

Energy Statement

Option 1 - Communal ASHP for Water and Heating

82-84 Market Street,
Manchester,
M1 1PD

Job number: 12201

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Building Assessments for a Sustainable Environment

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1 Executive Summary

This report has been produced by Base Energy on behalf of Cambridge Park Ltd and in support of the planning application for the development named as 82-84 Market Street, Manchester, M1 1PD comprising the conversion of the first, second, and third floors from office-space to 6 flats and the construction of an additional floor to create 2 additional flats falling under the requirements of Manchester City Council.

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

- National Planning Policy
- The Greater Manchester Combined Authority
- The Places for Everyone Plan (PFE)

The above policies require:

- Be Net Zero Carbon where feasible
- As an interim measure, development should be consistent with 2022 Part L building regulations (this would be Part L 2021)
- In the case of existing buildings, retrofitting them with measures to reduce energy consumption, in a manner consistent with their heritage interest

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 notional U-values
- A design which limits air permeability
- A design which limits thermal bridging
- Energy saving building services including low energy lighting and controls
- Low carbon Air Source Heat Pump

This results in an overall 22% carbon emissions reduction over Part L 2021.

2 Existing and Proposed Development

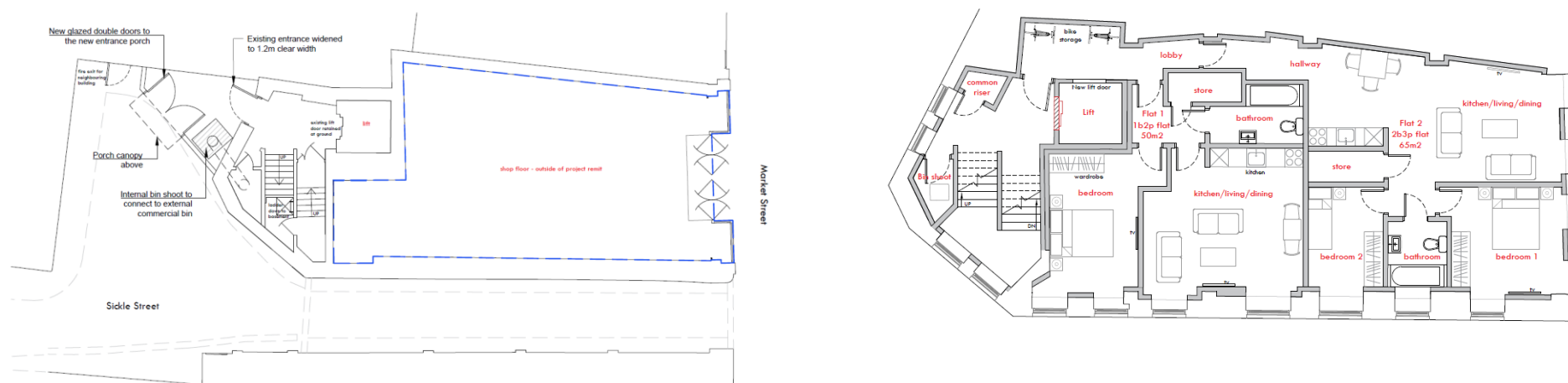
The development site is located at 82-84 Market Street, Manchester, M1 1PD.

The development proposals are for the conversion of the first, second, and third floors from office-space to 6 flats and the extension of an additional floor to create 2 additional flats. All dwellings have been assessed under Part L for existing dwellings.

The development proposals constitute a minor 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



3 Planning Policy

National Planning Policy Framework 2025

The NPPF was updated in 2025 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 Greater Manchester Combined Authority

The relevant Local Planning Policy requirements are as follows.

- Places for everyone joint development plan, JP-S2 Carbon and Energy

The development should target:

- Be Net Zero Carbon where feasible
 - From adoption to regulated operational carbon emissions
 - From 2028 to all emissions in construction
- As an interim measure, development should be consistent with 2022 Part L building regulations (this would be the current Part L 2021)
- From 2025 development should also calculate and minimise carbon emissions from unregulated emissions alongside regulated emissions. Development proposals should set out how this has been achieved in an energy statement in accordance with the energy hierarchy.
- Achieve energy demand reductions in terms of space heat demand; hot water energy demand and the delivery of on-site renewable energy generation, in accordance with Table 5.1.

Based on the above the development will meet and go beyond the new Part L 2021 building regulations and were feasible aim to be net zero carbon. However, due to the building being a conversion the development is limited in its capacity to be zero carbon.

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-values¹ 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 a baseline of energy demand and carbon dioxide emissions as appropriate from which any reductions or contributions have been measured.

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 Baseline Energy & CO2

Energy modelling software has been used to calculate a baseline for the development. This forms the basis from which compliance with planning policy has been measured.

Table 5.1: Baseline CO2

	CO2 Emission Rate (kg CO2/m2/year)	Floor Area (m2)	Total Baseline Emissions (kg CO2/year)
Baseline	7.7	454	3,495

The **Total Baseline CO2 Emissions** for the development are shown to be 3,495 kg/year.

6 Low Carbon Design – Fabric First – Be Lean

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) – Conversion

	Part L 2021 Limiting Parameters	Proposed Development
New Walls	0.18	0.17
Existing Walls	0.30	0.28
Exposed Floor	0.25	0.23
Existing Roof	0.16	0.16
New Roof	0.15	0.15
New Windows	1.4	1.4
Existing Windows	2.6	2.6
Doors	1.4	1.4

- Insulation: The specified building envelope is designed to meet and exceed the notional Part L targets and will help to limit the energy demand of the dwelling for space heating
- Thermal bridging: The design will seek to limit heat loss

Once heat retention has been addressed the next step is to ensure energy consuming building services are efficient.

- Lighting: Low energy LED lighting throughout with a minimum efficacy of 80 lumens per watt
- Space & Water Heating: SAP Default Air Source Heat Pump (250% space heating and hot water efficiency)
- Heating Controls: Programmer, room thermostat and TRVs
- Ventilation: Natural ventilation with localised extract fans

7 Low Carbon Technology Review & Recommendations

Having set out an energy efficient design, the next step is to incorporate low carbon technology for energy generation. A number of technologies exist and should be specified where they:

- Comply with planning policy
- Are feasible for the site
- Are cost efficient
- Are appropriate for proposed development form and function
- Protect against fuel poverty
- Promote fuel security
- Reduce reliance on fossil fuels
- Reduce carbon emissions
- Reduce resource depletion
- Reduce pollution

Site location and development form and function will influence the suitability of different technologies through:

- Orientation
- Space (inside and outside of the buildings)
- Surrounding topography, structures, and natural features
- Wind speed
- Overshading
- Geology and ground conditions
- Building form, function, and density

In determining the most feasible renewable technologies for the dwelling, the following have been reviewed:

- Wind turbines
- Ground Source Heat Pumps
- Air Source Heat Pumps
- Biomass
- Combined Heat and Power
- Photovoltaic Panels
- Solar water heating

WIND TURBINES

Wind turbines are used to produce electricity. They can be either pole mounted (in a suitably exposed position) or building mounted; building mounted systems need a sufficient wind speed at the structural height and both a structural survey and planning permission.

- Wind speed can be too low on low rise buildings
- Taller systems need sufficient space
- Wind resources very variable and unpredictable
- May need planning permission

Wind turbines technology is **not recommended** for this development

GROUND SOURCE HEAT PUMP (GSHP)

GSHPs use naturally occurring underground low-level heat in areas with appropriate geological features. Heat is transferred from the ground by either extracting and discharging (re-charging) water from/to the ground directly (open loop) or circulating water through pipes buried within the ground, (closed loop). The water is passed through a heat pump to transfer the heat from this water into a higher temperature water circuit to provide heating. The loop can be fitted horizontally (laid in a shallow trench) or vertically (in a borehole).

- Feasibility analysis is costly
- Suitable ground conditions required
- More capital intensive than air source heat pumps
- Can be more efficient and lower running costs than ASHPs
- Well suited to highly insulated buildings

Ground source heat pump technology is **not recommended** for this development

AIR SOURCE HEAT PUMP (ASHP)

ASHP systems absorb heat from outside air at a low temperature into a fluid which is then passed through an electrically driven compressor where its temperature is increased. There are two main types of ASHP systems: Air to Water systems distribute heat through wet central heating; Air to air produce warm air which is circulated by fans. For an ASHP system to be installed, there needs to be ample outdoor space for the external condensing unit; these units can also be noisy and blow out colder air to the neighbouring environment.

- Requires space for external plant and internal hot water tank for wet systems supplying DHW
- Can generate noise though quieter systems have been developed
- Least efficient when most needed
- Longer life than fossil fuel boilers
- High capital costs vs gas systems but lower than GSHPs
- Well suited to highly insulated buildings

Air source heat pump technology **is recommended** for this development, however space is limited and will need to be checked with an installer.

BIOMASS

Biomass systems burn wood pellets, chips, or logs to provide heat in a single room, or to power central heating and hot water boilers. There needs to be ample space available for both the boiler and the storage of fuel. There will also be regular deliveries of fuel and therefore adequate site access is required.

- Carbon emissions are cyclical unlike fossil fuel
- Requires fuel storage space and bulk delivery
- Carbon 'neutral' fuel in isolation but supply side emissions are still present so not neutral overall
- Harmful particulate emissions impact air quality and health

Biomass technology **is not recommended** for this development

COMBINED HEAT AND POWER (CHP)

CHP is effectively an on-site small power plant providing both electrical power and thermal heat energy. It is an energy efficiency and low carbon measure rather than a renewable energy technology. A CHP system operates by burning a primary fuel (normally natural gas) by use of either a reciprocating engine or turbine, which in turn drives an alternator to generate electrical power. The heat emitted by the engine and exhaust gases is recovered and used to heat the building or to provide hot water.

- Reduces consumption of and reliance on grid electricity
- Works best with high and consistent heat and hot water demand
- Recovers waste energy
- Can export to the grid
- Uses fossil fuel
- Emissions on site rather than upstream
- Efficiency is sensitive to sizing

CHP **is not recommended** for this development

DISTRICT HEATING

District Heating systems provide multiple buildings or dwellings with heat and hot water from a central boiler house, or 'energy centre'. The system can provide heating or cooling which is transferred from the energy centre through a network of highly insulated pipes carrying the heated water to each dwelling.

- Economies of scale
- Frees up space in habitable areas of development
- Variety of systems
- Can make use of waste heat from industry
- Can be fossil fuel based and dependent

Due to the location, there are no existing or proposed heat networks or energy centres within a suitable radius from the development and there are no existing networks local to the site.

District heating **is not recommended** for this development

SOLAR PHOTOVOLTAIC (PV)

Solar PV cells (which are mounted together in panels or tiles on the roof) convert sunlight into electricity. The cells are made from layers of semi-conducting material; when the light shines on the cell, an electric field is created across the layers. Although PV cells are most effective in bright sunlight, they can still generate electricity on a cloudy day. The power of a PV cell is measured in kilowatts peak (kWp). Each PV panel produces 250 Watts to 420 Watts depending on the manufacture.

- Passive technology, requires no energy input from grid
- Does not require sunny days to generate power
- Capital costs can be high although payback is effective
- Needs sufficient roof space and orientation
- Zero site or upstream emissions
- Can export to the grid

Solar PV technology **is recommended** for this development however, Air Source Heat Pumps are to be included and provide a greater emissions reduction

SOLAR HOT WATER

Solar hot water systems absorb energy from the sun and transfer this energy using heat exchangers to heat water which can then be stored. Systems should be roof mounted and oriented to face between a south-east and south-west direction.

- Mostly passive technology but requires pump energy
- Not suitable for combi boilers and developments without roof space
- Lower CO2 reductions than other technologies

Solar hot water technology **is not recommended** for this development

Low and Zero Carbon Technology Summary

The low carbon technology review indicates that solar PV panels and electric ASHP's would be potentially feasible to install. The following low carbon technology has been assessed:

ASHP – Assumed Model: Mitsubishi Ecodan 6.0 kW (350% heating efficiency and 190% hot water efficiency)

The technology is deemed optimal for meeting the needs of the development and achieving policy compliance. It has been incorporated into the energy model and the results are presented in the next section. The feasibility of the ASHP units will need to be further checked with an installer due to limited private space.

8 Low Carbon Technology – Renewable Energy Generation - Be Green

The selected Low Carbon Technology has been incorporated into the calculation and the results are set out below.

Table 8.1: Average Baseline vs Be Green CO2

	CO2 Emission Rate (kg CO2/m2/year)	Floor Area (m2)	Total Baseline Emissions (kg CO2/year)	Reduction in CO2
Baseline	7.7	454	3,495	N/A
Be Green Design	6.0	454	2,724	22%

The **CO2 Emissions reduction** as a result of energy efficient fabric and services is shown to be 771 kg/year.

9 Conclusion

Proposals are for the development named as 82-84 Market Street, Manchester, M1 1PD comprising the conversion of the first, second, and third floors from office-space to 6 flats consisting of different types and the construction of an additional floor to create 2 additional flats falling under the requirements of Manchester City Council.

Under the Manchester City Council local planning policy and The Greater Manchester Combined Authority the proposed development is required to be net zero carbon were feasible and meet Part L 2021 building regulations. However, due to the development being a conversion, net zero carbon will prove difficult to achieve, therefore best efforts will be made were feasible to improve the properties and reduce their carbon emissions.

Energy modelling software has been used to calculate a baseline against which compliance with the above can be measured.

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

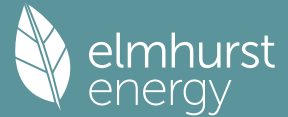
Low and zero carbon technology will be incorporated and is to comprise of Air Source Heat Pump (Efficiency of 350%)

This results in a 22% saving in CO2 emissions over Part L 2021 for existing dwellings.

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

10 Appendix 1 – SAP Worksheet Baseline

Full SAP Calculation Printout



Property Reference	12201 FF-01				Issued on Date	13/03/2025
Assessment Reference	Baseline ASHP		Prop Type Ref	First floor flat		
Property	Flat 01, Market Street, Manchester, M1 1PD					
SAP Rating	70 C	DER	8.83	TER	13.82	
Environmental	94 A	% DER < TER				36.11
CO ₂ Emissions (t/year)	0.4	DFEE	74.84	TFEE	27.95	
Compliance Check	See BREL	% DFEE < TFEE				-167.74
% DPER < TPER	-24.84	DPER	92.52	TPER	74.11	
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 (m ²)	Storey height (m)	Volume (m ³)
Main dwelling	50.0000 (1b)	2.5000 (2b)	125.0000 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000		125.0000 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 125.0000 (5)

2. Ventilation rate

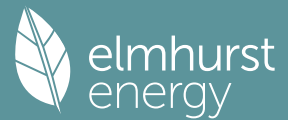
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1600 (8)
Pressure test	No
Pressure Test Method	Blower Door
Measured/design AP50	15.0000 (17)
Infiltration rate	0.9100 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.7053 (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)
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	0.8992	0.8816	0.8639	0.7758	0.7581	0.6700	0.6700	0.6524	0.7053	0.7581	0.7934	0.8287 (22b)
Effective ac	0.9043	0.8886	0.8732	0.8009	0.7874	0.7244	0.7244	0.7128	0.7487	0.7874	0.8147	0.8433 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Existing Windows			8.3000	2.3551	19.5471		(27)
Heat Loss Floor 1			50.0000	0.2500	12.5000		(28b)
External Wall (Existing)	21.5000	8.3000	13.2000	0.3000	3.9600		(29a)
Wall to stairwell	24.4000		24.4000	0.3000	7.3200		(29a)
Total net area of external elements A _{um} (A, m ²)			95.9000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.3271		(33)
Main dwelling							
Corridor Wall			6.2500	0.0000	0.0000		(32)
Party Wall Internal			26.2000	0.0000	0.0000		(32)
Party Ceilings 1			50.0000				(32b)
Thermal mass parameter (TMP = C _m / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Default value 0.200 * total exposed area)							19.1800 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	62.5071 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	37.3013	36.6538	36.0190	33.0377	32.4799	29.8832	29.8832
Heat transfer coeff						Aug	29.4024
						Sep	30.8834
						Oct	32.4799
						Nov	33.6083
						Dec	34.7880 (38)

Full SAP Calculation Printout



Average = Sum(39)m / 12 =	99.8084	99.1609	98.5261	95.5448	94.9870	92.3903	92.3903	91.9095	93.3905	94.9870	96.1154	97.2951 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.9962	1.9832	1.9705	1.9109	1.8997	1.8478	1.8478	1.8382	1.8678	1.8997	1.9223	1.9459 (40)
HLP (average)												1.9108
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.6901 (42)
Hot water usage for mixer showers												
72.2658	71.1798	69.5972	66.5693	64.3348	61.8429	60.4265	61.9971	63.7187	66.3942	69.4872	71.9889	(42a)
Hot water usage for baths												
22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses												
31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)
Average daily hot water use (litres/day)												116.7306 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	126.9285	124.3436	121.1244	116.0589	112.0068	107.6259	105.8165	109.0204	112.4173	117.0328	122.1814	126.5748 (44)
Energy conte	201.0237	177.0637	186.1637	158.8788	150.7827	132.3386	127.9759	134.9900	138.6218	158.8123	174.0698	198.1856 (45)
Energy content (annual)										Total = Sum(45)m =		1938.9067
Distribution loss (46)m = 0.15 x (45)m												
30.1536	26.5595	27.9246	23.8318	22.6174	19.8508	19.1964	20.2485	20.7933	23.8219	26.1105	29.7278	(46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8800 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0152 (55)
Total storage loss												
31.4712	28.4256	31.4712	30.4560	31.4712	30.4560	31.4712	31.4712	30.4560	31.4712	30.4560	31.4712	(56)
If cylinder contains dedicated solar storage												
31.4712	28.4256	31.4712	30.4560	31.4712	30.4560	31.4712	31.4712	30.4560	31.4712	30.4560	31.4712	(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	(61)
Total heat required for water heating calculated for each month												
255.7573	226.5005	240.8973	211.8468	205.5163	185.3066	182.7095	189.7236	191.5898	213.5459	227.0378	252.9192	(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												
255.7573	226.5005	240.8973	211.8468	205.5163	185.3066	182.7095	189.7236	191.5898	213.5459	227.0378	252.9192	(64)
Total per year (kWh/year)												2583.3507 (64)
Electric shower(s)												2583 (64)
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												
110.6273	98.4231	105.6863	95.2016	93.9221	86.3770	86.3389	88.6711	88.4661	96.5920	100.2526	109.6836	(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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
76.9289	85.1713	76.9289	79.4932	76.9289	79.4932	76.9289	76.9289	79.4932	76.9289	79.4932	76.9289	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)												
-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)												
148.6926	146.4630	142.0515	132.2244	126.2394	119.9681	116.0469	119.1815	122.8696	129.8279	139.2397	147.4242	(72)
Total internal gains												
424.2069	431.7475	415.2436	399.7845	380.8887	364.4575	351.4757	353.0825	363.1850	378.7753	401.0979	416.4422	(73)

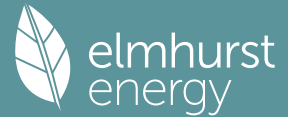
6. Solar gains

[Jan]												
	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
Southeast	8.3000	36.7938	0.7600	0.7000	0.7700	112.5895	(77)					
Solar gains	112.5895	191.7816	262.4040	325.1312	364.1741	361.5406	348.5637	319.4360	284.1280	211.9595	134.8563	96.3532 (83)
Total gains	536.7965	623.5291	677.6476	724.9157	745.0628	725.9981	700.0394	672.5185	647.3130	590.7349	535.9542	512.7953 (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	34.7889	35.0161	35.2416	36.3413	36.5547	37.5821	37.5821	37.7787	37.1796	36.5547	36.1256	35.6875
alpha	3.3193	3.3344	3.3494	3.4228	3.4370	3.5055	3.5055	3.5186	3.4786	3.4370	3.4084	3.3792
util living area												
0.9841	0.9730	0.9550	0.9135	0.8355	0.6925	0.5411	0.5767	0.7750	0.9235	0.9729	0.9863	(86)
MIT	19.3211	19.5259	19.8149	20.2126	20.5414	20.7858	20.8725	20.8625	20.7085	20.2847	19.7614	19.3236 (87)
Th 2	19.3359	19.3445	19.3531	19.3934	19.4010	19.4367	19.4367	19.4434	19.4229	19.4010	19.3856	19.3696 (88)
util rest of house												
0.9786	0.9637	0.9387	0.8802	0.7675	0.5669	0.3668	0.4046	0.6654	0.8868	0.9618	0.9815	(89)

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MIT 2	17.8842	18.0915	18.3795	18.7886	19.0855	19.2985	19.3413	19.3450	19.2400	18.8699	18.3574	17.9126 (90)
Living area fraction									FLA = Living area / (4) =			0.4540 (91)
MIT	18.5365	18.7427	19.0312	19.4351	19.7465	19.9737	20.0365	20.0339	19.9067	19.5122	18.9948	18.5532 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5365	18.7427	19.0312	19.4351	19.7465	19.9737	20.0365	20.0339	19.9067	19.5122	18.9948	18.5532 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9750	0.9594	0.9347	0.8812	0.7844	0.6142	0.4376	0.4744	0.7036	0.8900	0.9584	0.9783 (94)	
Useful gains	523.3988	598.2028	633.4042	638.8005	584.4237	445.9310	306.3263	319.0351	455.4701	525.7297	513.6372	501.6683 (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	1420.9267	1372.6574	1234.6505	1006.5752	764.3089	496.4788	317.4969	333.9930	542.2874	846.5406	1143.2752	1396.4986 (97)	
Space heating kWh	667.7607	520.4335	447.3272	264.7978	133.8346	0.0000	0.0000	0.0000	0.0000	238.6833	453.3394	665.7538 (98a)	
Space heating requirement - total per year (kWh/year)												3391.9304	
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	667.7607	520.4335	447.3272	264.7978	133.8346	0.0000	0.0000	0.0000	0.0000	238.6833	453.3394	665.7538 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												3391.9304	
Space heating per m2										(98c) / (4) =		67.8386 (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 %)													249.9000 (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	667.7607	520.4335	447.3272	264.7978	133.8346	0.0000	0.0000	0.0000	0.0000	238.6833	453.3394	665.7538 (98)	
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)	
Space heating fuel (main heating system)	267.2112	208.2567	179.0025	105.9615	53.5553	0.0000	0.0000	0.0000	0.0000	95.5115	181.4083	266.4081 (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	255.7573	226.5005	240.8973	211.8468	205.5163	185.3066	182.7095	189.7236	191.5898	213.5459	227.0378	252.9192 (64)	
Efficiency of water heater												175.1000 (216)	
(217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (217)	
Fuel for water heating, kWh/month	146.0636	129.3549	137.5770	120.9862	117.3708	105.8290	104.3458	108.3516	109.4173	121.9566	129.6618	144.4427 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)	
Lighting	19.8945	15.9601	14.3703	10.5283	8.1324	6.6442	7.4186	9.6430	12.5253	16.4339	18.5620	20.4475 (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												1357.3151 (211)	
Space heating fuel - main system 2												0.0000 (213)	
Space heating fuel - secondary												0.0000 (215)	
Efficiency of water heater												175.1000	
Water heating fuel used												1475.3573 (219)	
Space cooling fuel												0.0000 (221)	
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000 (231)	
Electricity for lighting (calculated in Appendix L)												160.5603 (232)	

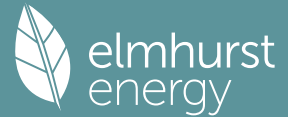
Energy saving/generation technologies (Appendices M ,N and Q)

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													2993.2327 (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	1357.3151	0.1549	210.2924 (261)	
Total CO2 associated with community systems			0.0000 (373)	

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Water heating (other fuel)	1475.3573	0.1409	207.8237 (264)
Space and water heating			418.1162 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	160.5603	0.1443	23.1738 (268)
Total CO2, kg/year			441.2900 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			8.8300 (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	1357.3151	1.5736	2135.8610 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1475.3573	1.5209	2243.8118 (278)
Space and water heating			4379.6728 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	160.5603	1.5338	246.2727 (282)
Total Primary energy kWh/year			4625.9455 (286)
Dwelling Primary energy Rate (DPER)			92.5200 (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	50.0000 (1b)	x 2.5000 (2b)	= 125.0000 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	125.0000 (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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1600 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4100 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3178 (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	0.4051	0.3972	0.3892	0.3495	0.3416	0.3019	0.3019	0.2939	0.3178	0.3416	0.3575	0.3734 (22b)
Effective ac	0.5821	0.5789	0.5758	0.5611	0.5583	0.5456	0.5456	0.5432	0.5505	0.5583	0.5639	0.5697 (25)

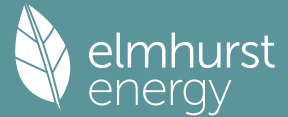
3. Heat losses and heat loss parameter

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 Opening Type			8.3000	1.1450	9.5038		(27)
Heat Loss Floor 1			50.0000	0.1300	6.5000		(28b)
External Wall (Existing)	21.5000	8.3000	13.2000	0.1800	2.3760		(29a)
Wall to stairwell	24.4000		24.4000	0.1800	4.3920		(29a)
Total net area of external elements Aum(A, m2)			95.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.7718		(33)
Main dwelling							
Corridor Wall			6.2500	0.0000	0.0000		(32)
Party Wall Internal			26.2000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)							4.7950 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	27.5668 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	24.0102	23.8788	23.7499	23.1447	23.0315	22.5044	22.5044	22.4068	22.7074	23.0315	23.2605	23.5000 (38)
Average = Sum(39)m / 12 =	51.5770	51.4456	51.3167	50.7115	50.5983	50.0712	50.0712	49.9736	50.2742	50.5983	50.8274	51.0668 (39)
												50.7110

7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												
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	67.3211	67.4931	67.6626	68.4701	68.6233	69.3457	69.3457	69.4812	69.0657	68.6233	68.3140	67.9937
alpha	5.4881	5.4995	5.5108	5.5647	5.5749	5.6230	5.6230	5.6321	5.6044	5.5749	5.5543	5.5329
util living area	0.9791	0.9567	0.9165	0.8229	0.6753	0.4913	0.3531	0.3822	0.5841	0.8410	0.9552	0.9829 (86)
MIT	20.1743	20.3761	20.5961	20.8252	20.9505	20.9930	20.9991	20.9986	20.9822	20.8318	20.4796	20.1389 (87)
Th 2	20.0571	20.0593	20.0614	20.0715	20.0734	20.0821	20.0821	20.0838	20.0788	20.0734	20.0696	20.0656 (88)
util rest of house	0.9732	0.9454	0.8958	0.7846	0.6186	0.4230	0.2798	0.3067	0.5118	0.7980	0.9416	0.9780 (89)
MIT 2	19.1261	19.3769	19.6431	19.9100	20.0360	20.0785	20.0819	20.0833	20.0684	19.9249	19.5162	19.0886 (90)
Living area fraction									fLA = Living area / (4) =			0.4540 (91)

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MIT	19.6020	19.8305	20.0758	20.3255	20.4512	20.4937	20.4983	20.4988	20.4832	20.3366	19.9536	19.5655 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6020	19.8305	20.0758	20.3255	20.4512	20.4937	20.4983	20.4988	20.4832	20.3366	19.9536	19.5655 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9698	0.9422	0.8961	0.7957	0.6423	0.4539	0.3131	0.3410	0.5441	0.8111	0.9396	0.9748	(94)
Useful gains	479.8724	535.4687	547.5137	516.4848	426.1739	293.1334	194.9951	204.5159	315.6104	433.7320	461.9721	461.8625	(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													
	789.2309	768.1097	696.6646	579.4066	442.7938	295.1042	195.1919	204.8339	320.9123	492.6550	653.3131	784.6654	(97)
Space heating kWh													
	230.1627	156.3348	110.9683	45.3037	12.3652	0.0000	0.0000	0.0000	0.0000	43.8388	137.7655	240.1653	(98a)
Space heating requirement - total per year (kWh/year)												976.9043	
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													
	230.1627	156.3348	110.9683	45.3037	12.3652	0.0000	0.0000	0.0000	0.0000	43.8388	137.7655	240.1653	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												976.9043	
Space heating per m2											(98c) / (4) =	19.5381	(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	230.1627	156.3348	110.9683	45.3037	12.3652	0.0000	0.0000	0.0000	0.0000	43.8388	137.7655	240.1653	(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)	249.3637	169.3768	120.2256	49.0831	13.3968	0.0000	0.0000	0.0000	0.0000	47.4959	149.2584	260.2008	(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	192.3778	170.2565	181.3342	160.6920	156.5861	141.9978	140.8668	146.0028	147.0824	162.9133	171.8587	190.4575	(64)
Efficiency of water heater (217)m	84.4630	83.8689	82.9933	81.6193	80.3964	79.8000	79.8000	79.8000	79.8000	81.5526	83.5686	84.5810	(216)
Fuel for water heating, kWh/month	227.7659	203.0030	218.4926	196.8800	194.7677	177.9421	176.5248	182.9609	184.3137	199.7647	205.6499	225.1778	(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	15.9843	12.8232	11.5459	8.4590	6.5340	5.3383	5.9605	7.7477	10.0635	13.2038	14.9137	16.4286	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-11.1961	-16.8539	-25.8519	-31.0911	-35.3448	-33.6806	-33.2897	-30.5254	-25.9693	-20.1553	-12.6886	-9.5603	(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	-3.4458	-7.4566	-15.2120	-23.4292	-31.5486	-31.8927	-31.4992	-26.3924	-18.9966	-10.8315	-4.6550	-2.7085	(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												1058.4012	(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												2393.2430	(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)												129.0025	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-494.2751	(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												3172.3716	(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	1058.4012	0.2100	222.2642	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2393.2430	0.2100	502.5810	(264)
Space and water heating			724.8453	(265)

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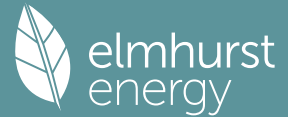
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	129.0025	0.1443	18.6190 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-286.2069	0.1332	-38.1278
PV Unit electricity exported	-208.0682	0.1252	-26.0464
Total			-64.1742 (269)
Total CO2, kg/year			691.2194 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.8200 (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	1058.4012	1.1300	1195.9933 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2393.2430	1.1300	2704.3646 (278)
Space and water heating			3900.3579 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	129.0025	1.5338	197.8683 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-286.2069	1.4923	-427.0983
PV Unit electricity exported	-208.0682	0.4595	-95.6012
Total			-522.6995 (283)
Total Primary energy kWh/year			3705.6276 (286)
Target Primary Energy Rate (TPER)			74.1100 (287)

11 Appendix 2 – SAP Worksheet Be Lean/Green

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Property Reference	12201 FF-01				Issued on Date	13/03/2025	
Assessment Reference	Be Green ASHP			Prop Type Ref	First floor flat		
Property	Flat 01, Market Street, Manchester, M1 1PD						
SAP Rating	77 C		DER	6.84		TER	14.04
Environmental	95 A		% DER < TER				51.28
CO ₂ Emissions (t/year)	0.31		DFEE	73.08		TFEE	27.95
Compliance Check	See BREL		% DFEE < TFEE				-161.43
% DPER < TPER	4.53		DPER	71.84		TPER	75.25
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 (m ²)	Storey height (m)	Volume (m ³)
Main dwelling	50.0000 (1b)	2.5000 (2b)	125.0000 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000		125.0000 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	125.0000 (5)

2. Ventilation rate

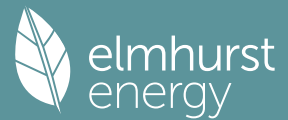
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1600 (8)
Pressure test	No
Pressure Test Method	Blower Door
Measured/design AP50	15.0000 (17)
Infiltration rate	0.9100 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.7053 (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	0.8992	0.8816	0.8639	0.7758	0.7581	0.6700	0.6700	0.6524	0.7053	0.7581	0.7934	0.8287 (22b)
Effective ac	0.9043	0.8886	0.8732	0.8009	0.7874	0.7244	0.7244	0.7128	0.7487	0.7874	0.8147	0.8433 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Existing Windows			8.3000	2.3551	19.5471		(27)
Heat Loss Floor 1			50.0000	0.2300	11.5000		(28b)
External Wall (Existing)	21.5000	8.3000	13.2000	0.2800	3.6960		(29a)
Wall to stairwell	24.4000		24.4000	0.2800	6.8320		(29a)
Total net area of external elements Aum(A, m ²)			95.9000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.5751		(33)
Main dwelling							
Corridor Wall			6.2500	0.0000	0.0000		(32)
Party Wall Internal			26.2000	0.0000	0.0000		(32)
Party Ceilings 1			50.0000				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Default value 0.200 * total exposed area)							19.1800 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	60.7551 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	37.3013	36.6538	36.0190	33.0377	32.4799	29.8832	29.8832
Heat transfer coeff						29.4024	30.8834
							32.4799
							33.6083
							34.7880 (38)

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Average = Sum(39)m / 12 =	98.0564	97.4089	96.7741	93.7928	93.2350	90.6383	90.6383	90.1575	91.6385	93.2350	94.3634	95.5431 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.9611	1.9482	1.9355	1.8759	1.8647	1.8128	1.8128	1.8031	1.8328	1.8647	1.8873	1.9109 (40)
HLP (average)												1.8758
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.6901 (42)
Hot water usage for mixer showers												
59.1265	58.2380	56.9432	54.4658	52.6376	50.5987	49.4399	50.7249	52.1335	54.3226	56.8531	58.9000	(42a)
Hot water usage for baths												
22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses												
31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)
Average daily hot water use (litres/day)												104.6166 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.7893	111.4018	108.4704	103.9553	100.3096	96.3818	94.8299	97.7482	100.8321	104.9611	109.5474	113.4859 (44)
Energy conte	180.2144	158.6347	166.7150	142.3097	135.0360	118.5126	114.6885	121.0327	124.3360	142.4312	156.0703	177.6915 (45)
Energy content (annual)										Total = Sum(45)m =		1737.6727
Distribution loss (46)m = 0.15 x (45)m												
27.0322	23.7952	25.0072	21.3465	20.2554	17.7769	17.2033	18.1549	18.6504	21.3647	23.4105	26.6537	(46)
Water storage 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	(61)
Total heat required for water heating calculated for each month												
230.4282	203.9891	216.9288	190.9037	185.2498	167.1066	164.9023	171.2465	172.9300	192.6450	204.6643	227.9053	(62)
WWHRS	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	(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	(63c)
FGHRS	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												
230.4282	203.9891	216.9288	190.9037	185.2498	167.1066	164.9023	171.2465	172.9300	192.6450	204.6643	227.9053	(64)
Total per year (kWh/year)												2328.8997 (64)
Electric shower(s)												2329 (64)
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												
100.0923	89.0296	95.6038	86.1932	85.0705	78.2806	78.3050	80.4144	80.2169	87.5294	90.7686	99.2535	(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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
76.9289	85.1713	76.9289	79.4932	76.9289	79.4932	76.9289	76.9289	79.4932	76.9289	79.4932	76.9289	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)												
134.5327	132.4845	128.4997	119.7127	114.3421	108.7231	105.2486	108.0839	111.4124	117.6471	126.0675	133.4052	(72)
Total internal gains												
407.0471	414.7690	398.6918	384.2728	365.9914	353.2126	340.6774	341.9849	351.7277	363.5944	384.9256	399.4232	(73)

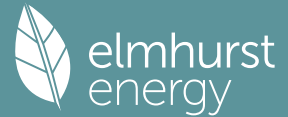
6. Solar gains

[Jan]												
	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
Southeast	8.3000	36.7938	0.7600	0.7000	0.7700	112.5895	(77)					
Solar gains	112.5895	191.7816	262.4040	325.1312	364.1741	361.5406	348.5637	319.4360	284.1280	211.9595	134.8563	96.3532 (83)
Total gains	519.6366	606.5507	661.0958	709.4040	730.1655	714.7531	689.2411	661.4208	635.8557	575.5540	519.7819	495.7764 (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	35.4104	35.6459	35.8797	37.0201	37.2416	38.3085	38.3085	38.5129	37.8904	37.2416	36.7963	36.3419
alpha	3.3607	3.3764	3.3920	3.4680	3.4828	3.5539	3.5539	3.5675	3.5260	3.4828	3.4531	3.4228
util living area												
0.9855	0.9748	0.9573	0.9162	0.8384	0.6929	0.5406	0.5768	0.7769	0.9269	0.9749	0.9875	(86)
Living	19.3317	19.5372	19.8255	20.2225	20.5489	20.7916	20.8757	20.8659	20.7148	20.2910	19.7698	19.3347
Non living	17.5031	17.7679	18.1347	18.6484	19.0252	19.2872	19.3405	19.3435	19.2162	18.7463	18.0942	17.5307
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

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16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.1466	19.5372	19.8255	20.2225	20.5489	20.7916	20.8757	20.8659	20.7148	20.2910	19.7698	19.5676 (87)
Th 2	19.3594	19.3681	19.3767	19.4174	19.4251	19.4611	19.4611	19.4678	19.4472	19.4251	19.4095	19.3934 (88)
util rest of house	0.9804	0.9661	0.9417	0.8839	0.7716	0.5688	0.3689	0.4071	0.6688	0.8916	0.9646	0.9832 (89)
MIT 2	18.6193	17.7679	18.1347	18.6484	19.0252	19.2872	19.3405	19.3435	19.2162	18.7463	18.0942	17.8664 (90)
Living area fraction									fLA = Living area / (4) =			0.4540 (91)
MIT	19.3127	18.5712	18.9023	19.3631	19.7170	19.9702	20.0375	20.0347	19.8966	19.4476	18.8549	18.6387 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3127	18.5712	18.9023	19.3631	19.7170	19.9702	20.0375	20.0347	19.8966	19.4476	18.8549	18.6387 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9802	0.9605	0.9359	0.8825	0.7859	0.6139	0.4369	0.4742	0.7044	0.8922	0.9598	0.9805 (94)
Useful gains	509.3696	582.5706	618.7282	626.0540	573.8586	438.7651	301.1272	313.6268	447.9197	513.5324	498.9084	486.1076 (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	1472.0914	1331.6963	1200.2242	981.3589	747.4627	486.7433	311.5668	327.6930	531.1885	824.9047	1109.2348	1379.5224 (97)
Space heating kWh	716.2650	503.4125	432.6330	255.8195	129.1614	0.0000	0.0000	0.0000	0.0000	231.6610	439.4350	664.7007 (98a)
Space heating requirement - total per year (kWh/year)												3373.0880
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	716.2650	503.4125	432.6330	255.8195	129.1614	0.0000	0.0000	0.0000	0.0000	231.6610	439.4350	664.7007 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3373.0880
Space heating per m2										(98c) / (4) =		67.4618 (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 %)	353.6694 (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	716.2650	503.4125	432.6330	255.8195	129.1614	0.0000	0.0000	0.0000	0.0000	231.6610	439.4350	664.7007 (98)
Space heating efficiency (main heating system 1)	353.6694	353.6694	353.6694	353.6694	353.6694	0.0000	0.0000	0.0000	0.0000	353.6694	353.6694	353.6694 (210)
Space heating fuel (main heating system)	202.5239	142.3398	122.3270	72.3330	36.5204	0.0000	0.0000	0.0000	0.0000	65.5021	124.2502	187.9441 (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	230.4282	203.9891	216.9288	190.9037	185.2498	167.1066	164.9023	171.2465	172.9300	192.6450	204.6643	227.9053 (64)
Efficiency of water heater	189.9248	189.9248	189.9248	189.9248	189.9248	189.9248	189.9248	189.9248	189.9248	189.9248	189.9248	189.9248 (216)
Fuel for water heating, kWh/month	121.3260	107.4052	114.2182	100.5154	97.5385	87.9857	86.8251	90.1654	91.0518	101.4322	107.7607	119.9977 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	18.2244	14.6203	13.1640	9.6445	7.4497	6.0865	6.7958	8.8335	11.4738	15.0543	17.0038	18.7309 (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												953.7404 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												189.9248
Water heating fuel used												1226.2219 (219)
Space cooling fuel												0.0000 (221)

Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	147.0816 (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	2327.0440 (238)

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

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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	953.7404	0.1551	147.9710 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1226.2219	0.1409	172.7141 (264)
Space and water heating			320.6852 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	147.0816	0.1443	21.2284 (268)
Total CO2, kg/year			341.9136 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			6.8400 (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	953.7404	1.5744	1501.5338 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1226.2219	1.5208	1864.8533 (278)
Space and water heating			3366.3871 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	147.0816	1.5338	225.5987 (282)
Total Primary energy kWh/year			3591.9858 (286)
Dwelling Primary energy Rate (DPER)			71.8400 (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	50.0000	2.5000	125.0000
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000		
Dwelling volume			

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)
Infiltration due to chimneys, flues and fans	(6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 20.0000 / (5) = 0.1600 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4100 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3178 (21)

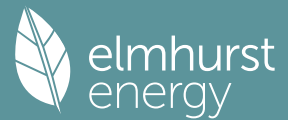
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4051	0.3972	0.3892	0.3495	0.3416	0.3019	0.3019	0.2939	0.3178	0.3416	0.3575	0.3734 (22b)
Effective ac	0.5821	0.5789	0.5758	0.5611	0.5583	0.5456	0.5456	0.5432	0.5505	0.5583	0.5639	0.5697 (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 Opening Type			8.3000	1.1450	9.5038		(27)
Heat Loss Floor 1			50.0000	0.1300	6.5000		(28b)
External Wall (Existing)	21.5000	8.3000	13.2000	0.1800	2.3760		(29a)
Wall to stairwell	24.4000		24.4000	0.1800	4.3920		(29a)
Total net area of external elements Aum(A, m2)			95.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.7718		(33)
Main dwelling							
Corridor Wall			6.2500	0.0000	0.0000		(32)
Party Wall Internal			26.2000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)							4.7950 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	27.5668 (37)

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

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(38)m	Jan 24.0102	Feb 23.8788	Mar 23.7499	Apr 23.1447	May 23.0315	Jun 22.5044	Jul 22.5044	Aug 22.4068	Sep 22.7074	Oct 23.0315	Nov 23.2605	Dec 23.5000	(38)
Heat transfer coeff	51.5770	51.4456	51.3167	50.7115	50.5983	50.0712	50.0712	49.9736	50.2742	50.5983	50.8274	51.0668	(39)
Average = Sum(39)m / 12 =												50.7110	
HLP	Jan 1.0315	Feb 1.0289	Mar 1.0263	Apr 1.0142	May 1.0120	Jun 1.0014	Jul 1.0014	Aug 0.9995	Sep 1.0055	Oct 1.0120	Nov 1.0165	Dec 1.0213	(40)
HLP (average)												1.0142	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.6901	(42)
Hot water usage for mixer showers	52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)	
Hot water usage for baths	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)	
Hot water usage for other uses	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)	
Average daily hot water use (litres/day)												98.5597	(43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)	
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)	
Energy content (annual)										Total =	Sum(45)m =	1637.0557		
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)	
Water storage 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	220.8185	195.4927	207.9993	183.3884	178.1713	160.9629	159.0536	165.0628	166.5564	185.2493	196.4339	218.4532	(62)	
WWHRS	-24.0268	-21.2495	-22.2513	-18.4249	-17.1714	-14.6937	-13.7730	-14.6462	-15.2026	-17.9222	-20.3037	-23.5819	(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	196.7916	174.2432	185.7480	164.9635	160.9999	146.2692	145.2806	150.4166	151.3538	167.3271	176.1301	194.8714	(64)	
12Total per year (kWh/year)										Total per year (kWh/year) =	Sum(64)m =	2014.3951	(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)	
												0.0000	(64a)	
Heat gains from water heating, kWh/month	97.2687	86.5402	93.0063	84.0540	83.0885	76.5975	76.7319	78.7300	78.4574	85.4420	88.3916	96.4823	(65)	

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

Metabolic gains (Table 5), Watts	Jan 84.5050	Feb 84.5050	Mar 84.5050	Apr 84.5050	May 84.5050	Jun 84.5050	Jul 84.5050	Aug 84.5050	Sep 84.5050	Oct 84.5050	Nov 84.5050	Dec 84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	76.9289	85.1713	76.9289	79.4932	76.9289	79.4932	76.9289	76.9289	79.4932	76.9289	79.4932	76.9289	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	130.7375	128.7800	125.0085	116.7416	111.6781	106.3854	103.1343	105.8198	108.9685	114.8414	122.7661	129.6805	(72)
Total internal gains	406.2519	414.0646	398.2006	384.3017	366.3275	350.8749	338.5631	339.7208	349.2839	363.7888	384.6242	398.6985	(73)

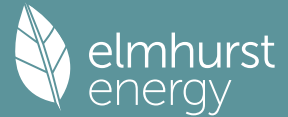
6. Solar gains

[Jan]												Gains
	Area		Solar flux		g		FF		Access		Gains	
	m2		Table 6a		Specific data		Specific data		factor		W	
			W/m2		or Table 6b		or Table 6c		Table 6d			
Southeast	8.3000		36.7938		0.6300		0.7000		0.7700		93.3308 (77)	
Solar gains	93.3308	158.9769	217.5191	269.5167	301.8811	299.6981	288.9410	264.7956	235.5272	175.7033	111.7888	79.8717 (83)
Total gains	499.5827	573.0414	615.7197	653.8184	668.2086	650.5730	627.5040	604.5164	584.8110	539.4921	496.4130	478.5702 (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	67.3211	67.4931	67.6626	68.4701	68.6233	69.3457	69.3457	69.4812	69.0657	68.6233	68.3140	67.9937
alpha	5.4881	5.4995	5.5108	5.5647	5.5749	5.6230	5.6230	5.6321	5.6044	5.5749	5.5543	5.5329
util living area	0.9782	0.9553	0.9143	0.8195	0.6715	0.4879	0.3505	0.3792	0.5798	0.8372	0.9535	0.9821 (86)
MIT	20.1835	20.3843	20.6026	20.8290	20.9519	20.9933	20.9991	20.9986	20.9828	20.8360	20.4877	20.1484 (87)

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Th 2	20.0571	20.0593	20.0614	20.0715	20.0734	20.0821	20.0821	20.0838	20.0788	20.0734	20.0696	20.0656 (88)
util rest of house	0.9721	0.9437	0.8932	0.7810	0.6148	0.4200	0.2777	0.3043	0.5079	0.7936	0.9395	0.9770 (89)
MIT 2	19.1376	19.3867	19.6506	19.9138	20.0371	20.0786	20.0819	20.0833	20.0687	19.9290	19.5258	19.1004 (90)
Living area fraction									fLA = Living area / (4) =			0.4540 (91)
MIT	19.6124	19.8396	20.0828	20.3293	20.4524	20.4939	20.4983	20.4989	20.4837	20.3407	19.9625	19.5762 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6124	19.8396	20.0828	20.3293	20.4524	20.4939	20.4983	20.4989	20.4837	20.3407	19.9625	19.5762 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9686	0.9406	0.8937	0.7923	0.6386	0.4507	0.3108	0.3383	0.5400	0.8071	0.9376	0.9737	(94)
Useful gains	483.9120	538.9796	550.2765	518.0363	426.6996	293.2104	195.0037	204.5302	315.8242	435.4287	465.4254	466.0033	(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	789.7693	768.5764	697.0256	579.5984	442.8554	295.1131	195.1930	204.8357	320.9370	492.8653	653.7667	785.2123	(97)
Space heating kWh	227.5578	154.2890	109.1814	44.3247	12.0199	0.0000	0.0000	0.0000	0.0000	42.7328	135.6057	237.4915	(98a)
Space heating requirement - total per year (kWh/year)												963.2029	
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	227.5578	154.2890	109.1814	44.3247	12.0199	0.0000	0.0000	0.0000	0.0000	42.7328	135.6057	237.4915	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												963.2029	
Space heating per m2											(98c) / (4) =	19.2641	(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	227.5578	154.2890	109.1814	44.3247	12.0199	0.0000	0.0000	0.0000	0.0000	42.7328	135.6057	237.4915	(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)	246.5415	167.1604	118.2897	48.0225	13.0227	0.0000	0.0000	0.0000	0.0000	46.2978	146.9185	257.3039	(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	196.7916	174.2432	185.7480	164.9635	160.9999	146.2692	145.2806	150.4166	151.3538	167.3271	176.1301	194.8714	(64)
Efficiency of water heater	84.3864	83.7881	82.9108	81.5505	80.3659	79.8000	79.8000	79.8000	79.8000	81.4800	83.4805	84.5044	(216)
(217)m	84.3864	83.7881	82.9108	81.5505	80.3659	79.8000	79.8000	79.8000	79.8000	81.4800	83.4805	84.5044	(217)
Fuel for water heating, kWh/month	233.2031	207.9569	224.0336	202.2839	200.3337	183.2948	182.0559	188.4920	189.6664	205.3598	210.9836	230.6048	(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	15.9843	12.8232	11.5459	8.4590	6.5340	5.3383	5.9605	7.7477	10.0635	13.2038	14.9137	16.4286	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.1961	-16.8539	-25.8519	-31.0911	-35.3448	-33.6806	-33.2897	-30.5254	-25.9693	-20.1553	-12.6886	-9.5603	(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	-3.4458	-7.4566	-15.2120	-23.4292	-31.5486	-31.8927	-31.4992	-26.3924	-18.9966	-10.8315	-4.6550	-2.7085	(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												1043.5568	(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												2458.2685	(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)												129.0025	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-494.2751	(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												3222.5527	(238)

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

Energy Emission factor Emissions

Full SAP Calculation Printout



	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	1043.5568	0.2100	219.1469 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2458.2685	0.2100	516.2364 (264)
Space and water heating			735.3833 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	129.0025	0.1443	18.6190 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-286.2069	0.1332	-38.1278
PV Unit electricity exported	-208.0682	0.1252	-26.0464
Total			-64.1742 (269)
Total CO2, kg/year			701.7574 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.0400 (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	1043.5568	1.1300	1179.2192 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2458.2685	1.1300	2777.8434 (278)
Space and water heating			3957.0626 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	129.0025	1.5338	197.8683 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-286.2069	1.4923	-427.0983
PV Unit electricity exported	-208.0682	0.4595	-95.6012
Total			-522.6995 (283)
Total Primary energy kWh/year			3762.3322 (286)
Target Primary Energy Rate (TPER)			75.2500 (287)

Energy Statement

Option 2 - Individual ASHPs for Water and Electric Heating

82-84 Market Street
Manchester
M1 1PD

Job number: 12201

Date: 05.03.2025

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BASEENERGY

Building Assessments for a Sustainable Environment

Revision	Issue Date	Author	Checked	Description
0	05.03.2025	RB	PK	First Issue

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1 Executive Summary

This report has been produced by Base Energy on behalf of Cambridge Park Ltd and in support of the planning application for the development named as 82-84 Market Street, Manchester, M1 1PD comprising the conversion of the first, second, and third floors from office-space to 6 flats and the construction of an additional floor to create 2 additional flats falling under the requirements of Manchester City Council.

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

- National Planning Policy
- The Greater Manchester Combined Authority
- The Places for Everyone Plan (PFE)

The above policies require:

- Be Net Zero Carbon where feasible
- As an interim measure, development should be consistent with 2022 Part L building regulations (this would be Part L 2021)
- In the case of existing buildings, retrofitting them with measures to reduce energy consumption, in a manner consistent with their heritage interest

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 notional U-values
- A design which limits air permeability, targeting 5.0
- A design which limits thermal bridging
- Energy saving building services including low energy lighting and controls
- Low carbon Air Source Heat Pump for hot water

This results in an overall 11% carbon emissions reduction over Part L 2021.

2 Existing and Proposed Development

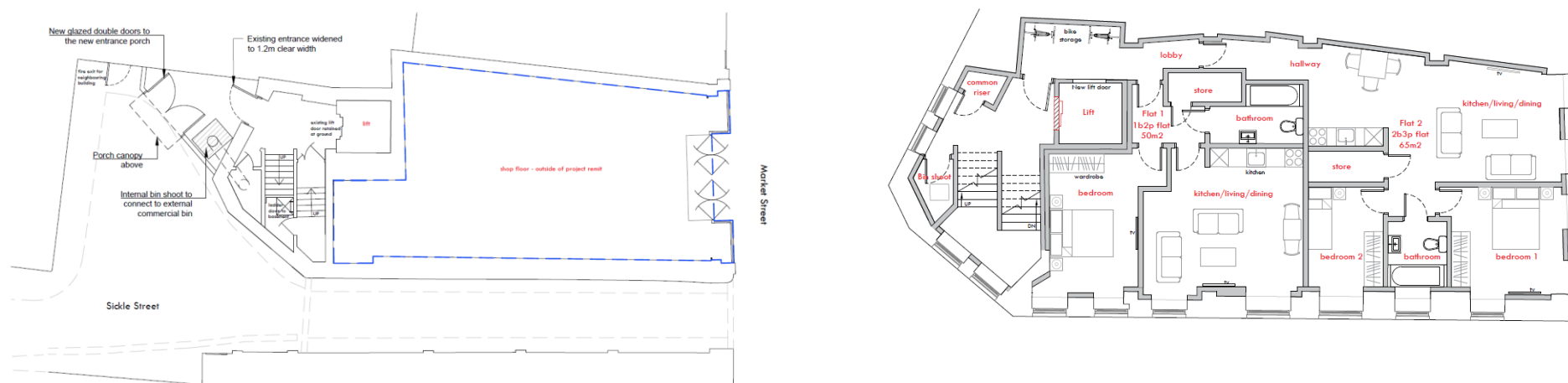
The development site is located at 82-84 Market Street, Manchester, M1 1PD.

The development proposals are for the conversion of the first, second, and third floors from office-space to 6 flats and the extension of an additional floor to create 2 additional flats. All dwellings have been assessed under Part L for existing dwellings.

The development proposals constitute a minor 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



3 Planning Policy

National Planning Policy Framework 2025

The NPPF was updated in February 2025 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 Greater Manchester Combined Authority

The relevant Local Planning Policy requirements are as follows.

- Places for everyone joint development plan, JP-S2 Carbon and Energy

The development should target:

- Be Net Zero Carbon where feasible
 - From adoption to regulated operational carbon emissions
 - From 2028 to all emissions in construction
- As an interim measure, development should be consistent with 2022 Part L building regulations (this would be the current Part L 2021)
- From 2025 development should also calculate and minimise carbon emissions from unregulated emissions alongside regulated emissions. Development proposals should set out how this has been achieved in an energy statement in accordance with the energy hierarchy.
- Achieve energy demand reductions in terms of space heat demand; hot water energy demand and the delivery of on-site renewable energy generation, in accordance with Table 5.1.

Based on the above the development will meet and go beyond the new Part L 2021 building regulations and were feasible aim to be net zero carbon. However, due to the building being a conversion the development is limited in its capacity to be zero carbon.

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-values¹ 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 a baseline of energy demand and carbon dioxide emissions as appropriate from which any reductions or contributions have been measured.

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 Baseline Energy & CO2

Energy modelling software has been used to calculate a baseline for the development. This forms the basis from which compliance with planning policy has been measured.

Table 5.1: Baseline CO2

	CO2 Emission Rate (kg CO2/m2/year)	Floor Area (m2)	Total Baseline Emissions (kg CO2/year)
Baseline	9.4	454	4,267

The **Total Baseline CO2 Emissions** for the development are shown to be 4,267 kg/year.

6 Low Carbon Design – Fabric First – Be Lean

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) – Conversion

	Part L 2021 Limiting Parameters	Proposed Development
New Walls	0.18	0.17
Existing Walls	0.30	0.28
Exposed Floor	0.25	0.23
Existing Roof	0.16	0.16
New Roof	0.15	0.15
New Windows	1.4	1.4
Existing Windows	2.6	2.6
Doors	1.4	1.4

- Insulation: The specified building envelope is designed to meet and exceed the notional Part L targets and will help to limit the energy demand of the dwelling for space heating
- Thermal bridging: The design will seek to limit heat loss

Once heat retention has been addressed the next step is to ensure energy consuming building services are efficient.

- Lighting: Low energy LED lighting throughout with a minimum efficacy of 80 lumens per watt
- Space & Water Heating: SAP Default Air Source Heat Pump (250% space heating and hot water efficiency)
- Heating Controls: Programmer, room thermostat and TRVs
- Ventilation: Natural ventilation with localised extract fans

7 Low Carbon Technology Review & Recommendations

Having set out an energy efficient design, the next step is to incorporate low carbon technology for energy generation. A number of technologies exist and should be specified where they:

- Comply with planning policy
- Are feasible for the site
- Are cost efficient
- Are appropriate for proposed development form and function
- Protect against fuel poverty
- Promote fuel security
- Reduce reliance on fossil fuels
- Reduce carbon emissions
- Reduce resource depletion
- Reduce pollution

Site location and development form and function will influence the suitability of different technologies through:

- Orientation
- Space (inside and outside of the buildings)
- Surrounding topography, structures, and natural features
- Wind speed
- Overshading
- Geology and ground conditions
- Building form, function, and density

In determining the most feasible renewable technologies for the dwelling, the following have been reviewed:

- Wind turbines
- Ground Source Heat Pumps
- Air Source Heat Pumps
- Biomass
- Combined Heat and Power
- Photovoltaic Panels
- Solar water heating

WIND TURBINES

Wind turbines are used to produce electricity. They can be either pole mounted (in a suitably exposed position) or building mounted; building mounted systems need a sufficient wind speed at the structural height and both a structural survey and planning permission.

- Wind speed can be too low on low rise buildings
- Taller systems need sufficient space
- Wind resources very variable and unpredictable
- May need planning permission

Wind turbines technology is **not recommended** for this development

GROUND SOURCE HEAT PUMP (GSHP)

GSHPs use naturally occurring underground low-level heat in areas with appropriate geological features. Heat is transferred from the ground by either extracting and discharging (re-charging) water from/to the ground directly (open loop) or circulating water through pipes buried within the ground, (closed loop). The water is passed through a heat pump to transfer the heat from this water into a higher temperature water circuit to provide heating. The loop can be fitted horizontally (laid in a shallow trench) or vertically (in a borehole).

- Feasibility analysis is costly
- Suitable ground conditions required
- More capital intensive than air source heat pumps
- Can be more efficient and lower running costs than ASHPs
- Well suited to highly insulated buildings

Ground source heat pump technology is **not recommended** for this development

AIR SOURCE HEAT PUMP (ASHP)

ASHP systems absorb heat from outside air at a low temperature into a fluid which is then passed through an electrically driven compressor where its temperature is increased. There are two main types of ASHP systems: Air to Water systems distribute heat through wet central heating; Air to air produce warm air which is circulated by fans. For an ASHP system to be installed, there needs to be ample outdoor space for the external condensing unit; these units can also be noisy and blow out colder air to the neighbouring environment.

- Requires space for external plant and internal hot water tank for wet systems supplying DHW
- Can generate noise though quieter systems have been developed
- Least efficient when most needed
- Longer life than fossil fuel boilers
- High capital costs vs gas systems but lower than GSHPs
- Well suited to highly insulated buildings

Air source heat pump technology **is recommended** for this development for hot water only.

BIOMASS

Biomass systems burn wood pellets, chips, or logs to provide heat in a single room, or to power central heating and hot water boilers. There needs to be ample space available for both the boiler and the storage of fuel. There will also be regular deliveries of fuel and therefore adequate site access is required.

- Carbon emissions are cyclical unlike fossil fuel
- Requires fuel storage space and bulk delivery
- Carbon 'neutral' fuel in isolation but supply side emissions are still present so not neutral overall
- Harmful particulate emissions impact air quality and health

Biomass technology **is not recommended** for this development

COMBINED HEAT AND POWER (CHP)

CHP is effectively an on-site small power plant providing both electrical power and thermal heat energy. It is an energy efficiency and low carbon measure rather than a renewable energy technology. A CHP system operates by burning a primary fuel (normally natural gas) by use of either a reciprocating engine or turbine, which in turn drives an alternator to generate electrical power. The heat emitted by the engine and exhaust gases is recovered and used to heat the building or to provide hot water.

- Reduces consumption of and reliance on grid electricity
- Works best with high and consistent heat and hot water demand
- Recovers waste energy
- Can export to the grid
- Uses fossil fuel
- Emissions on site rather than upstream
- Efficiency is sensitive to sizing

CHP **is not recommended** for this development

DISTRICT HEATING

District Heating systems provide multiple buildings or dwellings with heat and hot water from a central boiler house, or 'energy centre'. The system can provide heating or cooling which is transferred from the energy centre through a network of highly insulated pipes carrying the heated water to each dwelling.

- Economies of scale
- Frees up space in habitable areas of development
- Variety of systems
- Can make use of waste heat from industry
- Can be fossil fuel based and dependent

Due to the location, there are no existing or proposed heat networks or energy centres within a suitable radius from the development and there are no existing networks local to the site.

District heating **is not recommended** for this development

SOLAR PHOTOVOLTAIC (PV)

Solar PV cells (which are mounted together in panels or tiles on the roof) convert sunlight into electricity. The cells are made from layers of semi-conducting material; when the light shines on the cell, an electric field is created across the layers. Although PV cells are most effective in bright sunlight, they can still generate electricity on a cloudy day. The power of a PV cell is measured in kilowatts peak (kWp). Each PV panel produces 250 Watts to 420 Watts depending on the manufacture.

- Passive technology, requires no energy input from grid
- Does not require sunny days to generate power
- Capital costs can be high although payback is effective
- Needs sufficient roof space and orientation
- Zero site or upstream emissions
- Can export to the grid

Solar PV technology **is recommended** for this development

SOLAR HOT WATER

Solar hot water systems absorb energy from the sun and transfer this energy using heat exchangers to heat water which can then be stored. Systems should be roof mounted and oriented to face between a south-east and south-west direction.

- Mostly passive technology but requires pump energy
- Not suitable for combi boilers and developments without roof space
- Lower CO2 reductions than other technologies

Solar hot water technology **is not recommended** for this development

Low and Zero Carbon Technology Summary

The low carbon technology review indicates that electric ASHP's would be potentially feasible to install. The following low carbon technology is recommended:

ASHP for hot water – Assumed Model: Dimplex EDL 200UK (340% hot water efficiency)

Electric panel heaters for space heating

The technology is deemed optimal for meeting the needs of the development and achieving policy compliance. It has been incorporated into the energy model and the results are presented in the next section. This will need to be checked with an installer.

8 Low Carbon Technology – Renewable Energy Generation - Be Green

The selected Low Carbon Technology has been incorporated into the calculation and the results are set out below.

Table 8.1: Average Baseline vs Be Green CO2

	CO2 Emission Rate (kg CO2/m2/year)	Floor Area (m2)	Total Baseline Emissions (kg CO2/year)	Reduction in CO2
Baseline	9.4	454	4,267	N/A
Be Green Design	8.4	454	3,813	11%

The **CO2 Emissions reduction** as a result of energy efficient fabric and services is shown to be 454 kg/year.

9 Conclusion

Proposals are for the development named as 82-84 Market Street, Manchester, M1 1PD comprising the conversion of the first, second, and third floors from office-space to 6 flats and the construction of an additional floor to create 2 additional flats falling under the requirements of Manchester City Council.

Under the Manchester City Council local planning policy and The Greater Manchester Combined Authority the proposed development is required to be net zero carbon were feasible and meet Part L 2021 building regulations. However, due to the development being a conversion, net zero carbon will prove difficult to achieve, therefore best efforts will be made were feasible to improve the properties and reduce their carbon emissions.

Energy modelling software has been used to calculate a baseline against which compliance with the above can be measured.

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

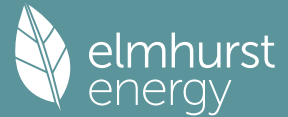
Low and zero carbon technology will be incorporated and is to comprise of Air Source Heat Pump for hot water (Hot Water efficiency of 340%) accompanied with electric panel heaters for space heating.

This results in a 11% saving in CO2 emissions over Part L 2021 for existing dwellings.

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

10 Appendix 1 – SAP Worksheet Baseline

Full SAP Calculation Printout



Property Reference	12201 FF-01				Issued on Date	13/03/2025
Assessment Reference	Baseline Dimplex		Prop Type Ref	First floor flat		
Property	Flat 01, Market Street, Manchester, M1 1PD					
SAP Rating	64 D	DER	10.93	TER	13.82	
Environmental	92 A	% DER < TER				20.91
CO ₂ Emissions (t/year)	0.49	DFEE	74.84	TFEE	27.95	
Compliance Check	See BREL	% DFEE < TFEE				-167.74
% DPER < TPER	-53.75	DPER	113.94	TPER	74.11	
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 (m ²)	Storey height (m)	Volume (m ³)
Main dwelling	50.0000 (1b)	2.5000 (2b)	125.0000 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000		125.0000 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	125.0000 (5)

2. Ventilation rate

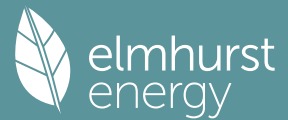
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	20.0000 / (5) = 0.1600 (8)
Pressure test	No
Pressure Test Method	Blower Door
Measured/design AP50	15.0000 (17)
Infiltration rate	0.9100 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.7053 (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	0.8992	0.8816	0.8639	0.7758	0.7581	0.6700	0.6700	0.6524	0.7053	0.7581	0.7934	0.8287 (22b)
Effective ac	0.9043	0.8886	0.8732	0.8009	0.7874	0.7244	0.7244	0.7128	0.7487	0.7874	0.8147	0.8433 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Existing Windows			8.3000	2.3551	19.5471		(27)
Heat Loss Floor 1			50.0000	0.2500	12.5000		(28b)
External Wall (Existing)	21.5000	8.3000	13.2000	0.3000	3.9600		(29a)
Wall to stairwell	24.4000		24.4000	0.3000	7.3200		(29a)
Total net area of external elements Aum(A, m ²)			95.9000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.3271		(33)
Main dwelling							
Corridor Wall			6.2500	0.0000	0.0000		(32)
Party Wall Internal			26.2000	0.0000	0.0000		(32)
Party Ceilings 1			50.0000				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Default value 0.200 * total exposed area)							19.1800 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	62.5071 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	37.3013	36.6538	36.0190	33.0377	32.4799	29.8832	29.8832
Heat transfer coeff						Aug	29.4024
						Sep	30.8834
						Oct	32.4799
						Nov	33.6083
						Dec	34.7880 (38)

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Average = Sum(39)m / 12 =	99.8084	99.1609	98.5261	95.5448	94.9870	92.3903	92.3903	91.9095	93.3905	94.9870	96.1154	97.2951 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.9962	1.9832	1.9705	1.9109	1.8997	1.8478	1.8478	1.8382	1.8678	1.8997	1.9223	1.9459 (40)
HLP (average)												1.9108
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.6901 (42)
Hot water usage for mixer showers												
72.2658	71.1798	69.5972	66.5693	64.3348	61.8429	60.4265	61.9971	63.7187	66.3942	69.4872	71.9889	(42a)
Hot water usage for baths												
22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses												
31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)
Average daily hot water use (litres/day)												116.7306 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	126.9285	124.3436	121.1244	116.0589	112.0068	107.6259	105.8165	109.0204	112.4173	117.0328	122.1814	126.5748 (44)
Energy conte	201.0237	177.0637	186.1637	158.8788	150.7827	132.3386	127.9759	134.9900	138.6218	158.8123	174.0698	198.1856 (45)
Energy content (annual)										Total = Sum(45)m =		1938.9067
Distribution loss (46)m = 0.15 x (45)m												
30.1536	26.5595	27.9246	23.8318	22.6174	19.8508	19.1964	20.2485	20.7933	23.8219	26.1105	29.7278	(46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8800 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0152 (55)
Total storage loss												
31.4712	28.4256	31.4712	30.4560	31.4712	30.4560	31.4712	31.4712	30.4560	31.4712	30.4560	31.4712	(56)
If cylinder contains dedicated solar storage												
31.4712	28.4256	31.4712	30.4560	31.4712	30.4560	31.4712	31.4712	30.4560	31.4712	30.4560	31.4712	(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	(61)
Total heat required for water heating calculated for each month												
255.7573	226.5005	240.8973	211.8468	205.5163	185.3066	182.7095	189.7236	191.5898	213.5459	227.0378	252.9192	(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												
255.7573	226.5005	240.8973	211.8468	205.5163	185.3066	182.7095	189.7236	191.5898	213.5459	227.0378	252.9192	(64)
Total per year (kWh/year)												2583.3507 (64)
Electric shower(s)												2583 (64)
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												
110.6273	98.4231	105.6863	95.2016	93.9221	86.3770	86.3389	88.6711	88.4661	96.5920	100.2526	109.6836	(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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
76.9289	85.1713	76.9289	79.4932	76.9289	79.4932	76.9289	76.9289	79.4932	76.9289	79.4932	76.9289	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)												
-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)												
148.6926	146.4630	142.0515	132.2244	126.2394	119.9681	116.0469	119.1815	122.8696	129.8279	139.2397	147.4242	(72)
Total internal gains												
424.2069	431.7475	415.2436	399.7845	380.8887	364.4575	351.4757	353.0825	363.1850	378.7753	401.0979	416.4422	(73)

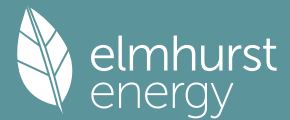
6. Solar gains

[Jan]												
	Area											
	m2											
	Solar flux											
	Table 6a											
	W/m2											
	Specific data											
	or Table 6b											
	Specific data											
	or Table 6c											
	FF											
	Access											
	factor											
	Table 6d											
	Gains											
	W											
Southeast	8.3000											112.5895 (77)
Solar gains	112.5895	191.7816	262.4040	325.1312	364.1741	361.5406	348.5637	319.4360	284.1280	211.9595	134.8563	96.3532 (83)
Total gains	536.7965	623.5291	677.6476	724.9157	745.0628	725.9981	700.0394	672.5185	647.3130	590.7349	535.9542	512.7953 (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	34.7889	35.0161	35.2416	36.3413	36.5547	37.5821	37.5821	37.7787	37.1796	36.5547	36.1256	35.6875
alpha	3.3193	3.3344	3.3494	3.4228	3.4370	3.5055	3.5055	3.5186	3.4786	3.4370	3.4084	3.3792
util living area												
0.9841	0.9730	0.9550	0.9135	0.8355	0.6925	0.5411	0.5767	0.7750	0.9235	0.9729	0.9863	(86)
MIT	19.3211	19.5259	19.8149	20.2126	20.5414	20.7858	20.8725	20.8625	20.7085	20.2847	19.7614	19.3236 (87)
Th 2	19.3359	19.3445	19.3531	19.3934	19.4010	19.4367	19.4367	19.4434	19.4229	19.4010	19.3856	19.3696 (88)
util rest of house												
0.9786	0.9637	0.9387	0.8802	0.7675	0.5669	0.3668	0.4046	0.6654	0.8868	0.9618	0.9815	(89)

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MIT 2	17.8842	18.0915	18.3795	18.7886	19.0855	19.2985	19.3413	19.3450	19.2400	18.8699	18.3574	17.9126 (90)
Living area fraction									FLA = Living area / (4) =			0.4540 (91)
MIT	18.5365	18.7427	19.0312	19.4351	19.7465	19.9737	20.0365	20.0339	19.9067	19.5122	18.9948	18.5532 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5365	18.7427	19.0312	19.4351	19.7465	19.9737	20.0365	20.0339	19.9067	19.5122	18.9948	18.5532 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9750	0.9594	0.9347	0.8812	0.7844	0.6142	0.4376	0.4744	0.7036	0.8900	0.9584	0.9783	(94)
Useful gains	523.3988	598.2028	633.4042	638.8005	584.4237	445.9310	306.3263	319.0351	455.4701	525.7297	513.6372	501.6683	(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	1420.9267	1372.6574	1234.6505	1006.5752	764.3089	496.4788	317.4969	333.9930	542.2874	846.5406	1143.2752	1396.4986	(97)
Space heating kWh	667.7607	520.4335	447.3272	264.7978	133.8346	0.0000	0.0000	0.0000	0.0000	238.6833	453.3394	665.7538	(98a)
Space heating requirement - total per year (kWh/year)												3391.9304	
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	667.7607	520.4335	447.3272	264.7978	133.8346	0.0000	0.0000	0.0000	0.0000	238.6833	453.3394	665.7538	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3391.9304	
Space heating per m2											(98c) / (4) =	67.8386	(99)

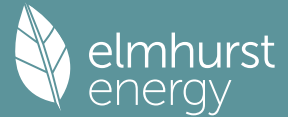
9a. Energy requirements - Individual heating systems, including micro-CHP

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 %)													170.0000 (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	667.7607	520.4335	447.3272	264.7978	133.8346	0.0000	0.0000	0.0000	0.0000	238.6833	453.3394	665.7538	(98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000	(210)
Space heating fuel (main heating system)	392.8004	306.1374	263.1337	155.7634	78.7262	0.0000	0.0000	0.0000	0.0000	140.4020	266.6702	391.6199	(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	255.7573	226.5005	240.8973	211.8468	205.5163	185.3066	182.7095	189.7236	191.5898	213.5459	227.0378	252.9192	(64)
Efficiency of water heater	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	(216)
Fuel for water heating, kWh/month	150.4455	133.2356	141.7043	124.6158	120.8919	109.0039	107.4762	111.6021	112.6999	125.6153	133.5517	148.7760	(217)
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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	19.8945	15.9601	14.3703	10.5283	8.1324	6.6442	7.4186	9.6430	12.5253	16.4339	18.5620	20.4475	(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													1995.2531 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													170.0000
Water heating fuel used													1519.6181 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year													0.0000 (231)
Electricity for lighting (calculated in Appendix L)													160.5603 (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													3675.4315 (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	1995.2531	0.1549	309.1298 (261)	
Total CO2 associated with community systems			0.0000 (373)	

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Water heating (other fuel)	1519.6181	0.1409	214.0585 (264)
Space and water heating			523.1883 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	160.5603	0.1443	23.1738 (268)
Total CO ₂ , kg/year			546.3621 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			10.9300 (273)

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

	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year
Space heating - main system 1	1995.2531	1.5736	3139.7156 (275)
Total CO ₂ associated with community systems			0.0000 (473)
Water heating (other fuel)	1519.6181	1.5209	2311.1262 (278)
Space and water heating			5450.8418 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	160.5603	1.5338	246.2727 (282)
Total Primary energy kWh/year			5697.1145 (286)
Dwelling Primary energy Rate (DPER)			113.9400 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling	50.0000 (1b)	x 2.5000 (2b)	= 125.0000 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 125.0000 (5)

2. Ventilation rate

	m ³ 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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1600 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4100 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3178 (21)

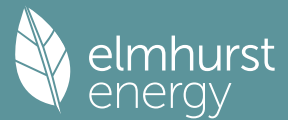
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4051	0.3972	0.3892	0.3495	0.3416	0.3019	0.3019	0.2939	0.3178	0.3416	0.3575	0.3734 (22b)
Effective ac	0.5821	0.5789	0.5758	0.5611	0.5583	0.5456	0.5456	0.5432	0.5505	0.5583	0.5639	0.5697 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
TER Opening Type			8.3000	1.1450	9.5038		(27)
Heat Loss Floor 1			50.0000	0.1300	6.5000		(28b)
External Wall (Existing)	21.5000	8.3000	13.2000	0.1800	2.3760		(29a)
Wall to stairwell	24.4000		24.4000	0.1800	4.3920		(29a)
Total net area of external elements Aum(A, m ²)			95.9000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	22.7718	(33)
Main dwelling							
Corridor Wall			6.2500	0.0000	0.0000		(32)
Party Wall Internal			26.2000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)							4.7950 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	27.5668 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	24.0102	23.8788	23.7499	23.1447	23.0315	22.5044	22.5044	22.4068	22.7074	23.0315	23.2605	23.5000 (38)
	51.5770	51.4456	51.3167	50.7115	50.5983	50.0712	50.0712	49.9736	50.2742	50.5983	50.8274	51.0668 (39)
Average = Sum(39)m / 12 =												50.7110

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HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0315	1.0289	1.0263	1.0142	1.0120	1.0014	1.0014	0.9995	1.0055	1.0120	1.0165	1.0213	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	1.0142	
												31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.6901 (42)
Hot water usage for mixer showers	52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)
Hot water usage for baths	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)
Average daily hot water use (litres/day)												98.5597	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy content (annual)	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)
Water storage 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	216.4047	191.5060	203.5855	179.1170	173.7575	156.6915	154.6398	160.6490	162.2850	180.8355	192.1624	214.0394	(62)
WWHRS	-24.0268	-21.2495	-22.2513	-18.4249	-17.1714	-14.6937	-13.7730	-14.6462	-15.2026	-17.9222	-20.3037	-23.5819	(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	192.3778	170.2565	181.3342	160.6920	156.5861	141.9978	140.8668	146.0028	147.0824	162.9133	171.8587	190.4575	(64)
12Total per year (kWh/year)												1962.4258	(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	93.7377	83.3508	89.4753	80.6368	79.5575	73.1803	73.2008	75.1989	75.0402	81.9109	84.9744	92.9512	(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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	76.9289	85.1713	76.9289	79.4932	76.9289	79.4932	76.9289	76.9289	79.4932	76.9289	79.4932	76.9289	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	125.9915	124.0340	120.2625	111.9956	106.9321	101.6394	98.3882	101.0738	104.2225	110.0953	118.0201	124.9344	(72)
Total internal gains	401.5058	409.3185	393.4546	379.5556	361.5814	346.1288	333.8170	334.9747	344.5378	359.0427	379.8782	393.9524	(73)

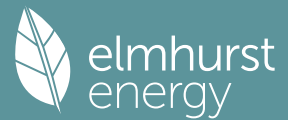
6. Solar gains

[Jan]													
	Area	Solar flux	Specific data	g	FF	Access	Gains						
	m2	Table 6a	or Table 6b	W/m2	or Table 6c	factor	W						
						Table 6d							
Southeast	8.3000	36.7938	0.6300	0.7000	0.7700		93.3308	(77)					
Solar gains	93.3308	158.9769	217.5191	269.5167	301.8811	299.6981	288.9410	264.7956	235.5272	175.7033	111.7888	79.8717	(83)
Total gains	494.8366	568.2954	610.9737	649.0723	663.4626	645.8269	622.7580	599.7704	580.0650	534.7460	491.6669	473.8242	(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	67.3211	67.4931	67.6626	68.4701	68.6233	69.3457	69.3457	69.4812	69.0657	68.6233	68.3140	67.9937	
alpha	5.4881	5.4995	5.5108	5.5647	5.5749	5.6230	5.6230	5.6321	5.6044	5.5749	5.5543	5.5329	
util living area													
	0.9791	0.9567	0.9165	0.8229	0.6753	0.4913	0.3531	0.3822	0.5841	0.8410	0.9552	0.9829	(86)
MIT	20.1743	20.3761	20.5961	20.8252	20.9505	20.9930	20.9991	20.9986	20.9822	20.8318	20.4796	20.1389	(87)
Th 2	20.0571	20.0593	20.0614	20.0715	20.0734	20.0821	20.0821	20.0838	20.0788	20.0734	20.0696	20.0656	(88)
util rest of house													
	0.9732	0.9454	0.8958	0.7846	0.6186	0.4230	0.2798	0.3067	0.5118	0.7980	0.9416	0.9780	(89)
MIT 2	19.1261	19.3769	19.6431	19.9100	20.0360	20.0785	20.0819	20.0833	20.0684	19.9249	19.5162	19.0886	(90)
Living area fraction													
									fLA = Living area /	(51) =		0.4540	(91)

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MIT	19.6020	19.8305	20.0758	20.3255	20.4512	20.4937	20.4983	20.4988	20.4832	20.3366	19.9536	19.5655 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6020	19.8305	20.0758	20.3255	20.4512	20.4937	20.4983	20.4988	20.4832	20.3366	19.9536	19.5655 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9698	0.9422	0.8961	0.7957	0.6423	0.4539	0.3131	0.3410	0.5441	0.8111	0.9396	0.9748	(94)
Useful gains	479.8724	535.4687	547.5137	516.4848	426.1739	293.1334	194.9951	204.5159	315.6104	433.7320	461.9721	461.8625	(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													
	789.2309	768.1097	696.6646	579.4066	442.7938	295.1042	195.1919	204.8339	320.9123	492.6550	653.3131	784.6654	(97)
Space heating kWh													
	230.1627	156.3348	110.9683	45.3037	12.3652	0.0000	0.0000	0.0000	0.0000	43.8388	137.7655	240.1653	(98a)
Space heating requirement - total per year (kWh/year)												976.9043	
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													
	230.1627	156.3348	110.9683	45.3037	12.3652	0.0000	0.0000	0.0000	0.0000	43.8388	137.7655	240.1653	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												976.9043	
Space heating per m2										(98c) / (4) =		19.5381	(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	230.1627	156.3348	110.9683	45.3037	12.3652	0.0000	0.0000	0.0000	0.0000	43.8388	137.7655	240.1653	(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)	249.3637	169.3768	120.2256	49.0831	13.3968	0.0000	0.0000	0.0000	0.0000	47.4959	149.2584	260.2008	(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	192.3778	170.2565	181.3342	160.6920	156.5861	141.9978	140.8668	146.0028	147.0824	162.9133	171.8587	190.4575	(64)
Efficiency of water heater (217)m	84.4630	83.8689	82.9933	81.6193	80.3964	79.8000	79.8000	79.8000	79.8000	81.5526	83.5686	84.5810	(216)
Fuel for water heating, kWh/month	227.7659	203.0030	218.4926	196.8800	194.7677	177.9421	176.5248	182.9609	184.3137	199.7647	205.6499	225.1778	(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	15.9843	12.8232	11.5459	8.4590	6.5340	5.3383	5.9605	7.7477	10.0635	13.2038	14.9137	16.4286	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-11.1961	-16.8539	-25.8519	-31.0911	-35.3448	-33.6806	-33.2897	-30.5254	-25.9693	-20.1553	-12.6886	-9.5603	(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	-3.4458	-7.4566	-15.2120	-23.4292	-31.5486	-31.8927	-31.4992	-26.3924	-18.9966	-10.8315	-4.6550	-2.7085	(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												1058.4012	(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												2393.2430	(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)												129.0025	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-494.2751	(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												3172.3716	(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	1058.4012	0.2100	222.2642	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2393.2430	0.2100	502.5810	(264)
Space and water heating			724.8453	(265)

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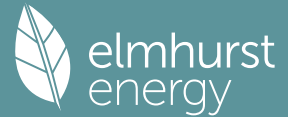
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	129.0025	0.1443	18.6190 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-286.2069	0.1332	-38.1278
PV Unit electricity exported	-208.0682	0.1252	-26.0464
Total			-64.1742 (269)
Total CO2, kg/year			691.2194 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.8200 (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	1058.4012	1.1300	1195.9933 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2393.2430	1.1300	2704.3646 (278)
Space and water heating			3900.3579 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	129.0025	1.5338	197.8683 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-286.2069	1.4923	-427.0983
PV Unit electricity exported	-208.0682	0.4595	-95.6012
Total			-522.6995 (283)
Total Primary energy kWh/year			3705.6276 (286)
Target Primary Energy Rate (TPER)			74.1100 (287)

11 Appendix 2 – SAP Worksheet Be Lean/Green

Full SAP Calculation Printout



Property Reference	12201 FF-01				Issued on Date	13/03/2025
Assessment Reference	Be Green Dimplex	Prop Type Ref	First floor flat			
Property	Flat 01, Market Street, Manchester, M1 1PD					
SAP Rating	66 D	DER	10.68	TER	13.82	
Environmental	93 A	% DER < TER				22.72
CO ₂ Emissions (t/year)	0.47	DFEE	61.35	TFEE	27.95	
Compliance Check	See BREL	% DFEE < TFEE				-119.46
% DPER < TPER	-48.02	DPER	109.70	TPER	74.11	
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 (m ²)	Storey height (m)	Volume (m ³)
Main dwelling	50.0000 (1b)	2.5000 (2b)	125.0000 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000		125.0000 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	125.0000 (5)

2. Ventilation rate

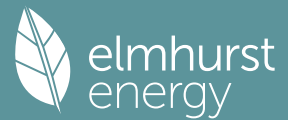
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1600 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4100 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3178 (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)
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	0.4051	0.3972	0.3892	0.3495	0.3416	0.3019	0.3019	0.2939	0.3178	0.3416	0.3575	0.3734 (22b)
Effective ac	0.5821	0.5789	0.5758	0.5611	0.5583	0.5456	0.5456	0.5432	0.5505	0.5583	0.5639	0.5697 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Existing Windows			8.3000	2.3551	19.5471		(27)
Heat Loss Floor 1			50.0000	0.2300	11.5000		(28b)
External Wall (Existing)	21.5000	8.3000	13.2000	0.2800	3.6960		(29a)
Wall to stairwell	24.4000		24.4000	0.2800	6.8320		(29a)
Total net area of external elements Aum(A, m ²)			95.9000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.5751		(33)
Main dwelling							
Corridor Wall			6.2500	0.0000	0.0000		(32)
Party Wall Internal			26.2000	0.0000	0.0000		(32)
Party Ceilings 1			50.0000				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Default value 0.200 * total exposed area)							19.1800 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	60.7551 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	24.0102	23.8788	23.7499	23.1447	23.0315	22.5044	22.5044
Heat transfer coeff						22.4068	22.7074
							23.0315
							23.2605
							23.5000 (38)

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Average = Sum(39)m / 12 =	84.7653	84.6339	84.5050	83.8998	83.7866	83.2595	83.2595	83.1619	83.4625	83.7866	84.0156	84.2551 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.6953	1.6927	1.6901	1.6780	1.6757	1.6652	1.6652	1.6632	1.6693	1.6757	1.6803	1.6851 (40)
HLP (average)												1.6780
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.6901 (42)
Hot water usage for mixer showers												
59.1265	58.2380	56.9432	54.4658	52.6376	50.5987	49.4399	50.7249	52.1335	54.3226	56.8531	58.9000	(42a)
Hot water usage for baths												
22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses												
31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)
Average daily hot water use (litres/day)												104.6166 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
113.7893	111.4018	108.4704	103.9553	100.3096	96.3818	94.8299	97.7482	100.8321	104.9611	109.5474	113.4859	(44)
Energy content	180.2144	158.6347	166.7150	142.3097	135.0360	118.5126	114.6885	121.0327	124.3360	142.4312	156.0703	(45)
Energy content (annual)										Total = Sum(45)m =	1737.6727	
Distribution loss (46)m = 0.15 x (45)m												
27.0322	23.7952	25.0072	21.3465	20.2554	17.7769	17.2033	18.1549	18.6504	21.3647	23.4105	26.6537	(46)
Water storage 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	26.9514	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	26.9514	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												
207.1658	182.9779	193.6664	168.3917	161.9874	144.5946	141.6399	147.9841	150.4180	169.3826	182.1523	204.6429	(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												
207.1658	182.9779	193.6664	168.3917	161.9874	144.5946	141.6399	147.9841	150.4180	169.3826	182.1523	204.6429	(64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 2055.0037 (64)
Electric shower(s)												2055 (64)
0.0000	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												
59.9213	52.7461	55.4327	47.3180	44.8995	39.4054	38.1339	40.2434	41.3417	47.3584	51.8934	59.0824	(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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	76.9289	85.1713	76.9289	79.4932	76.9289	79.4932	76.9289	76.9289	79.4932	76.9289	79.4932	76.9289 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505 (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)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040 (71)
Water heating gains (Table 5)	80.5394	78.4911	74.5063	65.7194	60.3487	54.7298	51.2553	54.0906	57.4191	63.6537	72.0741	79.4119 (72)
Total internal gains	353.0537	360.7757	344.6985	330.2794	311.9980	299.2192	286.6841	287.9915	297.7344	309.6011	330.9323	345.4299 (73)

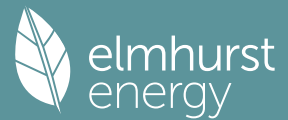
6. Solar gains

[Jan]												
	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
Southeast	8.3000	36.7938	0.7600	0.7000	0.7700	112.5895 (77)						
Solar gains	112.5895	191.7816	262.4040	325.1312	364.1741	361.5406	348.5637	319.4360	284.1280	211.9595	134.8563	96.3532 (83)
Total gains	465.6433	552.5573	607.1024	655.4107	676.1721	660.7598	635.2478	607.4275	581.8624	521.5607	465.7886	441.7830 (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	40.9628	41.0264	41.0890	41.3853	41.4413	41.7036	41.7036	41.7526	41.6022	41.4413	41.3283	41.2108
alpha	3.7309	3.7351	3.7393	3.7590	3.7628	3.7802	3.7802	3.7835	3.7735	3.7628	3.7552	3.7474
util living area												
	0.9893	0.9793	0.9621	0.9218	0.8421	0.6987	0.5439	0.5843	0.7864	0.9363	0.9807	0.9912 (86)
MIT	19.1377	19.3972	19.7484	20.1961	20.5895	20.8605	20.9591	20.9458	20.7683	20.2505	19.6099	19.0902 (87)
Th 2	19.5442	19.5461	19.5479	19.5566	19.5583	19.5659	19.5659	19.5673	19.5629	19.5583	19.5550	19.5515 (88)
util rest of house												
	0.9857	0.9723	0.9487	0.8924	0.7794	0.5812	0.3820	0.4230	0.6854	0.9058	0.9729	0.9882 (89)

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MIT 2	17.4591	17.7878	18.2288	18.7806	19.2284	19.4919	19.5551	19.5511	19.4193	18.8599	18.0666	17.4035 (90)
Living area fraction									FLA = Living area / (4) =			0.4540 (91)
MIT	18.2212	18.5185	18.9187	19.4233	19.8463	20.1132	20.1925	20.1843	20.0317	19.4913	18.7673	18.1693 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2212	18.5185	18.9187	19.4233	19.8463	20.1132	20.1925	20.1843	20.0317	19.4913	18.7673	18.1693 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9809	0.9655	0.9412	0.8891	0.7937	0.6298	0.4560	0.4964	0.7225	0.9040	0.9669	0.9840	(94)
Useful gains	456.7555	533.5092	571.3769	582.6988	536.6983	416.1513	289.6734	301.5420	420.3880	471.5029	450.3877	434.6993	(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	1180.0343	1152.5824	1049.4444	882.8990	682.5511	459.0271	299.1113	314.7080	495.0765	744.9682	980.2331	1176.9844	(97)
Space heating kWh	538.1195	416.0172	355.6822	216.1441	108.5145	0.0000	0.0000	0.0000	0.0000	203.4582	381.4887	552.2601	(98a)
Space heating requirement - total per year (kWh/year)												2771.6844	
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	538.1195	416.0172	355.6822	216.1441	108.5145	0.0000	0.0000	0.0000	0.0000	203.4582	381.4887	552.2601	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2771.6844	
Space heating per m2											(98c) / (4) =	55.4337	(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	538.1195	416.0172	355.6822	216.1441	108.5145	0.0000	0.0000	0.0000	0.0000	203.4582	381.4887	552.2601 (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)	538.1195	416.0172	355.6822	216.1441	108.5145	0.0000	0.0000	0.0000	0.0000	203.4582	381.4887	552.2601 (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	207.1658	182.9779	193.6664	168.3917	161.9874	144.5946	141.6399	147.9841	150.4180	169.3826	182.1523	204.6429 (64)	
Efficiency of water heater (217)m	348.0114	348.0114	348.0114	348.0114	348.0114	348.0114	348.0114	348.0114	348.0114	348.0114	348.0114	348.0114 (216)	
Fuel for water heating, kWh/month	59.5285	52.5781	55.6494	48.3868	46.5466	41.5488	40.6998	42.5228	43.2222	48.6716	52.3409	58.8035 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)	
Lighting	18.2244	14.6203	13.1640	9.6445	7.4497	6.0865	6.7958	8.8335	11.4738	15.0543	17.0038	18.7309 (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												2771.6844 (211)	
Space heating fuel - main system 2												0.0000 (213)	
Space heating fuel - secondary												0.0000 (215)	
Efficiency of water heater												348.0114	
Water heating fuel used												590.4990 (219)	
Space cooling fuel												0.0000 (221)	
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000 (231)	
Electricity for lighting (calculated in Appendix L)												147.0816 (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												3509.2650 (238)	

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

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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2771.6844	0.1549	429.2216 (261)
Space heating - main system 2	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (263)
Water heating (other fuel)	590.4990	0.1411	83.3404 (264)
Space and water heating			512.5621 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	147.0816	0.1443	21.2284 (268)
Total CO2, kg/year			533.7905 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			10.6800 (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	2771.6844	1.5733	4360.7397 (275)
Space heating - main system 2	0.0000	0.0000	0.0000 (276)
Total CO2 associated with community systems			0.0000 (273)
Water heating (other fuel)	590.4990	1.5219	898.6686 (278)
Space and water heating			5259.4083 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	147.0816	1.5338	225.5987 (282)
Total Primary energy kWh/year			5485.0070 (286)
Dwelling Primary energy Rate (DPER)			109.7000 (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	50.0000 (1b)	2.5000 (2b)	125.0000 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	125.0000 (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)

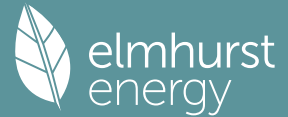
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1600 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4100	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3178 (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	0.4051	0.3972	0.3892	0.3495	0.3416	0.3019	0.3019	0.2939	0.3178	0.3416	0.3575	0.3734 (22b)
Effective ac	0.5821	0.5789	0.5758	0.5611	0.5583	0.5456	0.5456	0.5432	0.5505	0.5583	0.5639	0.5697 (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 Opening Type			8.3000	1.1450	9.5038		(27)
Heat Loss Floor 1			50.0000	0.1300	6.5000		(28b)
External Wall (Existing)	21.5000	8.3000	13.2000	0.1800	2.3760		(29a)
Wall to stairwell	24.4000		24.4000	0.1800	4.3920		(29a)
Total net area of external elements Aum (A, m2)			95.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.7718		(33)
Main dwelling							
Corridor Wall			6.2500	0.0000	0.0000		(32)
Party Wall Internal			26.2000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)							4.7950 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	27.5668 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 24.0102	Feb 23.8788	Mar 23.7499	Apr 23.1447	May 23.0315	Jun 22.5044	Jul 22.5044	Aug 22.4068	Sep 22.7074	Oct 23.0315	Nov 23.2605	Dec 23.5000 (38)
Heat transfer coeff	51.5770	51.4456	51.3167	50.7115	50.5983	50.0712	50.0712	49.9736	50.2742	50.5983	50.8274	51.0668 (39)
Average = Sum(39)m / 12 =												50.7110
HLP	Jan 1.0315	Feb 1.0289	Mar 1.0263	Apr 1.0142	May 1.0120	Jun 1.0014	Jul 1.0014	Aug 0.9995	Sep 1.0055	Oct 1.0120	Nov 1.0165	Dec 1.0213 (40)
HLP (average)												1.0142
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.6901 (42)
Hot water usage for mixer showers	52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556 (42a)
Hot water usage for baths	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476 (42b)
Hot water usage for other uses	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383 (42c)
Average daily hot water use (litres/day)												98.5597 (43)
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415 (44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445 (45)
Energy content (annual)												Total = Sum(45)m = 1637.0557
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167 (46)
Water storage 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	216.4047	191.5060	203.5855	179.1170	173.7575	156.6915	154.6398	160.6490	162.2850	180.8355	192.1624	214.0394 (62)
WWHRS	-24.0268	-21.2495	-22.2513	-18.4249	-17.1714	-14.6937	-13.7730	-14.6462	-15.2026	-17.9222	-20.3037	-23.5819 (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	192.3778	170.2565	181.3342	160.6920	156.5861	141.9978	140.8668	146.0028	147.0824	162.9133	171.8587	190.4575 (64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 1962.4258 (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	93.7377	83.3508	89.4753	80.6368	79.5575	73.1803	73.2008	75.1989	75.0402	81.9109	84.9744	92.9512 (65)

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

Metabolic gains (Table 5), Watts	Jan 84.5050	Feb 84.5050	Mar 84.5050	Apr 84.5050	May 84.5050	Jun 84.5050	Jul 84.5050	Aug 84.5050	Sep 84.5050	Oct 84.5050	Nov 84.5050	Dec 84.5050 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	76.9289	85.1713	76.9289	79.4932	76.9289	79.4932	76.9289	76.9289	79.4932	76.9289	79.4932	76.9289 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505 (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)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040 (71)
Water heating gains (Table 5)	125.9915	124.0340	120.2625	111.9956	106.9321	101.6394	98.3882	101.0738	104.2225	110.0953	118.0201	124.9344 (72)
Total internal gains	401.5058	409.3185	393.4546	379.5556	361.5814	346.1288	333.8170	334.9747	344.5378	359.0427	379.8782	393.9524 (73)

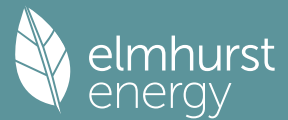
6. Solar gains

[Jan]												Gains
				Area	Solar flux		g		FF		Access	Gains
				m2	Table 6a	Specific data	or Table 6b	Specific data	or Table 6c		factor	W
					W/m2						Table 6d	
Southeast				8.3000	36.7938		0.6300		0.7000		0.7700	93.3308 (77)
Solar gains	93.3308	158.9769	217.5191	269.5167	301.8811	299.6981	288.9410	264.7956	235.5272	175.7033	111.7888	79.8717 (83)
Total gains	494.8366	568.2954	610.9737	649.0723	663.4626	645.8269	622.7580	599.7704	580.0650	534.7460	491.6669	473.8242 (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)												
tau	Jan 67.3211	Feb 67.4931	Mar 67.6626	Apr 68.4701	May 68.6233	Jun 69.3457	Jul 69.3457	Aug 69.4812	Sep 69.0657	Oct 68.6233	Nov 68.3140	Dec 67.9937
alpha	5.4881	5.4995	5.5108	5.5647	5.5749	5.6230	5.6230	5.6321	5.6044	5.5749	5.5543	5.5329
util living area	0.9791	0.9567	0.9165	0.8229	0.6753	0.4913	0.3531	0.3822	0.5841	0.8410	0.9552	0.9829 (86)

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MIT	20.1743	20.3761	20.5961	20.8252	20.9505	20.9930	20.9991	20.9986	20.9822	20.8318	20.4796	20.1389 (87)
Th 2	20.0571	20.0593	20.0614	20.0715	20.0734	20.0821	20.0821	20.0838	20.0788	20.0734	20.0696	20.0656 (88)
util rest of house												
	0.9732	0.9454	0.8958	0.7846	0.6186	0.4230	0.2798	0.3067	0.5118	0.7980	0.9416	0.9780 (89)
MIT 2	19.1261	19.3769	19.6431	19.9100	20.0360	20.0785	20.0819	20.0833	20.0684	19.9249	19.5162	19.0886 (90)
Living area fraction									fLA = Living area / (4) =			0.4540 (91)
MIT	19.6020	19.8305	20.0758	20.3255	20.4512	20.4937	20.4983	20.4988	20.4832	20.3366	19.9536	19.5655 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6020	19.8305	20.0758	20.3255	20.4512	20.4937	20.4983	20.4988	20.4832	20.3366	19.9536	19.5655 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9698	0.9422	0.8961	0.7957	0.6423	0.4539	0.3131	0.3410	0.5441	0.8111	0.9396	0.9748	(94)
Useful gains	479.8724	535.4687	547.5137	516.4848	426.1739	293.1334	194.9951	204.5159	315.6104	433.7320	461.9721	461.8625	(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													
Space heating	789.2309	768.1097	696.6646	579.4066	442.7938	295.1042	195.1919	204.8339	320.9123	492.6550	653.3131	784.6654	(97)
Space heating kWh	230.1627	156.3348	110.9683	45.3037	12.3652	0.0000	0.0000	0.0000	0.0000	43.8388	137.7655	240.1653	(98a)
Space heating requirement - total per year (kWh/year)												976.9043	
Solar heating kWh													
Solar heating contribution - total per year (kWh/year)	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)
Space heating kWh	230.1627	156.3348	110.9683	45.3037	12.3652	0.0000	0.0000	0.0000	0.0000	43.8388	137.7655	240.1653	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												976.9043	
Space heating per m2											(98c) / (4) =	19.5381	(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	230.1627	156.3348	110.9683	45.3037	12.3652	0.0000	0.0000	0.0000	0.0000	43.8388	137.7655	240.1653 (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)	249.3637	169.3768	120.2256	49.0831	13.3968	0.0000	0.0000	0.0000	0.0000	47.4959	149.2584	260.2008 (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	192.3778	170.2565	181.3342	160.6920	156.5861	141.9978	140.8668	146.0028	147.0824	162.9133	171.8587	190.4575 (64)
Efficiency of water heater (217)m	84.4630	83.8689	82.9933	81.6193	80.3964	79.8000	79.8000	79.8000	79.8000	81.5526	83.5686	79.8000 (216)
Fuel for water heating, kWh/month	227.7659	203.0030	218.4926	196.8800	194.7677	177.9421	176.5248	182.9609	184.3137	199.7647	205.6499	225.1778 (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)
(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	15.9843	12.8232	11.5459	8.4590	6.5340	5.3383	5.9605	7.7477	10.0635	13.2038	14.9137	16.4286 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-11.1961	-16.8539	-25.8519	-31.0911	-35.3448	-33.6806	-33.2897	-30.5254	-25.9693	-20.1553	-12.6886	-9.5603 (233a)
(233a)m	-11.1961	-16.8539	-25.8519	-31.0911	-35.3448	-33.6806	-33.2897	-30.5254	-25.9693	-20.1553	-12.6886	-9.5603 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)
(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)	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)
(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)	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)
(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)	-3.4458	-7.4566	-15.2120	-23.4292	-31.5486	-31.8927	-31.4992	-26.3924	-18.9966	-10.8315	-4.6550	-2.7085 (233b)
(233b)m	-3.4458	-7.4566	-15.2120	-23.4292	-31.5486	-31.8927	-31.4992	-26.3924	-18.9966	-10.8315	-4.6550	-2.7085 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)
(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)	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)
(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)	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)
(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												1058.4012 (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												2393.2430 (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)												129.0025 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-494.2751 (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												3172.3716 (238)

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

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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1058.4012	0.2100	222.2642 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2393.2430	0.2100	502.5810 (264)
Space and water heating			724.8453 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	129.0025	0.1443	18.6190 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-286.2069	0.1332	-38.1278
PV Unit electricity exported	-208.0682	0.1252	-26.0464
Total			-64.1742 (269)
Total CO2, kg/year			691.2194 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.8200 (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	1058.4012	1.1300	1195.9933 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2393.2430	1.1300	2704.3646 (278)
Space and water heating			3900.3579 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	129.0025	1.5338	197.8683 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-286.2069	1.4923	-427.0983
PV Unit electricity exported	-208.0682	0.4595	-95.6012
Total			-522.6995 (283)
Total Primary energy kWh/year			3705.6276 (286)
Target Primary Energy Rate (TPER)			74.1100 (287)