BASEENERGY
Building Assessments for a Sustainable Environment

Energy Statement

86-88 Tib Street, Manchester

Job number: 13707

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0	01.02.2023	AJ	PK	First Issue
1	04.02.2026	PK	CT	Second Issue, drawing layout has changed
2	17.02.2026	PK	-	Updated specifications
3	18.02.2026	PK	-	Changed client name

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1 Executive Summary

This report has been produced by Base Energy on behalf of Baniprop Ltd and in support of the planning application for the development at 86-88 Tib Street comprising a five -storey development to provide a ground floor commercial unit and four apartments and falling under the requirements of Manchester City Council. The previous Manchester Core Strategy (2012-2027) has been kept to for this report as this is an update to a previous application.

It sets out the design approach with regards to energy and carbon dioxide emissions in order to ensure the development complies with:

- National Planning Policy
- The Manchester City Council Local Plan (2012-2027) Policies EN4 and EN6

The above policies require:

- That the development follows the energy hierarchy
- An energy statement to show regulated energy demand and the impact of the design proposals. There is no target as the development is classed as minor at less than 1000sqm commercial and 10 units residential

The design of the development will incorporate energy efficient building fabric and services in addition to low carbon technology:

- Thermal specification exceeding Part L 2021 minimum standards
- A design which limits air permeability, targeting 4.00
- Solar Photovoltaic renewable energy generation for the residential units
- Low carbon Air Source Heat Pumps for the commercial space

This results in a 25% contribution to final energy demand from onsite low carbon and renewable technology.

2 Existing and Proposed Development

The development site is located on land at Tib Street in Manchester's Northern Quarter.

The site is brownfield, with an existing smaller building demolished.

The development proposals are for a five-storey building to provide a ground floor commercial unit with one apartment on each floor above and constitutes a minor mixed-use development.

Aspects of the site location, shape, and surroundings (in particular the adjacent buildings), along with any other requirements of planning, use type, and scale will naturally constrain the development proposals in terms of the layout, positioning, and orientation of the proposed development. Subsequently, these constraints will impact on the feasibility of certain renewable technologies (as discussed in Section 4 of this report).

Figure 2.1: Site Location and proposals

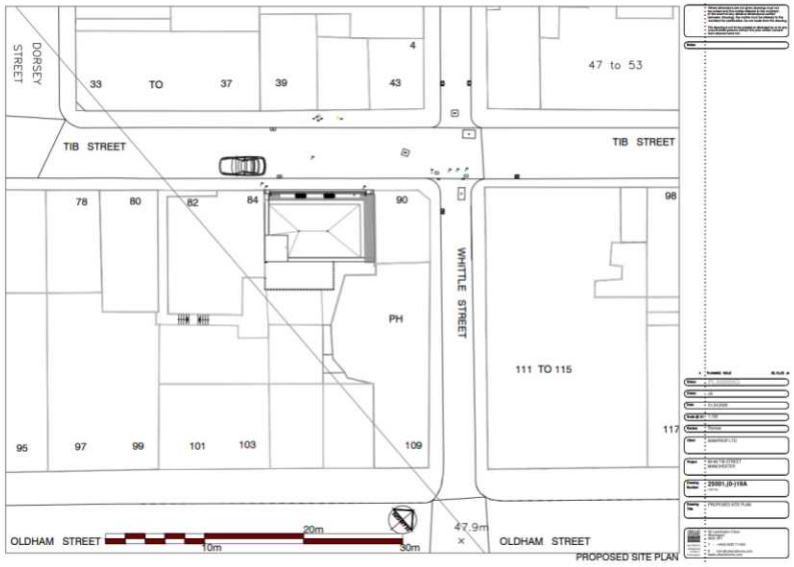
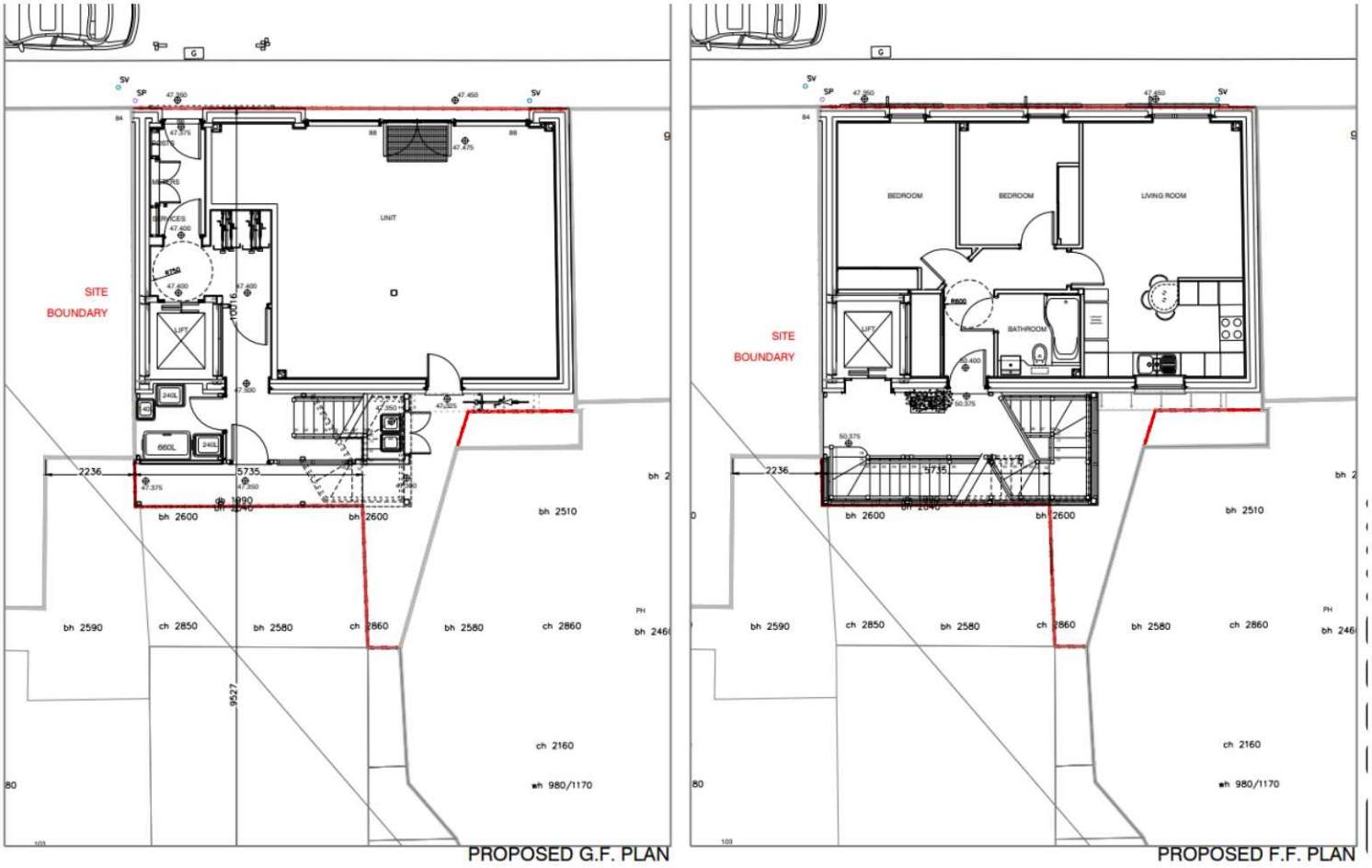


Figure 2.2: Ground and first floor layouts



3 Planning Policy

National Planning Policy Framework 2024

The NPPF was updated in July 2024 to place greater emphasis on beauty, place-making, the environment, and sustainable development. The strengthened environmental objectives aim to protect and enhance the natural, built, and historic environment, and encourage effective land use, greater biodiversity, prudent use of natural resources, minimisation of waste and pollution, and adaptation to climate change alongside a move to a low carbon economy.

Local Planning Policy

The relevant Manchester City Council local planning policy requirements are as follows:

Development Management **Policy EN 4** of Manchester City Council's Core Strategy document sets requirements for 'Reducing CO_2 Emissions by Enabling Low and Zero Carbon Development".

> *"The Council will seek to reduce fuel poverty and decouple growth in the economy, growth in CO_2 emissions, and rising fossil fuel prices, through the following actions:*

- *All development must follow the principle of the Energy Hierarchy, being designed:*
  - *to reduce the need for energy through design features that provide passive heating, natural lighting and cooling*
  - *to reduce the need for energy through energy efficient features such as improved insulation and glazing*
  - *to meet residual energy requirements through the use of low or zero carbon energy generating technologies*
- *Wherever possible new development and retrofit projects, including energy generation plant, must be located and designed in a manner that allows advantage to be taken of opportunities for low and zero carbon energy supplies.*
- *Where possible new development and retrofit projects will be used as a mechanism to help improve energy efficiency and provide low and zero carbon energy supplies to existing buildings.*
- *Where appropriate new development and retrofit projects will be required to connect to and/or make contributions to low or zero carbon energy schemes and/or to incorporate provision to enable future connection to any existing / potential decentralised energy schemes.*
- *The use of building materials with low embodied carbon in new development and refurbishment schemes.*

Policy EN 5 identifies "Strategic Areas for low and zero carbon decentralised energy infrastructure". Although the proposed development lies within a strategic area the size and nature of the development and the lack of established or proposed networks in the locale make building level low carbon solutions more appropriate.

An Energy Statement is required by the Local Authority in line with **Policy EN6** of the Manchester Core Strategy Development Plan which sets out carbon dioxide reduction targets and states the following:

> *"Applications for residential development of 10 or more units and all other development over 1,000 sq m will be expected as a minimum to meet the target shown in Tables 12.1 or 12.2, unless this can be shown not to be viable. This should be demonstrated through an energy statement, submitted as part of the Design and Access Statement. Such a statement will be expected to set out the projected regulated energy demand and associated CO2emissions for all phases of the development.*
>
> *The target framework relates to three broad development locations and their potential for low and zero carbon, decentralised energy. The areas are defined as follows.*
> - *Target 1 Network development areas: Locations where the proximity of new and existing buildings, the mix of uses and density of development provide the right conditions to support district heating (and cooling).*
> - *Target 2 Electricity intense areas: Locations where the predominant building type has an all electric fit-out such as retail units and leisure complexes.*
> - *Target 3 Micro-generation areas: Locations where lower densities and a fragmented mix of uses tend to mean that only building scale solutions are practical."*

Non-domestic CO_2 emissions reduction targets

Table 12.2

Target	% Minimum requirement
Target 1: Network development area	CHP/district heating anchor or connection or where not feasible, a 15% increase on Part L 2010
Target 2: Electricity intense buildings (Applies to commercial uses with a high proportion of emissions from electricity use (>45 kg CO2/m2))	+10%increase on Part L 2010
Target 3: Micro generation area	+15% increase on Part L 2010

The devlopment is less than the 1000sqm/10 unit threshold to trigger specific targets. However, the approach as set out in this energy statement and in line with **Policies EN4 & EN6** is to follow the energy hierarchy and propose low carbon and renewable technology. The energy hierarchy will be applied as follows:

- Use less energy through an efficient building fabric
- Supply energy efficiently
- Use low carbon solutions

The Energy Statement will assess the predicted regulated energy demand for the development and propose a strategy for a contribution from energy efficiency and low carbon technology in line with the policies outlined above.

The Standard Assessment Procedure (SAP) and Simplified Building Energy Model procedure (SBEM) will be used to assess energy use. Regulated energy as calculated in SAP and SBEM includes all fixed consumption inherent in the building, i.e. fixed lighting, space heating, water- heating and ventilation.

The development will comply with the new Part L 2021 requirements on CO2 emissions, Primary Energy, and Fabric Energy Efficiency. These standards represent a significant reduction over Part L 2010 and 2013 as referenced in the Manchester Core Strategy.

4 Methodology

The Standard Assessment Procedure (SAP) is the UK Government methodology for assessing and calculating the energy performance of dwellings.

The Simplified Building Energy Model (SBEM) is the UK Government methodology for assessing and calculating the energy performance of non-domestic buildings.

SAP and SBEM calculations take into account a range of factors that contribute to energy efficiency, including:

- Materials used for the construction and the thermal insulation of the building fabric (u-values[1] and thermal mass)
- Air permeability
- Efficiency, fuel source, and control of heating and cooling systems
- Ventilation system energy use and heat recovery
- Lighting energy
- Low carbon and energy saving or generating technologies

Approved Document Part L of current Building Regulations addresses the conservation of fuel and power. Part L is divided into two separate documents:

- Part L1 Newly constructed and extended or renovated existing dwellings
- Part L2 Newly constructed and extended or renovated existing non-domestic buildings

To comply with Part L, the calculations should demonstrate how the building will either meet or achieve a percentage reduction in the Building Emission Rate (BER) under the required Target Emission Rate (TER).

The calculation software has been used to calculate energy demand from which any reductions or contributions have been measured.

The building has been modelled using software and compliance thresholds based on the latest Part L 2021.

[1] U-values (Thermal Transmittance) - the measure of the overall rate of heat transfer by all mechanisms under standard conditions, through a particular section of a construction. Lower u-values mean better thermal insulation

5 Low Carbon Design Following the Energy Hierarchy

Before considering low carbon energy generating technology the development has been designed to reduce energy demand through the first step of the energy hierarchy by considering 'fabric first'. A thermally efficient building envelope will follow the design standards as set out below.

Table 6.0: Building Fabric Standards (including u-values W/m²K)

	Part L 2021 Limiting Parameters	Part L 2021 Targets	Proposed Development
External walls flats	0.26	0.18	0.14
Mansard wall	0.26	0.18	0.10
Ground/Exposed Floor	0.18	0.13	0.10
Roof	0.16	0.11	0.11
Windows	1.6	1.2	1.2
Doors	1.5	1.0	1.0
Air permeability	8.00	5.00	4.00 resi, 5.0 commercial

- Insulation: The specified building envelope is designed to better the Part L limiting values and will help to limit the energy demand of the development for space heating and cooling. The external walls will be designed to limit thermal bridging targeting a global y-value of 0.05
- Lighting: Low energy LED lighting throughout with a minimum efficacy of 120 luminaire lumens per circuit watt for commercial (and photoelectric dimming with a parasitic power no greater than 0.1W/m2, and 85 LL/CW for residential
- Space & Water Heating: Split system air source heat pumps will provide low carbon space heating with a SCOP of 4.5 and cooling with an SEER of 6.0 to the commercial units and condensing gas combi boilers for the apartments at 89% efficiency with delayed start thermostats
- Ventilation – flats to have continuous DMVE extractor fans, sfp 0.09
- Residential units will include solar PV arrays of 0.80kWp or more per unit, totalling 3.2kWp, horizontal angle with export meters, sufficient to ensure compliance with Part L CO2 limits.

6 Low Carbon Design Impact

The selected Low Carbon design parameters have been incorporated into the calculation model and the results are set out below.

Table 8.1: Energy Demand met by low carbon and renewable technology

	Commercial (kWh/m2/year)	Commercial Floor Area (m2)	Residential (kWh/m2/year)	Residential Floor Area (m2)	Total Energy Demand (kWh/year)	
Residual Energy Demand After fabric improvements	27.08	49	92.5	235.7	28,185	
	Commercial (kWh/m2/year)	**Commercial Floor Area (m2)**	**Residential (kWh/m2/year)**	**Residential Floor Area (m2)**	**Total Energy Demand (kWh/year)**	**Low Carbon Energy Contribution**
Low Carbon Energy	13.4 (ASHP)	49	75.9 (PV)	235.7	21,048	**25.0%**

Low carbon technology is shown to contribute an estimated 25.0% of regulated energy demand.

7 Conclusion

Proposals are for a development at Tib Street, comprising a five-storey building to provide a ground floor commercial unit with one apartment on each floor above, and constitutes a minor mixed-use development falling under the requirements of Manchester City Council.

Under the local planning policy the proposed development is required to follow the energy hierarchy and provide an energy statement setting out energy demand and the impacts of low carbon design including the proportion of final energy demand met by low carbon technology. Due to the development size there are no specific targets. It is noted however that given the development falls under the new more stringent Part L it would automatically better the Core Strategy targets for major development by a considerable margin.

Energy modelling software has been used to calculate energy demand and low carbon energy generation.

The proposed development will be designed to limit energy demand through the inclusion of a thermally efficient building fabric and energy efficient services.

Low carbon technology will be incorporated and is to comprise air source heat pumps and solar PV.

This results in a 25% contribution to final energy demand from onsite low carbon technology.

This Energy Statement and the calculations on which it is based demonstrate that the proposed development complies with the local planning policy requirements.

8 Appendix 1 - SBEM Output Part L 2021

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Retail Unit Tib St — As designed

Date: Fri Feb 06 12:09:25 2026

Administrative information

Building Details

Address: Manchester,

Certification tool

Calculation engine: SBEM
Calculation engine version: v6.1.e.2
Interface to calculation engine: DesignBuilder SBEM
Interface to calculation engine version: v7.3.1
BRUKL compliance module version: v6.1.e.1

Certifier details

Name:
Telephone number:
Address: , ,

Foundation area [m²]: 48.95

The CO_2 emission and primary energy rates of the building must not exceed the targets

Target CO_2 emission rate (TER), $kgCO_2/m^2$annum	4.15	
Building CO_2 emission rate (BER), $kgCO_2/m^2$annum	3.81	
Target primary energy rate (TPER), kWh_{PE}/m^2annum	44.21	
Building primary energy rate (BPER), kWh_{PE}/m^2annum	41.16	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	$U_{i\text{-Limit}}$	$U_{i\text{-Calc}}$	$U_{i\text{-Calc}}$	First surface with maximum value
Walls*	0.26	0.16	0.16	Block 1 - Retail unit_W_6
Floors	0.18	0.1	0.1	Block 1 - Retail unit_S_3
Pitched roofs	0.16	-	-	No heat loss pitched roofs
Flat roofs	0.18	-	-	No heat loss flat roofs
Windows** and roof windows	1.6	1.2	1.2	Block 1 - Retail unit_G_7
Rooflights***	2.2	-	-	No external rooflights
Personnel doors^	1.6	1.2	1.2	Block 1 - Retail unit_D_12
Vehicle access & similar large doors	1.3	-	-	No external vehicle access doors
High usage entrance doors	3	1.2	1.2	Block 1 - Retail unit_D_8

$U_{i\text{-Limit}}$ = Limiting area-weighted average U-values [W/m²K] — $U_{i\text{-Max}}$ = Calculated maximum individual element U-values [W/m²K]
$U_{i\text{-Calc}}$ = Calculated area-weighted average U-values [W/m²K]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.
^ For fire doors, limiting U-value is 1.8 W/m²K
NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	5

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Copy of Project HVAC

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.5	6	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

1- Copy of Project DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
Block 1 - Retail unit	120	80	1.875

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Block 1 - Retail unit	NO (-37.6%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	49	49
External area [m²]	79.2	79.2
Weather	MAN	MAN
Infiltration [m³/h.m²@ 50Pa]	5	3
Average conductance [W/K]	24.8	30.27
Average U-value [W/m²K]	0.31	0.38
Alpha value* [%]	36.07	26.94

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
100	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Terminals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	6.51	10.9
Cooling	5.19	3.27
Auxiliary	0	0
Lighting	13.69	13.74
Hot water	1.7	1.7
Equipment*	20.26	20.26
TOTAL**	27.08	29.6

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*0*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	177.77	155.32
Primary energy [kWh_{PE}/m^2]	41.16	44.21
Total emissions [kg/m²]	3.81	4.15

9 Appendix 2 - SAP Output Part L 2021 – Flat 1

Full SAP Calculation Printout

Plot Reference	13707 1 FF	Issued on Date	18/02/2026
Assessment Reference	v1	Plot Type Ref	First floor flat
Plot Address	Flat 1, Tib Street, Manchester	SAP Version	10.2

SAP Rating	88 B	DER	13.97	TER	14.22
Environmental	90 B	% DER < TER			1.76
CO_2 Emissions (t/year)	0.76	DFEE	29.41	TFEE	32.01
Compliance Check	See BREL	% DFEE < TFEE			8.13
% DPER < TPER	0.94	DPER	75.40	TPER	76.12

Assessor Details	Mr. Peter Kinsella	Assessor ID	L770-0002
Client			

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	62.0000	(1b)	x 2.4000	(2b) =	148.8000	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0000					
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	148.8000	(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	1 * 10 =	10.0000 (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) =	10.0000 / (5) =	0.0672 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.2672 (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) =	0.2271 (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	0.2896	0.2839	0.2782	0.2498	0.2442	0.2158	0.2158	0.2101	0.2271	0.2442	0.2555	0.2669	(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	0.5396	0.5339	0.5282	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5055	0.5169	(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								
Corridor door			1.8900	1.0000	1.8900			(26)
Windows			7.7200	1.1450	8.8397			(27)
Heat Loss Floor 1			62.0000	0.1000	6.2000			(28b)
External Wall 1	38.0000	7.7200	30.2800	0.1400	4.2392			(29a)
Corridor wall	22.9500	1.8900	21.0600	0.1400	2.9484			(29a)
Total net area of external elements Aum(A, m2)			122.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	24.1173			(33)
Main dwelling								
Party Wall 1			28.6000	0.0000	0.0000			(32)
Party Ceiling 1			62.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.1000	0.2000	1.0200
E3 Sill	4.2000	0.2000	0.8400

E4 Jamb	18.8000	0.1000	1.8800	
E7 Party floor between dwellings (in blocks of flats)	29.0000	0.0680	1.9720	
E16 Corner (normal)	4.8000	0.0500	0.2400	
E18 Party wall between dwellings	4.8000	0.0500	0.2400	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				6.1920 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =		30.3093 (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	26.4957	26.2168	25.9380	24.5520	24.5520	24.5520	24.5520	24.5520	24.5520	24.5520	24.8228	25.3804	(38)
Heat transfer coeff	56.8050	56.5261	56.2473	54.8613	54.8613	54.8613	54.8613	54.8613	54.8613	54.8613	55.1321	55.6897	(39)
Average = Sum(39)m / 12 =												55.3691	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9162	0.9117	0.9072	0.8849	0.8849	0.8849	0.8849	0.8849	0.8849	0.8849	0.8892	0.8982	(40)
HLP (average)												0.8931	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0376	(42)
Hot water usage for mixer showers	80.2768	79.0704	77.3124	73.9489	71.4666	68.6985	67.1251	68.8697	70.7822	73.7544	77.1902	79.9692	(42a)
Hot water usage for baths	25.2299	24.8552	24.3275	23.3546	22.6261	21.8183	21.3820	21.9060	22.4765	23.3408	24.3338	25.1446	(42b)
Hot water usage for other uses	35.4969	34.2061	32.9153	31.6245	30.3337	29.0429	29.0429	30.3337	31.6245	32.9153	34.2061	35.4969	(42c)
Average daily hot water use (litres/day)												129.6745	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	141.0035	138.1316	134.5552	128.9280	124.4264	119.5597	117.5500	121.1094	124.8832	130.0105	135.7300	140.6107	(44)
Energy conte	223.3151	196.6976	206.8063	176.4959	167.5019	147.0126	142.1665	149.9587	153.9934	176.4230	193.3723	220.1623	(45)
Energy content (annual)										Total = Sum(45)m =		2153.9058	
Distribution loss (46)m = 0.15 x (45)m	33.4973	29.5046	31.0210	26.4744	25.1253	22.0519	21.3250	22.4938	23.0990	26.4634	29.0058	33.0243	(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	23.5898	21.3049	23.5674	22.7432	23.4623	22.6625	23.3834	23.4023	22.6687	23.4709	22.7735	23.5805	(61)
Total heat required for water heating calculated for each month	246.9049	218.0025	230.3738	199.2391	190.9642	169.6751	165.5499	173.3610	176.6622	199.8939	216.1458	243.7428	(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	246.9049	218.0025	230.3738	199.2391	190.9642	169.6751	165.5499	173.3610	176.6622	199.8939	216.1458	243.7428	(64)
										Total per year (kWh/year) = Sum(64)m =		2430.5152	(64)
12Total per year (kWh/year)												2431	(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	80.1497	70.7282	74.6550	64.3707	61.5600	54.5473	53.1162	55.7119	56.8700	64.5284	69.9897	79.0991	(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	101.8790	101.8790	101.8790	101.8790	101.8790	101.8790	101.8790	101.8790	101.8790	101.8790	101.8790	101.8790	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	98.8189	109.4066	98.8189	102.1128	98.8189	102.1128	98.8189	98.8189	102.1128	98.8189	102.1128	98.8189	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	177.9613	179.8080	175.1544	165.2475	152.7418	140.9882	133.1361	131.2894	135.9430	145.8499	158.3556	170.1092	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1879	33.1879	33.1879	33.1879	33.1879	33.1879	33.1879	33.1879	33.1879	33.1879	33.1879	33.1879	(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)	-81.5032	-81.5032	-81.5032	-81.5032	-81.5032	-81.5032	-81.5032	-81.5032	-81.5032	-81.5032	-81.5032	-81.5032	(71)
Water heating gains (Table 5)	107.7281	105.2503	100.3427	89.4037	82.7419	75.7602	71.3928	74.8815	78.9861	86.7317	97.2079	106.3160	(72)
Total internal gains	441.0720	451.0286	430.8797	413.3278	390.8663	372.4249	356.9114	358.5535	370.6057	387.9642	414.2400	431.8078	(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	6.7200	10.6334	0.6300	0.7000	0.7700	21.8380	(74)
South	1.0000	46.7521	0.6300	0.7000	0.7700	14.2880	(78)

Solar gains	36.1260	65.1337	100.7231	147.5975	188.5512	198.0524	186.3746	153.7325	116.4010	74.9176	43.8762	30.5514	(83)
Total gains	477.1981	516.1623	531.6028	560.9253	579.4175	570.4773	543.2860	512.2860	487.0066	462.8817	458.1162	462.3592	(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	75.7954	76.1693	76.5468	78.4808	78.4808	78.4808	78.4808	78.4808	78.4808	78.4808	78.0953	77.3133	
alpha	6.0530	6.0780	6.1031	6.2321	6.2321	6.2321	6.2321	6.2321	6.2321	6.2321	6.2064	6.1542	
util living area													
	0.9922	0.9860	0.9732	0.9229	0.8014	0.6036	0.4427	0.4896	0.7343	0.9343	0.9831	0.9933	(86)
MIT	20.1419	20.2749	20.4605	20.7345	20.9167	20.9877	20.9984	20.9972	20.9620	20.7491	20.4264	20.1369	(87)
Th 2	20.1537	20.1576	20.1614	20.1804	20.1804	20.1804	20.1804	20.1804	20.1804	20.1804	20.1767	20.1690	(88)
util rest of house													
	0.9898	0.9818	0.9649	0.9003	0.7523	0.5315	0.3611	0.4040	0.6631	0.9101	0.9773	0.9913	(89)
MIT 2	19.3804	19.5147	19.6992	19.9735	20.1271	20.1750	20.1800	20.1796	20.1611	19.9908	19.6807	19.3881	(90)
Living area fraction										fLA = Living area / (4) =		0.4194	(91)
MIT	19.6997	19.8335	20.0185	20.2927	20.4582	20.5158	20.5232	20.5224	20.4969	20.3088	19.9934	19.7021	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.5497	19.6835	19.8685	20.1427	20.3082	20.3658	20.3732	20.3724	20.3469	20.1588	19.8434	19.5521	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9877	0.9789	0.9614	0.8991	0.7605	0.5481	0.3804	0.4242	0.6784	0.9093	0.9743	0.9894	(94)
Useful gains	471.3074	505.2464	511.0890	504.3228	440.6307	312.6975	206.6895	217.3233	330.3773	420.9097	446.3599	457.4681	(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													
	866.2607	835.6541	751.9405	616.7868	472.2567	316.3203	207.0032	217.9333	342.7156	524.4089	702.5713	854.9542	(97)
Space heating kWh													
	293.8453	222.0340	179.1935	80.9741	23.5298	0.0000	0.0000	0.0000	0.0000	77.0034	184.4722	295.7297	(98a)
Space heating requirement - total per year (kWh/year)												1356.7819	
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													
	293.8453	222.0340	179.1935	80.9741	23.5298	0.0000	0.0000	0.0000	0.0000	77.0034	184.4722	295.7297	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1356.7819	
Space heating per m2											(98c) / (4) =	21.8836	(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 %)												88.4000	(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													
	293.8453	222.0340	179.1935	80.9741	23.5298	0.0000	0.0000	0.0000	0.0000	77.0034	184.4722	295.7297	(98)
Space heating efficiency (main heating system 1)													
	88.4000	88.4000	88.4000	88.4000	88.4000	0.0000	0.0000	0.0000	0.0000	88.4000	88.4000	88.4000	(210)
Space heating fuel (main heating system)													
	332.4042	251.1696	202.7076	91.5997	26.6174	0.0000	0.0000	0.0000	0.0000	87.1079	208.6790	334.5358	(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													
	246.9049	218.0025	230.3738	199.2391	190.9642	169.6751	165.5499	173.3610	176.6622	199.8939	216.1458	243.7428	(64)
Efficiency of water heater												88.0000	(216)
(217)m	88.2169	88.2014	88.1746	88.1152	88.0437	88.0000	88.0000	88.0000	88.0000	88.1109	88.1837	88.2188	(217)
Fuel for water heating, kWh/month													
	279.8839	247.1645	261.2701	226.1120	216.8971	192.8126	188.1249	197.0012	200.7525	226.8663	245.1085	276.2934	(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	8.8999	8.0386	8.8999	8.6128	8.8999	8.6128	8.8999	8.8999	8.6128	8.8999	8.6128	8.8999	(231)
Lighting	23.4788	18.8356	16.9594	12.4252	9.5975	7.8413	8.7552	11.3803	14.7819	19.3947	21.9063	24.1314	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-9.9083	-16.7978	-29.3489	-38.8682	-46.2957	-44.7936	-43.9538	-38.9974	-30.8355	-21.2310	-11.6752	-8.1613	(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	-2.4718	-6.4265	-16.3625	-30.2518	-45.1270	-47.3664	-46.0404	-35.7597	-22.1565	-10.1956	-3.5312	-1.8380	(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												1534.8212	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												88.0000	
Water heating fuel used												2758.2870	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 0.8280, total flow = 8.0000, SFP = 0.1035)													
mechanical ventilation fans (SFP = 0.1035)												18.7890	(230a)
central heating pump												41.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												104.7890	(231)
Electricity for lighting (calculated in Appendix L)												189.4877	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-608.3942	(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	3978.9906	(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	1534.8212	0.2100	322.3124	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2758.2870	0.2100	579.2403	(264)
Space and water heating			901.5527	(265)
Pumps, fans and electric keep-hot	104.7890	0.1387	14.5355	(267)
Energy for lighting	189.4877	0.1443	27.3489	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-340.8667	0.1315	-44.8267	
PV Unit electricity exported	-267.5276	0.1211	-32.4042	
Total			-77.2308	(269)
Total CO2, kg/year			866.2063	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			13.9700	(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	1534.8212	1.1300	1734.3479	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2758.2870	1.1300	3116.8643	(278)
Space and water heating			4851.2122	(279)
Pumps, fans and electric keep-hot	104.7890	1.5128	158.5248	(281)
Energy for lighting	189.4877	1.5338	290.6425	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-340.8667	1.4859	-506.4796	
PV Unit electricity exported	-267.5276	0.4444	-118.8814	
Total			-625.3610	(283)
Total Primary energy kWh/year			4675.0184	(286)
Dwelling Primary energy Rate (DPER)			75.4000	(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		62.0000	(1b)	x 2.4000	(2b) =	148.8000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	148.8000	(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) =	0.1344	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3844	(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) =	0.3267	(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	0.4166	0.4084	0.4003	0.3594	0.3513	0.3104	0.3104	0.3022	0.3267	0.3513	0.3676	0.3839	(22b)
Effective ac	0.5868	0.5834	0.5801	0.5646	0.5617	0.5482	0.5482	0.5457	0.5534	0.5617	0.5676	0.5737	(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			1.8900	1.0000	1.8900			(26)
TER Opening Type			7.7200	1.1450	8.8397			(27)
Heat Loss Floor 1			62.0000	0.1300	8.0600			(28b)
External Wall 1	38.0000	7.7200	30.2800	0.1800	5.4504			(29a)
Corridor wall	22.9500	1.8900	21.0600	0.1800	3.7908			(29a)
Total net area of external elements Aum(A, m2)			122.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.0309			(33)
Main dwelling								
Party Wall 1			28.6000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	5.1000	0.0500	0.2550	
E3 Sill	4.2000	0.0500	0.2100	
E4 Jamb	18.8000	0.0500	0.9400	
E7 Party floor between dwellings (in blocks of flats)	29.0000	0.0700	2.0300	
E16 Corner (normal)	4.8000	0.0900	0.4320	
E18 Party wall between dwellings	4.8000	0.0600	0.2880	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.1550 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 32.1859 (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	28.8132	28.6477	28.4855	27.7237	27.5812	26.9177	26.9177	26.7948	27.1733	27.5812	27.8695	28.1710	(38)
Heat transfer coeff	60.9991	60.8336	60.6714	59.9096	59.7671	59.1036	59.1036	58.9807	59.3592	59.7671	60.0554	60.3569	(39)
Average = Sum(39)m / 12 =												59.9089	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9839	0.9812	0.9786	0.9663	0.9640	0.9533	0.9533	0.9513	0.9574	0.9640	0.9686	0.9735	(40)
HLP (average)												0.9663	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0376 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	58.3831	57.5057	56.2272	53.7810	51.9757	49.9625	48.8182	50.0871	51.4780	53.6395	56.1383	58.1594	(42a)
Hot water usage for baths	25.2299	24.8552	24.3275	23.3546	22.6261	21.8183	21.3820	21.9060	22.4765	23.3408	24.3338	25.1446	(42b)
Hot water usage for other uses	35.4969	34.2061	32.9153	31.6245	30.3337	29.0429	29.0429	30.3337	31.6245	32.9153	34.2061	35.4969	(42c)
Average daily hot water use (litres/day)												109.4892	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	119.1099	116.5670	113.4700	108.7601	104.9355	100.8238	99.2431	102.3267	105.5789	109.8956	114.6781	118.8009	(44)
Energy conte	188.6409	165.9898	174.3992	148.8871	141.2634	123.9746	120.0260	126.7019	130.1894	149.1274	163.3800	186.0135	(45)
Energy content (annual)										Total = Sum(45)m =		1818.5931	
Distribution loss (46)m = 0.15 x (45)m	28.2961	24.8985	26.1599	22.3331	21.1895	18.5962	18.0039	19.0053	19.5284	22.3691	24.5070	27.9020	(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	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.5732	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	239.5998	212.0172	225.3581	198.2022	192.2223	173.2897	170.5992	177.6608	179.5044	200.0863	212.6951	236.9724	(62)
WWHRS	-26.6903	-23.6051	-24.7179	-20.4674	-19.0749	-16.3225	-15.2998	-16.2698	-16.8879	-19.9090	-22.5545	-26.1961	(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	212.9095	188.4121	200.6401	177.7348	173.1474	156.9671	155.2994	161.3910	162.6165	180.1773	190.1406	210.7763	(64)
										Total per year (kWh/year) = Sum(64)m =		2170.2121	(64)
12Total per year (kWh/year)												2170	(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	75.4628	66.6985	70.7275	61.8337	59.7098	53.5503	52.5519	54.8681	55.6167	62.3246	66.6526	74.5892	(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	101.8790	101.8790	101.8790	101.8790	101.8790	101.8790	101.8790	101.8790	101.8790	101.8790	101.8790	101.8790	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	98.8189	109.4066	98.8189	102.1128	98.8189	102.1128	98.8189	98.8189	102.1128	98.8189	102.1128	98.8189	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	177.9613	179.8080	175.1544	165.2475	152.7418	140.9882	133.1361	131.2894	135.9430	145.8499	158.3556	170.1092	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1879	33.1879	33.1879	33.1879	33.1879	33.1879	33.1879	33.1879	33.1879	33.1879	33.1879	33.1879	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-81.5032	-81.5032	-81.5032	-81.5032	-81.5032	-81.5032	-81.5032	-81.5032	-81.5032	-81.5032	-81.5032	-81.5032	(71)
Water heating gains (Table 5)	101.4285	99.2537	95.0638	85.8802	80.2551	74.3754	70.6343	73.7474	77.2455	83.7696	92.5731	100.2543	(72)
Total internal gains	434.7724	445.0320	425.6008	409.8043	388.3795	371.0402	356.1530	357.4194	368.8650	385.0021	409.6053	425.7461	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a	g Specific data	FF Specific data	Access factor	Gains W

				W/m2	or Table 6b	or Table 6c	Table 6d					
North				6.7200	10.6334	0.6300	0.7000	0.7700				21.8380 (74)
South				1.0000	46.7521	0.6300	0.7000	0.7700				14.2880 (78)
Solar gains	36.1260	65.1337	100.7231	147.5975	188.5512	198.0524	186.3746	153.7325	116.4010	74.9176	43.8762	30.5514 (83)
Total gains	470.8985	510.1657	526.3239	557.4018	576.9307	569.0926	542.5276	511.1519	485.2660	459.9196	453.4814	456.2975 (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	70.5839	70.7759	70.9651	71.8675	72.0389	72.8476	72.8476	72.9994	72.5340	72.0389	71.6930	71.3350	
alpha	5.7056	5.7184	5.7310	5.7912	5.8026	5.8565	5.8565	5.8666	5.8356	5.8026	5.7795	5.7557	
util living area	0.9934	0.9884	0.9782	0.9394	0.8366	0.6430	0.4760	0.5246	0.7727	0.9480	0.9864	0.9944	(86)
MIT	20.0178	20.1523	20.3487	20.6399	20.8691	20.9779	20.9967	20.9944	20.9380	20.6679	20.3072	19.9992	(87)
Th 2	20.0968	20.0990	20.1012	20.1115	20.1135	20.1224	20.1224	20.1241	20.1190	20.1135	20.1096	20.1055	(88)
util rest of house	0.9913	0.9848	0.9711	0.9196	0.7886	0.5639	0.3829	0.4280	0.6992	0.9269	0.9814	0.9927	(89)
MIT 2	18.9603	19.1326	19.3819	19.7463	20.0035	20.1098	20.1214	20.1221	20.0776	19.7867	19.3381	18.9432	(90)
Living area fraction									fLA = Living area / (4) =			0.4194	(91)
MIT	19.4037	19.5602	19.7873	20.1210	20.3665	20.4738	20.4884	20.4879	20.4384	20.1562	19.7445	19.3860	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4037	19.5602	19.7873	20.1210	20.3665	20.4738	20.4884	20.4879	20.4384	20.1562	19.7445	19.3860	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9893	0.9820	0.9680	0.9198	0.8034	0.5964	0.4220	0.4686	0.7275	0.9281	0.9789	0.9909	(94)
Useful gains	465.8413	500.9972	509.5017	512.6957	463.4804	339.4131	228.9526	239.5460	353.0159	426.8567	443.9084	452.1240	(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	921.3141	891.8343	806.1625	672.2474	517.9704	347.1647	229.8209	241.1058	376.2420	571.1486	759.3705	916.5808	(97)
Space heating kWh	338.8718	262.6425	220.7157	114.8773	40.5406	0.0000	0.0000	0.0000	0.0000	107.3532	227.1327	345.5559	(98a)
Space heating requirement - total per year (kWh/year)												1657.6895	
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	338.8718	262.6425	220.7157	114.8773	40.5406	0.0000	0.0000	0.0000	0.0000	107.3532	227.1327	345.5559	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1657.6895	
Space heating per m2											(98c) / (4) =	26.7369	(99)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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 %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement	338.8718	262.6425	220.7157	114.8773	40.5406	0.0000	0.0000	0.0000	0.0000	107.3532	227.1327	345.5559	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	366.7443	284.2451	238.8698	124.3260	43.8751	0.0000	0.0000	0.0000	0.0000	116.1831	245.8146	373.9782	(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	212.9095	188.4121	200.6401	177.7348	173.1474	156.9671	155.2994	161.3910	162.6165	180.1773	190.1406	210.7763	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.3720	85.0932	84.5863	83.4701	81.8013	80.3000	80.3000	80.3000	80.3000	83.3090	84.7634	85.4334	(217)
Fuel for water heating, kWh/month	249.3902	221.4184	237.2017	212.9323	211.6683	195.4759	193.3990	200.9851	202.5112	216.2759	224.3193	246.7140	(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	20.5326	16.4720	14.8312	10.8660	8.3932	6.8573	7.6566	9.9523	12.9270	16.9610	19.1574	21.1033	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-13.8124	-20.7512	-31.7606	-38.1012	-43.2152	-41.1303	-40.6439	-37.3154	-31.8170	-24.7706	-15.6369	-11.7982	(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	-4.3437	-9.3938	-19.1586	-29.5040	-39.7326	-40.1806	-39.6944	-33.2627	-23.9406	-13.6530	-5.8691	-3.4151	(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												1794.0362	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	

Water heating fuel used	2612.2915	(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)	165.7099	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-612.9011	(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	4045.1366	(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	1794.0362	0.2100	376.7476	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2612.2915	0.2100	548.5812	(264)
Space and water heating			925.3288	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	165.7099	0.1443	23.9171	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-350.7529	0.1333	-46.7451	
PV Unit electricity exported	-262.1482	0.1252	-32.8152	
Total			-79.5603	(269)
Total CO2, kg/year			881.6148	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.2200	(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	1794.0362	1.1300	2027.2609	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2612.2915	1.1300	2951.8894	(278)
Space and water heating			4979.1503	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	165.7099	1.5338	254.1714	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-350.7529	1.4925	-523.4883	
PV Unit electricity exported	-262.1482	0.4595	-120.4456	
Total			-643.9339	(283)
Total Primary energy kWh/year			4719.4887	(286)
Target Primary Energy Rate (TPER)			76.1200	(287)