2016	1103.1436	1327.9817	(97)
Space heating kWh													
	627.1187	472.2715	373.6737	185.5486	67.3967	0.0000	0.0000	0.0000	0.0000	215.3441	439.8649	644.2998	(98a)
Space heating requirement - total per year (kWh/year)												3025.5181	
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													
	627.1187	472.2715	373.6737	185.5486	67.3967	0.0000	0.0000	0.0000	0.0000	215.3441	439.8649	644.2998	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3025.5181	
Space heating per m2											(98c) / (4) =	47.8570	(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	846.8633	666.6796	683.7336	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8780	0.9285	0.8998	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	743.5633	619.0050	615.2419	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1021.1366	976.0167	887.9603	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	199.8528	265.6167	202.9025	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	49.9632	66.4042	50.7256	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												167.0930	(107)
Energy for space heating												47.8570	(99)
Energy for space cooling												2.6430	(108)
Total												50.5000	(109)
Fabric Energy Efficiency (TFEE)												50.5	(109)

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	63.2200	(1b)	x 2.6000	(2b) =	164.3720	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.2200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		164.3720	(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	0 * 10 =	0.0000	(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) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(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) =	0.1700	(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													
	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Balanced mechanical ventilation with heat recovery

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)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 81.0000 (23c)

Effective ac	0.3117	0.3075	0.3033	0.2820	0.2777	0.2565	0.2565	0.2522	0.2650	0.2777	0.2863	0.2947	(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			1.9700	1.1000	2.1670			(26)
Windows			16.3100	1.1450	18.6756			(27)
Rooflight			6.8000	1.1450	7.7863			(27a)
Heatloss Floor 1			63.2200	0.0900	5.6898	110.0000	6954.2000	(28a)
External Wall 1	76.4400	18.2800	58.1600	0.1500	8.7240	110.0000	6397.6000	(29a)
External Roof 1	63.2200	6.8000	56.4200	0.0900	5.0778	9.0000	507.7800	(30)
Total net area of external elements Aum(A, m2)			202.8800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.1204			(33)
Main dwelling								
Party Wall 1			14.6600	0.0000	0.0000	110.0000	1612.6000	(32)
Internal Wall 1			55.0000			9.0000	495.0000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 15967.1800 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 252.5653 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.5000	0.2300	2.4150
E3 Sill	9.5600	0.0190	0.1816
E4 Jamb	24.3000	0.0160	0.3888
E5 Ground floor (normal)	29.6200	0.0940	2.7843
R11 Upstands or kerbs of rooflights	19.3800	0.2400	4.6512
E14 Flat roof	29.6200	0.1600	4.7392
E16 Corner (normal)	7.8000	0.0510	0.3978
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0700	-0.1820
E18 Party wall between dwellings	5.2000	0.0400	0.2080
P1 Party wall - Ground floor	5.6100	0.0680	0.3815
P4 Party wall - Roof (insulation at ceiling level)	5.6100	0.0910	0.5105

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.4759 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 64.5963 (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	16.9102	16.6796	16.4491	15.2965	15.0659	13.9133	13.9133	13.6827	14.3743	15.0659	15.5270	15.9881	(38)
Heat transfer coeff													
	81.5065	81.2760	81.0455	79.8928	79.6623	78.5096	78.5096	78.2791	78.9707	79.6623	80.1233	80.5844	(39)
Average = Sum(39)m / 12 =												79.8352	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2893	1.2856	1.2820	1.2637	1.2601	1.2418	1.2418	1.2382	1.2491	1.2601	1.2674	1.2747	(40)
HLP (average)												1.2628	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0711 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers													
	75.6831	74.5457	72.8883	69.7172	67.3771	64.7673	63.2839	64.9288	66.7318	69.5339	72.7731	75.3931	(42a)
Hot water usage for baths													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses													
	35.8397	34.5365	33.2332	31.9299	30.6267	29.3234	29.3234	30.6267	31.9299	33.2332	34.5365	35.8397	(42c)
Average daily hot water use (litres/day)												102.3588	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	111.5228	109.0822	106.1215	101.6472	98.0037	94.0907	92.6074	95.5554	98.6617	102.7671	107.3095	111.2328	(44)
Energy conte	176.6248	155.3315	163.1048	139.1499	131.9319	115.6955	112.0006	118.3176	121.6598	139.4540	152.8821	174.1637	(45)
Energy content (annual)										Total = Sum(45)m =		1700.3162	
Distribution loss (46)m = 0.15 x (45)m													
	26.4937	23.2997	24.4657	20.8725	19.7898	17.3543	16.8001	17.7476	18.2490	20.9181	22.9323	26.1246	(46)
Water storage loss (or HIU loss):													
Store volume												201.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8694	(55)
Total storage loss													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(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													
	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(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													
	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(64)
										Total per year (kWh/year) = Sum(64)m =		2017.6472	(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													
	58.7278	51.6477	54.2324	46.2673	43.8673	38.4688	37.2402	39.3406	40.4519	46.3684	50.8333	57.9094	(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	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.9156	18.5770	15.1078	11.4376	8.5497	7.2181	7.7994	10.1379	13.6071	17.2773	20.1652	21.4969	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	270.1324	272.9355	265.8717	250.8338	231.8510	214.0099	202.0909	199.2878	206.3516	221.3896	240.3723	258.2135	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	(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)													
	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	(71)
Water heating gains (Table 5)													
	78.9352	76.8567	72.8929	64.2602	58.9615	53.4288	50.0540	52.8772	56.1832	62.3232	70.6018	77.8353	(72)
Total internal gains													
	460.9017	459.2879	444.7912	417.4502	390.2809	365.5754	350.8629	353.2215	367.0605	391.9087	422.0579	448.4642	(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	
North	7.2800	10.6334	0.6300	0.7000	0.7700	23.6578	(74)
South	4.2800	46.7521	0.6300	0.7000	0.7700	61.1528	(78)
West	4.7500	19.6403	0.6300	0.7000	0.7700	28.5110	(80)
South	6.8000	34.8864	0.6300	0.7000	1.0000	94.1556	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	207.4773	383.3013	594.2628	837.6852	1019.4685	1044.7842	993.9032	855.2885	679.1423	443.3786	254.1856	173.7590	(83)
Total gains	668.3790	842.5892	1039.0540	1255.1353	1409.7494	1410.3597	1344.7662	1208.5100	1046.2028	835.2873	676.2435	622.2232	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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)													
tau	54.4168	54.5712	54.7264	55.5160	55.6766	56.4941	56.4941	56.6604	56.1642	55.6766	55.3563	55.0395	
alpha	4.6278	4.6381	4.6484	4.7011	4.7118	4.7663	4.7663	4.7774	4.7443	4.7118	4.6904	4.6693	
util living area													
	0.9807	0.9496	0.8696	0.7032	0.5132	0.3546	0.2566	0.2973	0.5093	0.8215	0.9598	0.9855	(86)
MIT	19.8422	20.1652	20.5538	20.8614	20.9713	20.9961	20.9993	20.9987	20.9800	20.7654	20.2347	19.7817	(87)
Th 2	19.8493	19.8521	19.8550	19.8694	19.8722	19.8867	19.8867	19.8896	19.8809	19.8722	19.8665	19.8607	(88)
util rest of house													
	0.9748	0.9358	0.8393	0.6535	0.4552	0.2937	0.1918	0.2259	0.4315	0.7707	0.9463	0.9810	(89)
MIT 2	18.5528	18.9530	19.4118	19.7507	19.8525	19.8848	19.8865	19.8892	19.8701	19.6714	19.0570	18.4853	(90)
Living area fraction									fLA = Living area / (4) =			0.4875	(91)
MIT	19.1814	19.5440	19.9685	20.2922	20.3979	20.4266	20.4290	20.4301	20.4112	20.2047	19.6312	19.1173	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1814	19.5440	19.9685	20.2922	20.3979	20.4266	20.4290	20.4301	20.4112	20.2047	19.6312	19.1173	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9705	0.9314	0.8426	0.6728	0.4826	0.3233	0.2234	0.2607	0.4689	0.7869	0.9428	0.9772	(94)
Useful gains	648.6574	784.7536	875.5264	844.4166	680.2771	455.9964	300.4296	315.0903	490.5480	657.2850	637.5820	608.0178	(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													
	1212.9310	1190.2037	1091.5610	910.1545	692.8977	457.4420	300.6146	315.4715	498.3989	765.1341	1004.0375	1202.1046	(97)
Space heating kWh													
	419.8196	272.4624	160.7298	47.3313	9.3898	0.0000	0.0000	0.0000	0.0000	80.2397	263.8480	442.0005	(98a)
Space heating requirement - total per year (kWh/year)												1695.8211	
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													
	419.8196	272.4624	160.7298	47.3313	9.3898	0.0000	0.0000	0.0000	0.0000	80.2397	263.8480	442.0005	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1695.8211	
Space heating per m2											(98c) / (4) =	26.8241	(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)
Fraction of main heating from main system 2	0.0000	(203)
Fraction of total heating from main system 1	1.0000	(204)
Fraction of total heating from main system 2	0.0000	(205)
Efficiency of main space heating system 1 (in %)	100.0000	(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													
	419.8196	272.4624	160.7298	47.3313	9.3898	0.0000	0.0000	0.0000	0.0000	80.2397	263.8480	442.0005	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	419.8196	272.4624	160.7298	47.3313	9.3898	0.0000	0.0000	0.0000	0.0000	80.2397	263.8480	442.0005	(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	(215)
Space heating fuel used, main system 2											0.0000	(213)
Water heating												
Water heating requirement												
	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151 (64)
Efficiency of water heater												348.7264 (216)
(217)m	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264 (217)
Fuel for water heating, kWh/month												
	58.3771	51.5231	54.5001	47.3815	45.5610	40.6558	39.8456	41.6570	42.3661	47.7180	51.3193	57.6713 (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	11.4964	10.3838	11.4964	11.1255	11.4964	11.1255	11.4964	11.4964	11.1255	11.4964	11.1255	11.4964 (231)
Lighting	18.3073	14.6868	13.2238	9.6883	7.4835	6.1141	6.8267	8.8737	11.5260	15.1227	17.0811	18.8161 (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	1695.8211	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	348.7264	
Water heating fuel used	578.5760	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6750)		
mechanical ventilation fans (SFP = 0.6750)	135.3603	(230a)
Total electricity for the above, kWh/year	135.3603	(231)
Electricity for lighting (calculated in Appendix L)	147.7501	(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	2557.5076	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1695.8211	16.4900	279.6409	(240)
Space heating - main system 2	0.0000	16.4900	0.0000	(241)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	578.5760	16.4900	95.4072	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	135.3603	16.4900	22.3209	(249)
Energy for lighting	147.7501	16.4900	24.3640	(250)
Additional standing charges			0.0000	(251)
Total energy cost			421.7330	(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] =	1.4029	(257)
SAP value		77.2587	
SAP rating (Section 12)		77	(258)
SAP band		C	

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	1695.8211	0.1577	267.4238	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	578.5760	0.1411	81.6624	(264)
Space and water heating			349.0862	(265)
Pumps, fans and electric keep-hot	135.3603	0.1387	18.7761	(267)
Energy for lighting	147.7501	0.1443	21.3249	(268)
Total CO2, kg/year			389.1872	(272)
CO2 emissions per m2			6.1600	(273)
EI value			95.1810	
EI rating			95	(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	63.2200 (1b)	x	2.6000 (2b)	=	164.3720	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.2200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	164.3720	(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	0 * 10 =	0.0000	(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) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(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) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.2210	0.2210	0.2125	0.1870	0.1827	0.1658	0.1573	0.1573	0.1742	0.1955	0.2040	0.1998	(22b)

Balanced mechanical ventilation with heat recovery

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)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3160	0.3160	0.3075	0.2820	0.2777	0.2607	0.2522	0.2522	0.2692	0.2905	0.2990	0.2947	(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			1.9700	1.1000	2.1670			(26)
Windows			16.3100	1.1450	18.6756			(27)
Rooflight			6.8000	1.1450	7.7863			(27a)
Heatloss Floor 1			63.2200	0.0900	5.6898	110.0000	6954.2000	(28a)
External Wall 1	76.4400	18.2800	58.1600	0.1500	8.7240	110.0000	6397.6000	(29a)
External Roof 1	63.2200	6.8000	56.4200	0.0900	5.0778	9.0000	507.7800	(30)
Total net area of external elements Aum(A, m2)			202.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.1204			(33)
Main dwelling								
Party Wall 1			14.6600	0.0000	0.0000	110.0000	1612.6000	(32)
Internal Wall 1			55.0000			9.0000	495.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 15967.1800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	252.5653 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.5000	0.2300	2.4150
E3 Sill	9.5600	0.0190	0.1816
E4 Jamb	24.3000	0.0160	0.3888
E5 Ground floor (normal)	29.6200	0.0940	2.7843
R11 Upstands or kerbs of rooflights	19.3800	0.2400	4.6512
E14 Flat roof	29.6200	0.1600	4.7392
E16 Corner (normal)	7.8000	0.0510	0.3978
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0700	-0.1820
E18 Party wall between dwellings	5.2000	0.0400	0.2080
P1 Party wall - Ground floor	5.6100	0.0680	0.3815
P4 Party wall - Roof (insulation at ceiling level)	5.6100	0.0910	0.5105

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	16.4759 (36)
Point Thermal bridges	(36a) = 0.0000
Total fabric heat loss	(33) + (36) + (36a) = 64.5963 (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	17.1407	17.1407	16.6796	15.2965	15.0659	14.1438	13.6827	13.6827	14.6049	15.7575	16.2186	15.9881	(38)
Heat transfer coeff	81.7371	81.7371	81.2760	79.8928	79.6623	78.7401	78.2791	78.2791	79.2012	80.3539	80.8149	80.5844	(39)

Average = Sum(39)m / 12 =	80.0465

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2929	1.2929	1.2856	1.2637	1.2601	1.2455	1.2382	1.2382	1.2528	1.2710	1.2783	1.2747	(40)
HLP (average)												1.2662	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0711	(42)
Hot water usage for mixer showers													
	75.6831	74.5457	72.8883	69.7172	67.3771	64.7673	63.2839	64.9288	66.7318	69.5339	72.7731	75.3931	(42a)
Hot water usage for baths													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses													
	35.8397	34.5365	33.2332	31.9299	30.6267	29.3234	29.3234	30.6267	31.9299	33.2332	34.5365	35.8397	(42c)
Average daily hot water use (litres/day)												102.3588	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	111.5228	109.0822	106.1215	101.6472	98.0037	94.0907	92.6074	95.5554	98.6617	102.7671	107.3095	111.2328	(44)
Energy conte	176.6248	155.3315	163.1048	139.1499	131.9319	115.6955	112.0006	118.3176	121.6598	139.4540	152.8821	174.1637	(45)
Energy content (annual)										Total = Sum(45)m =		1700.3162	
Distribution loss (46)m = 0.15 x (45)m													
	26.4937	23.2997	24.4657	20.8725	19.7898	17.3543	16.8001	17.7476	18.2490	20.9181	22.9323	26.1246	(46)
Water storage loss (or HIU loss):													
Store volume												201.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8694	(55)
Total storage loss													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(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													
	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(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													
	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(64)
										Total per year (kWh/year) = Sum(64)m =		2017.6472	(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													
	58.7278	51.6477	54.2324	46.2673	43.8673	38.4688	37.2402	39.3406	40.4519	46.3684	50.8333	57.9094	(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	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.9156	18.5770	15.1078	11.4376	8.5497	7.2181	7.7994	10.1379	13.6071	17.2773	20.1652	21.4969	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	270.1324	272.9355	265.8717	250.8338	231.8510	214.0099	202.0909	199.2878	206.3516	221.3896	240.3723	258.2135	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	(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)													
	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	(71)
Water heating gains (Table 5)													
	78.9352	76.8567	72.8929	64.2602	58.9615	53.4288	50.0540	52.8772	56.1832	62.3232	70.6018	77.8353	(72)
Total internal gains													
	460.9017	459.2879	444.7912	417.4502	390.2809	365.5754	350.8629	353.2215	367.0605	391.9087	422.0579	448.4642	(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	
North	7.2800	9.5462	0.6300	0.7000	0.7700	21.2390	(74)
South	4.2800	42.7195	0.6300	0.7000	0.7700	55.8782	(78)
West	4.7500	17.5237	0.6300	0.7000	0.7700	25.4385	(80)
South	6.8000	31.1868	0.6300	0.7000	1.0000	84.1708	(82)

Solar gains	186.7264	367.6620	595.2049	883.7008	1067.1843	1064.4337	1024.5339	855.4025	674.2843	422.5207	234.9927	159.9995	(83)
Total gains	647.6282	826.9499	1039.9960	1301.1510	1457.4652	1430.0091	1375.3968	1208.6240	1041.3448	814.4294	657.0507	608.4637	(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	54.2634	54.2634	54.5712	55.5160	55.6766	56.3287	56.6604	56.6604	56.0008	55.1974	54.8825	55.0395	
alpha	4.6176	4.6176	4.6381	4.7011	4.7118	4.7552	4.7774	4.7774	4.7334	4.6798	4.6588	4.6693	
util living area													
	0.9844	0.9586	0.8895	0.7248	0.5459	0.4251	0.3457	0.3985	0.5968	0.8656	0.9684	0.9882	(86)
MIT	19.7536	20.0616	20.4638	20.8294	20.9590	20.9895	20.9967	20.9938	20.9537	20.6658	20.1329	19.6958	(87)
Th 2	19.8464	19.8464	19.8521	19.8694	19.8722	19.8838	19.8896	19.8896	19.8780	19.8636	19.8579	19.8607	(88)
util rest of house													
	0.9797	0.9472	0.8639	0.6796	0.4915	0.3660	0.2835	0.3285	0.5247	0.8251	0.9577	0.9845	(89)
MIT 2	18.4390	18.8209	19.3046	19.7170	19.8419	19.8777	19.8881	19.8867	19.8479	19.5579	18.9252	18.3764	(90)
Living area fraction										fLA = Living area / (4) =		0.4875	(91)
MIT	19.0799	19.4257	19.8697	20.2593	20.3865	20.4197	20.4285	20.4264	20.3870	20.0980	19.5140	19.0196	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0799	19.4257	19.8697	20.2593	20.3865	20.4197	20.4285	20.4264	20.3870	20.0980	19.5140	19.0196	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9756	0.9423	0.8643	0.6958	0.5167	0.3945	0.3138	0.3625	0.5582	0.8343	0.9537	0.9810	(94)
Useful gains	631.8383	779.2090	898.9042	905.3130	753.0086	564.1970	431.5850	438.1736	581.2302	679.4815	626.6433	596.9137	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	1240.7569	1236.3342	1159.7868	987.4209	771.6455	568.4799	432.7698	440.4324	600.8987	835.5211	1043.6404	1234.5203	(97)
Space heating kWh	453.0355	307.1882	194.0967	59.1177	13.8659	0.0000	0.0000	0.0000	0.0000	116.0935	300.2379	474.3793	(98a)
Space heating requirement - total per year (kWh/year)												1918.0146	
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	453.0355	307.1882	194.0967	59.1177	13.8659	0.0000	0.0000	0.0000	0.0000	116.0935	300.2379	474.3793	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1918.0146	
Space heating per m2											(98c) / (4) =	30.3387	(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)
Fraction of main heating from main system 2	0.0000	(203)
Fraction of total heating from main system 1	1.0000	(204)
Fraction of total heating from main system 2	0.0000	(205)
Efficiency of main space heating system 1 (in %)	100.0000	(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	453.0355	307.1882	194.0967	59.1177	13.8659	0.0000	0.0000	0.0000	0.0000	116.0935	300.2379	474.3793	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	453.0355	307.1882	194.0967	59.1177	13.8659	0.0000	0.0000	0.0000	0.0000	116.0935	300.2379	474.3793	(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)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(64)
Efficiency of water heater												348.7264	(216)
(217)m	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	(217)
Fuel for water heating, kWh/month	58.3771	51.5231	54.5001	47.3815	45.5610	40.6558	39.8456	41.6570	42.3661	47.7180	51.3193	57.6713	(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	11.4964	10.3838	11.4964	11.1255	11.4964	11.1255	11.4964	11.4964	11.1255	11.4964	11.1255	11.4964	(231)
Lighting	18.3073	14.6868	13.2238	9.6883	7.4835	6.1141	6.8267	8.8737	11.5260	15.1227	17.0811	18.8161	(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	1918.0146	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	348.7264	
Water heating fuel used	578.5760	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6750)		
mechanical ventilation fans (SFP = 0.6750)	135.3603	(230a)
Total electricity for the above, kWh/year	135.3603	(231)
Electricity for lighting (calculated in Appendix L)	147.7501	(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	2779.7011	(238)

10a. Fuel costs - using BEDF prices (596)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1918.0146	27.6700	530.7146	(240)
Space heating - main system 2	0.0000	27.6700	0.0000	(241)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	578.5760	27.6700	160.0920	(247)
Energy for instantaneous electric shower(s)	0.0000	27.6700	0.0000	(247a)
Pumps, fans and electric keep-hot	135.3603	27.6700	37.4542	(249)
Energy for lighting	147.7501	27.6700	40.8825	(250)

Additional standing charges	0.0000	(251)
Total energy cost	769.1433	(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	1918.0146	0.1572	301.4243	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	578.5760	0.1411	81.6624	(264)
Space and water heating			383.0867	(265)
Pumps, fans and electric keep-hot	135.3603	0.1387	18.7761	(267)
Energy for lighting	147.7501	0.1443	21.3249	(268)
Total CO2, kg/year			423.1877	(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	1918.0146	1.5817	3033.8055	(275)
Space heating - main system 2	0.0000	0.0000	0.0000	(276)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	578.5760	1.5219	880.5409	(278)
Space and water heating			3914.3464	(279)
Pumps, fans and electric keep-hot	135.3603	1.5128	204.7731	(281)
Energy for lighting	147.7501	1.5338	226.6241	(282)
Total Primary energy kWh/year			4345.7436	(286)

SAP 10 EPC IMPROVEMENTS

Be Clean

Current energy efficiency rating: C 77
Current environmental impact rating: A 95

N Solar water heating — SAP increase too small
U Solar photovoltaic panels — Recommended
V2 Wind turbine — Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 9.9	-£ 275	-223 kg (52.7%)

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.8	-£ 24	-10 kg (2.4%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar photovoltaic panels	£275	3.53 kg/m²	B 87	A 98
Total Savings	£275	3.53 kg/m²		

Potential energy efficiency rating: B 87
Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 596 TEST (30 Jun 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£769	£769	£0
Space heating	£568	£568	£0
Water heating	£160	£160	£0
Lighting	£41	£41	£0
Generated (PV)	-£0	-£275	£275
Total cost of fuels	£769	£494	£275
Total cost of uses	£769	£494	£275
Delivered energy	44 kWh/m²	16 kWh/m²	28 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.2 tonnes	0.2 tonnes
CO2 emissions per m²	7 kg/m²	3 kg/m²	4 kg/m²
Primary energy	69 kWh/m²	43 kWh/m²	26 kWh/m²

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	63.2200	(1b)	x 2.6000	(2b) =	164.3720	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.2200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		164.3720	(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	0 * 10 =	0.0000	(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) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(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) =	0.1700	(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	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Balanced mechanical ventilation with heat recovery		
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)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		81.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3117	0.3075	0.3033	0.2820	0.2777	0.2565	0.2565	0.2522	0.2650	0.2777	0.2863	0.2947	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Door			1.9700	1.1000	2.1670			(26)
Windows			16.3100	1.1450	18.6756			(27)
Rooflight			6.8000	1.1450	7.7863			(27a)
Heatloss Floor 1			63.2200	0.0900	5.6898	110.0000	6954.2000	(28a)
External Wall 1	76.4400	18.2800	58.1600	0.1500	8.7240	110.0000	6397.6000	(29a)
External Roof 1	63.2200	6.8000	56.4200	0.0900	5.0778	9.0000	507.7800	(30)
Total net area of external elements Aum(A, m2)			202.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.1204			(33)
Main dwelling								
Party Wall 1			14.6600	0.0000	0.0000	110.0000	1612.6000	(32)
Internal Wall 1			55.0000			9.0000	495.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	15967.1800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		252.5653 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.5000	0.2300	2.4150
E3 Sill	9.5600	0.0190	0.1816
E4 Jamb	24.3000	0.0160	0.3888
E5 Ground floor (normal)	29.6200	0.0940	2.7843
R11 Upstands or kerbs of rooflights	19.3800	0.2400	4.6512
E14 Flat roof	29.6200	0.1600	4.7392
E16 Corner (normal)	7.8000	0.0510	0.3978
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0700	-0.1820
E18 Party wall between dwellings	5.2000	0.0400	0.2080
P1 Party wall - Ground floor	5.6100	0.0680	0.3815
P4 Party wall - Roof (insulation at ceiling level)	5.6100	0.0910	0.5105

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		16.4759 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	64.5963 (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	16.9102	16.6796	16.4491	15.2965	15.0659	13.9133	13.9133	13.6827	14.3743	15.0659	15.5270	15.9881	(38)
Heat transfer coeff	81.5065	81.2760	81.0455	79.8928	79.6623	78.5096	78.5096	78.2791	78.9707	79.6623	80.1233	80.5844	(39)
Average = Sum(39)m / 12 =												79.8352	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2893	1.2856	1.2820	1.2637	1.2601	1.2418	1.2418	1.2382	1.2491	1.2601	1.2674	1.2747	(40)
HLP (average)												1.2628	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0711	(42)

Hot water usage for mixer showers

75.6831	74.5457	72.8883	69.7172	67.3771	64.7673	63.2839	64.9288	66.7318	69.5339	72.7731	75.3931	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

35.8397	34.5365	33.2332	31.9299	30.6267	29.3234	29.3234	30.6267	31.9299	33.2332	34.5365	35.8397	(42c)

Average daily hot water use (litres/day)	102.3588	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5228	109.0822	106.1215	101.6472	98.0037	94.0907	92.6074	95.5554	98.6617	102.7671	107.3095	111.2328	(44)

Energy conte	176.6248	155.3315	163.1048	139.1499	131.9319	115.6955	112.0006	118.3176	121.6598	139.4540	152.8821	174.1637	(45)
Energy content (annual)										Total = Sum(45)m =		1700.3162	
Distribution loss (46)m = 0.15 x (45)m													
	26.4937	23.2997	24.4657	20.8725	19.7898	17.3543	16.8001	17.7476	18.2490	20.9181	22.9323	26.1246	(46)
Water storage loss (or HIU loss):													
Store volume												201.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8694	(55)
Total storage loss													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(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													
	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(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													
	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(64)
										Total per year (kWh/year) = Sum(64)m =		2017.6472	(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)
Heat gains from water heating, kWh/month													
	58.7278	51.6477	54.2324	46.2673	43.8673	38.4688	37.2402	39.3406	40.4519	46.3684	50.8333	57.9094	(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	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.9156	18.5770	15.1078	11.4376	8.5497	7.2181	7.7994	10.1379	13.6071	17.2773	20.1652	21.4969	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	270.1324	272.9355	265.8717	250.8338	231.8510	214.0099	202.0909	199.2878	206.3516	221.3896	240.3723	258.2135	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	(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)													
	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	(71)
Water heating gains (Table 5)													
	78.9352	76.8567	72.8929	64.2602	58.9615	53.4288	50.0540	52.8772	56.1832	62.3232	70.6018	77.8353	(72)
Total internal gains													
	460.9017	459.2879	444.7912	417.4502	390.2809	365.5754	350.8629	353.2215	367.0605	391.9087	422.0579	448.4642	(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	
North	7.2800	10.6334	0.6300	0.7000	0.7700	23.6578	(74)
South	4.2800	46.7521	0.6300	0.7000	0.7700	61.1528	(78)
West	4.7500	19.6403	0.6300	0.7000	0.7700	28.5110	(80)
South	6.8000	34.8864	0.6300	0.7000	1.0000	94.1556	(82)

Solar gains	207.4773	383.3013	594.2628	837.6852	1019.4685	1044.7842	993.9032	855.2885	679.1423	443.3786	254.1856	173.7590	(83)
Total gains	668.3790	842.5892	1039.0540	1255.1353	1409.7494	1410.3597	1344.7662	1208.5100	1046.2028	835.2873	676.2435	622.2232	(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	54.4168	54.5712	54.7264	55.5160	55.6766	56.4941	56.4941	56.6604	56.1642	55.6766	55.3563	55.0395	
alpha	4.6278	4.6381	4.6484	4.7011	4.7118	4.7663	4.7663	4.7774	4.7443	4.7118	4.6904	4.6693	
util living area													
	0.9807	0.9496	0.8696	0.7032	0.5132	0.3546	0.2566	0.2973	0.5093	0.8215	0.9598	0.9855	(86)
MIT	19.8422	20.1652	20.5538	20.8614	20.9713	20.9961	20.9993	20.9987	20.9800	20.7654	20.2347	19.7817	(87)
Th 2	19.8493	19.8521	19.8550	19.8694	19.8722	19.8867	19.8867	19.8896	19.8809	19.8722	19.8665	19.8607	(88)
util rest of house													
	0.9748	0.9358	0.8393	0.6535	0.4552	0.2937	0.1918	0.2259	0.4315	0.7707	0.9463	0.9810	(89)
MIT 2	18.5528	18.9530	19.4118	19.7507	19.8525	19.8848	19.8865	19.8892	19.8701	19.6714	19.0570	18.4853	(90)
Living area fraction										fLA = Living area / (4) =		0.4875	(91)
MIT	19.1814	19.5440	19.9685	20.2922	20.3979	20.4266	20.4290	20.4301	20.4112	20.2047	19.6312	19.1173	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1814	19.5440	19.9685	20.2922	20.3979	20.4266	20.4290	20.4301	20.4112	20.2047	19.6312	19.1173	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9705	0.9314	0.8426	0.6728	0.4826	0.3233	0.2234	0.2607	0.4689	0.7869	0.9428	0.9772	(94)
Useful gains	648.6574	784.7536	875.5264	844.4166	680.2771	455.9964	300.4296	315.0903	490.5480	657.2850	637.5820	608.0178	(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													
	1212.9310	1190.2037	1091.5610	910.1545	692.8977	457.4420	300.6146	315.4715	498.3989	765.1341	1004.0375	1202.1046	(97)
Space heating kWh													
	419.8196	272.4624	160.7298	47.3313	9.3898	0.0000	0.0000	0.0000	0.0000	80.2397	263.8480	442.0005	(98a)
Space heating requirement - total per year (kWh/year)												1695.8211	
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

419.8196	272.4624	160.7298	47.3313	9.3898	0.0000	0.0000	0.0000	0.0000	80.2397	263.8480	442.0005	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 1695.8211

Space heating per m2 (98c) / (4) = 26.8241 (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)
Fraction of main heating from main system 2												0.0000	(203)
Fraction of total heating from main system 1												1.0000	(204)
Fraction of total heating from main system 2												0.0000	(205)
Efficiency of main space heating system 1 (in %)												100.0000	(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													
	419.8196	272.4624	160.7298	47.3313	9.3898	0.0000	0.0000	0.0000	0.0000	80.2397	263.8480	442.0005	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000		(210)
Space heating fuel (main heating system)													
	419.8196	272.4624	160.7298	47.3313	9.3898	0.0000	0.0000	0.0000	0.0000	80.2397	263.8480	442.0005	(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)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement													
	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(64)
Efficiency of water heater												348.7264	(216)
(217)m	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	(217)
Fuel for water heating, kWh/month													
	58.3771	51.5231	54.5001	47.3815	45.5610	40.6558	39.8456	41.6570	42.3661	47.7180	51.3193	57.6713	(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	11.4964	10.3838	11.4964	11.1255	11.4964	11.1255	11.4964	11.4964	11.1255	11.4964	11.1255	11.4964	(231)
Lighting	18.3073	14.6868	13.2238	9.6883	7.4835	6.1141	6.8267	8.8737	11.5260	15.1227	17.0811	18.8161	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-38.5402	-56.4120	-80.6925	-85.8424	-89.2482	-82.2706	-81.2011	-76.3095	-67.2643	-60.3009	-42.5022	-33.0674	(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	-11.5463	-27.1679	-61.6537	-104.9296	-146.4346	-149.4431	-147.4504	-123.4644	-89.1988	-46.5449	-16.9076	-8.8464	(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												1695.8211	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												348.7264	
Water heating fuel used												578.5760	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6750)
mechanical ventilation fans (SFP = 0.6750) 135.3603 (230a)

Total electricity for the above, kWh/year 135.3603 (231)

Electricity for lighting (calculated in Appendix L) 147.7501 (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	830.2682	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1695.8211	16.4900	279.6409	(240)
Space heating - main system 2	0.0000	16.4900	0.0000	(241)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	578.5760	16.4900	95.4072	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	135.3603	16.4900	22.3209	(249)
Energy for lighting	147.7501	16.4900	24.3640	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-793.6516	16.4900	-130.8731	
PV Unit electricity exported	-933.5878	5.5900	-52.1876	
Total			-183.0607	(252)
Total energy cost			238.6723	(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] =	0.7940 (257)
SAP value		87.1300
SAP rating (Section 12)		87 (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	1695.8211	0.1577	267.4238	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	578.5760	0.1411	81.6624	(264)
Space and water heating			349.0862	(265)
Pumps, fans and electric keep-hot	135.3603	0.1387	18.7761	(267)
Energy for lighting	147.7501	0.1443	21.3249	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-793.6516	0.1353	-107.3576	
PV Unit electricity exported	-933.5878	0.1231	-114.8825	
Total			-222.2401	(269)
Total CO2, kg/year			166.9471	(272)
CO2 emissions per m2			2.6400	(273)
EI value			97.9328	
EI rating			98	(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	63.2200	(1b)	x 2.6000	(2b) =	164.3720	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.2200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	164.3720	(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	0 * 10 =	0.0000	(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) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(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) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.2210	0.2210	0.2125	0.1870	0.1827	0.1658	0.1573	0.1573	0.1742	0.1955	0.2040	0.1998	(22b)

Balanced mechanical ventilation with heat recovery

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)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		81.0000 (23c)

Effective ac	0.3160	0.3160	0.3075	0.2820	0.2777	0.2607	0.2522	0.2522	0.2692	0.2905	0.2990	0.2947	(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			1.9700	1.1000	2.1670			(26)
Windows			16.3100	1.1450	18.6756			(27)
Rooflight			6.8000	1.1450	7.7863			(27a)
Heatloss Floor 1			63.2200	0.0900	5.6898	110.0000	6954.2000	(28a)
External Wall 1	76.4400	18.2800	58.1600	0.1500	8.7240	110.0000	6397.6000	(29a)
External Roof 1	63.2200	6.8000	56.4200	0.0900	5.0778	9.0000	507.7800	(30)
Total net area of external elements Aum(A, m2)			202.8800					(31)

Fabric heat loss, W/K = Sum (A x U) (26)...(30) + (32) = 48.1204 (33)

Main dwelling

Party Wall 1	14.6600	0.0000	0.0000	110.0000	1612.6000	(32)
Internal Wall 1	55.0000			9.0000	495.0000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 15967.1800 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 252.5653 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.5000	0.2300	2.4150
E3 Sill	9.5600	0.0190	0.1816
E4 Jamb	24.3000	0.0160	0.3888
E5 Ground floor (normal)	29.6200	0.0940	2.7843
R11 Upstands or kerbs of rooflights	19.3800	0.2400	4.6512
E14 Flat roof	29.6200	0.1600	4.7392
E16 Corner (normal)	7.8000	0.0510	0.3978
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0700	-0.1820
E18 Party wall between dwellings	5.2000	0.0400	0.2080
P1 Party wall - Ground floor	5.6100	0.0680	0.3815
P4 Party wall - Roof (insulation at ceiling level)	5.6100	0.0910	0.5105

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.4759 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 64.5963 (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	17.1407	17.1407	16.6796	15.2965	15.0659	14.1438	13.6827	13.6827	14.6049	15.7575	16.2186	15.9881	(38)
Heat transfer coeff	81.7371	81.7371	81.2760	79.8928	79.6623	78.7401	78.2791	78.2791	79.2012	80.3539	80.8149	80.5844	(39)
Average = Sum(39)m / 12 =												80.0465	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2929	1.2929	1.2856	1.2637	1.2601	1.2455	1.2382	1.2382	1.2528	1.2710	1.2783	1.2747	(40)
HLP (average)												1.2662	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0711 (42)

Hot water usage for mixer showers

75.6831	74.5457	72.8883	69.7172	67.3771	64.7673	63.2839	64.9288	66.7318	69.5339	72.7731	75.3931	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

35.8397	34.5365	33.2332	31.9299	30.6267	29.3234	29.3234	30.6267	31.9299	33.2332	34.5365	35.8397	(42c)

Average daily hot water use (litres/day) 102.3588 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5228	109.0822	106.1215	101.6472	98.0037	94.0907	92.6074	95.5554	98.6617	102.7671	107.3095	111.2328	(44)
Energy conte	176.6248	155.3315	163.1048	139.1499	131.9319	115.6955	112.0006	118.3176	121.6598	139.4540	152.8821	174.1637	(45)
Energy content (annual)										Total = Sum(45)m =		1700.3162	

Distribution loss (46)m = 0.15 x (45)m

26.4937	23.2997	24.4657	20.8725	19.7898	17.3543	16.8001	17.7476	18.2490	20.9181	22.9323	26.1246	(46)

Water storage loss (or HIU loss):

Store volume 201.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.6100 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.8694 (55)

Total storage loss

26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)

If cylinder contains dedicated solar storage

26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(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

203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(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

203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(64)
							Total per year (kWh/year) = Sum(64)m =				2017.6472	(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

58.7278	51.6477	54.2324	46.2673	43.8673	38.4688	37.2402	39.3406	40.4519	46.3684	50.8333	57.9094	(65)

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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	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.9156	18.5770	15.1078	11.4376	8.5497	7.2181	7.7994	10.1379	13.6071	17.2773	20.1652	21.4969	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	270.1324	272.9355	265.8717	250.8338	231.8510	214.0099	202.0909	199.2878	206.3516	221.3896	240.3723	258.2135	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	(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)	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	(71)
Water heating gains (Table 5)	78.9352	76.8567	72.8929	64.2602	58.9615	53.4288	50.0540	52.8772	56.1832	62.3232	70.6018	77.8353	(72)
Total internal gains	460.9017	459.2879	444.7912	417.4502	390.2809	365.5754	350.8629	353.2215	367.0605	391.9087	422.0579	448.4642	(73)

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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	
North	7.2800	9.5462	0.6300	0.7000	0.7700	21.2390	(74)
South	4.2800	42.7195	0.6300	0.7000	0.7700	55.8782	(78)
West	4.7500	17.5237	0.6300	0.7000	0.7700	25.4385	(80)
South	6.8000	31.1868	0.6300	0.7000	1.0000	84.1708	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	186.7264	367.6620	595.2049	883.7008	1067.1843	1064.4337	1024.5339	855.4025	674.2843	422.5207	234.9927	159.9995	(83)
Total gains	647.6282	826.9499	1039.9960	1301.1510	1457.4652	1430.0091	1375.3968	1208.6240	1041.3448	814.4294	657.0507	608.4637	(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	54.2634	54.2634	54.5712	55.5160	55.6766	56.3287	56.6604	56.6604	56.0008	55.1974	54.8825	55.0395	
alpha	4.6176	4.6176	4.6381	4.7011	4.7118	4.7552	4.7774	4.7774	4.7334	4.6798	4.6588	4.6693	
util living area	0.9844	0.9586	0.8895	0.7248	0.5459	0.4251	0.3457	0.3985	0.5968	0.8656	0.9684	0.9882	(86)
MIT	19.7536	20.0616	20.4638	20.8294	20.9590	20.9895	20.9967	20.9938	20.9537	20.6658	20.1329	19.6958	(87)
Th 2	19.8464	19.8464	19.8521	19.8694	19.8722	19.8838	19.8896	19.8896	19.8780	19.8636	19.8579	19.8607	(88)
util rest of house	0.9797	0.9472	0.8639	0.6796	0.4915	0.3660	0.2835	0.3285	0.5247	0.8251	0.9577	0.9845	(89)
MIT 2	18.4390	18.8209	19.3046	19.7170	19.8419	19.8777	19.8881	19.8867	19.8479	19.5579	18.9252	18.3764	(90)
Living area fraction									fLA = Living area / (4) =			0.4875	(91)
MIT	19.0799	19.4257	19.8697	20.2593	20.3865	20.4197	20.4285	20.4264	20.3870	20.0980	19.5140	19.0196	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0799	19.4257	19.8697	20.2593	20.3865	20.4197	20.4285	20.4264	20.3870	20.0980	19.5140	19.0196	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9756	0.9423	0.8643	0.6958	0.5167	0.3945	0.3138	0.3625	0.5582	0.8343	0.9537	0.9810	(94)
Useful gains	631.8383	779.2090	898.9042	905.3130	753.0086	564.1970	431.5850	438.1736	581.2302	679.4815	626.6433	596.9137	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	1240.7569	1236.3342	1159.7868	987.4209	771.6455	568.4799	432.7698	440.4324	600.8987	835.5211	1043.6404	1234.5203	(97)
Space heating kWh	453.0355	307.1882	194.0967	59.1177	13.8659	0.0000	0.0000	0.0000	0.0000	116.0935	300.2379	474.3793	(98a)
Space heating requirement - total per year (kWh/year)												1918.0146	
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	453.0355	307.1882	194.0967	59.1177	13.8659	0.0000	0.0000	0.0000	0.0000	116.0935	300.2379	474.3793	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1918.0146	
Space heating per m2											(98c) / (4) =	30.3387	(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)
Fraction of main heating from main system 2	0.0000	(203)
Fraction of total heating from main system 1	1.0000	(204)
Fraction of total heating from main system 2	0.0000	(205)
Efficiency of main space heating system 1 (in %)	100.0000	(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	453.0355	307.1882	194.0967	59.1177	13.8659	0.0000	0.0000	0.0000	0.0000	116.0935	300.2379	474.3793	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	453.0355	307.1882	194.0967	59.1177	13.8659	0.0000	0.0000	0.0000	0.0000	116.0935	300.2379	474.3793	(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)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(64)
Efficiency of water heater												348.7264	(216)
(217)m	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	(217)
Fuel for water heating, kWh/month	58.3771	51.5231	54.5001	47.3815	45.5610	40.6558	39.8456	41.6570	42.3661	47.7180	51.3193	57.6713	(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	11.4964	10.3838	11.4964	11.1255	11.4964	11.1255	11.4964	11.4964	11.1255	11.4964	11.1255	11.4964	(231)
Lighting	18.3073	14.6868	13.2238	9.6883	7.4835	6.1141	6.8267	8.8737	11.5260	15.1227	17.0811	18.8161	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-35.3531	-55.2254	-82.5036	-90.0567	-92.1893	-83.0772	-82.4453	-76.3984	-67.0503	-59.9618	-40.2357	-30.8870	(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	-9.7090	-24.9655	-60.2408	-111.5990	-155.0787	-153.5173	-153.7810	-123.8339	-88.5393	-41.9202	-14.6787	-7.6892	(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	1918.0146	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	348.7264	
Water heating fuel used	578.5760	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6750)		
mechanical ventilation fans (SFP = 0.6750)	135.3603	(230a)
Total electricity for the above, kWh/year	135.3603	(231)
Electricity for lighting (calculated in Appendix L)	147.7501	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1740.9362	(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	1038.7649	(238)

10a. Fuel costs - using BEDF prices (596)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1918.0146	27.6700	530.7146	(240)
Space heating - main system 2	0.0000	27.6700	0.0000	(241)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	578.5760	27.6700	160.0920	(247)
Energy for instantaneous electric shower(s)	0.0000	27.6700	0.0000	(247a)
Pumps, fans and electric keep-hot	135.3603	27.6700	37.4542	(249)
Energy for lighting	147.7501	27.6700	40.8825	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-795.3838	27.6700	-220.0827	
PV Unit electricity exported	-945.5524	5.8100	-54.9366	
Total			-275.0193	(252)
Total energy cost			494.1240	(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	1918.0146	0.1572	301.4243	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	578.5760	0.1411	81.6624	(264)
Space and water heating			383.0867	(265)
Pumps, fans and electric keep-hot	135.3603	0.1387	18.7761	(267)
Energy for lighting	147.7501	0.1443	21.3249	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-795.3838	0.1350	-107.3912	
PV Unit electricity exported	-945.5524	0.1224	-115.7253	
Total			-223.1165	(269)
Total CO2, kg/year			200.0712	(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	1918.0146	1.5817	3033.8055	(275)
Space heating - main system 2	0.0000	0.0000	0.0000	(276)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	578.5760	1.5219	880.5409	(278)
Space and water heating			3914.3464	(279)
Pumps, fans and electric keep-hot	135.3603	1.5128	204.7731	(281)
Energy for lighting	147.7501	1.5338	226.6241	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-795.3838	1.4991	-1192.3291	
PV Unit electricity exported	-945.5524	0.4492	-424.7056	
Total			-1617.0347	(283)
Total Primary energy kWh/year			2728.7089	(286)

Full SAP Calculation Printout

Plot Reference	Plot 1	**Issued on Date**	04/08/2026
Assessment Reference	Be Lean	**Plot Type Ref**	
Plot Address		**SAP Version**	10.2

SAP Rating	70 C	**DER**	8.37	**TER**	11.40
Environmental	94 A	**% DER < TER**			26.58
CO_2 Emissions (t/year)	0.55	**DFEE**	47.65	**TFEE**	50.50
Compliance Check	See BREL	**% DFEE < TFEE**			5.64
% DPER < TPER	-41.33	**DPER**	86.13	**TPER**	60.94

Assessor Details	Mr. Andrew Graves	**Assessor ID**	K720-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	63.2200	(1b)	x 2.6000	(2b) =	164.3720	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.2200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	164.3720	(5)

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2. Ventilation rate

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	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	0 * 10 =	0.0000 (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) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.2000 (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) =	0.1700 (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	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(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	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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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			1.9700	1.1000	2.1670			(26)
Windows			16.3100	1.1450	18.6756			(27)
Rooflight			6.8000	1.1450	7.7863			(27a)
Heatloss Floor 1			63.2200	0.0900	5.6898	110.0000	6954.2000	(28a)
External Wall 1	76.4400	18.2800	58.1600	0.1500	8.7240	110.0000	6397.6000	(29a)
External Roof 1	63.2200	6.8000	56.4200	0.0900	5.0778	9.0000	507.7800	(30)
Total net area of external elements Aum(A, m2)			202.8800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.1204			(33)
Main dwelling								
Party Wall 1			14.6600	0.0000	0.0000	110.0000	1612.6000	(32)
Internal Wall 1			55.0000			9.0000	495.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 15967.1800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	252.5653 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			

E2 Other lintels (including other steel lintels)	10.5000	0.2300	2.4150	
E3 Sill	9.5600	0.0190	0.1816	
E4 Jamb	24.3000	0.0160	0.3888	
E5 Ground floor (normal)	29.6200	0.0940	2.7843	
R11 Upstands or kerbs of rooflights	19.3800	0.2400	4.6512	
E14 Flat roof	29.6200	0.1600	4.7392	
E16 Corner (normal)	7.8000	0.0510	0.3978	
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0700	-0.1820	
E18 Party wall between dwellings	5.2000	0.0400	0.2080	
P1 Party wall - Ground floor	5.6100	0.0680	0.3815	
P4 Party wall - Roof (insulation at ceiling level)	5.6100	0.0910	0.5105	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.4759 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 64.5963 (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	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	(38)
Heat transfer coeff	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	(39)

Average = Sum(39)m / 12 = 91.7177

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	(40)
HLP (average)												1.4508	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0711 (42)

Hot water usage for mixer showers

75.6831	74.5457	72.8883	69.7172	67.3771	64.7673	63.2839	64.9288	66.7318	69.5339	72.7731	75.3931	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

35.8397	34.5365	33.2332	31.9299	30.6267	29.3234	29.3234	30.6267	31.9299	33.2332	34.5365	35.8397	(42c)

Average daily hot water use (litres/day) 102.3588 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5228	109.0822	106.1215	101.6472	98.0037	94.0907	92.6074	95.5554	98.6617	102.7671	107.3095	111.2328	(44)
Energy conte	176.6248	155.3315	163.1048	139.1499	131.9319	115.6955	112.0006	118.3176	121.6598	139.4540	152.8821	174.1637	(45)

Energy content (annual) Total = Sum(45)m = 1700.3162

Distribution loss (46)m = 0.15 x (45)m

26.4937	23.2997	24.4657	20.8725	19.7898	17.3543	16.8001	17.7476	18.2490	20.9181	22.9323	26.1246	(46)

Water storage loss (or HIU loss):

Store volume 201.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.6100 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.8694 (55)

Total storage loss

26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)

If cylinder contains dedicated solar storage

26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(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

203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(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

203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(64)

Total per year (kWh/year) = Sum(64)m = 2017.6472 (64)

12Total per year (kWh/year) 2018 (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

58.7278	51.6477	54.2324	46.2673	43.8673	38.4688	37.2402	39.3406	40.4519	46.3684	50.8333	57.9094	(65)

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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	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	91.2880	101.0689	91.2880	94.3310	91.2880	94.3310	91.2880	91.2880	94.3310	91.2880	94.3310	91.2880	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	180.9887	182.8668	178.1341	168.0586	155.3402	143.3866	135.4009	133.5228	138.2556	148.3310	161.0495	173.0030	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	(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)	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	(71)
Water heating gains (Table 5)	78.9352	76.8567	72.8929	64.2602	58.9615	53.4288	50.0540	52.8772	56.1832	62.3232	70.6018	77.8353	(72)
Total internal gains	405.2778	414.8583	396.3809	380.7157	359.6556	345.2123	330.8089	331.7539	342.8356	356.0081	380.0481	396.1922	(73)

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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	
North	7.2800	10.6334	0.6300	0.7000	0.7700	23.6578	(74)
South	4.2800	46.7521	0.6300	0.7000	0.7700	61.1528	(78)
West	4.7500	19.6403	0.6300	0.7000	0.7700	28.5110	(80)
South	6.8000	34.8864	0.6300	0.7000	1.0000	94.1556	(82)

Solar gains	207.4773	383.3013	594.2628	837.6852	1019.4685	1044.7842	993.9032	855.2885	679.1423	443.3786	254.1856	173.7590	(83)
Total gains	612.7550	798.1596	990.6438	1218.4008	1379.1241	1389.9966	1324.7121	1187.0424	1021.9779	799.3868	634.2337	569.9512	(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	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	
alpha	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	
util living area	0.9874	0.9644	0.9064	0.7691	0.5847	0.4158	0.3032	0.3525	0.5853	0.8726	0.9730	0.9905	(86)
MIT	19.5217	19.8723	20.3108	20.7244	20.9257	20.9857	20.9970	20.9945	20.9447	20.5911	19.9506	19.4425	(87)
Th 2	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	(88)
util rest of house	0.9832	0.9536	0.8806	0.7181	0.5154	0.3358	0.2161	0.2563	0.4905	0.8266	0.9628	0.9874	(89)
MIT 2	18.0620	18.4994	19.0275	19.4834	19.6732	19.7181	19.7239	19.7231	19.6946	19.3642	18.6044	17.9618	(90)
Living area fraction									fLA = Living area / (4) =			0.4875	(91)
MIT	18.7736	19.1687	19.6531	20.0884	20.2838	20.3360	20.3446	20.3429	20.3041	19.9623	19.2607	18.6837	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7736	19.1687	19.6531	20.0884	20.2838	20.3360	20.3446	20.3429	20.3041	19.9623	19.2607	18.6837	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9791	0.9477	0.8789	0.7336	0.5466	0.3746	0.2586	0.3033	0.5350	0.8363	0.9581	0.9838	(94)
Useful gains	599.9324	756.4421	870.7166	893.7966	753.8520	520.6629	342.5927	359.9724	546.7153	668.5611	607.6312	560.7162	(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	1327.4851	1308.6889	1206.3716	1026.1726	787.2874	526.0950	343.4430	361.6358	569.0217	858.6881	1115.3508	1328.4083	(97)
Space heating kWh	541.2992	371.1099	249.7274	95.3108	24.8759	0.0000	0.0000	0.0000	0.0000	141.4545	365.5580	571.1629	(98a)
Space heating requirement - total per year (kWh/year)												2360.4986	
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	541.2992	371.1099	249.7274	95.3108	24.8759	0.0000	0.0000	0.0000	0.0000	141.4545	365.5580	571.1629	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2360.4986	
Space heating per m2											(98c) / (4) =	37.3378	(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)
Fraction of main heating from main system 2	0.0000	(203)
Fraction of total heating from main system 1	1.0000	(204)
Fraction of total heating from main system 2	0.0000	(205)
Efficiency of main space heating system 1 (in %)	100.0000	(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	541.2992	371.1099	249.7274	95.3108	24.8759	0.0000	0.0000	0.0000	0.0000	141.4545	365.5580	571.1629	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	541.2992	371.1099	249.7274	95.3108	24.8759	0.0000	0.0000	0.0000	0.0000	141.4545	365.5580	571.1629	(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)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(64)
Efficiency of water heater												348.7264	(216)
(217)m	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	(217)
Fuel for water heating, kWh/month	58.3771	51.5231	54.5001	47.3815	45.5610	40.6558	39.8456	41.6570	42.3661	47.7180	51.3193	57.6713	(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	34.0633	30.7668	34.0633	32.9645	34.0633	32.9645	34.0633	34.0633	32.9645	34.0633	32.9645	34.0633	(231)
Lighting	18.3073	14.6868	13.2238	9.6883	7.4835	6.1141	6.8267	8.8737	11.5260	15.1227	17.0811	18.8161	(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												2360.4986	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												348.7264	

Water heating fuel used	578.5760	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Table 4g: in-use factor = 2.5000, SFP = 2.0000)		
mechanical ventilation fans (SFP = 2.0000)	401.0677	(230a)
Total electricity for the above, kWh/year	401.0677	(231)
Electricity for lighting (calculated in Appendix L)	147.7501	(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	3487.8924	(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	2360.4986	0.1569	370.2673	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	578.5760	0.1411	81.6624	(264)
Space and water heating			451.9297	(265)
Pumps, fans and electric keep-hot	401.0677	0.1387	55.6330	(267)
Energy for lighting	147.7501	0.1443	21.3249	(268)
Total CO2, kg/year			528.8877	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			8.3700	(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	2360.4986	1.5807	3731.1601	(275)
Space heating - main system 2	0.0000	0.0000	0.0000	(276)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	578.5760	1.5219	880.5409	(278)
Space and water heating			4611.7010	(279)
Pumps, fans and electric keep-hot	401.0677	1.5128	606.7352	(281)
Energy for lighting	147.7501	1.5338	226.6241	(282)
Total Primary energy kWh/year			5445.0603	(286)
Dwelling Primary energy Rate (DPER)			86.1300	(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	63.2200 (1b)	x	2.6000 (2b)	=	164.3720	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.2200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	164.3720	(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	2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1217	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3717	(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) =	0.3159	(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	0.4028	0.3949	0.3870	0.3475	0.3396	0.3001	0.3001	0.2922	0.3159	0.3396	0.3554	0.3712	(22b)
Effective ac	0.5811	0.5780	0.5749	0.5604	0.5577	0.5450	0.5450	0.5427	0.5499	0.5577	0.5632	0.5689	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
TER Opaque door			1.9700	1.0000	1.9700			(26)
TER Opening Type			9.7600	1.1450	11.1756			(27)
TER Roof Light			4.0700	1.5918	8.2298			(27a)
Heatloss Floor 1			63.2200	0.1300	8.2186			(28a)
External Wall 1	76.4400	11.7300	64.7100	0.1800	11.6478			(29a)
External Roof 1	63.2200	4.0700	59.1500	0.1100	6.5065			(30)
Total net area of external elements Aum(A, m2)			202.8800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	47.7483			(33)
Main dwelling								
Party Wall 1			14.6600	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 252.5653 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	10.5000	0.0500	0.5250	
E3 Sill	9.5600	0.0500	0.4780	
E4 Jamb	24.3000	0.0500	1.2150	
E5 Ground floor (normal)	29.6200	0.1600	4.7392	
R11 Upstands or kerbs of rooflights	19.3800	0.0800	1.5504	
E14 Flat roof	29.6200	0.0800	2.3696	
E16 Corner (normal)	7.8000	0.0900	0.7020	
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0900	-0.2340	
E18 Party wall between dwellings	5.2000	0.0600	0.3120	
P1 Party wall - Ground floor	5.6100	0.0800	0.4488	
P4 Party wall - Roof (insulation at ceiling level)	5.6100	0.1200	0.6732	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.7792 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 60.5275 (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	31.5218	31.3510	31.1835	30.3968	30.2496	29.5644	29.5644	29.4375	29.8283	30.2496	30.5473	30.8586	(38)
Heat transfer coeff	92.0493	91.8784	91.7109	90.9242	90.7770	90.0918	90.0918	89.9649	90.3558	90.7770	91.0748	91.3861	(39)

Average = Sum(39)m / 12 = 90.9235

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4560	1.4533	1.4507	1.4382	1.4359	1.4251	1.4251	1.4230	1.4292	1.4359	1.4406	1.4455	(40)
HLP (average)												1.4382	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0711 (42)

Hot water usage for mixer showers

75.6831	74.5457	72.8883	69.7172	67.3771	64.7673	63.2839	64.9288	66.7318	69.5339	72.7731	75.3931	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

35.8397	34.5365	33.2332	31.9299	30.6267	29.3234	29.3234	30.6267	31.9299	33.2332	34.5365	35.8397	(42c)

Average daily hot water use (litres/day) 102.3588 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5228	109.0822	106.1215	101.6472	98.0037	94.0907	92.6074	95.5554	98.6617	102.7671	107.3095	111.2328	(44)
Energy conte	176.6248	155.3315	163.1048	139.1499	131.9319	115.6955	112.0006	118.3176	121.6598	139.4540	152.8821	174.1637	(45)
Energy content (annual)										Total = Sum(45)m =		1700.3162	

Distribution loss (46)m = 0.15 x (45)m

26.4937	23.2997	24.4657	20.8725	19.7898	17.3543	16.8001	17.7476	18.2490	20.9181	22.9323	26.1246	(46)

Water storage loss (or HIU loss):

Store volume 150.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.3938 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.7527 (55)

Total storage loss

23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)

If cylinder contains dedicated solar storage

23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(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

223.2197	197.4173	209.6997	184.2417	178.5268	160.7874	158.5955	164.9125	166.7516	186.0489	197.9739	220.7586	(62)
WWHRS -34.5991	-30.5998	-32.0423	-26.5323	-24.7271	-21.1592	-19.8334	-21.0908	-21.8921	-25.8084	-29.2378	-33.9584	(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

188.6206	166.8175	177.6574	157.7095	153.7996	139.6282	138.7621	143.8217	144.8595	160.2405	168.7362	186.8002	(64)
								Total per year (kWh/year) = Sum(64)m =			1927.4529	(64)

12Total per year (kWh/year) 1927 (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

96.0037	85.3163	91.5083	82.3408	81.1433	74.5422	74.5161	76.6165	76.5254	83.6444	86.9068	95.1854	(65)

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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	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	91.2880	101.0689	91.2880	94.3310	91.2880	94.3310	91.2880	91.2880	94.3310	91.2880	94.3310	91.2880	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	180.9887	182.8668	178.1341	168.0586	155.3402	143.3866	135.4009	133.5228	138.2556	148.3310	161.0495	173.0030	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	(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)													
	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	(71)
Water heating gains (Table 5)													
	129.0372	126.9588	122.9950	114.3622	109.0635	103.5309	100.1561	102.9792	106.2852	112.4252	120.7039	127.9373	(72)
Total internal gains													
	458.3798	467.9604	449.4830	433.8177	412.7576	395.3144	380.9109	381.8560	392.9376	409.1102	433.1502	449.2942	(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	
North	4.3600	10.6334	0.6300	0.7000	0.7700	14.1687	(74)
South	2.5600	46.7521	0.6300	0.7000	0.7700	36.5774	(78)
West	2.8400	19.6403	0.6300	0.7000	0.7700	17.0466	(80)
South	4.0700	34.8864	0.6300	0.7000	1.0000	56.3549	(82)

Solar gains	124.1476	229.3586	355.6032	501.2826	610.0796	625.2359	594.7842	511.8224	406.4000	265.3101	152.0969	103.9713	(83)
Total gains	582.5274	697.3190	805.0862	935.1003	1022.8372	1020.5503	975.6951	893.6784	799.3377	674.4203	585.2471	553.2655	(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	48.1843	48.2739	48.3620	48.7805	48.8596	49.2312	49.2312	49.3006	49.0874	48.8596	48.6998	48.5340	
alpha	4.2123	4.2183	4.2241	4.2520	4.2573	4.2821	4.2821	4.2867	4.2725	4.2573	4.2467	4.2356	
util living area													
	0.9895	0.9774	0.9489	0.8691	0.7252	0.5426	0.4011	0.4537	0.6987	0.9177	0.9793	0.9915	(86)
MIT	19.4686	19.7280	20.0973	20.5404	20.8361	20.9633	20.9920	20.9866	20.8960	20.4800	19.8929	19.4245	(87)
Th 2	19.7206	19.7227	19.7247	19.7342	19.7359	19.7442	19.7442	19.7457	19.7410	19.7359	19.7323	19.7286	(88)
util rest of house													
	0.9860	0.9701	0.9325	0.8301	0.6548	0.4455	0.2893	0.3347	0.6004	0.8831	0.9713	0.9886	(89)
MIT 2	17.9923	18.3202	18.7788	19.3056	19.6134	19.7262	19.7421	19.7418	19.6798	19.2562	18.5388	17.9417	(90)
Living area fraction										fLA = Living area / (4) =		0.4875	(91)
MIT	18.7120	19.0065	19.4216	19.9076	20.2094	20.3293	20.3514	20.3487	20.2727	19.8528	19.1989	18.6646	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7120	19.0065	19.4216	19.9076	20.2094	20.3293	20.3514	20.3487	20.2727	19.8528	19.1989	18.6646	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9822	0.9648	0.9278	0.8361	0.6827	0.4919	0.3440	0.3929	0.6444	0.8869	0.9669	0.9853	(94)
Useful gains	572.1855	672.7755	746.9460	781.7917	698.2860	502.0047	335.6048	351.1093	515.1235	598.1590	565.8657	545.1392	(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													
	1326.6150	1296.0866	1185.0476	1000.8551	772.4618	516.1641	337.9718	355.2427	557.7376	839.9443	1101.9082	1321.8594	(97)
Space heating kWh													
	561.2955	418.8651	325.9476	157.7257	55.1869	0.0000	0.0000	0.0000	0.0000	179.8883	385.9506	577.8798	(98a)
Space heating requirement - total per year (kWh/year)												2662.7394	
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													
	561.2955	418.8651	325.9476	157.7257	55.1869	0.0000	0.0000	0.0000	0.0000	179.8883	385.9506	577.8798	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2662.7394	
Space heating per m2											(98c) / (4) =	42.1186	(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													
	561.2955	418.8651	325.9476	157.7257	55.1869	0.0000	0.0000	0.0000	0.0000	179.8883	385.9506	577.8798	(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)													
	608.1208	453.8083	353.1393	170.8837	59.7907	0.0000	0.0000	0.0000	0.0000	194.8952	418.1480	626.0887	(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													
	188.6206	166.8175	177.6574	157.7095	153.7996	139.6282	138.7621	143.8217	144.8595	160.2405	168.7362	186.8002	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.3505	86.0362	85.4022	84.0600	81.9945	79.8000	79.8000	79.8000	79.8000	84.3198	85.8545	86.4191	(217)
Fuel for water heating, kWh/month													
	218.4361	193.8921	208.0245	187.6153	187.5732	174.9727	173.8873	180.2277	181.5282	190.0390	196.5374	216.1562	(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	18.9678	15.2167	13.7010	10.0379	7.7536	6.3347	7.0731	9.1938	11.9419	15.6684	17.6974	19.4950	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-49.4928	-65.3855	-88.1850	-92.9041	-95.3001	-87.3413	-86.2873	-83.7679	-78.7250	-71.6863	-52.8412	-43.3292	(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	-43.0738	-88.3051	-171.4210	-251.7733	-327.6003	-327.2132	-323.3080	-276.0664	-205.5491	-124.2121	-56.8048	-34.2342	(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	2884.8748	(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	2308.8897	(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)	153.0814	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3124.8069	(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	2308.0390	(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	2884.8748	0.2100	605.8237	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2308.8897	0.2100	484.8668	(264)
Space and water heating			1090.6905	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	153.0814	0.1443	22.0944	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-895.2457	0.1360	-121.7225	
PV Unit electricity exported	-2229.5612	0.1266	-282.1998	
Total			-403.9223	(269)
Total CO2, kg/year			720.7919	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.4000	(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	2884.8748	1.1300	3259.9085	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2308.8897	1.1300	2609.0453	(278)
Space and water heating			5868.9539	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	153.0814	1.5338	234.8014	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-895.2457	1.5026	-1345.1785	
PV Unit electricity exported	-2229.5612	0.4646	-1035.9349	
Total			-2381.1134	(283)
Total Primary energy kWh/year			3852.7426	(286)
Target Primary Energy Rate (TPER)			60.9400	(287)

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

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling							
Ground floor		63.2200	(1b)	x 2.6000	(2b) =	164.3720	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.2200						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		164.3720	(5)

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2. Ventilation rate

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	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	2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1217	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3217	(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) =	0.2734	(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	0.3486	0.3418	0.3349	0.3008	0.2939	0.2598	0.2598	0.2529	0.2734	0.2939	0.3076	0.3213	(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	0.5608	0.5584	0.5561	0.5452	0.5432	0.5337	0.5337	0.5320	0.5374	0.5432	0.5473	0.5516	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Door			1.9700	1.1000	2.1670			(26)
Windows			16.3100	1.1450	18.6756			(27)
Rooflight			6.8000	1.1450	7.7863			(27a)
Heatloss Floor 1			63.2200	0.0900	5.6898	110.0000	6954.2000	(28a)
External Wall 1	76.4400	18.2800	58.1600	0.1500	8.7240	110.0000	6397.6000	(29a)
External Roof 1	63.2200	6.8000	56.4200	0.0900	5.0778	9.0000	507.7800	(30)
Total net area of external elements Aum(A, m2)			202.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.1204			(33)
Main dwelling								
Party Wall 1			14.6600	0.0000	0.0000	110.0000	1612.6000	(32)
Internal Wall 1			55.0000			9.0000	495.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	15967.1800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		252.5653 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.5000	0.2300	2.4150
E3 Sill	9.5600	0.0190	0.1816
E4 Jamb	24.3000	0.0160	0.3888
E5 Ground floor (normal)	29.6200	0.0940	2.7843
R11 Upstands or kerbs of rooflights	19.3800	0.2400	4.6512
E14 Flat roof	29.6200	0.1600	4.7392
E16 Corner (normal)	7.8000	0.0510	0.3978
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0700	-0.1820
E18 Party wall between dwellings	5.2000	0.0400	0.2080
P1 Party wall - Ground floor	5.6100	0.0680	0.3815
P4 Party wall - Roof (insulation at ceiling level)	5.6100	0.0910	0.5105

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		16.4759 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	64.5963 (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	30.4175	30.2895	30.1641	29.5748	29.4645	28.9513	28.9513	28.8563	29.1490	29.4645	29.6876	29.9208	(38)
Heat transfer coeff	95.0139	94.8859	94.7604	94.1711	94.0609	93.5476	93.5476	93.4526	93.7453	94.0609	94.2839	94.5171	(39)
Average = Sum(39)m / 12 =												94.1706	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5029	1.5009	1.4989	1.4896	1.4878	1.4797	1.4797	1.4782	1.4828	1.4878	1.4914	1.4951	(40)
HLP (average)												1.4896	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.0711 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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

25.4713	25.0930	24.5603	23.5781	22.8426	22.0271	21.5866	22.1156	22.6915	23.5642	24.5666	25.3852	(42b)

Hot water usage for other uses

35.8397	34.5365	33.2332	31.9299	30.6267	29.3234	29.3234	30.6267	31.9299	33.2332	34.5365	35.8397	(42c)

Average daily hot water use (litres/day)		56.1975 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	61.3110	59.6295	57.7935	55.5080	53.4693	51.3505	50.9100	52.7422	54.6215	56.7974	59.1031	61.2249	(44)
Energy conte	97.1016	84.9115	88.8264	75.9877	71.9799	63.1414	61.5712	65.3059	67.3537	77.0735	84.2031	95.8634	(45)
Energy content (annual)										Total = Sum(45)m =		933.3196	
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													
	82.5364	72.1748	75.5025	64.5895	61.1829	53.6702	52.3356	55.5100	57.2507	65.5125	71.5727	81.4839	(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													
	82.5364	72.1748	75.5025	64.5895	61.1829	53.6702	52.3356	55.5100	57.2507	65.5125	71.5727	81.4839	(64)
											Total per year (kWh/year) = Sum(64)m =	793.3216	(64)
12Total per year (kWh/year)												793	(64)
Electric shower(s)													
	47.2047	42.0598	45.9277	43.8282	44.6506	42.5924	44.0121	44.6506	43.8282	45.9277	45.0640	47.2047	(64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	536.9506	(64a)
Heat gains from water heating, kWh/month													
	32.4353	28.5586	30.3575	27.1044	26.4584	24.0656	24.0869	25.0402	25.2697	27.8600	29.1592	32.1721	(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	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	91.2880	101.0689	91.2880	94.3310	91.2880	94.3310	91.2880	91.2880	94.3310	91.2880	94.3310	91.2880	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	180.9887	182.8668	178.1341	168.0586	155.3402	143.3866	135.4009	133.5228	138.2556	148.3310	161.0495	173.0030	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	(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)													
	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	(71)
Water heating gains (Table 5)													
	43.5958	42.4980	40.8031	37.6450	35.5624	33.4245	32.3749	33.6561	35.0968	37.4463	40.4989	43.2421	(72)
Total internal gains													
	369.9384	380.4996	364.2911	354.1005	336.2565	325.2080	313.1297	312.5329	321.7493	331.1312	349.9452	361.5991	(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	
North	7.2800	10.6334	0.6300	0.7000	0.7700	23.6578	(74)
South	4.2800	46.7521	0.6300	0.7000	0.7700	61.1528	(78)
West	4.7500	19.6403	0.6300	0.7000	0.7700	28.5110	(80)
South	6.8000	34.8864	0.6300	0.7000	1.0000	94.1556	(82)

Solar gains	207.4773	383.3013	594.2628	837.6852	1019.4685	1044.7842	993.9032	855.2885	679.1423	443.3786	254.1856	173.7590	(83)
Total gains	577.4157	763.8009	958.5540	1191.7857	1355.7250	1369.9922	1307.0330	1167.8214	1000.8915	774.5099	604.1308	535.3581	(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	46.6809	46.7438	46.8057	47.0986	47.1538	47.4125	47.4125	47.4607	47.3125	47.1538	47.0423	46.9262	
alpha	4.1121	4.1163	4.1204	4.1399	4.1436	4.1608	4.1608	4.1640	4.1542	4.1436	4.1362	4.1284	
util living area													
	0.9900	0.9703	0.9185	0.7870	0.6036	0.4290	0.3132	0.3645	0.6046	0.8868	0.9777	0.9925	(86)
MIT	19.3950	19.7559	20.2191	20.6805	20.9105	20.9827	20.9963	20.9932	20.9338	20.5381	19.8595	19.3272	(87)
Th 2	19.6853	19.6868	19.6883	19.6953	19.6966	19.7027	19.7027	19.7039	19.7004	19.6966	19.6940	19.6912	(88)
util rest of house													
	0.9866	0.9610	0.8949	0.7367	0.5322	0.3456	0.2217	0.2636	0.5068	0.8435	0.9690	0.9900	(89)
MIT 2	18.2747	18.6286	19.0682	19.4757	19.6481	19.6966	19.7021	19.7025	19.6722	19.3759	18.7403	18.2121	(90)
Living area fraction											fLA = Living area / (4) =	0.4875	(91)
MIT	18.8208	19.1782	19.6292	20.0631	20.2635	20.3236	20.3330	20.3317	20.2873	19.9425	19.2859	18.7557	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8208	19.1782	19.6292	20.0631	20.2635	20.3236	20.3330	20.3317	20.2873	19.9425	19.2859	18.7557	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9836	0.9565	0.8936	0.7519	0.5642	0.3860	0.2664	0.3129	0.5526	0.8528	0.9655	0.9875	(94)
Useful gains	567.9628	730.5380	856.5931	896.0985	764.9008	528.8310	348.1599	365.3830	553.1222	660.5327	583.2999	528.6623	(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													
	1379.6813	1354.7964	1244.1309	1051.2381	805.4930	535.4252	349.2157	367.4296	580.0271	878.7596	1148.9331	1375.7667	(97)
Space heating kWh													
	603.9185	419.5017	288.3281	111.7005	30.2006	0.0000	0.0000	0.0000	0.0000	162.3608	407.2559	630.2457	(98a)
Space heating requirement - total per year (kWh/year)												2653.5119	
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													
	603.9185	419.5017	288.3281	111.7005	30.2006	0.0000	0.0000	0.0000	0.0000	162.3608	407.2559	630.2457	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2653.5119	
Space heating per m2											(98c) / (4) =	41.9727	(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	879.3478	692.2526	710.2397	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9495	0.9727	0.9576	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	834.9010	673.3748	680.1305	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1473.9558	1406.8345	1258.9920	0.0000	0.0000	0.0000	0.0000	(103)

Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	460.1194	545.6940	430.6730	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	115.0299	136.4235	107.6682	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												359.1216	(107)
Energy for space heating												41.9727	(99)
Energy for space cooling												5.6805	(108)
Total												47.6532	(109)
Fabric Energy Efficiency (DFEE)												47.7	(109)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	63.2200	(1b)	x 2.6000	(2b) =	164.3720	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.2200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	164.3720	(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	2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1217	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3717	(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) =	0.3159	(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													
	0.4028	0.3949	0.3870	0.3475	0.3396	0.3001	0.3001	0.2922	0.3159	0.3396	0.3554	0.3712	(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	0.5811	0.5780	0.5749	0.5604	0.5577	0.5450	0.5450	0.5427	0.5499	0.5577	0.5632	0.5689	(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								
TER Opaque door			1.9700	1.0000	1.9700			(26)
TER Opening Type			9.7600	1.1450	11.1756			(27)
TER Roof Light			4.0700	1.5918	8.2298			(27a)
Heatloss Floor 1			63.2200	0.1300	8.2186			(28a)
External Wall 1	76.4400	11.7300	64.7100	0.1800	11.6478			(29a)
External Roof 1	63.2200	4.0700	59.1500	0.1100	6.5065			(30)
Total net area of external elements Aum(A, m2)			202.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.7483			(33)
Main dwelling								
Party Wall 1			14.6600	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	252.5653	(35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	10.5000	0.0500	0.5250	
E3 Sill	9.5600	0.0500	0.4780	
E4 Jamb	24.3000	0.0500	1.2150	
E5 Ground floor (normal)	29.6200	0.1600	4.7392	
R11 Upstands or kerbs of rooflights	19.3800	0.0800	1.5504	
E14 Flat roof	29.6200	0.0800	2.3696	
E16 Corner (normal)	7.8000	0.0900	0.7020	
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0900	-0.2340	
E18 Party wall between dwellings	5.2000	0.0600	0.3120	
P1 Party wall - Ground floor	5.6100	0.0800	0.4488	
P4 Party wall - Roof (insulation at ceiling level)	5.6100	0.1200	0.6732	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.7792	(36)
Point Thermal bridges	(36a) = 0.0000	
Total fabric heat loss	(33) + (36) + (36a) = 60.5275	(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	31.5218	31.3510	31.1835	30.3968	30.2496	29.5644	29.5644	29.4375	29.8283	30.2496	30.5473	30.8586	(38)
Heat transfer coeff	92.0493	91.8784	91.7109	90.9242	90.7770	90.0918	90.0918	89.9649	90.3558	90.7770	91.0748	91.3861	(39)
Average = Sum(39)m / 12 =												90.9235	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4560	1.4533	1.4507	1.4382	1.4359	1.4251	1.4251	1.4230	1.4292	1.4359	1.4406	1.4455	(40)
HLP (average)												1.4382	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0711 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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

25.4713	25.0930	24.5603	23.5781	22.8426	22.0271	21.5866	22.1156	22.6915	23.5642	24.5666	25.3852	(42b)

Hot water usage for other uses

35.8397	34.5365	33.2332	31.9299	30.6267	29.3234	29.3234	30.6267	31.9299	33.2332	34.5365	35.8397	(42c)

Average daily hot water use (litres/day) 56.1975 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	61.3110	59.6295	57.7935	55.5080	53.4693	51.3505	50.9100	52.7422	54.6215	56.7974	59.1031	61.2249	(44)
Energy conte	97.1016	84.9115	88.8264	75.9877	71.9799	63.1414	61.5712	65.3059	67.3537	77.0735	84.2031	95.8634	(45)
Energy content (annual)										Total = Sum(45)m =		933.3196	

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

82.5364	72.1748	75.5025	64.5895	61.1829	53.6702	52.3356	55.5100	57.2507	65.5125	71.5727	81.4839	(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

82.5364	72.1748	75.5025	64.5895	61.1829	53.6702	52.3356	55.5100	57.2507	65.5125	71.5727	81.4839	(64)
									Total per year (kWh/year) = Sum(64)m =		793.3216	(64)
12Total per year (kWh/year)											793	(64)

Electric shower(s)

47.2047	42.0598	45.9277	43.8282	44.6506	42.5924	44.0121	44.6506	43.8282	45.9277	45.0640	47.2047	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											536.9506	(64a)

Heat gains from water heating, kWh/month

32.4353	28.5586	30.3575	27.1044	26.4584	24.0656	24.0869	25.0402	25.2697	27.8600	29.1592	32.1721	(65)

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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	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	91.2880	101.0689	91.2880	94.3310	91.2880	94.3310	91.2880	91.2880	94.3310	91.2880	94.3310	91.2880	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	180.9887	182.8668	178.1341	168.0586	155.3402	143.3866	135.4009	133.5228	138.2556	148.3310	161.0495	173.0030	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	(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)	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	(71)
Water heating gains (Table 5)	43.5958	42.4980	40.8031	37.6450	35.5624	33.4245	32.3749	33.6561	35.0968	37.4463	40.4989	43.2421	(72)
Total internal gains	369.9384	380.4996	364.2911	354.1005	336.2565	325.2080	313.1297	312.5329	321.7493	331.1312	349.9452	361.5991	(73)

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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	
North	4.3600	10.6334	0.6300	0.7000	0.7700	14.1687	(74)
South	2.5600	46.7521	0.6300	0.7000	0.7700	36.5774	(78)
West	2.8400	19.6403	0.6300	0.7000	0.7700	17.0466	(80)
South	4.0700	34.8864	0.6300	0.7000	1.0000	56.3549	(82)

Solar gains	124.1476	229.3586	355.6032	501.2826	610.0796	625.2359	594.7842	511.8224	406.4000	265.3101	152.0969	103.9713	(83)
Total gains	494.0860	609.8582	719.8943	855.3831	946.3361	950.4439	907.9139	824.3553	728.1493	596.4413	502.0421	465.5703	(84)

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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	48.1843	48.2739	48.3620	48.7805	48.8596	49.2312	49.2312	49.3006	49.0874	48.8596	48.6998	48.5340	
alpha	4.2123	4.2183	4.2241	4.2520	4.2573	4.2821	4.2821	4.2867	4.2725	4.2573	4.2467	4.2356	
util living area	0.9943	0.9859	0.9642	0.8959	0.7609	0.5764	0.4294	0.4886	0.7427	0.9428	0.9880	0.9955	(86)
MIT	19.3329	19.5999	19.9859	20.4663	20.8015	20.9540	20.9896	20.9823	20.8677	20.3894	19.7696	19.2886	(87)

Th 2	19.7206	19.7227	19.7247	19.7342	19.7359	19.7442	19.7442	19.7457	19.7410	19.7359	19.7323	19.7286	(88)
util rest of house	0.9923	0.9811	0.9520	0.8620	0.6926	0.4758	0.3105	0.3620	0.6460	0.9162	0.9831	0.9940	(89)
MIT 2	18.2397	18.5051	18.8831	19.3381	19.6175	19.7262	19.7420	19.7416	19.6781	19.2835	18.6825	18.2016	(90)
Living area fraction										fLA = Living area / (4) =		0.4875	(91)
MIT	18.7726	19.0389	19.4207	19.8881	20.1947	20.3247	20.3502	20.3465	20.2580	19.8226	19.2125	18.7316	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7726	19.0389	19.4207	19.8881	20.1947	20.3247	20.3502	20.3465	20.2580	19.8226	19.2125	18.7316	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9903	0.9777	0.9484	0.8667	0.7191	0.5238	0.3687	0.4240	0.6888	0.9184	0.9804	0.9923	(94)
Useful gains	489.2941	596.2703	682.7228	741.3807	680.5357	497.8296	334.7693	349.5161	501.5441	547.7606	492.2202	461.9874	(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	1332.1957	1299.0553	1184.9725	999.0870	771.1227	515.7528	337.8642	355.0431	556.4115	837.2016	1103.1436	1327.9817	(97)
Space heating kWh	627.1187	472.2715	373.6737	185.5486	67.3967	0.0000	0.0000	0.0000	0.0000	215.3441	439.8649	644.2998	(98a)
Space heating requirement - total per year (kWh/year)												3025.5181	
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	627.1187	472.2715	373.6737	185.5486	67.3967	0.0000	0.0000	0.0000	0.0000	215.3441	439.8649	644.2998	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3025.5181	
Space heating per m2											(98c) / (4) =	47.8570	(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	846.8633	666.6796	683.7336	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8780	0.9285	0.8998	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	743.5633	619.0050	615.2419	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1021.1366	976.0167	887.9603	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	199.8528	265.6167	202.9025	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	49.9632	66.4042	50.7256	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												167.0930	(107)
Energy for space heating												47.8570	(99)
Energy for space cooling												2.6430	(108)
Total												50.5000	(109)
Fabric Energy Efficiency (TFEE)												50.5	(109)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	63.2200	(1b)	x 2.6000	(2b) =	164.3720	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.2200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		164.3720	(5)

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2. Ventilation rate

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	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	0 * 10 =	0.0000 (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) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.2000 (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) =	0.1700 (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													
	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(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	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Door			1.9700	1.1000	2.1670			(26)
Windows			16.3100	1.1450	18.6756			(27)
Rooflight			6.8000	1.1450	7.7863			(27a)
Heatloss Floor 1			63.2200	0.0900	5.6898	110.0000	6954.2000	(28a)
External Wall 1	76.4400	18.2800	58.1600	0.1500	8.7240	110.0000	6397.6000	(29a)
External Roof 1	63.2200	6.8000	56.4200	0.0900	5.0778	9.0000	507.7800	(30)
Total net area of external elements Aum(A, m2)			202.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.1204			(33)
Main dwelling								
Party Wall 1			14.6600	0.0000	0.0000	110.0000	1612.6000	(32)
Internal Wall 1			55.0000			9.0000	495.0000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 15967.1800 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 252.5653 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.5000	0.2300	2.4150
E3 Sill	9.5600	0.0190	0.1816
E4 Jamb	24.3000	0.0160	0.3888
E5 Ground floor (normal)	29.6200	0.0940	2.7843
R11 Upstands or kerbs of rooflights	19.3800	0.2400	4.6512
E14 Flat roof	29.6200	0.1600	4.7392
E16 Corner (normal)	7.8000	0.0510	0.3978
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0700	-0.1820
E18 Party wall between dwellings	5.2000	0.0400	0.2080
P1 Party wall - Ground floor	5.6100	0.0680	0.3815
P4 Party wall - Roof (insulation at ceiling level)	5.6100	0.0910	0.5105

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.4759 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 64.5963 (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	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	(38)
Heat transfer coeff													
	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	(39)
Average = Sum(39)m / 12 =												91.7177	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	(40)
HLP (average)												1.4508	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0711 (42)

Hot water usage for mixer showers

75.6831	74.5457	72.8883	69.7172	67.3771	64.7673	63.2839	64.9288	66.7318	69.5339	72.7731	75.3931	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

35.8397	34.5365	33.2332	31.9299	30.6267	29.3234	29.3234	30.6267	31.9299	33.2332	34.5365	35.8397	(42c)

Average daily hot water use (litres/day) 102.3588 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	111.5228	109.0822	106.1215	101.6472	98.0037	94.0907	92.6074	95.5554	98.6617	102.7671	107.3095	111.2328	(44)
Energy conte	176.6248	155.3315	163.1048	139.1499	131.9319	115.6955	112.0006	118.3176	121.6598	139.4540	152.8821	174.1637	(45)
Energy content (annual)										Total = Sum(45)m =		1700.3162	
Distribution loss (46)m = 0.15 x (45)m													
	26.4937	23.2997	24.4657	20.8725	19.7898	17.3543	16.8001	17.7476	18.2490	20.9181	22.9323	26.1246	(46)

Water storage loss (or HIU loss):

Store volume 201.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.6100 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.8694 (55)

Total storage loss

26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)

If cylinder contains dedicated solar storage

26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(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

203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(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													
203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(64)

Total per year (kWh/year) = Sum(64)m = 2017.6472 (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

58.7278	51.6477	54.2324	46.2673	43.8673	38.4688	37.2402	39.3406	40.4519	46.3684	50.8333	57.9094	(65)

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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	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.9156	18.5770	15.1078	11.4376	8.5497	7.2181	7.7994	10.1379	13.6071	17.2773	20.1652	21.4969	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	270.1324	272.9355	265.8717	250.8338	231.8510	214.0099	202.0909	199.2878	206.3516	221.3896	240.3723	258.2135	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	(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)													
	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	(71)
Water heating gains (Table 5)													
	78.9352	76.8567	72.8929	64.2602	58.9615	53.4288	50.0540	52.8772	56.1832	62.3232	70.6018	77.8353	(72)
Total internal gains													
	460.9017	459.2879	444.7912	417.4502	390.2809	365.5754	350.8629	353.2215	367.0605	391.9087	422.0579	448.4642	(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	
North	7.2800	10.6334	0.6300	0.7000	0.7700	23.6578	(74)
South	4.2800	46.7521	0.6300	0.7000	0.7700	61.1528	(78)
West	4.7500	19.6403	0.6300	0.7000	0.7700	28.5110	(80)
South	6.8000	34.8864	0.6300	0.7000	1.0000	94.1556	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	207.4773	383.3013	594.2628	837.6852	1019.4685	1044.7842	993.9032	855.2885	679.1423	443.3786	254.1856	173.7590	(83)
Total gains	668.3790	842.5892	1039.0540	1255.1353	1409.7494	1410.3597	1344.7662	1208.5100	1046.2028	835.2873	676.2435	622.2232	(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	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	
alpha	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	
util living area													
	0.9828	0.9576	0.8936	0.7558	0.5742	0.4101	0.2988	0.3464	0.5741	0.8581	0.9665	0.9869	(86)
MIT	19.6044	19.9315	20.3596	20.7430	20.9306	20.9864	20.9972	20.9948	20.9486	20.6218	20.0089	19.5216	(87)
Th 2	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	(88)
util rest of house													
	0.9773	0.9451	0.8655	0.7040	0.5055	0.3311	0.2129	0.2518	0.4802	0.8093	0.9543	0.9827	(89)
MIT 2	18.1658	18.5714	19.0826	19.5012	19.6768	19.7184	19.7240	19.7232	19.6969	19.3953	18.6754	18.0616	(90)
Living area fraction									fLA = Living area / (4) =			0.4875	(91)
MIT	18.8672	19.2345	19.7051	20.1066	20.2880	20.3366	20.3447	20.3431	20.3071	19.9932	19.3255	18.7733	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8672	19.2345	19.7051	20.1066	20.2880	20.3366	20.3447	20.3431	20.3071	19.9932	19.3255	18.7733	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9725	0.9392	0.8650	0.7205	0.5366	0.3694	0.2548	0.2980	0.5244	0.8209	0.9495	0.9785	(94)
Useful gains	649.9709	791.3690	898.7839	904.2807	756.4463	520.9904	342.6500	360.1021	548.5824	685.6580	642.1045	608.8158	(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													
	1336.0664	1314.7240	1211.1442	1027.8400	787.6738	526.1436	343.4523	361.6563	569.3009	861.5268	1121.2960	1336.6317	(97)
Space heating kWh													
	510.4550	351.6946	232.3960	88.9627	23.2332	0.0000	0.0000	0.0000	0.0000	130.8464	345.0179	541.4951	(98a)
Space heating requirement - total per year (kWh/year)												2224.1010	
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													
	510.4550	351.6946	232.3960	88.9627	23.2332	0.0000	0.0000	0.0000	0.0000	130.8464	345.0179	541.4951	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2224.1010	
Space heating per m2											(98c) / (4) =	35.1803	(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)
Fraction of main heating from main system 2	0.0000	(203)
Fraction of total heating from main system 1	1.0000	(204)
Fraction of total heating from main system 2	0.0000	(205)
Efficiency of main space heating system 1 (in %)	100.0000	(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													
	510.4550	351.6946	232.3960	88.9627	23.2332	0.0000	0.0000	0.0000	0.0000	130.8464	345.0179	541.4951	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	510.4550	351.6946	232.3960	88.9627	23.2332	0.0000	0.0000	0.0000	0.0000	130.8464	345.0179	541.4951	(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)
Space heating fuel used, main system 2												0.0000	(213)

Water heating
Water heating requirement

	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151 (64)
Efficiency of water heater												348.7264 (216)
(217)m	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264 (217)
Fuel for water heating, kWh/month												
	58.3771	51.5231	54.5001	47.3815	45.5610	40.6558	39.8456	41.6570	42.3661	47.7180	51.3193	57.6713 (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	34.0633	30.7668	34.0633	32.9645	34.0633	32.9645	34.0633	34.0633	32.9645	34.0633	32.9645	34.0633 (231)
Lighting	18.3073	14.6868	13.2238	9.6883	7.4835	6.1141	6.8267	8.8737	11.5260	15.1227	17.0811	18.8161 (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	2224.1010 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	348.7264
Water heating fuel used	578.5760 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(MEVDecentralised, Table 4g: in-use factor = 2.5000, SFP = 2.0000)	
mechanical ventilation fans (SFP = 2.0000)	401.0677 (230a)
Total electricity for the above, kWh/year	401.0677 (231)
Electricity for lighting (calculated in Appendix L)	147.7501 (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	3351.4948 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2224.1010	16.4900	366.7542	(240)
Space heating - main system 2	0.0000	16.4900	0.0000	(241)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	578.5760	16.4900	95.4072	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	401.0677	16.4900	66.1361	(249)
Energy for lighting	147.7501	16.4900	24.3640	(250)
Additional standing charges			0.0000	(251)
Total energy cost			552.6615	(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] =	1.8385 (257)
SAP value		70.1986
SAP rating (Section 12)		70 (258)
SAP band		C

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	2224.1010	0.1569	348.9769	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	578.5760	0.1411	81.6624	(264)
Space and water heating			430.6393	(265)
Pumps, fans and electric keep-hot	401.0677	0.1387	55.6330	(267)
Energy for lighting	147.7501	0.1443	21.3249	(268)
Total CO2, kg/year			507.5972	(272)
CO2 emissions per m2			8.0300	(273)
EI value			93.7148	
EI rating			94	(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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	63.2200	(1b)	x 2.6000	(2b) =	164.3720	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.2200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	164.3720	(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	0 * 10 =	0.0000 (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) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.2000 (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) =	0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.2210	0.2210	0.2125	0.1870	0.1827	0.1658	0.1573	0.1573	0.1742	0.1955	0.2040	0.1998	(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	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(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			1.9700	1.1000	2.1670			(26)
Windows			16.3100	1.1450	18.6756			(27)
Rooflight			6.8000	1.1450	7.7863			(27a)
Heatloss Floor 1			63.2200	0.0900	5.6898	110.0000	6954.2000	(28a)
External Wall 1	76.4400	18.2800	58.1600	0.1500	8.7240	110.0000	6397.6000	(29a)
External Roof 1	63.2200	6.8000	56.4200	0.0900	5.0778	9.0000	507.7800	(30)
Total net area of external elements Aum(A, m2)			202.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.1204			(33)
Main dwelling								
Party Wall 1			14.6600	0.0000	0.0000	110.0000	1612.6000	(32)
Internal Wall 1			55.0000			9.0000	495.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	15967.1800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		252.5653 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.5000	0.2300	2.4150
E3 Sill	9.5600	0.0190	0.1816
E4 Jamb	24.3000	0.0160	0.3888
E5 Ground floor (normal)	29.6200	0.0940	2.7843
R11 Upstands or kerbs of rooflights	19.3800	0.2400	4.6512
E14 Flat roof	29.6200	0.1600	4.7392
E16 Corner (normal)	7.8000	0.0510	0.3978
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0700	-0.1820
E18 Party wall between dwellings	5.2000	0.0400	0.2080
P1 Party wall - Ground floor	5.6100	0.0680	0.3815
P4 Party wall - Roof (insulation at ceiling level)	5.6100	0.0910	0.5105

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		16.4759 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	64.5963 (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	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	(38)
Heat transfer coeff	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	(39)
Average = Sum(39)m / 12 =												91.7177	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	(40)
HLP (average)												1.4508	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.0711 (42)
Hot water usage for mixer showers		

	75.6831	74.5457	72.8883	69.7172	67.3771	64.7673	63.2839	64.9288	66.7318	69.5339	72.7731	75.3931	(42a)
Hot water usage for baths													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses													
	35.8397	34.5365	33.2332	31.9299	30.6267	29.3234	29.3234	30.6267	31.9299	33.2332	34.5365	35.8397	(42c)
Average daily hot water use (litres/day)												102.3588	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	111.5228	109.0822	106.1215	101.6472	98.0037	94.0907	92.6074	95.5554	98.6617	102.7671	107.3095	111.2328	(44)
Energy conte	176.6248	155.3315	163.1048	139.1499	131.9319	115.6955	112.0006	118.3176	121.6598	139.4540	152.8821	174.1637	(45)
Energy content (annual)										Total = Sum(45)m =		1700.3162	
Distribution loss (46)m = 0.15 x (45)m													
	26.4937	23.2997	24.4657	20.8725	19.7898	17.3543	16.8001	17.7476	18.2490	20.9181	22.9323	26.1246	(46)
Water storage loss (or HIU loss):													
Store volume												201.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8694	(55)
Total storage loss													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(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													
	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(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													
	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(64)
										Total per year (kWh/year) = Sum(64)m =		2017.6472	(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													
	58.7278	51.6477	54.2324	46.2673	43.8673	38.4688	37.2402	39.3406	40.4519	46.3684	50.8333	57.9094	(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	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.9156	18.5770	15.1078	11.4376	8.5497	7.2181	7.7994	10.1379	13.6071	17.2773	20.1652	21.4969	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	270.1324	272.9355	265.8717	250.8338	231.8510	214.0099	202.0909	199.2878	206.3516	221.3896	240.3723	258.2135	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	(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)													
	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	(71)
Water heating gains (Table 5)													
	78.9352	76.8567	72.8929	64.2602	58.9615	53.4288	50.0540	52.8772	56.1832	62.3232	70.6018	77.8353	(72)
Total internal gains													
	460.9017	459.2879	444.7912	417.4502	390.2809	365.5754	350.8629	353.2215	367.0605	391.9087	422.0579	448.4642	(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	
North	7.2800	9.5462	0.6300	0.7000	0.7700	21.2390	(74)
South	4.2800	42.7195	0.6300	0.7000	0.7700	55.8782	(78)
West	4.7500	17.5237	0.6300	0.7000	0.7700	25.4385	(80)
South	6.8000	31.1868	0.6300	0.7000	1.0000	84.1708	(82)

Solar gains	186.7264	367.6620	595.2049	883.7008	1067.1843	1064.4337	1024.5339	855.4025	674.2843	422.5207	234.9927	159.9995	(83)
Total gains	647.6282	826.9499	1039.9960	1301.1510	1457.4652	1430.0091	1375.3968	1208.6240	1041.3448	814.4294	657.0507	608.4637	(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	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	
alpha	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	
util living area													
	0.9859	0.9645	0.9093	0.7751	0.6074	0.4865	0.4013	0.4600	0.6601	0.8919	0.9730	0.9892	(86)
MIT	19.5165	19.8290	20.2553	20.6921	20.9052	20.9686	20.9880	20.9797	20.8969	20.5055	19.9129	19.4289	(87)
Th 2	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	(88)
util rest of house													
	0.9814	0.9542	0.8858	0.7287	0.5442	0.4123	0.3199	0.3700	0.5780	0.8542	0.9632	0.9857	(89)
MIT 2	18.0546	18.4440	18.9584	19.4456	19.6538	19.7065	19.7195	19.7155	19.6567	19.2666	18.5560	17.9438	(90)
Living area fraction										fLA = Living area / (4) =		0.4875	(91)
MIT	18.7673	19.1191	19.5907	20.0532	20.2639	20.3217	20.3379	20.3318	20.2613	19.8705	19.2175	18.6678	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7673	19.1191	19.5907	20.0532	20.2639	20.3217	20.3379	20.3318	20.2613	19.8705	19.2175	18.6678	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9769	0.9481	0.8829	0.7414	0.5717	0.4476	0.3594	0.4135	0.6141	0.8591	0.9583	0.9818	(94)

Useful gains	632.6772	784.0494	918.2350	964.7179	833.1780	640.0090	494.3516	499.7571	639.4976	699.7074	629.6259	597.4095	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	1363.5955	1359.1782	1283.1932	1114.6671	877.1791	653.1897	498.7536	507.3658	684.3301	932.8193	1157.2499	1372.8102	(97)
Space heating kWh													
	543.8032	386.4865	271.5289	107.9634	32.7368	0.0000	0.0000	0.0000	0.0000	173.4352	379.8892	576.8981	(98a)
Space heating requirement - total per year (kWh/year)												2472.7414	
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													
	543.8032	386.4865	271.5289	107.9634	32.7368	0.0000	0.0000	0.0000	0.0000	173.4352	379.8892	576.8981	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2472.7414	
Space heating per m2											(98c) / (4) =	39.1133	(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)
Fraction of main heating from main system 2												0.0000	(203)
Fraction of total heating from main system 1												1.0000	(204)
Fraction of total heating from main system 2												0.0000	(205)
Efficiency of main space heating system 1 (in %)												100.0000	(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													
	543.8032	386.4865	271.5289	107.9634	32.7368	0.0000	0.0000	0.0000	0.0000	173.4352	379.8892	576.8981	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	543.8032	386.4865	271.5289	107.9634	32.7368	0.0000	0.0000	0.0000	0.0000	173.4352	379.8892	576.8981	(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)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement													
	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(64)
Efficiency of water heater												348.7264	(216)
(217)m	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	(217)
Fuel for water heating, kWh/month													
	58.3771	51.5231	54.5001	47.3815	45.5610	40.6558	39.8456	41.6570	42.3661	47.7180	51.3193	57.6713	(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	34.0633	30.7668	34.0633	32.9645	34.0633	32.9645	34.0633	34.0633	32.9645	34.0633	32.9645	34.0633	(231)
Lighting	18.3073	14.6868	13.2238	9.6883	7.4835	6.1141	6.8267	8.8737	11.5260	15.1227	17.0811	18.8161	(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												2472.7414	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												348.7264	
Water heating fuel used												578.5760	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVDecentralised, Table 4g: in-use factor = 2.5000, SFP = 2.0000)													
mechanical ventilation fans (SFP = 2.0000)												401.0677	(230a)
Total electricity for the above, kWh/year												401.0677	(231)
Electricity for lighting (calculated in Appendix L)												147.7501	(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												3600.1353	(238)

10a. Fuel costs - using BEDF prices (596)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2472.7414	27.6700	684.2076	(240)
Space heating - main system 2	0.0000	27.6700	0.0000	(241)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	578.5760	27.6700	160.0920	(247)
Energy for instantaneous electric shower(s)	0.0000	27.6700	0.0000	(247a)
Pumps, fans and electric keep-hot	401.0677	27.6700	110.9754	(249)
Energy for lighting	147.7501	27.6700	40.8825	(250)
Additional standing charges			0.0000	(251)
Total energy cost			996.1574	(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	2472.7414	0.1564	386.7666	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	578.5760	0.1411	81.6624	(264)
Space and water heating			468.4290	(265)
Pumps, fans and electric keep-hot	401.0677	0.1387	55.6330	(267)
Energy for lighting	147.7501	0.1443	21.3249	(268)
Total CO2, kg/year			545.3869	(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	2472.7414	1.5790	3904.5253	(275)
Space heating - main system 2	0.0000	0.0000	0.0000	(276)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	578.5760	1.5219	880.5409	(278)
Space and water heating			4785.0662	(279)
Pumps, fans and electric keep-hot	401.0677	1.5128	606.7352	(281)
Energy for lighting	147.7501	1.5338	226.6241	(282)
Total Primary energy kWh/year			5618.4255	(286)

SAP 10 EPC IMPROVEMENTS

Be Lean

Current energy efficiency rating: C 70
Current environmental impact rating: A 94

N	Solar water heating	SAP increase too small	
U	Solar photovoltaic panels	Recommended	
V2	Wind turbine	Not applicable	

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 10.1	-£ 284	-223 kg (40.9%)

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.8	-£ 24	-10 kg (1.9%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar photovoltaic panels	£284	3.53 kg/m²	C 80	A 96
Total Savings	£284	3.53 kg/m²		

Potential energy efficiency rating: C 80
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 596 TEST (30 Jun 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£996	£996	£0
Space heating	£795	£795	£0
Water heating	£160	£160	£0
Lighting	£41	£41	£0
Generated (PV)	-£0	-£284	£284
Total cost of fuels	£996	£712	£284
Total cost of uses	£996	£712	£284
Delivered energy	57 kWh/m²	29 kWh/m²	28 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.3 tonnes	0.2 tonnes
CO2 emissions per m²	9 kg/m²	5 kg/m²	4 kg/m²
Primary energy	89 kWh/m²	63 kWh/m²	26 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	63.2200	(1b)	x 2.6000	(2b) =	164.3720	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.2200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	164.3720	(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	0 * 10 =	0.0000	(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) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(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) =	0.1700	(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	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(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	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(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			1.9700	1.1000	2.1670			(26)
Windows			16.3100	1.1450	18.6756			(27)
Rooflight			6.8000	1.1450	7.7863			(27a)
Heatloss Floor 1			63.2200	0.0900	5.6898	110.0000	6954.2000	(28a)
External Wall 1	76.4400	18.2800	58.1600	0.1500	8.7240	110.0000	6397.6000	(29a)
External Roof 1	63.2200	6.8000	56.4200	0.0900	5.0778	9.0000	507.7800	(30)
Total net area of external elements Aum(A, m2)			202.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.1204			(33)
Main dwelling								
Party Wall 1			14.6600	0.0000	0.0000	110.0000	1612.6000	(32)
Internal Wall 1			55.0000			9.0000	495.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	15967.1800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		252.5653 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.5000	0.2300	2.4150
E3 Sill	9.5600	0.0190	0.1816
E4 Jamb	24.3000	0.0160	0.3888
E5 Ground floor (normal)	29.6200	0.0940	2.7843
R11 Upstands or kerbs of rooflights	19.3800	0.2400	4.6512
E14 Flat roof	29.6200	0.1600	4.7392
E16 Corner (normal)	7.8000	0.0510	0.3978
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0700	-0.1820
E18 Party wall between dwellings	5.2000	0.0400	0.2080
P1 Party wall - Ground floor	5.6100	0.0680	0.3815
P4 Party wall - Roof (insulation at ceiling level)	5.6100	0.0910	0.5105

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		16.4759 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	64.5963 (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	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	(38)
Heat transfer coeff	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	(39)
Average = Sum(39)m / 12 =												91.7177	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	(40)
HLP (average)												1.4508	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0711	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
75.6831	74.5457	72.8883	69.7172	67.3771	64.7673	63.2839	64.9288	66.7318	69.5339	72.7731	75.3931	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

35.8397	34.5365	33.2332	31.9299	30.6267	29.3234	29.3234	30.6267	31.9299	33.2332	34.5365	35.8397	(42c)

Average daily hot water use (litres/day)	102.3588 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5228	109.0822	106.1215	101.6472	98.0037	94.0907	92.6074	95.5554	98.6617	102.7671	107.3095	111.2328	(44)
Energy conte	176.6248	155.3315	163.1048	139.1499	131.9319	115.6955	112.0006	118.3176	121.6598	139.4540	152.8821	174.1637	(45)
Energy content (annual)										Total = Sum(45)m =		1700.3162	
Distribution loss (46)m = 0.15 x (45)m	26.4937	23.2997	24.4657	20.8725	19.7898	17.3543	16.8001	17.7476	18.2490	20.9181	22.9323	26.1246	(46)

Water storage loss (or HIU loss):

Store volume												201.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8694	(55)
Total storage loss													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(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													
	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(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													
	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(64)
									Total per year (kWh/year) = Sum(64)m =			2017.6472	(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													
	58.7278	51.6477	54.2324	46.2673	43.8673	38.4688	37.2402	39.3406	40.4519	46.3684	50.8333	57.9094	(65)

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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	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.9156	18.5770	15.1078	11.4376	8.5497	7.2181	7.7994	10.1379	13.6071	17.2773	20.1652	21.4969	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	270.1324	272.9355	265.8717	250.8338	231.8510	214.0099	202.0909	199.2878	206.3516	221.3896	240.3723	258.2135	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	(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)													
	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	(71)
Water heating gains (Table 5)													
	78.9352	76.8567	72.8929	64.2602	58.9615	53.4288	50.0540	52.8772	56.1832	62.3232	70.6018	77.8353	(72)
Total internal gains													
	460.9017	459.2879	444.7912	417.4502	390.2809	365.5754	350.8629	353.2215	367.0605	391.9087	422.0579	448.4642	(73)

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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	
North	7.2800	10.6334	0.6300	0.7000	0.7700	23.6578	(74)
South	4.2800	46.7521	0.6300	0.7000	0.7700	61.1528	(78)
West	4.7500	19.6403	0.6300	0.7000	0.7700	28.5110	(80)
South	6.8000	34.8864	0.6300	0.7000	1.0000	94.1556	(82)

Solar gains	207.4773	383.3013	594.2628	837.6852	1019.4685	1044.7842	993.9032	855.2885	679.1423	443.3786	254.1856	173.7590	(83)
Total gains	668.3790	842.5892	1039.0540	1255.1353	1409.7494	1410.3597	1344.7662	1208.5100	1046.2028	835.2873	676.2435	622.2232	(84)

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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	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	
alpha	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	
util living area													
	0.9828	0.9576	0.8936	0.7558	0.5742	0.4101	0.2988	0.3464	0.5741	0.8581	0.9665	0.9869	(86)
MIT	19.6044	19.9315	20.3596	20.7430	20.9306	20.9864	20.9972	20.9948	20.9486	20.6218	20.0089	19.5216	(87)
Th 2	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	(88)
util rest of house													
	0.9773	0.9451	0.8655	0.7040	0.5055	0.3311	0.2129	0.2518	0.4802	0.8093	0.9543	0.9827	(89)
MIT 2	18.1658	18.5714	19.0826	19.5012	19.6768	19.7184	19.7240	19.7232	19.6969	19.3953	18.6754	18.0616	(90)
Living area fraction									fLA = Living area / (4) =			0.4875	(91)
MIT	18.8672	19.2345	19.7051	20.1066	20.2880	20.3366	20.3447	20.3431	20.3071	19.9932	19.3255	18.7733	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8672	19.2345	19.7051	20.1066	20.2880	20.3366	20.3447	20.3431	20.3071	19.9932	19.3255	18.7733	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9725	0.9392	0.8650	0.7205	0.5366	0.3694	0.2548	0.2980	0.5244	0.8209	0.9495	0.9785	(94)
Useful gains	649.9709	791.3690	898.7839	904.2807	756.4463	520.9904	342.6500	360.1021	548.5824	685.6580	642.1045	608.8158	(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													
	1336.0664	1314.7240	1211.1442	1027.8400	787.6738	526.1436	343.4523	361.6563	569.3009	861.5268	1121.2960	1336.6317	(97)
Space heating kWh													
	510.4550	351.6946	232.3960	88.9627	23.2332	0.0000	0.0000	0.0000	0.0000	130.8464	345.0179	541.4951	(98a)
Space heating requirement - total per year (kWh/year)												2224.1010	
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													
	510.4550	351.6946	232.3960	88.9627	23.2332	0.0000	0.0000	0.0000	0.0000	130.8464	345.0179	541.4951	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2224.1010	
Space heating per m2											(98c) / (4) =	35.1803	(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)
Fraction of main heating from main system 2												0.0000	(203)
Fraction of total heating from main system 1												1.0000	(204)
Fraction of total heating from main system 2												0.0000	(205)
Efficiency of main space heating system 1 (in %)												100.0000	(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													
	510.4550	351.6946	232.3960	88.9627	23.2332	0.0000	0.0000	0.0000	0.0000	130.8464	345.0179	541.4951	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	510.4550	351.6946	232.3960	88.9627	23.2332	0.0000	0.0000	0.0000	0.0000	130.8464	345.0179	541.4951	(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)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement													
	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(64)
Efficiency of water heater												348.7264	(216)
(217)m	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	(217)
Fuel for water heating, kWh/month													
	58.3771	51.5231	54.5001	47.3815	45.5610	40.6558	39.8456	41.6570	42.3661	47.7180	51.3193	57.6713	(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	34.0633	30.7668	34.0633	32.9645	34.0633	32.9645	34.0633	34.0633	32.9645	34.0633	32.9645	34.0633	(231)
Lighting	18.3073	14.6868	13.2238	9.6883	7.4835	6.1141	6.8267	8.8737	11.5260	15.1227	17.0811	18.8161	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-39.2682	-58.2572	-85.0090	-92.2558	-94.9794	-86.2529	-85.3059	-79.8626	-69.8895	-63.6975	-43.7500	-33.6619	(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	-10.8183	-25.3227	-57.3373	-98.5162	-140.7034	-145.4609	-143.3456	-119.9114	-86.5736	-43.1483	-15.6599	-8.2519	(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												2224.1010	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												348.7264	
Water heating fuel used												578.5760	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVDecentralised, Table 4g: in-use factor = 2.5000, SFP = 2.0000)													
mechanical ventilation fans (SFP = 2.0000)												401.0677	(230a)
Total electricity for the above, kWh/year												401.0677	(231)
Electricity for lighting (calculated in Appendix L)												147.7501	(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												1624.2554	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2224.1010	16.4900	366.7542	(240)
Space heating - main system 2	0.0000	16.4900	0.0000	(241)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	578.5760	16.4900	95.4072	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	401.0677	16.4900	66.1361	(249)
Energy for lighting	147.7501	16.4900	24.3640	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-832.1898	16.4900	-137.2281	
PV Unit electricity exported	-895.0496	5.5900	-50.0333	
Total			-187.2614	(252)
Total energy cost			365.4001	(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] =	1.2155	(257)
SAP value		80.2964	

SAP rating (Section 12) 80 (258)
SAP band C

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	2224.1010	0.1569	348.9769	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	578.5760	0.1411	81.6624	(264)
Space and water heating			430.6393	(265)
Pumps, fans and electric keep-hot	401.0677	0.1387	55.6330	(267)
Energy for lighting	147.7501	0.1443	21.3249	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-832.1898	0.1352	-112.5045	
PV Unit electricity exported	-895.0496	0.1226	-109.6976	
Total			-222.2021	(269)
Total CO2, kg/year			285.3951	(272)
CO2 emissions per m2			4.5100	(273)
EI value			96.4662	
EI rating			96	(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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	63.2200	(1b)	x 2.6000	(2b) =	164.3720	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.2200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	164.3720	(5)

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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	0 * 10 =	0.0000 (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) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.2000 (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) =	0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.2210	0.2210	0.2125	0.1870	0.1827	0.1658	0.1573	0.1573	0.1742	0.1955	0.2040	0.1998	(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	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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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			1.9700	1.1000	2.1670			(26)
Windows			16.3100	1.1450	18.6756			(27)
Rooflight			6.8000	1.1450	7.7863			(27a)
Heatloss Floor 1			63.2200	0.0900	5.6898	110.0000	6954.2000	(28a)
External Wall 1	76.4400	18.2800	58.1600	0.1500	8.7240	110.0000	6397.6000	(29a)
External Roof 1	63.2200	6.8000	56.4200	0.0900	5.0778	9.0000	507.7800	(30)
Total net area of external elements Aum(A, m2)			202.8800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.1204			(33)
Main dwelling								
Party Wall 1			14.6600	0.0000	0.0000	110.0000	1612.6000	(32)
Internal Wall 1			55.0000			9.0000	495.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	15967.1800	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		252.5653	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.5000	0.2300	2.4150
E3 Sill	9.5600	0.0190	0.1816
E4 Jamb	24.3000	0.0160	0.3888
E5 Ground floor (normal)	29.6200	0.0940	2.7843
R11 Upstands or kerbs of rooflights	19.3800	0.2400	4.6512
E14 Flat roof	29.6200	0.1600	4.7392
E16 Corner (normal)	7.8000	0.0510	0.3978
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0700	-0.1820
E18 Party wall between dwellings	5.2000	0.0400	0.2080
P1 Party wall - Ground floor	5.6100	0.0680	0.3815
P4 Party wall - Roof (insulation at ceiling level)	5.6100	0.0910	0.5105

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		16.4759	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	64.5963	(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	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	27.1214	(38)
Heat transfer coeff	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	91.7177	(39)
Average = Sum(39)m / 12 =												91.7177	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	1.4508	(40)
HLP (average)												1.4508	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.0711	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
75.6831	74.5457	72.8883	69.7172	67.3771	64.7673	63.2839	64.9288	66.7318	69.5339	72.7731	75.3931	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

35.8397	34.5365	33.2332	31.9299	30.6267	29.3234	29.3234	30.6267	31.9299	33.2332	34.5365	35.8397	(42c)

Average daily hot water use (litres/day)	102.3588	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5228	109.0822	106.1215	101.6472	98.0037	94.0907	92.6074	95.5554	98.6617	102.7671	107.3095	111.2328	(44)
Energy conte	176.6248	155.3315	163.1048	139.1499	131.9319	115.6955	112.0006	118.3176	121.6598	139.4540	152.8821	174.1637	(45)
Energy content (annual)										Total = Sum(45)m =		1700.3162	

Distribution loss (46)m = 0.15 x (45)m

26.4937	23.2997	24.4657	20.8725	19.7898	17.3543	16.8001	17.7476	18.2490	20.9181	22.9323	26.1246	(46)

Water storage loss (or HIU loss):	
Store volume	201.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.6100 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.8694 (55)

Total storage loss

26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)

If cylinder contains dedicated solar storage

26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(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

203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(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

203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(64)
									Total per year (kWh/year) = Sum(64)m =		2017.6472	(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

58.7278	51.6477	54.2324	46.2673	43.8673	38.4688	37.2402	39.3406	40.4519	46.3684	50.8333	57.9094	(65)

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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	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.9156	18.5770	15.1078	11.4376	8.5497	7.2181	7.7994	10.1379	13.6071	17.2773	20.1652	21.4969	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	270.1324	272.9355	265.8717	250.8338	231.8510	214.0099	202.0909	199.2878	206.3516	221.3896	240.3723	258.2135	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	(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)	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	(71)
Water heating gains (Table 5)	78.9352	76.8567	72.8929	64.2602	58.9615	53.4288	50.0540	52.8772	56.1832	62.3232	70.6018	77.8353	(72)
Total internal gains	460.9017	459.2879	444.7912	417.4502	390.2809	365.5754	350.8629	353.2215	367.0605	391.9087	422.0579	448.4642	(73)

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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	
North	7.2800	9.5462	0.6300	0.7000	0.7700	21.2390	(74)

South				4.2800		42.7195		0.6300		0.7000		0.7700	55.8782 (78)
West				4.7500		17.5237		0.6300		0.7000		0.7700	25.4385 (80)
South				6.8000		31.1868		0.6300		0.7000		1.0000	84.1708 (82)
Solar gains	186.7264	367.6620	595.2049	883.7008	1067.1843	1064.4337	1024.5339	855.4025	674.2843	422.5207	234.9927	159.9995	(83)
Total gains	647.6282	826.9499	1039.9960	1301.1510	1457.4652	1430.0091	1375.3968	1208.6240	1041.3448	814.4294	657.0507	608.4637	(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	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	48.3585	
alpha	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	4.2239	
util living area	0.9859	0.9645	0.9093	0.7751	0.6074	0.4865	0.4013	0.4600	0.6601	0.8919	0.9730	0.9892	(86)
MIT	19.5165	19.8290	20.2553	20.6921	20.9052	20.9686	20.9880	20.9797	20.8969	20.5055	19.9129	19.4289	(87)
Th 2	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	19.7246	(88)
util rest of house	0.9814	0.9542	0.8858	0.7287	0.5442	0.4123	0.3199	0.3700	0.5780	0.8542	0.9632	0.9857	(89)
MIT 2	18.0546	18.4440	18.9584	19.4456	19.6538	19.7065	19.7195	19.7155	19.6567	19.2666	18.5560	17.9438	(90)
Living area fraction										fLA = Living area / (4) =		0.4875	(91)
MIT	18.7673	19.1191	19.5907	20.0532	20.2639	20.3217	20.3379	20.3318	20.2613	19.8705	19.2175	18.6678	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7673	19.1191	19.5907	20.0532	20.2639	20.3217	20.3379	20.3318	20.2613	19.8705	19.2175	18.6678	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9769	0.9481	0.8829	0.7414	0.5717	0.4476	0.3594	0.4135	0.6141	0.8591	0.9583	0.9818	(94)
Useful gains	632.6772	784.0494	918.2350	964.7179	833.1780	640.0090	494.3516	499.7571	639.4976	699.7074	629.6259	597.4095	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	1363.5955	1359.1782	1283.1932	1114.6671	877.1791	653.1897	498.7536	507.3658	684.3301	932.8193	1157.2499	1372.8102	(97)
Space heating kWh	543.8032	386.4865	271.5289	107.9634	32.7368	0.0000	0.0000	0.0000	0.0000	173.4352	379.8892	576.8981	(98a)
Space heating requirement - total per year (kWh/year)												2472.7414	
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	543.8032	386.4865	271.5289	107.9634	32.7368	0.0000	0.0000	0.0000	0.0000	173.4352	379.8892	576.8981	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2472.7414	
Space heating per m2											(98c) / (4) =	39.1133	(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)
Fraction of main heating from main system 2	0.0000 (203)
Fraction of total heating from main system 1	1.0000 (204)
Fraction of total heating from main system 2	0.0000 (205)
Efficiency of main space heating system 1 (in %)	100.0000 (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	543.8032	386.4865	271.5289	107.9634	32.7368	0.0000	0.0000	0.0000	0.0000	173.4352	379.8892	576.8981	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	543.8032	386.4865	271.5289	107.9634	32.7368	0.0000	0.0000	0.0000	0.0000	173.4352	379.8892	576.8981	(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)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(64)
Efficiency of water heater												348.7264	(216)
(217)m	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	(217)
Fuel for water heating, kWh/month	58.3771	51.5231	54.5001	47.3815	45.5610	40.6558	39.8456	41.6570	42.3661	47.7180	51.3193	57.6713	(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	34.0633	30.7668	34.0633	32.9645	34.0633	32.9645	34.0633	34.0633	32.9645	34.0633	32.9645	34.0633	(231)
Lighting	18.3073	14.6868	13.2238	9.6883	7.4835	6.1141	6.8267	8.8737	11.5260	15.1227	17.0811	18.8161	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-35.9470	-56.8468	-86.7190	-97.2964	-98.8730	-87.1426	-86.6847	-79.9599	-69.6595	-63.0486	-41.2552	-31.3989	(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	-9.1150	-23.3441	-56.0254	-104.3593	-148.3951	-149.4519	-149.5416	-120.2725	-85.9302	-38.8333	-13.6591	-7.1773	(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												2472.7414	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	348.7264	
Water heating fuel used	578.5760	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Table 4g: in-use factor = 2.5000, SFP = 2.0000)		
mechanical ventilation fans (SFP = 2.0000)	401.0677	(230a)
Total electricity for the above, kWh/year	401.0677	(231)
Electricity for lighting (calculated in Appendix L)	147.7501	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1740.9362	(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	1859.1990	(238)

10a. Fuel costs - using BEDF prices (596)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2472.7414	27.6700	684.2076	(240)
Space heating - main system 2	0.0000	27.6700	0.0000	(241)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	578.5760	27.6700	160.0920	(247)
Energy for instantaneous electric shower(s)	0.0000	27.6700	0.0000	(247a)
Pumps, fans and electric keep-hot	401.0677	27.6700	110.9754	(249)
Energy for lighting	147.7501	27.6700	40.8825	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-834.8315	27.6700	-230.9979	
PV Unit electricity exported	-906.1047	5.8100	-52.6447	
Total			-283.6426	(252)
Total energy cost			712.5149	(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	2472.7414	0.1564	386.7666	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	578.5760	0.1411	81.6624	(264)
Space and water heating			468.4290	(265)
Pumps, fans and electric keep-hot	401.0677	0.1387	55.6330	(267)
Energy for lighting	147.7501	0.1443	21.3249	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-834.8315	0.1349	-112.6427	
PV Unit electricity exported	-906.1047	0.1219	-110.4550	
Total			-223.0977	(269)
Total CO2, kg/year			322.2892	(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	2472.7414	1.5790	3904.5253	(275)
Space heating - main system 2	0.0000	0.0000	0.0000	(276)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	578.5760	1.5219	880.5409	(278)
Space and water heating			4785.0662	(279)
Pumps, fans and electric keep-hot	401.0677	1.5128	606.7352	(281)
Energy for lighting	147.7501	1.5338	226.6241	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-834.8315	1.4987	-1251.1893	
PV Unit electricity exported	-906.1047	0.4473	-405.3122	
Total			-1656.5015	(283)
Total Primary energy kWh/year			3961.9240	(286)

Full SAP Calculation Printout

Plot Reference	Plot 1	**Issued on Date**	04/08/2026
Assessment Reference	Baseline	**Plot Type Ref**	
Plot Address		**SAP Version**	10.2

SAP Rating	54 E	**DER**	12.75	**TER**	11.40
Environmental	90 B	**% DER < TER**			-11.84
CO_2 Emissions (t/year)	0.84	**DFEE**	73.06	**TFEE**	50.50
Compliance Check	See BREL	**% DFEE < TFEE**			-44.66
% DPER < TPER	-114.66	**DPER**	130.81	**TPER**	60.94

Assessor Details	Mr. Andrew Graves	**Assessor ID**	K720-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	63.2200	(1b)	x 2.6000	(2b) =	164.3720	(1b) - (3b)
						(4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.2200					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		164.3720	(5)

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2. Ventilation rate

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		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	0 * 10 =	0.0000	(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) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		8.0000	(17)
Infiltration rate		0.4000	(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) =	0.3400	(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	0.4335	0.4250	0.4165	0.3740	0.3655	0.3230	0.3230	0.3145	0.3400	0.3655	0.3825	0.3995	(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	0.6835	0.6750	0.6665	0.6240	0.6155	0.5730	0.5730	0.5645	0.5900	0.6155	0.6325	0.6495	(25)

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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			1.9700	1.6000	3.1520			(26)
Windows			16.3100	1.5038	24.5263			(27)
Rooflight			6.8000	2.0221	13.7500			(27a)
Heatloss Floor 1			63.2200	0.1800	11.3796	110.0000	6954.2000	(28a)
External Wall 1	76.4400	18.2800	58.1600	0.2600	15.1216	110.0000	6397.6000	(29a)
External Roof 1	63.2200	6.8000	56.4200	0.1600	9.0272	9.0000	507.7800	(30)
Total net area of external elements Aum(A, m2)			202.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		76.9567			(33)
Main dwelling								
Party Wall 1			14.6600	0.0000	0.0000	110.0000	1612.6000	(32)
Internal Wall 1			55.0000			9.0000	495.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	15967.1800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		252.5653 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			

E2 Other lintels (including other steel lintels)	10.5000	0.2300	2.4150	
E3 Sill	9.5600	0.0190	0.1816	
E4 Jamb	24.3000	0.0160	0.3888	
E5 Ground floor (normal)	29.6200	0.0940	2.7843	
R11 Upstands or kerbs of rooflights	19.3800	0.2400	4.6512	
E14 Flat roof	29.6200	0.1600	4.7392	
E16 Corner (normal)	7.8000	0.0510	0.3978	
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0700	-0.1820	
E18 Party wall between dwellings	5.2000	0.0400	0.2080	
P1 Party wall - Ground floor	5.6100	0.0680	0.3815	
P4 Party wall - Roof (insulation at ceiling level)	5.6100	0.0910	0.5105	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.4759 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 93.4326 (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	37.0749	36.6139	36.1528	33.8475	33.3864	31.0811	31.0811	30.6200	32.0032	33.3864	34.3085	35.2307	(38)
Heat transfer coeff	130.5076	130.0465	129.5854	127.2801	126.8190	124.5137	124.5137	124.0527	125.4359	126.8190	127.7412	128.6633	(39)

Average = Sum(39)m / 12 = 127.1648

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.0643	2.0570	2.0498	2.0133	2.0060	1.9695	1.9695	1.9622	1.9841	2.0060	2.0206	2.0352	(40)
HLP (average)												2.0115	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0711 (42)

Hot water usage for mixer showers

75.6831	74.5457	72.8883	69.7172	67.3771	64.7673	63.2839	64.9288	66.7318	69.5339	72.7731	75.3931	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

35.8397	34.5365	33.2332	31.9299	30.6267	29.3234	29.3234	30.6267	31.9299	33.2332	34.5365	35.8397	(42c)

Average daily hot water use (litres/day) 102.3588 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5228	109.0822	106.1215	101.6472	98.0037	94.0907	92.6074	95.5554	98.6617	102.7671	107.3095	111.2328	(44)
Energy conte	176.6248	155.3315	163.1048	139.1499	131.9319	115.6955	112.0006	118.3176	121.6598	139.4540	152.8821	174.1637	(45)
Energy content (annual)										Total = Sum(45)m =		1700.3162	
Distribution loss (46)m = 0.15 x (45)m	26.4937	23.2997	24.4657	20.8725	19.7898	17.3543	16.8001	17.7476	18.2490	20.9181	22.9323	26.1246	(46)

Water storage loss (or HIU loss):

Store volume	201.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.6100	(48)
Temperature factor from Table 2b	0.5400	(49)
Enter (49) or (54) in (55)	0.8694	(55)

Total storage loss

26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)

If cylinder contains dedicated solar storage

26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(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

203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(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

203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(64)
									Total per year (kWh/year) = Sum(64)m =		2017.6472	(64)
12Total per year (kWh/year)											2018	(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

58.7278	51.6477	54.2324	46.2673	43.8673	38.4688	37.2402	39.3406	40.4519	46.3684	50.8333	57.9094	(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	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	91.2880	101.0689	91.2880	94.3310	91.2880	94.3310	91.2880	91.2880	94.3310	91.2880	94.3310	91.2880	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	180.9887	182.8668	178.1341	168.0586	155.3402	143.3866	135.4009	133.5228	138.2556	148.3310	161.0495	173.0030	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	(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)	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	(71)
Water heating gains (Table 5)	78.9352	76.8567	72.8929	64.2602	58.9615	53.4288	50.0540	52.8772	56.1832	62.3232	70.6018	77.8353	(72)
Total internal gains	405.2778	414.8583	396.3809	380.7157	359.6556	345.2123	330.8089	331.7539	342.8356	356.0081	380.0481	396.1922	(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	
North	7.2800	10.6334	0.6300	0.7000	0.7700	23.6578	(74)
South	4.2800	46.7521	0.6300	0.7000	0.7700	61.1528	(78)
West	4.7500	19.6403	0.6300	0.7000	0.7700	28.5110	(80)
South	6.8000	34.8864	0.6300	0.7000	1.0000	94.1556	(82)

Solar gains	207.4773	383.3013	594.2628	837.6852	1019.4685	1044.7842	993.9032	855.2885	679.1423	443.3786	254.1856	173.7590	(83)
Total gains	612.7550	798.1596	990.6438	1218.4008	1379.1241	1389.9966	1324.7121	1187.0424	1021.9779	799.3868	634.2337	569.9512	(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	33.9852	34.1057	34.2271	34.8470	34.9737	35.6212	35.6212	35.7536	35.3593	34.9737	34.7212	34.4724	
alpha	3.2657	3.2737	3.2818	3.3231	3.3316	3.3747	3.3747	3.3836	3.3573	3.3316	3.3147	3.2982	
util living area	0.9885	0.9732	0.9382	0.8494	0.7058	0.5323	0.4010	0.4589	0.7028	0.9161	0.9786	0.9909	(86)
MIT	18.7283	19.0968	19.6261	20.2650	20.6998	20.9165	20.9756	20.9620	20.7848	20.1455	19.3214	18.6846	(87)
Th 2	19.2908	19.2956	19.3004	19.3245	19.3293	19.3537	19.3537	19.3586	19.3439	19.3293	19.3196	19.3100	(88)
util rest of house	0.9844	0.9638	0.9166	0.8003	0.6196	0.4118	0.2568	0.3051	0.5824	0.8758	0.9694	0.9876	(89)
MIT 2	16.7842	17.2506	17.9067	18.6678	19.1181	19.3170	19.3487	19.3496	19.2266	18.5686	17.5551	16.7399	(90)
Living area fraction									fLA = Living area / (4) =			0.4875	(91)
MIT	17.7320	18.1506	18.7449	19.4464	19.8892	20.0968	20.1418	20.1356	19.9862	19.3374	18.4162	17.6879	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.7320	18.1506	18.7449	19.4464	19.8892	20.0968	20.1418	20.1356	19.9862	19.3374	18.4162	17.6879	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9787	0.9551	0.9077	0.8044	0.6508	0.4684	0.3274	0.3804	0.6336	0.8760	0.9623	0.9828	(94)
Useful gains	599.7328	762.3341	899.1701	980.1254	897.5959	651.1170	433.7580	451.5063	647.5121	700.2575	610.3531	560.1403	(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	1752.9727	1723.1975	1586.7659	1342.3520	1038.5483	684.4220	441.0046	463.4170	738.3439	1108.0644	1445.5453	1735.4033	(97)
Space heating kWh	858.0105	645.7002	511.5713	260.8031	104.8686	0.0000	0.0000	0.0000	0.0000	303.4084	601.3384	874.3957	(98a)
Space heating requirement - total per year (kWh/year)												4160.0961	
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	858.0105	645.7002	511.5713	260.8031	104.8686	0.0000	0.0000	0.0000	0.0000	303.4084	601.3384	874.3957	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4160.0961	
Space heating per m2											(98c) / (4) =	65.8035	(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)
Fraction of main heating from main system 2	0.0000	(203)
Fraction of total heating from main system 1	1.0000	(204)
Fraction of total heating from main system 2	0.0000	(205)
Efficiency of main space heating system 1 (in %)	100.0000	(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	858.0105	645.7002	511.5713	260.8031	104.8686	0.0000	0.0000	0.0000	0.0000	303.4084	601.3384	874.3957	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	858.0105	645.7002	511.5713	260.8031	104.8686	0.0000	0.0000	0.0000	0.0000	303.4084	601.3384	874.3957	(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)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(64)
Efficiency of water heater												348.7264	(216)
(217)m	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	(217)
Fuel for water heating, kWh/month	58.3771	51.5231	54.5001	47.3815	45.5610	40.6558	39.8456	41.6570	42.3661	47.7180	51.3193	57.6713	(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	34.0633	30.7668	34.0633	32.9645	34.0633	32.9645	34.0633	34.0633	32.9645	34.0633	32.9645	34.0633	(231)
Lighting	18.3073	14.6868	13.2238	9.6883	7.4835	6.1141	6.8267	8.8737	11.5260	15.1227	17.0811	18.8161	(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												4160.0961	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												348.7264	

Water heating fuel used	578.5760	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Table 4g: in-use factor = 2.5000, SFP = 2.0000)		
mechanical ventilation fans (SFP = 2.0000)	401.0677	(230a)
Total electricity for the above, kWh/year	401.0677	(231)
Electricity for lighting (calculated in Appendix L)	147.7501	(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	5287.4899	(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	4160.0961	0.1556	647.1678	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	578.5760	0.1411	81.6624	(264)
Space and water heating			728.8302	(265)
Pumps, fans and electric keep-hot	401.0677	0.1387	55.6330	(267)
Energy for lighting	147.7501	0.1443	21.3249	(268)
Total CO2, kg/year			805.7881	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			12.7500	(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	4160.0961	1.5759	6555.9873	(275)
Space heating - main system 2	0.0000	0.0000	0.0000	(276)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	578.5760	1.5219	880.5409	(278)
Space and water heating			7436.5283	(279)
Pumps, fans and electric keep-hot	401.0677	1.5128	606.7352	(281)
Energy for lighting	147.7501	1.5338	226.6241	(282)
Total Primary energy kWh/year			8269.8875	(286)
Dwelling Primary energy Rate (DPER)			130.8100	(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	63.2200 (1b)	x	2.6000 (2b)	=	164.3720	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.2200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	164.3720	(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	2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1217	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3717	(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) =	0.3159	(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	0.4028	0.3949	0.3870	0.3475	0.3396	0.3001	0.3001	0.2922	0.3159	0.3396	0.3554	0.3712	(22b)
Effective ac	0.5811	0.5780	0.5749	0.5604	0.5577	0.5450	0.5450	0.5427	0.5499	0.5577	0.5632	0.5689	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
TER Opaque door			1.9700	1.0000	1.9700			(26)
TER Opening Type			9.7600	1.1450	11.1756			(27)
TER Roof Light			4.0700	1.5918	8.2298			(27a)
Heatloss Floor 1			63.2200	0.1300	8.2186			(28a)
External Wall 1	76.4400	11.7300	64.7100	0.1800	11.6478			(29a)
External Roof 1	63.2200	4.0700	59.1500	0.1100	6.5065			(30)
Total net area of external elements Aum(A, m2)			202.8800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	47.7483			(33)
Main dwelling								
Party Wall 1			14.6600	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 252.5653 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	10.5000	0.0500	0.5250	
E3 Sill	9.5600	0.0500	0.4780	
E4 Jamb	24.3000	0.0500	1.2150	
E5 Ground floor (normal)	29.6200	0.1600	4.7392	
R11 Upstands or kerbs of rooflights	19.3800	0.0800	1.5504	
E14 Flat roof	29.6200	0.0800	2.3696	
E16 Corner (normal)	7.8000	0.0900	0.7020	
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0900	-0.2340	
E18 Party wall between dwellings	5.2000	0.0600	0.3120	
P1 Party wall - Ground floor	5.6100	0.0800	0.4488	
P4 Party wall - Roof (insulation at ceiling level)	5.6100	0.1200	0.6732	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.7792 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 60.5275 (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	31.5218	31.3510	31.1835	30.3968	30.2496	29.5644	29.5644	29.4375	29.8283	30.2496	30.5473	30.8586	(38)
Heat transfer coeff	92.0493	91.8784	91.7109	90.9242	90.7770	90.0918	90.0918	89.9649	90.3558	90.7770	91.0748	91.3861	(39)

Average = Sum(39)m / 12 = 90.9235

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4560	1.4533	1.4507	1.4382	1.4359	1.4251	1.4251	1.4230	1.4292	1.4359	1.4406	1.4455	(40)
HLP (average)												1.4382	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0711 (42)

Hot water usage for mixer showers

75.6831	74.5457	72.8883	69.7172	67.3771	64.7673	63.2839	64.9288	66.7318	69.5339	72.7731	75.3931	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

35.8397	34.5365	33.2332	31.9299	30.6267	29.3234	29.3234	30.6267	31.9299	33.2332	34.5365	35.8397	(42c)

Average daily hot water use (litres/day) 102.3588 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5228	109.0822	106.1215	101.6472	98.0037	94.0907	92.6074	95.5554	98.6617	102.7671	107.3095	111.2328	(44)
Energy conte	176.6248	155.3315	163.1048	139.1499	131.9319	115.6955	112.0006	118.3176	121.6598	139.4540	152.8821	174.1637	(45)
Energy content (annual)										Total = Sum(45)m =		1700.3162	

Distribution loss (46)m = 0.15 x (45)m

26.4937	23.2997	24.4657	20.8725	19.7898	17.3543	16.8001	17.7476	18.2490	20.9181	22.9323	26.1246	(46)

Water storage loss (or HIU loss):

Store volume 150.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.3938 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.7527 (55)

Total storage loss

23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)

If cylinder contains dedicated solar storage

23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(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

223.2197	197.4173	209.6997	184.2417	178.5268	160.7874	158.5955	164.9125	166.7516	186.0489	197.9739	220.7586	(62)
WWHRS -34.5991	-30.5998	-32.0423	-26.5323	-24.7271	-21.1592	-19.8334	-21.0908	-21.8921	-25.8084	-29.2378	-33.9584	(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

188.6206	166.8175	177.6574	157.7095	153.7996	139.6282	138.7621	143.8217	144.8595	160.2405	168.7362	186.8002	(64)
								Total per year (kWh/year) = Sum(64)m =			1927.4529	(64)

12Total per year (kWh/year) 1927 (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

96.0037	85.3163	91.5083	82.3408	81.1433	74.5422	74.5161	76.6165	76.5254	83.6444	86.9068	95.1854	(65)

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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	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	91.2880	101.0689	91.2880	94.3310	91.2880	94.3310	91.2880	91.2880	94.3310	91.2880	94.3310	91.2880	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	180.9887	182.8668	178.1341	168.0586	155.3402	143.3866	135.4009	133.5228	138.2556	148.3310	161.0495	173.0030	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	(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)													
	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	(71)
Water heating gains (Table 5)													
	129.0372	126.9588	122.9950	114.3622	109.0635	103.5309	100.1561	102.9792	106.2852	112.4252	120.7039	127.9373	(72)
Total internal gains													
	458.3798	467.9604	449.4830	433.8177	412.7576	395.3144	380.9109	381.8560	392.9376	409.1102	433.1502	449.2942	(73)

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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	
North	4.3600	10.6334	0.6300	0.7000	0.7700	14.1687	(74)
South	2.5600	46.7521	0.6300	0.7000	0.7700	36.5774	(78)
West	2.8400	19.6403	0.6300	0.7000	0.7700	17.0466	(80)
South	4.0700	34.8864	0.6300	0.7000	1.0000	56.3549	(82)

Solar gains	124.1476	229.3586	355.6032	501.2826	610.0796	625.2359	594.7842	511.8224	406.4000	265.3101	152.0969	103.9713	(83)
Total gains	582.5274	697.3190	805.0862	935.1003	1022.8372	1020.5503	975.6951	893.6784	799.3377	674.4203	585.2471	553.2655	(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	48.1843	48.2739	48.3620	48.7805	48.8596	49.2312	49.2312	49.3006	49.0874	48.8596	48.6998	48.5340	
alpha	4.2123	4.2183	4.2241	4.2520	4.2573	4.2821	4.2821	4.2867	4.2725	4.2573	4.2467	4.2356	
util living area													
	0.9895	0.9774	0.9489	0.8691	0.7252	0.5426	0.4011	0.4537	0.6987	0.9177	0.9793	0.9915	(86)
MIT	19.4686	19.7280	20.0973	20.5404	20.8361	20.9633	20.9920	20.9866	20.8960	20.4800	19.8929	19.4245	(87)
Th 2	19.7206	19.7227	19.7247	19.7342	19.7359	19.7442	19.7442	19.7457	19.7410	19.7359	19.7323	19.7286	(88)
util rest of house													
	0.9860	0.9701	0.9325	0.8301	0.6548	0.4455	0.2893	0.3347	0.6004	0.8831	0.9713	0.9886	(89)
MIT 2	17.9923	18.3202	18.7788	19.3056	19.6134	19.7262	19.7421	19.7418	19.6798	19.2562	18.5388	17.9417	(90)
Living area fraction										fLA = Living area / (4) =		0.4875	(91)
MIT	18.7120	19.0065	19.4216	19.9076	20.2094	20.3293	20.3514	20.3487	20.2727	19.8528	19.1989	18.6646	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7120	19.0065	19.4216	19.9076	20.2094	20.3293	20.3514	20.3487	20.2727	19.8528	19.1989	18.6646	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9822	0.9648	0.9278	0.8361	0.6827	0.4919	0.3440	0.3929	0.6444	0.8869	0.9669	0.9853	(94)
Useful gains	572.1855	672.7755	746.9460	781.7917	698.2860	502.0047	335.6048	351.1093	515.1235	598.1590	565.8657	545.1392	(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													
	1326.6150	1296.0866	1185.0476	1000.8551	772.4618	516.1641	337.9718	355.2427	557.7376	839.9443	1101.9082	1321.8594	(97)
Space heating kWh													
	561.2955	418.8651	325.9476	157.7257	55.1869	0.0000	0.0000	0.0000	0.0000	179.8883	385.9506	577.8798	(98a)
Space heating requirement - total per year (kWh/year)												2662.7394	
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													
	561.2955	418.8651	325.9476	157.7257	55.1869	0.0000	0.0000	0.0000	0.0000	179.8883	385.9506	577.8798	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2662.7394	
Space heating per m2											(98c) / (4) =	42.1186	(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													
	561.2955	418.8651	325.9476	157.7257	55.1869	0.0000	0.0000	0.0000	0.0000	179.8883	385.9506	577.8798	(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)													
	608.1208	453.8083	353.1393	170.8837	59.7907	0.0000	0.0000	0.0000	0.0000	194.8952	418.1480	626.0887	(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													
	188.6206	166.8175	177.6574	157.7095	153.7996	139.6282	138.7621	143.8217	144.8595	160.2405	168.7362	186.8002	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.3505	86.0362	85.4022	84.0600	81.9945	79.8000	79.8000	79.8000	79.8000	84.3198	85.8545	86.4191	(217)
Fuel for water heating, kWh/month													
	218.4361	193.8921	208.0245	187.6153	187.5732	174.9727	173.8873	180.2277	181.5282	190.0390	196.5374	216.1562	(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	18.9678	15.2167	13.7010	10.0379	7.7536	6.3347	7.0731	9.1938	11.9419	15.6684	17.6974	19.4950	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-49.4928	-65.3855	-88.1850	-92.9041	-95.3001	-87.3413	-86.2873	-83.7679	-78.7250	-71.6863	-52.8412	-43.3292	(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	-43.0738	-88.3051	-171.4210	-251.7733	-327.6003	-327.2132	-323.3080	-276.0664	-205.5491	-124.2121	-56.8048	-34.2342	(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	2884.8748	(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	2308.8897	(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)	153.0814	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3124.8069	(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	2308.0390	(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	2884.8748	0.2100	605.8237	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2308.8897	0.2100	484.8668	(264)
Space and water heating			1090.6905	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	153.0814	0.1443	22.0944	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-895.2457	0.1360	-121.7225	
PV Unit electricity exported	-2229.5612	0.1266	-282.1998	
Total			-403.9223	(269)
Total CO2, kg/year			720.7919	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.4000	(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	2884.8748	1.1300	3259.9085	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2308.8897	1.1300	2609.0453	(278)
Space and water heating			5868.9539	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	153.0814	1.5338	234.8014	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-895.2457	1.5026	-1345.1785	
PV Unit electricity exported	-2229.5612	0.4646	-1035.9349	
Total			-2381.1134	(283)
Total Primary energy kWh/year			3852.7426	(286)
Target Primary Energy Rate (TPER)			60.9400	(287)

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

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling							
Ground floor		63.2200	(1b)	x 2.6000	(2b) =	164.3720	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.2200						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		164.3720	(5)

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2. Ventilation rate

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	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	2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1217	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		8.0000	(17)
Infiltration rate		0.5217	(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) =	0.4434	(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	0.5654	0.5543	0.5432	0.4878	0.4767	0.4213	0.4213	0.4102	0.4434	0.4767	0.4989	0.5210	(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	0.6598	0.6536	0.6475	0.6190	0.6136	0.5887	0.5887	0.5841	0.5983	0.6136	0.6244	0.6357	(25)

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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			1.9700	1.6000	3.1520			(26)
Windows			16.3100	1.5038	24.5263			(27)
Rooflight			6.8000	2.0221	13.7500			(27a)
Heatloss Floor 1			63.2200	0.1800	11.3796	110.0000	6954.2000	(28a)
External Wall 1	76.4400	18.2800	58.1600	0.2600	15.1216	110.0000	6397.6000	(29a)
External Roof 1	63.2200	6.8000	56.4200	0.1600	9.0272	9.0000	507.7800	(30)
Total net area of external elements Aum(A, m2)			202.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		76.9567			(33)
Main dwelling								
Party Wall 1			14.6600	0.0000	0.0000	110.0000	1612.6000	(32)
Internal Wall 1			55.0000			9.0000	495.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	15967.1800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		252.5653 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.5000	0.2300	2.4150
E3 Sill	9.5600	0.0190	0.1816
E4 Jamb	24.3000	0.0160	0.3888
E5 Ground floor (normal)	29.6200	0.0940	2.7843
R11 Upstands or kerbs of rooflights	19.3800	0.2400	4.6512
E14 Flat roof	29.6200	0.1600	4.7392
E16 Corner (normal)	7.8000	0.0510	0.3978
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0700	-0.1820
E18 Party wall between dwellings	5.2000	0.0400	0.2080
P1 Party wall - Ground floor	5.6100	0.0680	0.3815
P4 Party wall - Roof (insulation at ceiling level)	5.6100	0.0910	0.5105

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		16.4759 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	93.4326 (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	35.7904	35.4538	35.1238	33.5740	33.2840	31.9342	31.9342	31.6842	32.4541	33.2840	33.8706	34.4839	(38)
Heat transfer coeff	129.2230	128.8864	128.5564	127.0066	126.7166	125.3668	125.3668	125.1168	125.8867	126.7166	127.3032	127.9165	(39)
Average = Sum(39)m / 12 =												127.0052	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.0440	2.0387	2.0335	2.0090	2.0044	1.9830	1.9830	1.9791	1.9912	2.0044	2.0137	2.0234	(40)
HLP (average)												2.0089	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.0711 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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

25.4713	25.0930	24.5603	23.5781	22.8426	22.0271	21.5866	22.1156	22.6915	23.5642	24.5666	25.3852	(42b)

Hot water usage for other uses

35.8397	34.5365	33.2332	31.9299	30.6267	29.3234	29.3234	30.6267	31.9299	33.2332	34.5365	35.8397	(42c)

Average daily hot water use (litres/day)		56.1975 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	61.3110	59.6295	57.7935	55.5080	53.4693	51.3505	50.9100	52.7422	54.6215	56.7974	59.1031	61.2249	(44)
Energy conte	97.1016	84.9115	88.8264	75.9877	71.9799	63.1414	61.5712	65.3059	67.3537	77.0735	84.2031	95.8634	(45)
Energy content (annual)										Total = Sum(45)m =		933.3196	

Distribution loss (46)m = 0.15 x (45)m

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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

82.5364	72.1748	75.5025	64.5895	61.1829	53.6702	52.3356	55.5100	57.2507	65.5125	71.5727	81.4839	(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	82.5364	72.1748	75.5025	64.5895	61.1829	53.6702	52.3356	55.5100	57.2507	65.5125	71.5727	81.4839	(64)
									Total per year (kWh/year) = Sum(64)m =			793.3216	(64)
12Total per year (kWh/year)												793	(64)
Electric shower(s)	47.2047	42.0598	45.9277	43.8282	44.6506	42.5924	44.0121	44.6506	43.8282	45.9277	45.0640	47.2047	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			536.9506	(64a)
Heat gains from water heating, kWh/month	32.4353	28.5586	30.3575	27.1044	26.4584	24.0656	24.0869	25.0402	25.2697	27.8600	29.1592	32.1721	(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	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	91.2880	101.0689	91.2880	94.3310	91.2880	94.3310	91.2880	91.2880	94.3310	91.2880	94.3310	91.2880	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	180.9887	182.8668	178.1341	168.0586	155.3402	143.3866	135.4009	133.5228	138.2556	148.3310	161.0495	173.0030	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	(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)	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	(71)
Water heating gains (Table 5)	43.5958	42.4980	40.8031	37.6450	35.5624	33.4245	32.3749	33.6561	35.0968	37.4463	40.4989	43.2421	(72)
Total internal gains	369.9384	380.4996	364.2911	354.1005	336.2565	325.2080	313.1297	312.5329	321.7493	331.1312	349.9452	361.5991	(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	
North	7.2800	10.6334	0.6300	0.7000	0.7700	23.6578	(74)
South	4.2800	46.7521	0.6300	0.7000	0.7700	61.1528	(78)
West	4.7500	19.6403	0.6300	0.7000	0.7700	28.5110	(80)
South	6.8000	34.8864	0.6300	0.7000	1.0000	94.1556	(82)

Solar gains	207.4773	383.3013	594.2628	837.6852	1019.4685	1044.7842	993.9032	855.2885	679.1423	443.3786	254.1856	173.7590	(83)
Total gains	577.4157	763.8009	958.5540	1191.7857	1355.7250	1369.9922	1307.0330	1167.8214	1000.8915	774.5099	604.1308	535.3581	(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	34.3230	34.4127	34.5010	34.9220	35.0019	35.3788	35.3788	35.4495	35.2327	35.0019	34.8406	34.6736	
alpha	3.2882	3.2942	3.3001	3.3281	3.3335	3.3586	3.3586	3.3633	3.3488	3.3335	3.3227	3.3116	
util living area	0.9904	0.9762	0.9426	0.8556	0.7127	0.5411	0.4083	0.4686	0.7128	0.9221	0.9813	0.9925	(86)
MIT	18.7031	19.0733	19.6068	20.2472	20.6908	20.9107	20.9737	20.9586	20.7734	20.1204	19.2880	18.6499	(87)
Th 2	19.3041	19.3077	19.3111	19.3274	19.3304	19.3447	19.3447	19.3473	19.3392	19.3304	19.3242	19.3178	(88)
util rest of house	0.9868	0.9677	0.9224	0.8077	0.6270	0.4189	0.2611	0.3113	0.5925	0.8839	0.9732	0.9897	(89)
MIT 2	17.3216	17.6877	18.2047	18.8007	19.1601	19.3140	19.3405	19.3396	19.2421	18.7159	17.9155	17.2782	(90)
Living area fraction										fLA = Living area / (4) =		0.4875	(91)
MIT	17.9951	18.3632	18.8882	19.5059	19.9063	20.0924	20.1367	20.1289	19.9886	19.4006	18.5846	17.9469	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.9951	18.3632	18.8882	19.5059	19.9063	20.0924	20.1367	20.1289	19.9886	19.4006	18.5846	17.9469	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9829	0.9614	0.9160	0.8136	0.6590	0.4765	0.3332	0.3883	0.6442	0.8859	0.9682	0.9864	(94)
Useful gains	567.5503	734.2838	878.0290	969.6531	893.3963	652.8065	435.5485	453.5078	644.8068	686.1080	584.9043	528.0606	(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	1769.7245	1735.2174	1592.5867	1347.0164	1039.8774	688.5675	443.3802	466.5451	741.2988	1115.1856	1462.0246	1758.4569	(97)
Space heating kWh	894.4176	672.6273	531.6309	271.7016	108.9820	0.0000	0.0000	0.0000	0.0000	319.2337	631.5266	915.4149	(98a)
Space heating requirement - total per year (kWh/year)												4345.5346	
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	894.4176	672.6273	531.6309	271.7016	108.9820	0.0000	0.0000	0.0000	0.0000	319.2337	631.5266	915.4149	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4345.5346	
Space heating per m2											(98c) / (4) =	68.7367	(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	1178.4479	927.7143	950.8879	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8482	0.8995	0.8652	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	999.5480	834.4976	822.6700	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1473.9558	1406.8345	1258.9920	0.0000	0.0000	0.0000	0.0000	(103)

Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	341.5736	425.8187	324.6236	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	85.3934	106.4547	81.1559	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												273.0040	(107)
Energy for space heating												68.7367	(99)
Energy for space cooling												4.3183	(108)
Total												73.0550	(109)
Fabric Energy Efficiency (DFEE)												73.1	(109)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	63.2200	(1b)	x 2.6000	(2b) =	164.3720	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.2200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	164.3720	(5)

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2. Ventilation rate

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		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	2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1217	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3717	(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) =	0.3159	(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													
	0.4028	0.3949	0.3870	0.3475	0.3396	0.3001	0.3001	0.2922	0.3159	0.3396	0.3554	0.3712	(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	0.5811	0.5780	0.5749	0.5604	0.5577	0.5450	0.5450	0.5427	0.5499	0.5577	0.5632	0.5689	(25)

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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								
TER Opaque door			1.9700	1.0000	1.9700			(26)
TER Opening Type			9.7600	1.1450	11.1756			(27)
TER Roof Light			4.0700	1.5918	8.2298			(27a)
Heatloss Floor 1			63.2200	0.1300	8.2186			(28a)
External Wall 1	76.4400	11.7300	64.7100	0.1800	11.6478			(29a)
External Roof 1	63.2200	4.0700	59.1500	0.1100	6.5065			(30)
Total net area of external elements Aum(A, m2)			202.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.7483			(33)
Main dwelling								
Party Wall 1			14.6600	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							252.5653	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.5000	0.0500	0.5250
E3 Sill	9.5600	0.0500	0.4780
E4 Jamb	24.3000	0.0500	1.2150
E5 Ground floor (normal)	29.6200	0.1600	4.7392
R11 Upstands or kerbs of rooflights	19.3800	0.0800	1.5504
E14 Flat roof	29.6200	0.0800	2.3696
E16 Corner (normal)	7.8000	0.0900	0.7020
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0900	-0.2340
E18 Party wall between dwellings	5.2000	0.0600	0.3120
P1 Party wall - Ground floor	5.6100	0.0800	0.4488
P4 Party wall - Roof (insulation at ceiling level)	5.6100	0.1200	0.6732

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		12.7792	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	60.5275	(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	31.5218	31.3510	31.1835	30.3968	30.2496	29.5644	29.5644	29.4375	29.8283	30.2496	30.5473	30.8586	(38)
Heat transfer coeff	92.0493	91.8784	91.7109	90.9242	90.7770	90.0918	90.0918	89.9649	90.3558	90.7770	91.0748	91.3861	(39)
Average = Sum(39)m / 12 =												90.9235	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4560	1.4533	1.4507	1.4382	1.4359	1.4251	1.4251	1.4230	1.4292	1.4359	1.4406	1.4455	(40)
HLP (average)												1.4382	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0711 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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

25.4713	25.0930	24.5603	23.5781	22.8426	22.0271	21.5866	22.1156	22.6915	23.5642	24.5666	25.3852	(42b)

Hot water usage for other uses

35.8397	34.5365	33.2332	31.9299	30.6267	29.3234	29.3234	30.6267	31.9299	33.2332	34.5365	35.8397	(42c)

Average daily hot water use (litres/day) 56.1975 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	61.3110	59.6295	57.7935	55.5080	53.4693	51.3505	50.9100	52.7422	54.6215	56.7974	59.1031	61.2249	(44)
Energy conte	97.1016	84.9115	88.8264	75.9877	71.9799	63.1414	61.5712	65.3059	67.3537	77.0735	84.2031	95.8634	(45)
Energy content (annual)										Total = Sum(45)m =		933.3196	

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

82.5364	72.1748	75.5025	64.5895	61.1829	53.6702	52.3356	55.5100	57.2507	65.5125	71.5727	81.4839	(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

82.5364	72.1748	75.5025	64.5895	61.1829	53.6702	52.3356	55.5100	57.2507	65.5125	71.5727	81.4839	(64)
									Total per year (kWh/year) = Sum(64)m =		793.3216	(64)
12Total per year (kWh/year)											793	(64)

Electric shower(s)

47.2047	42.0598	45.9277	43.8282	44.6506	42.5924	44.0121	44.6506	43.8282	45.9277	45.0640	47.2047	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	536.9506	(64a)

Heat gains from water heating, kWh/month

32.4353	28.5586	30.3575	27.1044	26.4584	24.0656	24.0869	25.0402	25.2697	27.8600	29.1592	32.1721	(65)

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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	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	103.5530	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	91.2880	101.0689	91.2880	94.3310	91.2880	94.3310	91.2880	91.2880	94.3310	91.2880	94.3310	91.2880	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	180.9887	182.8668	178.1341	168.0586	155.3402	143.3866	135.4009	133.5228	138.2556	148.3310	161.0495	173.0030	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	33.3553	(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)	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	(71)
Water heating gains (Table 5)	43.5958	42.4980	40.8031	37.6450	35.5624	33.4245	32.3749	33.6561	35.0968	37.4463	40.4989	43.2421	(72)
Total internal gains	369.9384	380.4996	364.2911	354.1005	336.2565	325.2080	313.1297	312.5329	321.7493	331.1312	349.9452	361.5991	(73)

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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	
North	4.3600	10.6334	0.6300	0.7000	0.7700	14.1687	(74)
South	2.5600	46.7521	0.6300	0.7000	0.7700	36.5774	(78)
West	2.8400	19.6403	0.6300	0.7000	0.7700	17.0466	(80)
South	4.0700	34.8864	0.6300	0.7000	1.0000	56.3549	(82)

Solar gains	124.1476	229.3586	355.6032	501.2826	610.0796	625.2359	594.7842	511.8224	406.4000	265.3101	152.0969	103.9713	(83)
Total gains	494.0860	609.8582	719.8943	855.3831	946.3361	950.4439	907.9139	824.3553	728.1493	596.4413	502.0421	465.5703	(84)

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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	48.1843	48.2739	48.3620	48.7805	48.8596	49.2312	49.2312	49.3006	49.0874	48.8596	48.6998	48.5340	
alpha	4.2123	4.2183	4.2241	4.2520	4.2573	4.2821	4.2821	4.2867	4.2725	4.2573	4.2467	4.2356	
util living area	0.9943	0.9859	0.9642	0.8959	0.7609	0.5764	0.4294	0.4886	0.7427	0.9428	0.9880	0.9955	(86)
MIT	19.3329	19.5999	19.9859	20.4663	20.8015	20.9540	20.9896	20.9823	20.8677	20.3894	19.7696	19.2886	(87)

Th 2	19.7206	19.7227	19.7247	19.7342	19.7359	19.7442	19.7442	19.7457	19.7410	19.7359	19.7323	19.7286	(88)
util rest of house	0.9923	0.9811	0.9520	0.8620	0.6926	0.4758	0.3105	0.3620	0.6460	0.9162	0.9831	0.9940	(89)
MIT 2	18.2397	18.5051	18.8831	19.3381	19.6175	19.7262	19.7420	19.7416	19.6781	19.2835	18.6825	18.2016	(90)
Living area fraction										fLA = Living area / (4) =		0.4875	(91)
MIT	18.7726	19.0389	19.4207	19.8881	20.1947	20.3247	20.3502	20.3465	20.2580	19.8226	19.2125	18.7316	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7726	19.0389	19.4207	19.8881	20.1947	20.3247	20.3502	20.3465	20.2580	19.8226	19.2125	18.7316	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9903	0.9777	0.9484	0.8667	0.7191	0.5238	0.3687	0.4240	0.6888	0.9184	0.9804	0.9923	(94)
Useful gains	489.2941	596.2703	682.7228	741.3807	680.5357	497.8296	334.7693	349.5161	501.5441	547.7606	492.2202	461.9874	(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	1332.1957	1299.0553	1184.9725	999.0870	771.1227	515.7528	337.8642	355.0431	556.4115	837.2016	1103.1436	1327.9817	(97)
Space heating kWh	627.1187	472.2715	373.6737	185.5486	67.3967	0.0000	0.0000	0.0000	0.0000	215.3441	439.8649	644.2998	(98a)
Space heating requirement - total per year (kWh/year)												3025.5181	
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	627.1187	472.2715	373.6737	185.5486	67.3967	0.0000	0.0000	0.0000	0.0000	215.3441	439.8649	644.2998	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3025.5181	
Space heating per m2											(98c) / (4) =	47.8570	(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	846.8633	666.6796	683.7336	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8780	0.9285	0.8998	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	743.5633	619.0050	615.2419	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1021.1366	976.0167	887.9603	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	199.8528	265.6167	202.9025	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	49.9632	66.4042	50.7256	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												167.0930	(107)
Energy for space heating												47.8570	(99)
Energy for space cooling												2.6430	(108)
Total												50.5000	(109)
Fabric Energy Efficiency (TFEE)												50.5	(109)

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	63.2200	(1b)	x 2.6000	(2b) =	164.3720	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.2200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		164.3720	(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	0 * 10 =	0.0000	(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) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		8.0000	(17)
Infiltration rate		0.4000	(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) =	0.3400	(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													
	0.4335	0.4250	0.4165	0.3740	0.3655	0.3230	0.3230	0.3145	0.3400	0.3655	0.3825	0.3995	(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	0.6835	0.6750	0.6665	0.6240	0.6155	0.5730	0.5730	0.5645	0.5900	0.6155	0.6325	0.6495	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Door			1.9700	1.6000	3.1520			(26)
Windows			16.3100	1.5038	24.5263			(27)
Rooflight			6.8000	2.0221	13.7500			(27a)
Heatloss Floor 1			63.2200	0.1800	11.3796	110.0000	6954.2000	(28a)
External Wall 1	76.4400	18.2800	58.1600	0.2600	15.1216	110.0000	6397.6000	(29a)
External Roof 1	63.2200	6.8000	56.4200	0.1600	9.0272	9.0000	507.7800	(30)
Total net area of external elements Aum(A, m2)			202.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		76.9567			(33)
Main dwelling								
Party Wall 1			14.6600	0.0000	0.0000	110.0000	1612.6000	(32)
Internal Wall 1			55.0000			9.0000	495.0000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 15967.1800 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 252.5653 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.5000	0.2300	2.4150
E3 Sill	9.5600	0.0190	0.1816
E4 Jamb	24.3000	0.0160	0.3888
E5 Ground floor (normal)	29.6200	0.0940	2.7843
R11 Upstands or kerbs of rooflights	19.3800	0.2400	4.6512
E14 Flat roof	29.6200	0.1600	4.7392
E16 Corner (normal)	7.8000	0.0510	0.3978
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0700	-0.1820
E18 Party wall between dwellings	5.2000	0.0400	0.2080
P1 Party wall - Ground floor	5.6100	0.0680	0.3815
P4 Party wall - Roof (insulation at ceiling level)	5.6100	0.0910	0.5105

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.4759 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 93.4326 (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	37.0749	36.6139	36.1528	33.8475	33.3864	31.0811	31.0811	30.6200	32.0032	33.3864	34.3085	35.2307	(38)
Heat transfer coeff													
	130.5076	130.0465	129.5854	127.2801	126.8190	124.5137	124.5137	124.0527	125.4359	126.8190	127.7412	128.6633	(39)
Average = Sum(39)m / 12 =												127.1648	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.0643	2.0570	2.0498	2.0133	2.0060	1.9695	1.9695	1.9622	1.9841	2.0060	2.0206	2.0352	(40)
HLP (average)												2.0115	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0711 (42)

Hot water usage for mixer showers

75.6831	74.5457	72.8883	69.7172	67.3771	64.7673	63.2839	64.9288	66.7318	69.5339	72.7731	75.3931	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

35.8397	34.5365	33.2332	31.9299	30.6267	29.3234	29.3234	30.6267	31.9299	33.2332	34.5365	35.8397	(42c)

Average daily hot water use (litres/day) 102.3588 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	111.5228	109.0822	106.1215	101.6472	98.0037	94.0907	92.6074	95.5554	98.6617	102.7671	107.3095	111.2328	(44)
Energy conte	176.6248	155.3315	163.1048	139.1499	131.9319	115.6955	112.0006	118.3176	121.6598	139.4540	152.8821	174.1637	(45)
Energy content (annual)										Total = Sum(45)m =		1700.3162	
Distribution loss (46)m = 0.15 x (45)m													
	26.4937	23.2997	24.4657	20.8725	19.7898	17.3543	16.8001	17.7476	18.2490	20.9181	22.9323	26.1246	(46)
Water storage loss (or HIU loss):													
Store volume												201.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8694	(55)
Total storage loss													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(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													
	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(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													
	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(64)
									Total per year (kWh/year) = Sum(64)m =			2017.6472	(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													
	58.7278	51.6477	54.2324	46.2673	43.8673	38.4688	37.2402	39.3406	40.4519	46.3684	50.8333	57.9094	(65)

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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	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.9156	18.5770	15.1078	11.4376	8.5497	7.2181	7.7994	10.1379	13.6071	17.2773	20.1652	21.4969	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	270.1324	272.9355	265.8717	250.8338	231.8510	214.0099	202.0909	199.2878	206.3516	221.3896	240.3723	258.2135	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	(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)													
	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	(71)
Water heating gains (Table 5)													
	78.9352	76.8567	72.8929	64.2602	58.9615	53.4288	50.0540	52.8772	56.1832	62.3232	70.6018	77.8353	(72)
Total internal gains													
	460.9017	459.2879	444.7912	417.4502	390.2809	365.5754	350.8629	353.2215	367.0605	391.9087	422.0579	448.4642	(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	
North	7.2800	10.6334	0.6300	0.7000	0.7700	23.6578	(74)
South	4.2800	46.7521	0.6300	0.7000	0.7700	61.1528	(78)
West	4.7500	19.6403	0.6300	0.7000	0.7700	28.5110	(80)
South	6.8000	34.8864	0.6300	0.7000	1.0000	94.1556	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	207.4773	383.3013	594.2628	837.6852	1019.4685	1044.7842	993.9032	855.2885	679.1423	443.3786	254.1856	173.7590	(83)
Total gains	668.3790	842.5892	1039.0540	1255.1353	1409.7494	1410.3597	1344.7662	1208.5100	1046.2028	835.2873	676.2435	622.2232	(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	33.9852	34.1057	34.2271	34.8470	34.9737	35.6212	35.6212	35.7536	35.3593	34.9737	34.7212	34.4724	
alpha	3.2657	3.2737	3.2818	3.3231	3.3316	3.3747	3.3747	3.3836	3.3573	3.3316	3.3147	3.2982	
util living area													
	0.9853	0.9690	0.9305	0.8403	0.6964	0.5260	0.3955	0.4517	0.6928	0.9071	0.9744	0.9882	(86)
MIT	18.8045	19.1542	19.6804	20.2938	20.7122	20.9194	20.9766	20.9638	20.7944	20.1825	19.3770	18.7573	(87)
Th 2	19.2908	19.2956	19.3004	19.3245	19.3293	19.3537	19.3537	19.3586	19.3439	19.3293	19.3196	19.3100	(88)
util rest of house													
	0.9801	0.9583	0.9070	0.7896	0.6099	0.4064	0.2531	0.2999	0.5721	0.8637	0.9636	0.9840	(89)
MIT 2	16.8803	17.3214	17.9704	18.6975	19.1280	19.3185	19.3489	19.3501	19.2328	18.6086	17.6238	16.8318	(90)
Living area fraction									fLA = Living area / (4) =			0.4875	(91)
MIT	17.8184	18.2149	18.8040	19.4757	19.9003	20.0989	20.1424	20.1367	19.9941	19.3759	18.4785	17.7705	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.8184	18.2149	18.8040	19.4757	19.9003	20.0989	20.1424	20.1367	19.9941	19.3759	18.4785	17.7705	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9735	0.9491	0.8983	0.7948	0.6418	0.4627	0.3228	0.3742	0.6238	0.8652	0.9561	0.9783	(94)
Useful gains	650.6541	799.6898	933.3819	997.5910	904.7589	652.5854	434.1388	452.2173	652.6221	722.7117	646.5258	608.7383	(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													
	1764.2486	1731.5504	1594.4244	1346.0729	1039.9542	684.6919	441.0793	463.5534	739.3274	1112.9475	1453.5037	1746.0241	(97)
Space heating kWh													
	828.5144	626.2103	491.8156	250.9070	100.5854	0.0000	0.0000	0.0000	0.0000	290.3354	581.0241	846.1406	(98a)
Space heating requirement - total per year (kWh/year)												4015.5327	
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													
	828.5144	626.2103	491.8156	250.9070	100.5854	0.0000	0.0000	0.0000	0.0000	290.3354	581.0241	846.1406	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4015.5327	
Space heating per m2											(98c) / (4) =	63.5168	(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)
Fraction of main heating from main system 2	0.0000	(203)
Fraction of total heating from main system 1	1.0000	(204)
Fraction of total heating from main system 2	0.0000	(205)
Efficiency of main space heating system 1 (in %)	100.0000	(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													
	828.5144	626.2103	491.8156	250.9070	100.5854	0.0000	0.0000	0.0000	0.0000	290.3354	581.0241	846.1406	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	828.5144	626.2103	491.8156	250.9070	100.5854	0.0000	0.0000	0.0000	0.0000	290.3354	581.0241	846.1406	(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)
Space heating fuel used, main system 2												0.0000	(213)

Water heating
Water heating requirement

	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151 (64)
Efficiency of water heater												348.7264 (216)
(217)m	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264 (217)
Fuel for water heating, kWh/month												
	58.3771	51.5231	54.5001	47.3815	45.5610	40.6558	39.8456	41.6570	42.3661	47.7180	51.3193	57.6713 (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	34.0633	30.7668	34.0633	32.9645	34.0633	32.9645	34.0633	34.0633	32.9645	34.0633	32.9645	34.0633 (231)
Lighting	18.3073	14.6868	13.2238	9.6883	7.4835	6.1141	6.8267	8.8737	11.5260	15.1227	17.0811	18.8161 (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	4015.5327 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	348.7264
Water heating fuel used	578.5760 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(MEVDecentralised, Table 4g: in-use factor = 2.5000, SFP = 2.0000)	
mechanical ventilation fans (SFP = 2.0000)	401.0677 (230a)
Total electricity for the above, kWh/year	401.0677 (231)
Electricity for lighting (calculated in Appendix L)	147.7501 (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	5142.9266 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4015.5327	16.4900	662.1613	(240)
Space heating - main system 2	0.0000	16.4900	0.0000	(241)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	578.5760	16.4900	95.4072	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	401.0677	16.4900	66.1361	(249)
Energy for lighting	147.7501	16.4900	24.3640	(250)
Additional standing charges			0.0000	(251)
Total energy cost			848.0686	(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] =	2.8211 (257)
SAP value		54.2692
SAP rating (Section 12)		54 (258)
SAP band		E

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	4015.5327	0.1556	624.7874	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	578.5760	0.1411	81.6624	(264)
Space and water heating			706.4498	(265)
Pumps, fans and electric keep-hot	401.0677	0.1387	55.6330	(267)
Energy for lighting	147.7501	0.1443	21.3249	(268)
Total CO2, kg/year			783.4078	(272)
CO2 emissions per m2			12.3900	(273)
EI value			90.2997	
EI rating			90	(274)
EI band			B	

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	63.2200	(1b)	x 2.6000	(2b) =	164.3720	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.2200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	164.3720	(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	0 * 10 =	0.0000 (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) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		8.0000 (17)
Infiltration rate		0.4000 (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) =	0.3400 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.4420	0.4420	0.4250	0.3740	0.3655	0.3315	0.3145	0.3145	0.3485	0.3910	0.4080	0.3995	(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	0.6920	0.6920	0.6750	0.6240	0.6155	0.5815	0.5645	0.5645	0.5985	0.6410	0.6580	0.6495	(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			1.9700	1.6000	3.1520			(26)
Windows			16.3100	1.5038	24.5263			(27)
Rooflight			6.8000	2.0221	13.7500			(27a)
Heatloss Floor 1			63.2200	0.1800	11.3796	110.0000	6954.2000	(28a)
External Wall 1	76.4400	18.2800	58.1600	0.2600	15.1216	110.0000	6397.6000	(29a)
External Roof 1	63.2200	6.8000	56.4200	0.1600	9.0272	9.0000	507.7800	(30)
Total net area of external elements Aum(A, m2)			202.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		76.9567			(33)
Main dwelling								
Party Wall 1			14.6600	0.0000	0.0000	110.0000	1612.6000	(32)
Internal Wall 1			55.0000			9.0000	495.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 15967.1800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	252.5653 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.5000	0.2300	2.4150
E3 Sill	9.5600	0.0190	0.1816
E4 Jamb	24.3000	0.0160	0.3888
E5 Ground floor (normal)	29.6200	0.0940	2.7843
R11 Upstands or kerbs of rooflights	19.3800	0.2400	4.6512
E14 Flat roof	29.6200	0.1600	4.7392
E16 Corner (normal)	7.8000	0.0510	0.3978
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0700	-0.1820
E18 Party wall between dwellings	5.2000	0.0400	0.2080
P1 Party wall - Ground floor	5.6100	0.0680	0.3815
P4 Party wall - Roof (insulation at ceiling level)	5.6100	0.0910	0.5105

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		16.4759 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	93.4326 (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	37.5360	37.5360	36.6139	33.8475	33.3864	31.5422	30.6200	30.6200	32.4643	34.7696	35.6917	35.2307	(38)
Heat transfer coeff	130.9686	130.9686	130.0465	127.2801	126.8190	124.9748	124.0527	124.0527	125.8969	128.2022	129.1244	128.6633	(39)
Average = Sum(39)m / 12 =												127.5875	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.0716	2.0716	2.0570	2.0133	2.0060	1.9768	1.9622	1.9622	1.9914	2.0279	2.0425	2.0352	(40)
HLP (average)												2.0182	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0711 (42)
Hot water usage for mixer showers	

	75.6831	74.5457	72.8883	69.7172	67.3771	64.7673	63.2839	64.9288	66.7318	69.5339	72.7731	75.3931 (42a)
Hot water usage for baths												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses												
	35.8397	34.5365	33.2332	31.9299	30.6267	29.3234	29.3234	30.6267	31.9299	33.2332	34.5365	35.8397 (42c)
Average daily hot water use (litres/day)												102.3588 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	111.5228	109.0822	106.1215	101.6472	98.0037	94.0907	92.6074	95.5554	98.6617	102.7671	107.3095	111.2328	(44)
Energy conte	176.6248	155.3315	163.1048	139.1499	131.9319	115.6955	112.0006	118.3176	121.6598	139.4540	152.8821	174.1637	(45)
Energy content (annual)										Total = Sum(45)m =		1700.3162	
Distribution loss (46)m = 0.15 x (45)m													
	26.4937	23.2997	24.4657	20.8725	19.7898	17.3543	16.8001	17.7476	18.2490	20.9181	22.9323	26.1246	(46)
Water storage loss (or HIU loss):													
Store volume												201.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8694	(55)
Total storage loss													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(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													
	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(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													
	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(64)
										Total per year (kWh/year) = Sum(64)m =		2017.6472	(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													
	58.7278	51.6477	54.2324	46.2673	43.8673	38.4688	37.2402	39.3406	40.4519	46.3684	50.8333	57.9094	(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	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.9156	18.5770	15.1078	11.4376	8.5497	7.2181	7.7994	10.1379	13.6071	17.2773	20.1652	21.4969	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	270.1324	272.9355	265.8717	250.8338	231.8510	214.0099	202.0909	199.2878	206.3516	221.3896	240.3723	258.2135	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	(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)													
	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	(71)
Water heating gains (Table 5)													
	78.9352	76.8567	72.8929	64.2602	58.9615	53.4288	50.0540	52.8772	56.1832	62.3232	70.6018	77.8353	(72)
Total internal gains													
	460.9017	459.2879	444.7912	417.4502	390.2809	365.5754	350.8629	353.2215	367.0605	391.9087	422.0579	448.4642	(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	
North	7.2800	9.5462	0.6300	0.7000	0.7700	21.2390	(74)
South	4.2800	42.7195	0.6300	0.7000	0.7700	55.8782	(78)
West	4.7500	17.5237	0.6300	0.7000	0.7700	25.4385	(80)
South	6.8000	31.1868	0.6300	0.7000	1.0000	84.1708	(82)

Solar gains	186.7264	367.6620	595.2049	883.7008	1067.1843	1064.4337	1024.5339	855.4025	674.2843	422.5207	234.9927	159.9995	(83)
Total gains	647.6282	826.9499	1039.9960	1301.1510	1457.4652	1430.0091	1375.3968	1208.6240	1041.3448	814.4294	657.0507	608.4637	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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)													
tau	33.8656	33.8656	34.1057	34.8470	34.9737	35.4898	35.7536	35.7536	35.2298	34.5963	34.3493	34.4724	
alpha	3.2577	3.2577	3.2737	3.3231	3.3316	3.3660	3.3836	3.3836	3.3487	3.3064	3.2900	3.2982	
util living area													
	0.9875	0.9734	0.9401	0.8535	0.7254	0.6081	0.5148	0.5782	0.7667	0.9288	0.9787	0.9899	(86)
MIT	18.6929	19.0070	19.5187	20.1898	20.6372	20.8461	20.9287	20.8969	20.6584	19.9951	19.2382	18.6457	(87)
Th 2	19.2860	19.2860	19.2956	19.3245	19.3293	19.3488	19.3586	19.3586	19.3391	19.3148	19.3052	19.3100	(88)
util rest of house													
	0.9831	0.9645	0.9205	0.8094	0.6496	0.5045	0.3909	0.4481	0.6728	0.8964	0.9699	0.9863	(89)
MIT 2	16.7356	17.1303	17.7681	18.5759	19.0534	19.2604	19.3296	19.3137	19.1093	18.3786	17.4405	16.6896	(90)
Living area fraction											fLA = Living area / (4) =	0.4875	(91)
MIT	17.6898	18.0452	18.6215	19.3627	19.8255	20.0334	20.1091	20.0855	19.8645	19.1667	18.3169	17.6432	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.6898	18.0452	18.6215	19.3627	19.8255	20.0334	20.1091	20.0855	19.8645	19.1667	18.3169	17.6432	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9770	0.9555	0.9107	0.8106	0.6740	0.5498	0.4498	0.5089	0.7060	0.8928	0.9626	0.9811	(94)

Useful gains	632.7336	790.1436	947.0877	1054.7013	982.3004	786.1949	618.6068	615.0143	735.2217	727.1186	632.4578	596.9888	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	1806.0321	1800.1894	1693.4026	1458.9770	1157.2883	854.0090	646.2073	655.6799	889.4015	1213.6471	1512.9312	1793.9793	(97)
Space heating kWh													
	872.9341	678.7507	555.2583	291.0785	130.1910	0.0000	0.0000	0.0000	0.0000	361.9772	633.9408	890.5609	(98a)
Space heating requirement - total per year (kWh/year)												4414.6916	
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													
	872.9341	678.7507	555.2583	291.0785	130.1910	0.0000	0.0000	0.0000	0.0000	361.9772	633.9408	890.5609	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4414.6916	
Space heating per m2											(98c) / (4) =	69.8306	(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)
Fraction of main heating from main system 2												0.0000	(203)
Fraction of total heating from main system 1												1.0000	(204)
Fraction of total heating from main system 2												0.0000	(205)
Efficiency of main space heating system 1 (in %)												100.0000	(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													
	872.9341	678.7507	555.2583	291.0785	130.1910	0.0000	0.0000	0.0000	0.0000	361.9772	633.9408	890.5609	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	872.9341	678.7507	555.2583	291.0785	130.1910	0.0000	0.0000	0.0000	0.0000	361.9772	633.9408	890.5609	(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)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement													
	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(64)
Efficiency of water heater												348.7264	(216)
(217)m	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	(217)
Fuel for water heating, kWh/month													
	58.3771	51.5231	54.5001	47.3815	45.5610	40.6558	39.8456	41.6570	42.3661	47.7180	51.3193	57.6713	(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	34.0633	30.7668	34.0633	32.9645	34.0633	32.9645	34.0633	34.0633	32.9645	34.0633	32.9645	34.0633	(231)
Lighting	18.3073	14.6868	13.2238	9.6883	7.4835	6.1141	6.8267	8.8737	11.5260	15.1227	17.0811	18.8161	(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												4414.6916	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												348.7264	
Water heating fuel used												578.5760	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVDecentralised, Table 4g: in-use factor = 2.5000, SFP = 2.0000)													
mechanical ventilation fans (SFP = 2.0000)												401.0677	(230a)
Total electricity for the above, kWh/year												401.0677	(231)
Electricity for lighting (calculated in Appendix L)												147.7501	(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												5542.0854	(238)

10a. Fuel costs - using BEDF prices (596)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4414.6916	27.6700	1221.5452	(240)
Space heating - main system 2	0.0000	27.6700	0.0000	(241)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	578.5760	27.6700	160.0920	(247)
Energy for instantaneous electric shower(s)	0.0000	27.6700	0.0000	(247a)
Pumps, fans and electric keep-hot	401.0677	27.6700	110.9754	(249)
Energy for lighting	147.7501	27.6700	40.8825	(250)
Additional standing charges			0.0000	(251)
Total energy cost			1533.4950	(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	4414.6916	0.1551	684.7677	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	578.5760	0.1411	81.6624	(264)
Space and water heating			766.4301	(265)
Pumps, fans and electric keep-hot	401.0677	0.1387	55.6330	(267)
Energy for lighting	147.7501	0.1443	21.3249	(268)
Total CO2, kg/year			843.3881	(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	4414.6916	1.5743	6949.8327	(275)
Space heating - main system 2	0.0000	0.0000	0.0000	(276)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	578.5760	1.5219	880.5409	(278)
Space and water heating			7830.3736	(279)
Pumps, fans and electric keep-hot	401.0677	1.5128	606.7352	(281)
Energy for lighting	147.7501	1.5338	226.6241	(282)
Total Primary energy kWh/year			8663.7329	(286)

SAP 10 EPC IMPROVEMENTS

Baseline

Current energy efficiency rating: E 54
Current environmental impact rating: B 90

N Solar water heating			SAP increase too small
U Solar photovoltaic panels			Recommended
V2 Wind turbine			Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 10.4	-£ 294	-223 kg (26.4%)

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.8	-£ 24	-10 kg (1.2%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar photovoltaic panels	£294	3.52 kg/m²	D 65	A 93
Total Savings	£294	3.52 kg/m²		

Potential energy efficiency rating: D 65
Potential environmental impact rating: A 93

Fuel prices for cost data on this page from database revision number 596 TEST (30 Jun 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£1533	£1533	£0
Space heating	£1333	£1333	£0
Water heating	£160	£160	£0
Lighting	£41	£41	£0
Generated (PV)	-£0	-£294	£294
Total cost of fuels	£1533	£1239	£294
Total cost of uses	£1534	£1240	£294
Delivered energy	88 kWh/m²	60 kWh/m²	28 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	13 kg/m²	10 kg/m²	4 kg/m²
Primary energy	137 kWh/m²	110 kWh/m²	27 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	63.2200	(1b)	x 2.6000	(2b) =	164.3720	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.2200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	164.3720	(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	0 * 10 =	0.0000	(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) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		8.0000	(17)
Infiltration rate		0.4000	(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) =	0.3400	(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	0.4335	0.4250	0.4165	0.3740	0.3655	0.3230	0.3230	0.3145	0.3400	0.3655	0.3825	0.3995	(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	0.6835	0.6750	0.6665	0.6240	0.6155	0.5730	0.5730	0.5645	0.5900	0.6155	0.6325	0.6495	(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			1.9700	1.6000	3.1520			(26)
Windows			16.3100	1.5038	24.5263			(27)
Rooflight			6.8000	2.0221	13.7500			(27a)
Heatloss Floor 1			63.2200	0.1800	11.3796	110.0000	6954.2000	(28a)
External Wall 1	76.4400	18.2800	58.1600	0.2600	15.1216	110.0000	6397.6000	(29a)
External Roof 1	63.2200	6.8000	56.4200	0.1600	9.0272	9.0000	507.7800	(30)
Total net area of external elements Aum(A, m2)			202.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		76.9567			(33)
Main dwelling								
Party Wall 1			14.6600	0.0000	0.0000	110.0000	1612.6000	(32)
Internal Wall 1			55.0000			9.0000	495.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	15967.1800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		252.5653 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.5000	0.2300	2.4150
E3 Sill	9.5600	0.0190	0.1816
E4 Jamb	24.3000	0.0160	0.3888
E5 Ground floor (normal)	29.6200	0.0940	2.7843
R11 Upstands or kerbs of rooflights	19.3800	0.2400	4.6512
E14 Flat roof	29.6200	0.1600	4.7392
E16 Corner (normal)	7.8000	0.0510	0.3978
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0700	-0.1820
E18 Party wall between dwellings	5.2000	0.0400	0.2080
P1 Party wall - Ground floor	5.6100	0.0680	0.3815
P4 Party wall - Roof (insulation at ceiling level)	5.6100	0.0910	0.5105

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		16.4759 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	93.4326 (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	37.0749	36.6139	36.1528	33.8475	33.3864	31.0811	31.0811	30.6200	32.0032	33.3864	34.3085	35.2307	(38)
Heat transfer coeff	130.5076	130.0465	129.5854	127.2801	126.8190	124.5137	124.5137	124.0527	125.4359	126.8190	127.7412	128.6633	(39)
Average = Sum(39)m / 12 =												127.1648	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.0643	2.0570	2.0498	2.0133	2.0060	1.9695	1.9695	1.9622	1.9841	2.0060	2.0206	2.0352	(40)
HLP (average)												2.0115	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0711	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
75.6831	74.5457	72.8883	69.7172	67.3771	64.7673	63.2839	64.9288	66.7318	69.5339	72.7731	75.3931	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

35.8397	34.5365	33.2332	31.9299	30.6267	29.3234	29.3234	30.6267	31.9299	33.2332	34.5365	35.8397	(42c)

Average daily hot water use (litres/day)	102.3588	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5228	109.0822	106.1215	101.6472	98.0037	94.0907	92.6074	95.5554	98.6617	102.7671	107.3095	111.2328	(44)
Energy conte	176.6248	155.3315	163.1048	139.1499	131.9319	115.6955	112.0006	118.3176	121.6598	139.4540	152.8821	174.1637	(45)
Energy content (annual)										Total = Sum(45)m =		1700.3162	
Distribution loss (46)m = 0.15 x (45)m	26.4937	23.2997	24.4657	20.8725	19.7898	17.3543	16.8001	17.7476	18.2490	20.9181	22.9323	26.1246	(46)

Water storage loss (or HIU loss):

Store volume												201.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8694	(55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(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	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(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	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(64)
Total per year (kWh/year) = Sum(64)m =												2017.6472	(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	58.7278	51.6477	54.2324	46.2673	43.8673	38.4688	37.2402	39.3406	40.4519	46.3684	50.8333	57.9094	(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	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.9156	18.5770	15.1078	11.4376	8.5497	7.2181	7.7994	10.1379	13.6071	17.2773	20.1652	21.4969	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	270.1324	272.9355	265.8717	250.8338	231.8510	214.0099	202.0909	199.2878	206.3516	221.3896	240.3723	258.2135	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	(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)	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	(71)
Water heating gains (Table 5)	78.9352	76.8567	72.8929	64.2602	58.9615	53.4288	50.0540	52.8772	56.1832	62.3232	70.6018	77.8353	(72)
Total internal gains	460.9017	459.2879	444.7912	417.4502	390.2809	365.5754	350.8629	353.2215	367.0605	391.9087	422.0579	448.4642	(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	
North	7.2800	10.6334	0.6300	0.7000	0.7700	23.6578	(74)
South	4.2800	46.7521	0.6300	0.7000	0.7700	61.1528	(78)
West	4.7500	19.6403	0.6300	0.7000	0.7700	28.5110	(80)
South	6.8000	34.8864	0.6300	0.7000	1.0000	94.1556	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	207.4773	383.3013	594.2628	837.6852	1019.4685	1044.7842	993.9032	855.2885	679.1423	443.3786	254.1856	173.7590	(83)
Total gains	668.3790	842.5892	1039.0540	1255.1353	1409.7494	1410.3597	1344.7662	1208.5100	1046.2028	835.2873	676.2435	622.2232	(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	33.9852	34.1057	34.2271	34.8470	34.9737	35.6212	35.6212	35.7536	35.3593	34.9737	34.7212	34.4724	
alpha	3.2657	3.2737	3.2818	3.3231	3.3316	3.3747	3.3747	3.3836	3.3573	3.3316	3.3147	3.2982	
util living area	0.9853	0.9690	0.9305	0.8403	0.6964	0.5260	0.3955	0.4517	0.6928	0.9071	0.9744	0.9882	(86)
MIT	18.8045	19.1542	19.6804	20.2938	20.7122	20.9194	20.9766	20.9638	20.7944	20.1825	19.3770	18.7573	(87)
Th 2	19.2908	19.2956	19.3004	19.3245	19.3293	19.3537	19.3537	19.3586	19.3439	19.3293	19.3196	19.3100	(88)
util rest of house	0.9801	0.9583	0.9070	0.7896	0.6099	0.4064	0.2531	0.2999	0.5721	0.8637	0.9636	0.9840	(89)
MIT 2	16.8803	17.3214	17.9704	18.6975	19.1280	19.3185	19.3489	19.3501	19.2328	18.6086	17.6238	16.8318	(90)
Living area fraction									fLA = Living area / (4) =			0.4875	(91)
MIT	17.8184	18.2149	18.8040	19.4757	19.9003	20.0989	20.1424	20.1367	19.9941	19.3759	18.4785	17.7705	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.8184	18.2149	18.8040	19.4757	19.9003	20.0989	20.1424	20.1367	19.9941	19.3759	18.4785	17.7705	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9735	0.9491	0.8983	0.7948	0.6418	0.4627	0.3228	0.3742	0.6238	0.8652	0.9561	0.9783	(94)
Useful gains	650.6541	799.6898	933.3819	997.5910	904.7589	652.5854	434.1388	452.2173	652.6221	722.7117	646.5258	608.7383	(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	1764.2486	1731.5504	1594.4244	1346.0729	1039.9542	684.6919	441.0793	463.5534	739.3274	1112.9475	1453.5037	1746.0241	(97)
Space heating kWh	828.5144	626.2103	491.8156	250.9070	100.5854	0.0000	0.0000	0.0000	0.0000	290.3354	581.0241	846.1406	(98a)
Space heating requirement - total per year (kWh/year)												4015.5327	
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	828.5144	626.2103	491.8156	250.9070	100.5854	0.0000	0.0000	0.0000	0.0000	290.3354	581.0241	846.1406	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4015.5327	
Space heating per m2											(98c) / (4) =	63.5168	(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)
Fraction of main heating from main system 2												0.0000	(203)
Fraction of total heating from main system 1												1.0000	(204)
Fraction of total heating from main system 2												0.0000	(205)
Efficiency of main space heating system 1 (in %)												100.0000	(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													
	828.5144	626.2103	491.8156	250.9070	100.5854	0.0000	0.0000	0.0000	0.0000	290.3354	581.0241	846.1406	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	828.5144	626.2103	491.8156	250.9070	100.5854	0.0000	0.0000	0.0000	0.0000	290.3354	581.0241	846.1406	(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)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement													
	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(64)
Efficiency of water heater												348.7264	(216)
(217)m	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	(217)
Fuel for water heating, kWh/month													
	58.3771	51.5231	54.5001	47.3815	45.5610	40.6558	39.8456	41.6570	42.3661	47.7180	51.3193	57.6713	(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	34.0633	30.7668	34.0633	32.9645	34.0633	32.9645	34.0633	34.0633	32.9645	34.0633	32.9645	34.0633	(231)
Lighting	18.3073	14.6868	13.2238	9.6883	7.4835	6.1141	6.8267	8.8737	11.5260	15.1227	17.0811	18.8161	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-40.7428	-61.8391	-93.2512	-104.1829	-105.0391	-86.2529	-85.3059	-79.8626	-69.8895	-69.0085	-45.7909	-34.7374	(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	-9.3437	-21.7409	-49.0951	-86.5891	-130.6437	-145.4609	-143.3456	-119.9114	-86.5736	-37.8374	-13.6189	-7.1765	(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												4015.5327	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												348.7264	
Water heating fuel used												578.5760	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVDecentralised, Table 4g: in-use factor = 2.5000, SFP = 2.0000)													
mechanical ventilation fans (SFP = 2.0000)												401.0677	(230a)
Total electricity for the above, kWh/year												401.0677	(231)
Electricity for lighting (calculated in Appendix L)												147.7501	(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												3415.6872	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4015.5327	16.4900	662.1613	(240)
Space heating - main system 2	0.0000	16.4900	0.0000	(241)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	578.5760	16.4900	95.4072	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	401.0677	16.4900	66.1361	(249)
Energy for lighting	147.7501	16.4900	24.3640	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-875.9027	16.4900	-144.4364	
PV Unit electricity exported	-851.3367	5.5900	-47.5897	
Total			-192.0261	(252)
Total energy cost			656.0425	(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] =	2.1824	(257)
SAP value		64.6239	

SAP rating (Section 12) 65 (258)
SAP band D

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	4015.5327	0.1556	624.7874	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	578.5760	0.1411	81.6624	(264)
Space and water heating			706.4498	(265)
Pumps, fans and electric keep-hot	401.0677	0.1387	55.6330	(267)
Energy for lighting	147.7501	0.1443	21.3249	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-875.9027	0.1357	-118.8183	
PV Unit electricity exported	-851.3367	0.1208	-102.8734	
Total			-221.6916	(269)
Total CO2, kg/year			561.7161	(272)
CO2 emissions per m2			8.8900	(273)
EI value			93.0447	
EI rating			93	(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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	63.2200	(1b)	x 2.6000	(2b) =	164.3720	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.2200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	164.3720	(5)

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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	0 * 10 =	0.0000 (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) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		8.0000 (17)
Infiltration rate		0.4000 (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) =	0.3400 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.4420	0.4420	0.4250	0.3740	0.3655	0.3315	0.3145	0.3145	0.3485	0.3910	0.4080	0.3995	(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	0.6920	0.6920	0.6750	0.6240	0.6155	0.5815	0.5645	0.5645	0.5985	0.6410	0.6580	0.6495	(25)

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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			1.9700	1.6000	3.1520			(26)
Windows			16.3100	1.5038	24.5263			(27)
Rooflight			6.8000	2.0221	13.7500			(27a)
Heatloss Floor 1			63.2200	0.1800	11.3796	110.0000	6954.2000	(28a)
External Wall 1	76.4400	18.2800	58.1600	0.2600	15.1216	110.0000	6397.6000	(29a)
External Roof 1	63.2200	6.8000	56.4200	0.1600	9.0272	9.0000	507.7800	(30)
Total net area of external elements Aum(A, m2)			202.8800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.9567			(33)
Main dwelling								
Party Wall 1			14.6600	0.0000	0.0000	110.0000	1612.6000	(32)
Internal Wall 1			55.0000			9.0000	495.0000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 15967.1800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 252.5653 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.5000	0.2300	2.4150
E3 Sill	9.5600	0.0190	0.1816
E4 Jamb	24.3000	0.0160	0.3888
E5 Ground floor (normal)	29.6200	0.0940	2.7843
R11 Upstands or kerbs of rooflights	19.3800	0.2400	4.6512
E14 Flat roof	29.6200	0.1600	4.7392
E16 Corner (normal)	7.8000	0.0510	0.3978
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0700	-0.1820
E18 Party wall between dwellings	5.2000	0.0400	0.2080
P1 Party wall - Ground floor	5.6100	0.0680	0.3815
P4 Party wall - Roof (insulation at ceiling level)	5.6100	0.0910	0.5105

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.4759 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 93.4326 (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	37.5360	37.5360	36.6139	33.8475	33.3864	31.5422	30.6200	30.6200	32.4643	34.7696	35.6917	35.2307	(38)
Heat transfer coeff	130.9686	130.9686	130.0465	127.2801	126.8190	124.9748	124.0527	124.0527	125.8969	128.2022	129.1244	128.6633	(39)
Average = Sum(39)m / 12 =												127.5875	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.0716	2.0716	2.0570	2.0133	2.0060	1.9768	1.9622	1.9622	1.9914	2.0279	2.0425	2.0352	(40)
HLP (average)												2.0182	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0711 (42)
Hot water usage for mixer showers

75.6831	74.5457	72.8883	69.7172	67.3771	64.7673	63.2839	64.9288	66.7318	69.5339	72.7731	75.3931	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

35.8397	34.5365	33.2332	31.9299	30.6267	29.3234	29.3234	30.6267	31.9299	33.2332	34.5365	35.8397	(42c)

Average daily hot water use (litres/day) 102.3588 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5228	109.0822	106.1215	101.6472	98.0037	94.0907	92.6074	95.5554	98.6617	102.7671	107.3095	111.2328	(44)
Energy conte	176.6248	155.3315	163.1048	139.1499	131.9319	115.6955	112.0006	118.3176	121.6598	139.4540	152.8821	174.1637	(45)
Energy content (annual)										Total = Sum(45)m =		1700.3162	

Distribution loss (46)m = 0.15 x (45)m

26.4937	23.2997	24.4657	20.8725	19.7898	17.3543	16.8001	17.7476	18.2490	20.9181	22.9323	26.1246	(46)

Water storage loss (or HIU loss):
Store volume 201.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.6100 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.8694 (55)
Total storage loss

26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)

If cylinder contains dedicated solar storage

26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(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

203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(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	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(64)
								Total per year (kWh/year) = Sum(64)m =				2017.6472	(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

58.7278	51.6477	54.2324	46.2673	43.8673	38.4688	37.2402	39.3406	40.4519	46.3684	50.8333	57.9094	(65)

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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	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	124.2636	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.9156	18.5770	15.1078	11.4376	8.5497	7.2181	7.7994	10.1379	13.6071	17.2773	20.1652	21.4969	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	270.1324	272.9355	265.8717	250.8338	231.8510	214.0099	202.0909	199.2878	206.3516	221.3896	240.3723	258.2135	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	49.4974	(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)	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	-82.8424	(71)
Water heating gains (Table 5)	78.9352	76.8567	72.8929	64.2602	58.9615	53.4288	50.0540	52.8772	56.1832	62.3232	70.6018	77.8353	(72)
Total internal gains	460.9017	459.2879	444.7912	417.4502	390.2809	365.5754	350.8629	353.2215	367.0605	391.9087	422.0579	448.4642	(73)

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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	
North	7.2800	9.5462	0.6300	0.7000	0.7700	21.2390	(74)

South				4.2800		42.7195		0.6300		0.7000		0.7700	55.8782 (78)
West				4.7500		17.5237		0.6300		0.7000		0.7700	25.4385 (80)
South				6.8000		31.1868		0.6300		0.7000		1.0000	84.1708 (82)
Solar gains	186.7264	367.6620	595.2049	883.7008	1067.1843	1064.4337	1024.5339	855.4025	674.2843	422.5207	234.9927	159.9995	(83)
Total gains	647.6282	826.9499	1039.9960	1301.1510	1457.4652	1430.0091	1375.3968	1208.6240	1041.3448	814.4294	657.0507	608.4637	(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	33.8656	33.8656	34.1057	34.8470	34.9737	35.4898	35.7536	35.7536	35.2298	34.5963	34.3493	34.4724	
alpha	3.2577	3.2577	3.2737	3.3231	3.3316	3.3660	3.3836	3.3836	3.3487	3.3064	3.2900	3.2982	
util living area	0.9875	0.9734	0.9401	0.8535	0.7254	0.6081	0.5148	0.5782	0.7667	0.9288	0.9787	0.9899	(86)
MIT	18.6929	19.0070	19.5187	20.1898	20.6372	20.8461	20.9287	20.8969	20.6584	19.9951	19.2382	18.6457	(87)
Th 2	19.2860	19.2860	19.2956	19.3245	19.3293	19.3488	19.3586	19.3586	19.3391	19.3148	19.3052	19.3100	(88)
util rest of house	0.9831	0.9645	0.9205	0.8094	0.6496	0.5045	0.3909	0.4481	0.6728	0.8964	0.9699	0.9863	(89)
MIT 2	16.7356	17.1303	17.7681	18.5759	19.0534	19.2604	19.3296	19.3137	19.1093	18.3786	17.4405	16.6896	(90)
Living area fraction										fLA = Living area / (4) =		0.4875	(91)
MIT	17.6898	18.0452	18.6215	19.3627	19.8255	20.0334	20.1091	20.0855	19.8645	19.1667	18.3169	17.6432	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.6898	18.0452	18.6215	19.3627	19.8255	20.0334	20.1091	20.0855	19.8645	19.1667	18.3169	17.6432	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9770	0.9555	0.9107	0.8106	0.6740	0.5498	0.4498	0.5089	0.7060	0.8928	0.9626	0.9811	(94)
Useful gains	632.7336	790.1436	947.0877	1054.7013	982.3004	786.1949	618.6068	615.0143	735.2217	727.1186	632.4578	596.9888	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	1806.0321	1800.1894	1693.4026	1458.9770	1157.2883	854.0090	646.2073	655.6799	889.4015	1213.6471	1512.9312	1793.9793	(97)
Space heating kWh	872.9341	678.7507	555.2583	291.0785	130.1910	0.0000	0.0000	0.0000	0.0000	361.9772	633.9408	890.5609	(98a)
Space heating requirement - total per year (kWh/year)												4414.6916	
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	872.9341	678.7507	555.2583	291.0785	130.1910	0.0000	0.0000	0.0000	0.0000	361.9772	633.9408	890.5609	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4414.6916	
Space heating per m2											(98c) / (4) =	69.8306	(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)
Fraction of main heating from main system 2	0.0000 (203)
Fraction of total heating from main system 1	1.0000 (204)
Fraction of total heating from main system 2	0.0000 (205)
Efficiency of main space heating system 1 (in %)	100.0000 (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	872.9341	678.7507	555.2583	291.0785	130.1910	0.0000	0.0000	0.0000	0.0000	361.9772	633.9408	890.5609	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	872.9341	678.7507	555.2583	291.0785	130.1910	0.0000	0.0000	0.0000	0.0000	361.9772	633.9408	890.5609	(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)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement	203.5762	179.6747	190.0562	165.2319	158.8833	141.7775	138.9520	145.2690	147.7418	166.4054	178.9641	201.1151	(64)
Efficiency of water heater												348.7264	(216)
(217)m	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	348.7264	(217)
Fuel for water heating, kWh/month	58.3771	51.5231	54.5001	47.3815	45.5610	40.6558	39.8456	41.6570	42.3661	47.7180	51.3193	57.6713	(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	34.0633	30.7668	34.0633	32.9645	34.0633	32.9645	34.0633	34.0633	32.9645	34.0633	32.9645	34.0633	(231)
Lighting	18.3073	14.6868	13.2238	9.6883	7.4835	6.1141	6.8267	8.8737	11.5260	15.1227	17.0811	18.8161	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-37.1942	-60.2008	-94.9673	-110.6899	-111.4588	-87.1426	-86.6847	-79.9599	-69.6595	-68.1874	-43.0811	-32.3315	(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	-7.8678	-19.9900	-47.7770	-90.9658	-135.8093	-149.4519	-149.5416	-120.2725	-85.9302	-33.6945	-11.8333	-6.2448	(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												4414.6916	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	348.7264	
Water heating fuel used	578.5760	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Table 4g: in-use factor = 2.5000, SFP = 2.0000)		
mechanical ventilation fans (SFP = 2.0000)	401.0677	(230a)
Total electricity for the above, kWh/year	401.0677	(231)
Electricity for lighting (calculated in Appendix L)	147.7501	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1740.9362	(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	3801.1492	(238)

10a. Fuel costs - using BEDF prices (596)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4414.6916	27.6700	1221.5452	(240)
Space heating - main system 2	0.0000	27.6700	0.0000	(241)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	578.5760	27.6700	160.0920	(247)
Energy for instantaneous electric shower(s)	0.0000	27.6700	0.0000	(247a)
Pumps, fans and electric keep-hot	401.0677	27.6700	110.9754	(249)
Energy for lighting	147.7501	27.6700	40.8825	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-881.5576	27.6700	-243.9270	
PV Unit electricity exported	-859.3786	5.8100	-49.9299	
Total			-293.8569	(252)
Total energy cost			1239.6381	(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	4414.6916	0.1551	684.7677	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	578.5760	0.1411	81.6624	(264)
Space and water heating			766.4301	(265)
Pumps, fans and electric keep-hot	401.0677	0.1387	55.6330	(267)
Energy for lighting	147.7501	0.1443	21.3249	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-881.5576	0.1354	-119.3478	
PV Unit electricity exported	-859.3786	0.1202	-103.2556	
Total			-222.6034	(269)
Total CO2, kg/year			620.7846	(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	4414.6916	1.5743	6949.8327	(275)
Space heating - main system 2	0.0000	0.0000	0.0000	(276)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	578.5760	1.5219	880.5409	(278)
Space and water heating			7830.3736	(279)
Pumps, fans and electric keep-hot	401.0677	1.5128	606.7352	(281)
Energy for lighting	147.7501	1.5338	226.6241	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-881.5576	1.5005	-1322.7402	
PV Unit electricity exported	-859.3786	0.4407	-378.7091	
Total			-1701.4493	(283)
Total Primary energy kWh/year			6962.2836	(286)