

Energy Statement

119-121 East Barnet Road
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1 Executive Summary

This report has been produced by Base Energy on behalf of Hoselynn Ltd and in support of the planning application for the development named as 119-121 East Barnet Road comprising of the conversion and extension of an existing building to create 4no. residential units falling under the requirements of The London Borough of Barnet.

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 London Plan
- The London Borough of Barnet's SPD on sustainable design and construction

The above policies require:

- An on-site reduction of 35 per cent reduction in CO2 over Part L 2013
- 10% reduction in regulated carbon emissions through energy efficiency measures alone (Be Lean) for domestic
- As Part L 2021 requires a further 31% reduction in CO2 over Part L 2013 we will aim for a minimum 4% CO2 reduction over Part L1 2021

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 heating controls
- Solar PV Panels

This results in a 15% reduction in CO2 over Part L 2021 Building Regulations. (46% reduction in CO2 over Part L 2013) and 12% saving from the energy efficiency measure alone.

2 Existing and Proposed Development

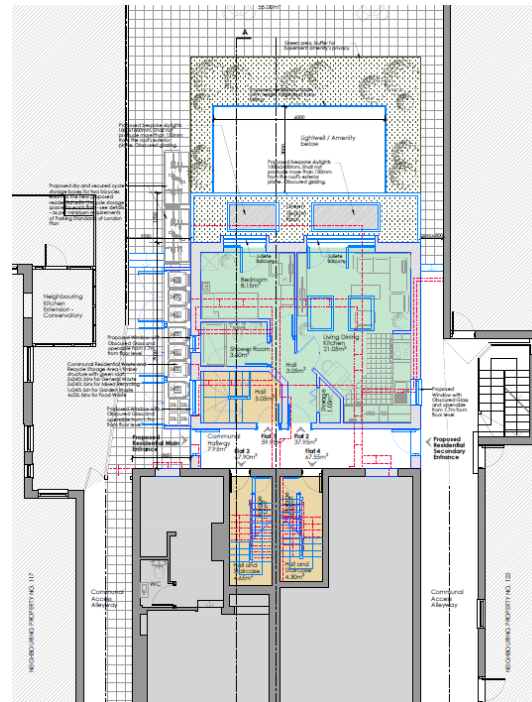
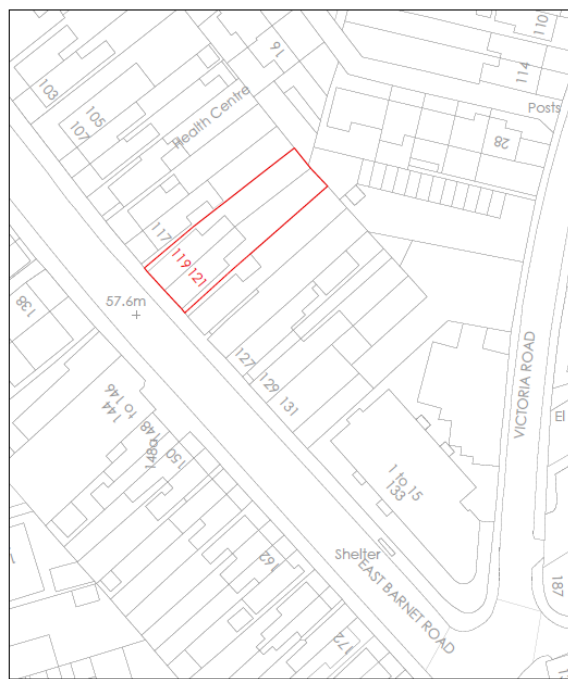
The development site is located on land at 119-121 East Barnet Road, London.

The development proposals are for the conversion and extension of an existing building to create 4no. residential units.

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 2021

The NPPF was updated in July 2021 to place greater emphasis on beauty, place-making, the environment, and sustainable development. The strengthened environmental objectives aim to protect and enhance the natural, built, and historic environment, and encourage effective land use, greater biodiversity, prudent use of natural resources, minimisation of waste and pollution, and adaptation to climate change alongside a move to a low carbon economy.

Local Planning Policy

The relevant London Borough of Barnet Local Planning Policy requirements are as follows.

The development should target:

- London Borough of Barnet's SPD on sustainable design and construction
 - An on-site reduction of 35 per cent reduction in CO₂ over Part L 2013 as per the adopted London Plan
 - 10% reduction in regulated carbon emissions through energy efficiency measures alone (Be Lean) for domestic
 - As Part L 2021 requires a further 31% reduction in CO₂ over Part L 2013 we will aim for a minimum 4% CO₂ reduction over Part L1 2021

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	31.21	233.35	7,284

The **Total Baseline CO2 Emissions** for the development are shown to be 7,284 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)

	Part L 2021 Limiting Parameters	Proposed Development
New External Walls	0.18	0.17
Basement Wall & Wall to commercial	0.30	0.17
Existing Wall Upgrade	0.30	0.18
Dormer Wall	0.18	0.17
Stud Wall	0.18	0.11
Ground Floor	0.25	0.16
Flat Roof	0.16	0.15
Pitch Roof	0.15	0.15
Windows	1.4	1.2
Doors	1.4	1.4

- Insulation: The specified building envelope is designed to 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 through thermal

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: Condensing gas boiler
- Heating Controls: Comprising programmer, thermostat, and TRVs
- Ventilation: Natural extract fans

Table 6.1: Baseline vs Be Lean CO2

	CO2 Emission Rate (kg CO2/m2/year)	Floor Area (m2)	Total Baseline Emissions (kg CO2/year)	Reduction in CO2
Baseline	31.21	233.35	7,284	N/A
Be Lean	27.39	233.35	6,393	12%

The **CO2 Emissions reduction** as a result of energy efficient fabric and services is shown to be 891 kg/year.

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

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)

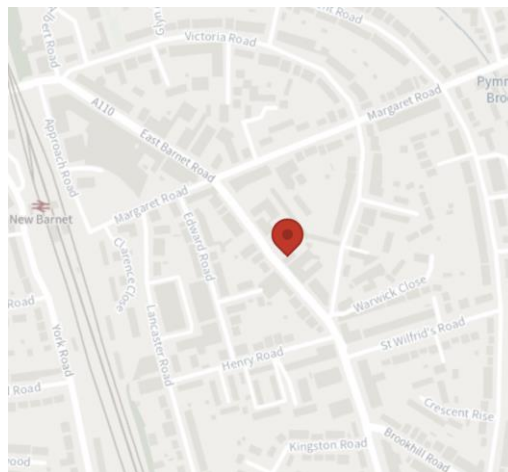
CHP is effectively an on-site small power plant providing both electrical power and thermal heat energy. It is an energy efficiency and low carbon measure rather than a renewable energy technology. A CHP system operates by burning a primary fuel (normally natural gas) by use of either a reciprocating 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



- 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

With reference to the Local Heat Map it has been determined that 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 (See adjacent image)

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

each dwelling.

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 Carbon Technology Summary

The low carbon technology review indicates that ASHP and Solar PV would be potentially feasible. The following low carbon technology is recommended:

Solar PV – 0.4kW per flat (1.6kW total) south-west facing to be displayed at 30 degrees elevation with none or little shading.

This 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.

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: 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	31.21	233.35	7,284	N/A
Lean & Green Design	26.60	233.35	6,208	15%

The **CO2 Emissions reduction** as a result of energy efficient fabric and services is shown to be 1,076 kg/year.

9 Conclusion

119-121 East Barnet Road comprising of the conversion and extension of an existing building to create 4no. residential units falling under the requirements of The London Borough of Barnet.

Under the local planning policy the proposed development is required to achieve:

- An on-site reduction of 35 per cent reduction in CO₂ over Part L 2013
- 10% reduction in regulated carbon emissions through energy efficiency measures alone (Be Lean) for domestic
- A minimum 4% CO₂ reduction over Part L 2021

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 carbon technology will be incorporated and is to comprise:

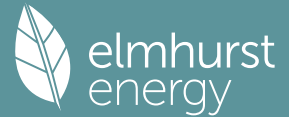
- Solar PV – 0.4kW per flat (1.6kW total) south-west facing to be displayed at 30 degrees elevation with none or little shading.

This results in a 15% reduction in CO₂ over Part L 2021 Building Regulations. (46% reduction in CO₂ over Part L 2013) and 12% saving from the energy efficiency measure alone.

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 Baseline DER/TER SAP Worksheets

Full SAP Calculation Printout



Property Reference	11552 1		Issued on Date	20/02/2024	
Assessment Reference	Baseline	Prop Type Ref	Flat 1		
Property	119-121, East Barnet Road, Barnet, EN4 8RF				
SAP Rating	75 C	DER	30.71	TER	15.83
Environmental	77 C	% DER < TER			-94.00
CO ₂ Emissions (t/year)	1.67	DFEE	80.78	TFEE	43.81
Compliance Check	See BREL	% DFEE < TFEE			-84.38
% DPER < TPER	-100.06	DPER	168.53	TPER	84.24
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)
Ground floor	54.2800 (1b)	x 2.5000 (2b)	= 135.7000 (1b) - (3b)
First floor	5.0400 (1c)	x 2.9000 (2c)	= 14.6160 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 150.3160 (5)

2. Ventilation rate

	Value	Reference
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1996 (8)
Pressure test		No
Pressure Test Method		Blower Door
Measured/design AP50		15.0000 (17)
Infiltration rate		0.9496 (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) =	0.7359 (21)

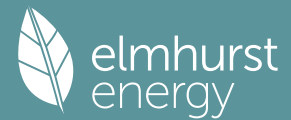
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.9383	0.9199	0.9015	0.8095	0.7911	0.6991	0.6991	0.6807	0.7359	0.7911	0.8279	0.8647 (22b)
Effective ac	0.9402	0.9231	0.9064	0.8277	0.8129	0.7444	0.7444	0.7317	0.7708	0.8129	0.8427	0.8739 (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
Door			1.8900	1.4000	2.6460		(26)
Window (Uw = 1.40)			12.4800	1.3258	16.5455		(27)
RL1, RL2			3.6000	2.0221	7.2794		(27a)
Heat Loss Floor 1			52.1900	0.2500	13.0475		(28a)
Basement Wall	54.3700		54.3700	0.3000	16.3110		(29a)
New External Wall	23.1000	12.4800	10.6200	0.1800	1.9116		(29a)
Wall To Corridor	8.2700	1.8900	6.3800	0.1800	1.1484		(29a)
Green Roof	9.6500	3.6000	6.0500	0.1600	0.9680		(30)
Total net area of external elements Aum(A, m ²)			147.5800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.8574		(33)
Party Wall 1			12.7700	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Default value 0.200 * total exposed area)							29.5160 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	89.3734 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Full SAP Calculation Printout



(38)m	46.6383	45.7903	44.9592	41.0554	40.3250	36.9249	36.9249	36.2953	38.2346	40.3250	41.8026	43.3473 (38)
Heat transfer coeff	136.0116	135.1637	134.3326	130.4288	129.6984	126.2983	126.2983	125.6686	127.6080	129.6984	131.1760	132.7207 (39)
Average = Sum(39)m / 12 =												130.4253
HLP	Jan 2.2928	Feb 2.2786	Mar 2.2645	Apr 2.1987	May 2.1864	Jun 2.1291	Jul 2.1291	Aug 2.1185	Sep 2.1512	Oct 2.1864	Nov 2.2113	Dec 2.2374 (40)
HLP (average)												2.1987
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9623 (42)
Hot water usage for mixer showers	78.5422	77.3619	75.6419	72.3510	69.9224	67.2141	65.6747	67.3817	69.2528	72.1607	75.5223	78.2413 (42a)
Hot water usage for baths	24.6874	24.3208	23.8044	22.8525	22.1396	21.3492	20.9223	21.4350	21.9932	22.8390	23.8106	24.6039 (42b)
Hot water usage for other uses	34.7264	33.4636	32.2008	30.9380	29.6753	28.4125	28.4125	29.6753	30.9380	32.2008	33.4636	34.7264 (42c)
Average daily hot water use (litres/day)												126.8718 (43)
Daily hot water use	Jan 137.9560	Feb 135.1462	Mar 131.6472	Apr 126.1415	May 121.7373	Jun 116.9758	Jul 115.0094	Aug 118.4919	Sep 122.1840	Oct 127.2005	Nov 132.7964	Dec 137.5716 (44)
Energy conte	218.4886	192.4464	202.3368	172.6814	163.8818	143.8354	139.0939	146.7177	150.6651	172.6099	189.1929	215.4039 (45)
Energy content (annual)												Total = Sum(45)m = 2107.3539
Distribution loss (46)m = 0.15 x (45)m	32.7733	28.8670	30.3505	25.9022	24.5823	21.5753	20.8641	22.0077	22.5998	25.8915	28.3789	32.3106 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8900 (48)
Temperature factor from Table 2b												0.7800 (49)
Enter (49) or (54) in (55)												1.4742 (55)
Total storage loss	45.7002	41.2776	45.7002	44.2260	45.7002	44.2260	45.7002	45.7002	44.2260	45.7002	44.2260	45.7002 (56)
If cylinder contains dedicated solar storage	45.7002	41.2776	45.7002	44.2260	45.7002	44.2260	45.7002	45.7002	44.2260	45.7002	44.2260	45.7002 (57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576 (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	319.0464	283.2728	302.8946	269.9954	264.4396	210.5734	208.0565	215.6803	217.4031	273.1677	286.5069	315.9617 (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	319.0464	283.2728	302.8946	269.9954	264.4396	210.5734	208.0565	215.6803	217.4031	273.1677	286.5069	315.9617 (64)
Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 3166.9985 (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	116.5335	103.6275	111.1631	99.8870	98.3768	65.8349	64.8587	67.3936	68.1058	101.2789	105.3770	115.5079 (65)

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

Metabolic gains (Table 5), Watts	Jan 98.1172	Feb 98.1172	Mar 98.1172	Apr 98.1172	May 98.1172	Jun 98.1172	Jul 98.1172	Aug 98.1172	Sep 98.1172	Oct 98.1172	Nov 98.1172	Dec 98.1172 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	86.3652	95.6187	86.3652	89.2441	86.3652	89.2441	86.3652	86.3652	89.2441	86.3652	89.2441	86.3652 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	171.2287	173.0056	168.5280	158.9959	146.9633	135.6544	128.0993	126.3225	130.8000	140.3321	152.3647	163.6737 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938 (71)
Water heating gains (Table 5)	156.6311	154.2076	149.4127	138.7319	132.2269	91.4373	87.1756	90.5827	94.5913	136.1275	146.3570	155.2525 (72)
Total internal gains	469.6602	478.2669	459.7411	442.4071	420.9906	368.7709	354.0753	355.7056	367.0706	418.2601	443.4010	460.7266 (73)

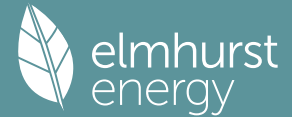
6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast	11.5200	11.2829	0.6300	0.7000	0.7700	39.7234 (75)						
Northwest	0.9600	11.2829	0.6300	0.7000	0.7700	3.3103 (81)						
South	3.6000	26.0000	0.6300	0.7000	1.0000	37.1498 (82)						
Solar gains	80.1835	164.7537	294.9894	473.5130	622.7355	657.1974	617.5153	501.3307	356.6237	201.3531	101.2993	65.1491 (83)
Total gains	549.8438	643.0206	754.7306	915.9201	1043.7261	1025.9683	971.5907	857.0363	723.6943	619.6132	544.7002	525.8757 (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 12.1150	Feb 12.1910	Mar 12.2664	Apr 12.6335	May 12.7047	Jun 13.0467	Jul 13.0467	Aug 13.1121	Sep 12.9128	Oct 12.7047	Nov 12.5616	Dec 12.4154
alpha	1.8077	1.8127	1.8178	1.8422	1.8470	1.8698	1.8698	1.8741	1.8609	1.8470	1.8374	1.8277
util living area	0.9405	0.9201	0.8826	0.8043	0.6946	0.5719	0.4641	0.5196	0.7121	0.8557	0.9213	0.9445 (86)

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MIT	16.7162	17.1157	17.8459	18.8915	19.7901	20.4340	20.7324	20.6598	20.0729	18.9418	17.7002	16.7036 (87)
Th 2	19.1452	19.1541	19.1628	19.2041	19.2119	19.2487	19.2487	19.2555	19.2345	19.2119	19.1962	19.1798 (88)
util rest of house												
	0.9289	0.9045	0.8587	0.7632	0.6262	0.4643	0.3120	0.3668	0.6177	0.8156	0.9033	0.9337 (89)
MIT 2	15.4618	15.8568	16.5717	17.5883	18.4057	18.9657	19.1686	19.1416	18.7059	17.6743	16.4627	15.4682 (90)
Living area fraction									fLA = Living area / (4) =			0.3936 (91)
MIT	15.9555	16.3523	17.0732	18.1012	18.9506	19.5437	19.7841	19.7392	19.2440	18.1732	16.9498	15.9545 (92)
Temperature adjustment												0.0000
adjusted MIT	15.9555	16.3523	17.0732	18.1012	18.9506	19.5437	19.7841	19.7392	19.2440	18.1732	16.9498	15.9545 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8985	0.8701	0.8215	0.7315	0.6145	0.4847	0.3633	0.4144	0.6183	0.7842	0.8705	0.9048 (94)
Useful gains	494.0261	559.4963	619.9801	670.0024	641.3624	497.2459	352.9412	355.1869	447.4781	485.9274	474.1833	475.7875 (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												
	1585.2875	1547.9392	1420.3303	1200.1076	940.3932	624.3779	402.1505	419.6386	656.4180	982.2354	1292.0592	1560.0661 (97)
Space heating kWh	811.8985	664.2336	595.4606	381.6758	222.4789	0.0000	0.0000	0.0000	0.0000	369.2531	588.8707	806.7032 (98a)
Space heating requirement - total per year (kWh/year)												4440.5745
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	811.8985	664.2336	595.4606	381.6758	222.4789	0.0000	0.0000	0.0000	0.0000	369.2531	588.8707	806.7032 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4440.5745
Space heating per m2										(98c) / (4) =		74.8580 (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 %)												89.5000 (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	811.8985	664.2336	595.4606	381.6758	222.4789	0.0000	0.0000	0.0000	0.0000	369.2531	588.8707	806.7032 (98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000 (210)
Space heating fuel (main heating system)	907.1491	742.1604	665.3191	426.4534	248.5798	0.0000	0.0000	0.0000	0.0000	412.5733	657.9561	901.3444 (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	319.0464	283.2728	302.8946	269.9954	264.4396	210.5734	208.0565	215.6803	217.4031	273.1677	286.5069	315.9617 (64)
Efficiency of water heater (217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000 (216)
Fuel for water heating, kWh/month	356.4764	316.5059	338.4297	301.6709	295.4633	235.2775	232.4654	240.9836	242.9085	305.2153	320.1194	353.0298 (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	21.1574	16.9733	15.2825	11.1967	8.6486	7.0660	7.8896	10.2551	13.3204	17.4771	19.7404	21.7455 (232)
Electricity generated by PVs (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 (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)
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)
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)
Electricity generated by PVs (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 (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)
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)
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)
Annual totals kWh/year												
Space heating fuel - main system 1												4961.5357 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												89.5000
Water heating fuel used												3538.5458 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
central heating pump												41.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												86.0000 (231)
Electricity for lighting (calculated in Appendix L)												170.7525 (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												8756.8340 (238)

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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	4961.5357	0.2100	1041.9225 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3538.5458	0.2100	743.0946 (264)
Space and water heating			1785.0171 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	170.7525	0.1443	24.6449 (268)
Total CO2, kg/year			1821.5912 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			30.7100 (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	4961.5357	1.1300	5606.5354 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3538.5458	1.1300	3998.5567 (278)
Space and water heating			9605.0921 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	170.7525	1.5338	261.9059 (282)
Total Primary energy kWh/year			9997.0988 (286)
Dwelling Primary energy Rate (DPER)			168.5300 (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)
Ground floor	54.2800 (1b)	x 2.5000 (2b)	= 135.7000 (1b) - (3b)
First floor	5.0400 (1c)	x 2.9000 (2c)	= 14.6160 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 150.3160 (5)

2. Ventilation rate

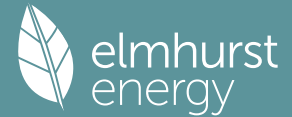
		m3 per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number 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) = 0.1331 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3831	(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) =	0.2969 (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	0.3785	0.3711	0.3637	0.3266	0.3191	0.2820	0.2820	0.2746	0.2969	0.3191	0.3340	0.3488 (22b)
Effective ac	0.5716	0.5689	0.5661	0.5533	0.5509	0.5398	0.5398	0.5377	0.5441	0.5509	0.5558	0.5608 (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
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type (Uw = 1.20)			10.0400	1.1450	11.4962		(27)
RL1, RL2			2.9000	2.0221	5.8640		(27a)
Heat Loss Floor 1			52.1900	0.1300	6.7847		(28a)
Basement Wall	54.3700		54.3700	0.1800	9.7866		(29a)
New External Wall	23.1000	10.0400	13.0600	0.1800	2.3508		(29a)
Wall To Corridor	8.2700	1.8900	6.3800	0.1800	1.1484		(29a)
Green Roof	9.6500	2.9000	6.7500	0.1100	0.7425		(30)
Total net area of external elements Aum(A, m2)			147.5800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	40.0632	(33)
Party Wall 1			12.7700	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)							7.3790 (36)

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tau	21.7392	21.7788	21.8178	22.0029	22.0379	22.2022	22.2022	22.2329	22.1386	22.0379	21.9672	21.8939
alpha	2.4493	2.4519	2.4545	2.4669	2.4692	2.4801	2.4801	2.4822	2.4759	2.4692	2.4645	2.4596
util living area	0.9326	0.9059	0.8563	0.7535	0.6147	0.4655	0.3553	0.4062	0.6138	0.8172	0.9068	0.9383 (86)
MIT	18.3992	18.7392	19.2926	20.0017	20.5332	20.8330	20.9378	20.9121	20.6574	19.9393	19.0592	18.3413 (87)
Th 2	19.8583	19.8601	19.8619	19.8704	19.8719	19.8793	19.8793	19.8807	19.8765	19.8719	19.8687	19.8654 (88)
util rest of house	0.9228	0.8926	0.8360	0.7200	0.5647	0.3976	0.2721	0.3184	0.5451	0.7834	0.8914	0.9294 (89)
MIT 2	16.8655	17.2907	17.9768	18.8345	19.4399	19.7557	19.8469	19.8317	19.5973	18.7887	17.7055	16.7969 (90)
Living area fraction									FLA = Living area / (4) =			
MIT	17.4692	17.8608	18.4947	19.2939	19.8703	20.1798	20.2764	20.2570	20.0146	19.2416	18.2383	17.4048 (92)
Temperature adjustment												0.0000
adjusted MIT	17.4692	17.8608	18.4947	19.2939	19.8703	20.1798	20.2764	20.2570	20.0146	19.2416	18.2383	17.4048 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8952	0.8625	0.8064	0.7008	0.5647	0.4165	0.3024	0.3490	0.5542	0.7610	0.8625	0.9028 (94)
Useful gains	456.6783	506.3999	543.5911	562.1466	509.2603	380.0532	262.0123	270.1634	370.4492	425.7677	433.4202	441.7509 (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	998.1935	980.6113	905.8930	778.3916	610.8940	414.1123	272.8478	285.8580	440.2232	646.1366	835.4948	993.8214 (97)
Space heating kWh	402.8873	318.6701	269.5526	155.6964	75.6155	0.0000	0.0000	0.0000	0.0000	163.9545	289.4937	410.7405 (98a)
Space heating requirement - total per year (kWh/year)												2086.6104
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	402.8873	318.6701	269.5526	155.6964	75.6155	0.0000	0.0000	0.0000	0.0000	163.9545	289.4937	410.7405 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2086.6104
Space heating per m2										(98c) / (4) =		35.1755 (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	402.8873	318.6701	269.5526	155.6964	75.6155	0.0000	0.0000	0.0000	0.0000	163.9545	289.4937	410.7405 (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)	436.4976	345.2547	292.0396	168.6852	81.9236	0.0000	0.0000	0.0000	0.0000	177.6322	313.6443	445.0059 (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	205.0448	181.3928	193.0409	170.7358	166.1424	150.4171	149.0575	154.6400	155.9442	173.0201	182.8734	202.9578 (64)
Efficiency of water heater (217)m	85.5459	85.3099	84.8086	83.8536	82.4125	79.8000	79.8000	79.8000	79.8000	83.9392	85.0850	79.8000 (216)
Fuel for water heating, kWh/month	239.6899	212.6280	227.6196	203.6119	201.5986	188.4926	186.7889	193.7845	195.4188	206.1254	214.9303	237.0808 (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	7.0685	7.3041	7.0685	7.3041	7.0685 (231)
Lighting	17.9414	14.3932	12.9595	9.4947	7.3340	5.9919	6.6903	8.6963	11.2956	14.8205	16.7397	18.4400 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.9848	-23.7324	-35.9089	-42.5792	-47.8686	-45.4124	-44.8714	-41.3929	-35.5945	-28.1065	-17.9976	-13.6846 (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	-5.7292	-12.3200	-24.9889	-38.2744	-51.3344	-51.8328	-51.2105	-43.0163	-31.0898	-17.8468	-7.7229	-4.5100 (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												2260.6830 (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												2507.7694 (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)												144.7970 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-733.0099 (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												4266.2395 (238)

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

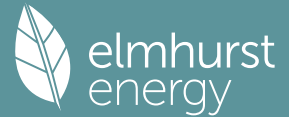
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2260.6830	0.2100	474.7434 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2507.7694	0.2100	526.6316 (264)
Space and water heating			1001.3750 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	144.7970	0.1443	20.8987 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-393.1338	0.1335	-52.4837
PV Unit electricity exported	-339.8761	0.1253	-42.5974
Total			-95.0812 (269)
Total CO2, kg/year			939.1218 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.8300 (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	2260.6830	1.1300	2554.5718 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2507.7694	1.1300	2833.7794 (278)
Space and water heating			5388.3512 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	144.7970	1.5338	222.0945 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-393.1338	1.4933	-587.0804
PV Unit electricity exported	-339.8761	0.4600	-156.3530
Total			-743.4334 (283)
Total Primary energy kWh/year			4997.1131 (286)
Target Primary Energy Rate (TPER)			84.2400 (287)

11 Appendix 1 Be Lean DER/TER SAP Worksheets

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Property Reference	11552 1		Issued on Date	20/02/2024	
Assessment Reference	Be Lean	Prop Type Ref	Flat 1		
Property	119-121, East Barnet Road, Barnet, EN4 8RF				
SAP Rating	78 C	DER	26.08	TER	16.28
Environmental	80 C	% DER < TER			-60.20
CO ₂ Emissions (t/year)	1.41	DFEE	71.35	TFEE	43.81
Compliance Check	See BREL	% DFEE < TFEE			-62.87
% DPER < TPER	-65.77	DPER	143.62	TPER	86.64
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)
Ground floor	54.2800 (1b)	x 2.5000 (2b)	= 135.7000 (1b) - (3b)
First floor	5.0400 (1c)	x 2.9000 (2c)	= 14.6160 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 150.3160 (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	3 * 10 = 30.0000 (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) =	30.0000 / (5) = 0.1996 (8)
Pressure test	No
Pressure Test Method	Blower Door
Measured/design AP50	15.0000 (17)
Infiltration rate	0.9496 (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) = 0.7359 (21)

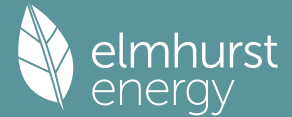
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.9383	0.9199	0.9015	0.8095	0.7911	0.6991	0.6991	0.6807	0.7359	0.7911	0.8279	0.8647 (22b)
Effective ac	0.9402	0.9231	0.9064	0.8277	0.8129	0.7444	0.7444	0.7317	0.7708	0.8129	0.8427	0.8739 (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
Door			1.8900	1.4000	2.6460		(26)
Window (Uw = 1.40)			12.4800	1.3258	16.5455		(27)
RL1 RL2			3.6000	1.3258	4.7727		(27a)
Heat Loss Floor 1			52.1900	0.1600	8.3504		(28a)
Basement Wall	54.3700		54.3700	0.1700	9.2429		(29a)
New External Wall	23.1000	12.4800	10.6200	0.1700	1.8054		(29a)
Wall To Corridor	8.2700	1.8900	6.3800	0.1700	1.0846		(29a)
Green Roof	9.6500	3.6000	6.0500	0.1500	0.9075		(30)
Total net area of external elements Aum(A, m ²)			147.5800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 45.3550		(33)
Party Wall 1			12.7700	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Default value 0.200 * total exposed area)							29.5160 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	74.8710 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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(38)m	46.6383	45.7903	44.9592	41.0554	40.3250	36.9249	36.9249	36.2953	38.2346	40.3250	41.8026	43.3473 (38)
Heat transfer coeff	121.5093	120.6613	119.8302	115.9264	115.1960	111.7959	111.7959	111.1663	113.1056	115.1960	116.6736	118.2183 (39)
Average = Sum(39)m / 12 =												115.9229
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	2.0484	2.0341	2.0201	1.9543	1.9419	1.8846	1.8846	1.8740	1.9067	1.9419	1.9669	1.9929 (40)
HLP (average)												1.9542
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9623 (42)
Hot water usage for mixer showers	78.5422	77.3619	75.6419	72.3510	69.9224	67.2141	65.6747	67.3817	69.2528	72.1607	75.5223	78.2413 (42a)
Hot water usage for baths	24.6874	24.3208	23.8044	22.8525	22.1396	21.3492	20.9223	21.4350	21.9932	22.8390	23.8106	24.6039 (42b)
Hot water usage for other uses	34.7264	33.4636	32.2008	30.9380	29.6753	28.4125	28.4125	29.6753	30.9380	32.2008	33.4636	34.7264 (42c)
Average daily hot water use (litres/day)												126.8718 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	137.9560	135.1462	131.6472	126.1415	121.7373	116.9758	115.0094	118.4919	122.1840	127.2005	132.7964	137.5716 (44)
Energy conte	218.4886	192.4464	202.3368	172.6814	163.8818	143.8354	139.0939	146.7177	150.6651	172.6099	189.1929	215.4039 (45)
Energy content (annual)												Total = Sum(45)m =
Distribution loss (46)m = 0.15 x (45)m	32.7733	28.8670	30.3505	25.9022	24.5823	21.5753	20.8641	22.0077	22.5998	25.8915	28.3789	32.3106 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
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 (57)
Combi loss	32.0139	28.9109	31.9978	30.9425	31.9593	30.9136	31.9346	31.9422	30.9205	31.9681	30.9590	32.0109 (61)
Total heat required for water heating calculated for each month	250.5025	221.3574	234.3346	203.6239	195.8412	174.7490	171.0285	178.6599	181.5856	204.5780	220.1519	247.4147 (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	250.5025	221.3574	234.3346	203.6239	195.8412	174.7490	171.0285	178.6599	181.5856	204.5780	220.1519	247.4147 (64)
												Total per year (kWh/year) = Sum(64)m =
12Total per year (kWh/year)												2483.8271 (64)
Electric shower(s)												2484 (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	80.6509	71.2162	75.2764	65.1522	62.4805	55.5537	54.2324	56.7692	57.8263	65.3848	70.6464	79.6245 (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	98.1172	98.1172	98.1172	98.1172	98.1172	98.1172	98.1172	98.1172	98.1172	98.1172	98.1172	98.1172 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	86.3652	95.6187	86.3652	89.2441	86.3652	89.2441	86.3652	86.3652	89.2441	86.3652	89.2441	86.3652 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	171.2287	173.0056	168.5280	158.9959	146.9633	135.6544	128.0993	126.3225	130.8000	140.3321	152.3647	163.6737 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938 (71)
Water heating gains (Table 5)	108.4018	105.9764	101.1780	90.4892	83.9792	77.1579	72.8930	76.3027	80.3143	87.8828	98.1200	107.0222 (72)
Total internal gains	421.4309	430.0358	411.5064	394.1643	372.7430	354.4915	339.7927	341.4256	352.7935	370.0154	395.1640	412.4963 (73)

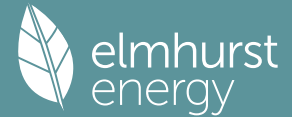
6. Solar gains

[Jan]		Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W					
Northeast		11.5200	11.2829	0.6300	0.7000	0.7700	39.7234 (75)					
Northwest		0.9600	11.2829	0.6300	0.7000	0.7700	3.3103 (81)					
South		3.6000	26.0000	0.6300	0.7000	1.0000	37.1498 (82)					
Solar gains	80.1835	164.7537	294.9894	473.5130	622.7355	657.1974	617.5153	501.3307	356.6237	201.3531	101.2993	65.1491 (83)
Total gains	501.6145	594.7895	706.4958	867.6774	995.4785	1011.6889	957.3080	842.7562	709.4172	571.3685	496.4632	477.6454 (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	13.5609	13.6562	13.7509	14.2140	14.3041	14.7392	14.7392	14.8226	14.5685	14.3041	14.1230	13.9384
alpha	1.9041	1.9104	1.9167	1.9476	1.9536	1.9826	1.9826	1.9882	1.9712	1.9536	1.9415	1.9292
util living area	0.9465	0.9253	0.8860	0.8024	0.6854	0.5455	0.4365	0.4928	0.6946	0.8613	0.9281	0.9507 (86)
MIT	16.9383	17.3472	18.0721	19.1039	19.9523	20.5520	20.7973	20.7362	20.2173	19.0988	17.8954	16.9335 (87)
Th 2	19.3013	19.3107	19.3200	19.3640	19.3723	19.4114	19.4114	19.4186	19.3963	19.3723	19.3555	19.3381 (88)
util rest of house	0.9364	0.9113	0.8640	0.7638	0.6214	0.4478	0.3032	0.3572	0.6061	0.8248	0.9124	0.9414 (89)

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MIT 2	15.7657	16.1709	16.8815	17.8870	18.6581	19.1789	19.3455	19.3237	18.9363	17.9200	16.7431	15.7814 (90)
Living area fraction									FLA = Living area / (4) =			0.3936 (91)
MIT	16.2272	16.6340	17.3501	18.3660	19.1675	19.7194	19.9169	19.8797	19.4405	18.3840	17.1967	16.2349 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.0772	16.4840	17.2001	18.2160	19.0175	19.5694	19.7669	19.7297	19.2905	18.2340	17.0467	16.0849 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9073	0.8775	0.8262	0.7300	0.6052	0.4585	0.3356	0.3867	0.5991	0.7905	0.8801	0.9140	(94)
Useful gains	455.1373	521.9341	583.7004	633.4233	602.4938	463.8964	321.3171	325.9327	425.0184	451.6874	436.9298	436.5770	(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													
	1431.0416	1397.7366	1282.1994	1079.9712	842.9512	555.5591	354.0517	370.1504	587.0783	879.4086	1160.5132	1405.0151	(97)
Space heating kWh													
	726.0728	588.5393	519.6832	321.5145	178.9003	0.0000	0.0000	0.0000	0.0000	318.2246	520.9800	720.5180	(98a)
Space heating requirement - total per year (kWh/year)													3894.4327
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													
	726.0728	588.5393	519.6832	321.5145	178.9003	0.0000	0.0000	0.0000	0.0000	318.2246	520.9800	720.5180	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)													3894.4327
Space heating per m2													(98c) / (4) = 65.6513 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													88.8000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	726.0728	588.5393	519.6832	321.5145	178.9003	0.0000	0.0000	0.0000	0.0000	318.2246	520.9800	720.5180	(98)
Space heating efficiency (main heating system 1)	88.8000	88.8000	88.8000	88.8000	88.8000	0.0000	0.0000	0.0000	0.0000	88.8000	88.8000	88.8000	(210)
Space heating fuel (main heating system)	817.6496	662.7695	585.2288	362.0659	201.4643	0.0000	0.0000	0.0000	0.0000	358.3610	586.6892	811.3941	(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 requirement	250.5025	221.3574	234.3346	203.6239	195.8412	174.7490	171.0285	178.6599	181.5856	204.5780	220.1519	247.4147	(64)
Efficiency of water heater (217)m	88.6453	88.6352	88.6127	88.5664	88.4854	88.2000	88.2000	88.2000	88.2000	88.5642	88.6209	88.6459	(216)
Fuel for water heating, kWh/month	282.5897	249.7398	264.4482	229.9111	221.3259	198.1282	193.9099	202.5622	205.8794	230.9939	248.4198	279.1047	(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	21.1574	16.9733	15.2825	11.1967	8.6486	7.0660	7.8896	10.2551	13.3204	17.4771	19.7404	21.7455	(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													4385.6224 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													88.2000
Water heating fuel used													2807.0125 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
central heating pump													41.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													86.0000 (231)
Electricity for lighting (calculated in Appendix L)													170.7525 (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													7449.3875 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
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Space heating - main system 1	4385.6224	0.2100	920.9807 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2807.0125	0.2100	589.4726 (264)
Space and water heating			1510.4533 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	170.7525	0.1443	24.6449 (268)
Total CO2, kg/year			1547.0275 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			26.0800 (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	4385.6224	1.1300	4955.7533 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2807.0125	1.1300	3171.9242 (278)
Space and water heating			8127.6775 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	170.7525	1.5338	261.9059 (282)
Total Primary energy kWh/year			8519.6842 (286)
Dwelling Primary energy Rate (DPER)			143.6200 (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)
Ground floor	54.2800 (1b)	x 2.5000 (2b)	= 135.7000 (1b) - (3b)
First floor	5.0400 (1c)	x 2.9000 (2c)	= 14.6160 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 150.3160 (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) =	0.1331 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3831	(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) =	0.2969 (21)

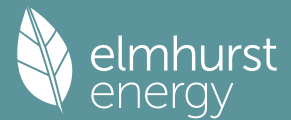
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3785	0.3711	0.3637	0.3266	0.3191	0.2820	0.2820	0.2746	0.2969	0.3191	0.3340	0.3488 (22b)
Effective ac	0.5716	0.5689	0.5661	0.5533	0.5509	0.5398	0.5398	0.5377	0.5441	0.5509	0.5558	0.5608 (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
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type (Uw = 1.20)			10.0400	1.1450	11.4962		(27)
RL1 RL2			2.9000	2.0221	5.8640		(27a)
Heat Loss Floor 1			52.1900	0.1300	6.7847		(28a)
Basement Wall	54.3700		54.3700	0.1800	9.7866		(29a)
New External Wall	23.1000	10.0400	13.0600	0.1800	2.3508		(29a)
Wall To Corridor	8.2700	1.8900	6.3800	0.1800	1.1484		(29a)
Green Roof	9.6500	2.9000	6.7500	0.1100	0.7425		(30)
Total net area of external elements Aum(A, m2)			147.5800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.0632		(33)
Party Wall 1			12.7700	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)							7.3790 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	47.4422 (37)

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

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	28.3554	28.2175	28.0822	27.4470	27.3281	26.7748	26.7748	26.6724	26.9879	27.3281	27.5685	27.8199	(38)
Heat transfer coeff	75.7976	75.6596	75.5244	74.8891	74.7703	74.2170	74.2170	74.1145	74.4301	74.7703	75.0107	75.2621	(39)
Average = Sum(39)m / 12 =												74.8885	
HLP	1.2778	1.2754	1.2732	1.2625	1.2605	1.2511	1.2511	1.2494	1.2547	1.2605	1.2645	1.2687	(40)
HLP (average)												1.2625	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.9623	(42)
Hot water usage for mixer showers	57.1216	56.2632	55.0123	52.6189	50.8527	48.8830	47.7634	49.0048	50.3657	52.4805	54.9253	56.9028	(42a)	
Hot water usage for baths	24.6874	24.3208	23.8044	22.8525	22.1396	21.3492	20.9223	21.4350	21.9932	22.8390	23.8106	24.6039	(42b)	
Hot water usage for other uses	34.7264	33.4636	32.2008	30.9380	29.6753	28.4125	28.4125	29.6753	30.9380	32.2008	33.4636	34.7264	(42c)	
Average daily hot water use (litres/day)												107.1227	(43)	
Daily hot water use	116.5354	114.0475	111.0175	106.4094	102.6676	98.6447	97.0982	100.1151	103.2969	107.5203	112.1995	116.2331	(44)	
Energy conte	184.5635	162.4022	170.6298	145.6692	138.2103	121.2951	117.4318	123.9634	127.3754	145.9041	159.8487	181.9929	(45)	
Energy content (annual)												1779.2864		
Distribution loss (46)m = 0.15 x (45)m	27.6845	24.3603	25.5945	21.8504	20.7315	18.1943	17.6148	18.5945	19.1063	21.8856	23.9773	27.2989	(46)	
Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)	
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)	
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)	
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	48.6467	49.4802	50.9589	49.3151	50.9589	49.3151	50.9589	(61)	
Total heat required for water heating calculated for each month	235.5225	208.4296	221.5887	194.9843	189.1692	169.9418	166.9120	174.9223	176.6905	196.8630	209.1638	232.9518	(62)	
WWHRS	-26.1136	-23.0951	-24.1839	-20.0252	-18.6628	-15.9699	-14.9692	-15.9182	-16.5230	-19.4788	-22.0671	-25.6300	(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	209.4088	185.3345	197.4049	174.9591	170.5064	153.9720	151.9428	159.0040	160.1675	177.3841	187.0966	207.3218	(64)	
12Total per year (kWh/year)												2134.5024	(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 =												2135	(64)	
Heat gains from water heating, kWh/month	74.1071	65.5056	69.4741	60.7638	58.6946	52.4923	51.4161	53.9575	54.6811	61.2528	65.4785	73.2524	(65)	

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	86.3477	95.5993	86.3477	89.2260	86.3477	89.2260	86.3477	86.3477	89.2260	86.3477	89.2260	86.3477	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	171.2287	173.0056	168.5280	158.9959	146.9633	135.6544	128.0993	126.3225	130.8000	140.3321	152.3647	163.6737	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117	(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)	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	(71)
Water heating gains (Table 5)	99.6063	97.4785	93.3792	84.3941	78.8907	72.9060	69.1077	72.5236	75.9460	82.3291	90.9423	98.4575	(72)
Total internal gains	412.6180	421.5185	403.6902	388.0512	367.6369	350.2215	335.9899	337.6290	348.4071	364.4441	387.9682	403.9140	(73)

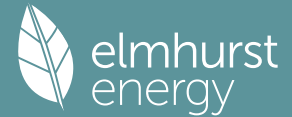
6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
Northeast	9.2700	11.2829	0.6300	0.7000	0.7700	31.9649 (75)							
Northwest	0.7700	11.2829	0.6300	0.7000	0.7700	2.6551 (81)							
South	2.9000	26.0000	0.6300	0.7000	1.0000	29.9263 (82)							
Solar gains	64.5463	132.6247	237.4617	381.1641	501.2758	529.0122	497.0717	403.5538	287.0747	162.0868	81.5443	52.4437	(83)
Total gains	477.1643	554.1432	641.1519	769.2153	868.9127	879.2337	833.0616	741.1827	635.4819	526.5309	469.5125	456.3577	(84)

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)													
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
alpha	21.7392	21.7788	21.8178	22.0029	22.0379	22.2022	22.2022	22.2329	22.1386	22.0379	21.9672	21.8939	(85)
util living area	0.9408	0.9154	0.8678	0.7672	0.6290	0.4791	0.3677	0.4212	0.6332	0.8337	0.9179	0.9463	(86)
MIT	18.3109	18.6581	19.2239	19.9544	20.5073	20.8216	20.9328	20.9046	20.6312	19.8788	18.9774	18.2511	(87)
Th 2	19.8583	19.8601	19.8619	19.8704	19.8719	19.8793	19.8793	19.8807	19.8765	19.8719	19.8687	19.8654	(88)
util rest of house													

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MIT 2	0.9321	0.9032	0.8486	0.7346	0.5791	0.4102	0.2822	0.3311	0.5646	0.8017	0.9039	0.9383 (89)	
Living area fraction	16.7556	17.1910	17.8945	18.7813	19.4140	19.7466	19.8441	19.8271	19.5736	18.7200	17.6056	16.6844 (90)	
MIT	17.3678	17.7685	18.4178	19.2431	19.8443	20.1698	20.2726	20.2512	fLA = Living area / (4) =	19.9899	19.1761	18.1456	0.3936 (91)
Temperature adjustment												17.3011 (92)	
adjusted MIT	17.3678	17.7685	18.4178	19.2431	19.8443	20.1698	20.2726	20.2512	19.9899	19.1761	18.1456	17.3011 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9058	0.8738	0.8187	0.7140	0.5778	0.4288	0.3131	0.3621	0.5721	0.7780	0.8757	0.9132 (94)
Useful gains	432.2078	484.1972	524.9320	549.2384	502.0858	377.0466	260.8507	268.3880	363.5817	409.6367	411.1754	416.7469 (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	990.5061	973.6249	900.0828	774.5828	608.9531	413.3710	272.5729	285.4321	438.3881	641.2407	828.5390	986.0140 (97)
Space heating kWh	415.3739	328.8954	279.1122	162.2480	79.5092	0.0000	0.0000	0.0000	0.0000	172.3134	300.5018	423.5347 (98a)
Space heating requirement - total per year (kWh/year)												2161.4885
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	415.3739	328.8954	279.1122	162.2480	79.5092	0.0000	0.0000	0.0000	0.0000	172.3134	300.5018	423.5347 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2161.4885
Space heating per m2												(98c) / (4) = 36.4378 (99)

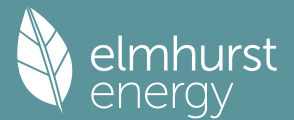
9a. Energy requirements - Individual heating systems, including micro-CHP

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 %)												92.4000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	415.3739	328.8954	279.1122	162.2480	79.5092	0.0000	0.0000	0.0000	0.0000	172.3134	300.5018	423.5347 (98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000 (210)
Space heating fuel (main heating system)	449.5388	355.9474	302.0695	175.5930	86.0489	0.0000	0.0000	0.0000	0.0000	186.4863	325.2184	458.3709 (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 requirement	209.4088	185.3345	197.4049	174.9591	170.5064	153.9720	151.9428	159.0040	160.1675	177.3841	187.0966	207.3218 (64)
Efficiency of water heater (217)m	85.8194	85.5960	85.1233	84.2201	82.8488	80.3000	80.3000	80.3000	80.3000	84.3193	85.3909	80.3000 (216)
Fuel for water heating, kWh/month	244.0110	216.5222	231.9046	207.7403	205.8044	191.7459	189.2189	198.0125	199.4613	210.3719	219.1061	85.8774 (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	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	17.9414	14.3932	12.9595	9.4947	7.3340	5.9919	6.6903	8.6963	11.2956	14.8205	16.7397	18.4400 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-15.9848	-23.7324	-35.9089	-42.5792	-47.8686	-45.4124	-44.8714	-41.3929	-35.5945	-28.1065	-17.9976	-13.6846 (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	-5.7292	-12.3200	-24.9889	-38.2744	-51.3344	-51.8328	-51.2105	-43.0163	-31.0898	-17.8468	-7.7229	-4.5100 (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												2339.2733 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												80.3000
Water heating fuel used												2555.3152 (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)												144.7970 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-733.0099 (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												4392.3755 (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	2339.2733	0.2100	491.2474 (261)

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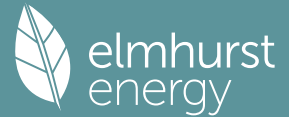
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2555.3152	0.2100	536.6162 (264)
Space and water heating			1027.8636 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	144.7970	0.1443	20.8987 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-393.1338	0.1335	-52.4837
PV Unit electricity exported	-339.8761	0.1253	-42.5974
Total			-95.0812 (269)
Total CO2, kg/year			965.6104 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			16.2800 (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	2339.2733	1.1300	2643.3788 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2555.3152	1.1300	2887.5061 (278)
Space and water heating			5530.8849 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	144.7970	1.5338	222.0945 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-393.1338	1.4933	-587.0804
PV Unit electricity exported	-339.8761	0.4600	-156.3530
Total			-743.4334 (283)
Total Primary energy kWh/year			5139.6468 (286)
Target Primary Energy Rate (TPER)			86.6400 (287)

12 Appendix 2 Be Green DER/TER SAP Worksheets

Full SAP Calculation Printout



Property Reference	11552 1		Issued on Date	20/02/2024	
Assessment Reference	Be Green	Prop Type Ref	Flat 1		
Property	119-121, East Barnet Road, Barnet, EN4 8RF				
SAP Rating	80 C	DER	25.36	TER	16.28
Environmental	81 B	% DER < TER			-55.77
CO ₂ Emissions (t/year)	1.36	DFEE	71.35	TFEE	43.81
Compliance Check	See BREL	% DFEE < TFEE			-62.87
% DPER < TPER	-58.51	DPER	137.33	TPER	86.64
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)
Ground floor	54.2800 (1b)	x 2.5000 (2b)	= 135.7000 (1b) - (3b)
First floor	5.0400 (1c)	x 2.9000 (2c)	= 14.6160 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	150.3160 (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	3 * 10 = 30.0000 (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) =	30.0000 / (5) = 0.1996 (8)
Pressure test	No
Pressure Test Method	Blower Door
Measured/design AP50	15.0000 (17)
Infiltration rate	0.9496 (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) = 0.7359 (21)

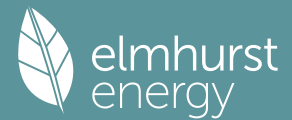
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.9383	0.9199	0.9015	0.8095	0.7911	0.6991	0.6991	0.6807	0.7359	0.7911	0.8279	0.8647 (22b)
Effective ac	0.9402	0.9231	0.9064	0.8277	0.8129	0.7444	0.7444	0.7317	0.7708	0.8129	0.8427	0.8739 (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
Door			1.8900	1.4000	2.6460		(26)
Window (Uw = 1.40)			12.4800	1.3258	16.5455		(27)
RL1 RL2			3.6000	1.3258	4.7727		(27a)
Heat Loss Floor 1			52.1900	0.1600	8.3504		(28a)
Basement Wall	54.3700		54.3700	0.1700	9.2429		(29a)
New External Wall	23.1000	12.4800	10.6200	0.1700	1.8054		(29a)
Wall To Corridor	8.2700	1.8900	6.3800	0.1700	1.0846		(29a)
Green Roof	9.6500	3.6000	6.0500	0.1500	0.9075		(30)
Total net area of external elements Aum(A, m ²)			147.5800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	45.3550	(33)
Party Wall 1			12.7700	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Default value 0.200 * total exposed area)							29.5160 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	74.8710 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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(38)m	46.6383	45.7903	44.9592	41.0554	40.3250	36.9249	36.9249	36.2953	38.2346	40.3250	41.8026	43.3473 (38)
Heat transfer coeff	121.5093	120.6613	119.8302	115.9264	115.1960	111.7959	111.7959	111.1663	113.1056	115.1960	116.6736	118.2183 (39)
Average = Sum(39)m / 12 =												115.9229
HLP	Jan 2.0484	Feb 2.0341	Mar 2.0201	Apr 1.9543	May 1.9419	Jun 1.8846	Jul 1.8846	Aug 1.8740	Sep 1.9067	Oct 1.9419	Nov 1.9669	Dec 1.9929 (40)
HLP (average)												1.9542
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9623 (42)
Hot water usage for mixer showers	78.5422	77.3619	75.6419	72.3510	69.9224	67.2141	65.6747	67.3817	69.2528	72.1607	75.5223	78.2413 (42a)
Hot water usage for baths	24.6874	24.3208	23.8044	22.8525	22.1396	21.3492	20.9223	21.4350	21.9932	22.8390	23.8106	24.6039 (42b)
Hot water usage for other uses	34.7264	33.4636	32.2008	30.9380	29.6753	28.4125	28.4125	29.6753	30.9380	32.2008	33.4636	34.7264 (42c)
Average daily hot water use (litres/day)												126.8718 (43)
Daily hot water use	Jan 137.9560	Feb 135.1462	Mar 131.6472	Apr 126.1415	May 121.7373	Jun 116.9758	Jul 115.0094	Aug 118.4919	Sep 122.1840	Oct 127.2005	Nov 132.7964	Dec 137.5716 (44)
Energy conte	218.4886	192.4464	202.3368	172.6814	163.8818	143.8354	139.0939	146.7177	150.6651	172.6099	189.1929	215.4039 (45)
Energy content (annual)												Total = Sum(45)m = 2107.3539
Distribution loss (46)m = 0.15 x (45)m	32.7733	28.8670	30.3505	25.9022	24.5823	21.5753	20.8641	22.0077	22.5998	25.8915	28.3789	32.3106 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
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 (57)
Combi loss	32.0139	28.9109	31.9978	30.9425	31.9593	30.9136	31.9346	31.9422	30.9205	31.9681	30.9590	32.0109 (61)
Total heat required for water heating calculated for each month	250.5025	221.3574	234.3346	203.6239	195.8412	174.7490	171.0285	178.6599	181.5856	204.5780	220.1519	247.4147 (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	250.5025	221.3574	234.3346	203.6239	195.8412	174.7490	171.0285	178.6599	181.5856	204.5780	220.1519	247.4147 (64)
Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 2483.8271 (64) 2484 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	80.6509	71.2162	75.2764	65.1522	62.4805	55.5537	54.2324	56.7692	57.8263	65.3848	70.6464	79.6245 (65)

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

Metabolic gains (Table 5), Watts	Jan 98.1172	Feb 98.1172	Mar 98.1172	Apr 98.1172	May 98.1172	Jun 98.1172	Jul 98.1172	Aug 98.1172	Sep 98.1172	Oct 98.1172	Nov 98.1172	Dec 98.1172 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	86.3652	95.6187	86.3652	89.2441	86.3652	89.2441	86.3652	86.3652	89.2441	86.3652	89.2441	86.3652 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	171.2287	173.0056	168.5280	158.9959	146.9633	135.6544	128.0993	126.3225	130.8000	140.3321	152.3647	163.6737 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938 (71)
Water heating gains (Table 5)	108.4018	105.9764	101.1780	90.4892	83.9792	77.1579	72.8930	76.3027	80.3143	87.8828	98.1200	107.0222 (72)
Total internal gains	421.4309	430.0358	411.5064	394.1643	372.7430	354.4915	339.7927	341.4256	352.7935	370.0154	395.1640	412.4963 (73)

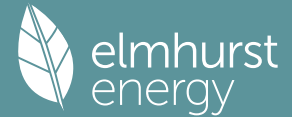
6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast	11.5200	11.2829	0.6300	0.7000	0.7700	39.7234 (75)						
Northwest	0.9600	11.2829	0.6300	0.7000	0.7700	3.3103 (81)						
South	3.6000	26.0000	0.6300	0.7000	1.0000	37.1498 (82)						
Solar gains	80.1835	164.7537	294.9894	473.5130	622.7355	657.1974	617.5153	501.3307	356.6237	201.3531	101.2993	65.1491 (83)
Total gains	501.6145	594.7895	706.4958	867.6774	995.4785	1011.6889	957.3080	842.7562	709.4172	571.3685	496.4632	477.6454 (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 13.5609	Feb 13.6562	Mar 13.7509	Apr 14.2140	May 14.3041	Jun 14.7392	Jul 14.7392	Aug 14.8226	Sep 14.5685	Oct 14.3041	Nov 14.1230	Dec 13.9384
alpha	1.9041	1.9104	1.9167	1.9476	1.9536	1.9826	1.9826	1.9882	1.9712	1.9536	1.9415	1.9292
util living area	0.9465	0.9253	0.8860	0.8024	0.6854	0.5455	0.4365	0.4928	0.6946	0.8613	0.9281	0.9507 (86)
MIT	16.9383	17.3472	18.0721	19.1039	19.9523	20.5520	20.7973	20.7362	20.2173	19.0988	17.8954	16.9335 (87)
Th 2	19.3013	19.3107	19.3200	19.3640	19.3723	19.4114	19.4114	19.4186	19.3963	19.3723	19.3555	19.3381 (88)
util rest of house	0.9364	0.9113	0.8640	0.7638	0.6214	0.4478	0.3032	0.3572	0.6061	0.8248	0.9124	0.9414 (89)

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MIT 2	15.7657	16.1709	16.8815	17.8870	18.6581	19.1789	19.3455	19.3237	18.9363	17.9200	16.7431	15.7814 (90)
Living area fraction									FLA = Living area / (4) =			0.3936 (91)
MIT	16.2272	16.6340	17.3501	18.3660	19.1675	19.7194	19.9169	19.8797	19.4405	18.3840	17.1967	16.2349 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.0772	16.4840	17.2001	18.2160	19.0175	19.5694	19.7669	19.7297	19.2905	18.2340	17.0467	16.0849 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9073	0.8775	0.8262	0.7300	0.6052	0.4585	0.3356	0.3867	0.5991	0.7905	0.8801	0.9140 (94)	
Useful gains	455.1373	521.9341	583.7004	633.4233	602.4938	463.8964	321.3171	325.9327	425.0184	451.6874	436.9298	436.5770 (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													
	1431.0416	1397.7366	1282.1994	1079.9712	842.9512	555.5591	354.0517	370.1504	587.0783	879.4086	1160.5132	1405.0151 (97)	
Space heating kWh													
	726.0728	588.5393	519.6832	321.5145	178.9003	0.0000	0.0000	0.0000	0.0000	318.2246	520.9800	720.5180 (98a)	
Space heating requirement - total per year (kWh/year)													3894.4327
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													
	726.0728	588.5393	519.6832	321.5145	178.9003	0.0000	0.0000	0.0000	0.0000	318.2246	520.9800	720.5180 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)													3894.4327
Space heating per m2													(98c) / (4) = 65.6513 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													88.8000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	726.0728	588.5393	519.6832	321.5145	178.9003	0.0000	0.0000	0.0000	0.0000	318.2246	520.9800	720.5180 (98)	
Space heating efficiency (main heating system 1)	88.8000	88.8000	88.8000	88.8000	88.8000	0.0000	0.0000	0.0000	0.0000	88.8000	88.8000	88.8000 (210)	
Space heating fuel (main heating system)	817.6496	662.7695	585.2288	362.0659	201.4643	0.0000	0.0000	0.0000	0.0000	358.3610	586.6892	811.3941 (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 requirement	250.5025	221.3574	234.3346	203.6239	195.8412	174.7490	171.0285	178.6599	181.5856	204.5780	220.1519	247.4147 (64)	
Efficiency of water heater (217)m	88.6453	88.6352	88.6127	88.5664	88.4854	88.2000	88.2000	88.2000	88.2000	88.5642	88.6209	88.6459 (216)	
Fuel for water heating, kWh/month	282.5897	249.7398	264.4482	229.9111	221.3259	198.1282	193.9099	202.5622	205.8794	230.9939	248.4198	279.1047 (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	21.1574	16.9733	15.2825	11.1967	8.6486	7.0660	7.8896	10.2551	13.3204	17.4771	19.7404	21.7455 (232)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-7.2768	-11.5783	-18.8754	-23.9621	-28.1806	-27.1750	-26.7915	-24.0460	-19.6259	-14.2796	-8.4199	-6.1286 (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	-1.5394	-3.5355	-7.7588	-12.7464	-17.8401	-18.2933	-17.9857	-14.6695	-10.0183	-5.3013	-2.1209	-1.1906 (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													4385.6224 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													88.2000
Water heating fuel used													2807.0125 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
central heating pump													41.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													86.0000 (231)
Electricity for lighting (calculated in Appendix L)													170.7525 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-329.3397 (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													7120.0477 (238)

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

Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
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Space heating - main system 1	4385.6224	0.2100	920.9807 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2807.0125	0.2100	589.4726 (264)
Space and water heating			1510.4533 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	170.7525	0.1443	24.6449 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-216.3398	0.1322	-28.6078
PV Unit electricity exported	-113.0000	0.1236	-13.9675
Total			-42.5752 (269)
Total CO2, kg/year			1504.4522 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			25.3600 (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	4385.6224	1.1300	4955.7533 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2807.0125	1.1300	3171.9242 (278)
Space and water heating			8127.6775 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	170.7525	1.5338	261.9059 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-216.3398	1.4886	-322.0401
PV Unit electricity exported	-113.0000	0.4536	-51.2577
Total			-373.2978 (283)
Total Primary energy kWh/year			8146.3865 (286)
Dwelling Primary energy Rate (DPER)			137.3300 (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)
Ground floor	54.2800 (1b)	x 2.5000 (2b)	= 135.7000 (1b) - (3b)
First floor	5.0400 (1c)	x 2.9000 (2c)	= 14.6160 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	150.3160 (5)

 2. Ventilation rate

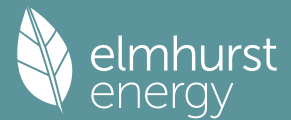
			m3 per hour
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
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) =	0.1331 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.3831 (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) =	0.2969 (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												
Effective ac	0.3785	0.3711	0.3637	0.3266	0.3191	0.2820	0.2820	0.2746	0.2969	0.3191	0.3340	0.3488 (22b)
	0.5716	0.5689	0.5661	0.5533	0.5509	0.5398	0.5398	0.5377	0.5441	0.5509	0.5558	0.5608 (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
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type (Uw = 1.20)			10.0400	1.1450	11.4962		(27)
RL1 RL2			2.9000	2.0221	5.8640		(27a)
Heat Loss Floor 1			52.1900	0.1300	6.7847		(28a)
Basement Wall	54.3700		54.3700	0.1800	9.7866		(29a)
New External Wall	23.1000	10.0400	13.0600	0.1800	2.3508		(29a)
Wall To Corridor	8.2700	1.8900	6.3800	0.1800	1.1484		(29a)
Green Roof	9.6500	2.9000	6.7500	0.1100	0.7425		(30)

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Total net area of external elements Aum(A, m2)	147.5800												(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...	(30) + (32) =	40.0632										(33)
Party Wall 1	12.7700	0.0000	0.0000										(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K													100.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)													7.3790 (36)
Point Thermal bridges													(36a) = 0.0000
Total fabric heat loss													(33) + (36) + (36a) = 47.4422 (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	28.3554	28.2175	28.0822	27.4470	27.3281	26.7748	26.7748	26.6724	26.9879	27.3281	27.5685	27.8199	(38)
Average = Sum(39)m / 12 =	75.7976	75.6596	75.5244	74.8891	74.7703	74.2170	74.2170	74.1145	74.4301	74.7703	75.0107	75.2621	(39)
												74.8885	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.2778	1.2754	1.2732	1.2625	1.2605	1.2511	1.2511	1.2494	1.2547	1.2605	1.2645	1.2687	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.9623 (42)
Hot water usage for mixer showers	57.1216	56.2632	55.0123	52.6189	50.8527	48.8830	47.7634	49.0048	50.3657	52.4805	54.9253	56.9028	(42a)
Hot water usage for baths	24.6874	24.3208	23.8044	22.8525	22.1396	21.3492	20.9223	21.4350	21.9932	22.8390	23.8106	24.6039	(42b)
Hot water usage for other uses	34.7264	33.4636	32.2008	30.9380	29.6753	28.4125	28.4125	29.6753	30.9380	32.2008	33.4636	34.7264	(42c)
Average daily hot water use (litres/day)													107.1227 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	116.5354	114.0475	111.0175	106.4094	102.6676	98.6447	97.0982	100.1151	103.2969	107.5203	112.1995	116.2331	(44)
Energy content (annual)	184.5635	162.4022	170.6298	145.6692	138.2103	121.2951	117.4318	123.9634	127.3754	145.9041	159.8487	181.9929	(45)
Distribution loss (46)m = 0.15 x (45)m	27.6845	24.3603	25.5945	21.8504	20.7315	18.1943	17.6148	18.5945	19.1063	21.8856	23.9773	27.2989	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
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	(57)
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	(59)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.9589	49.3151	50.9589	48.6467	49.4802	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
WWHRS	235.5225	208.4296	221.5887	194.9843	189.1692	169.9418	166.9120	174.9223	176.6905	196.8630	209.1638	232.9518	(62)
PV diverter	-26.1136	-23.0951	-24.1839	-20.0252	-18.6628	-15.9699	-14.9692	-15.9182	-16.5230	-19.4788	-22.0671	-25.6300	(63a)
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	(63b)
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	(63c)
Output from w/h	209.4088	185.3345	197.4049	174.9591	170.5064	153.9720	151.9428	159.0040	160.1675	177.3841	187.0966	207.3218	(64)
12Total per year (kWh/year)													2134.5024 (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	74.1071	65.5056	69.4741	60.7638	58.6946	52.4923	51.4161	53.9575	54.6811	61.2528	65.4785	73.2524	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	98.1172	98.1172	98.1172	98.1172	98.1172	98.1172	98.1172	98.1172	98.1172	98.1172	98.1172	98.1172	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	86.3477	95.5993	86.3477	89.2260	86.3477	89.2260	86.3477	86.3477	89.2260	86.3477	89.2260	86.3477	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	171.2287	173.0056	168.5280	158.9959	146.9633	135.6544	128.0993	126.3225	130.8000	140.3321	152.3647	163.6737	(68)
Pumps, fans	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117	32.8117	(69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Water heating gains (Table 5)	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	-78.4938	(71)
Total internal gains	99.6063	97.4785	93.3792	84.3941	78.8907	72.9060	69.1077	72.5236	75.9460	82.3291	90.9423	98.4575	(72)
	412.6180	421.5185	403.6902	388.0512	367.6369	350.2215	335.9899	337.6290	348.4071	364.4441	387.9682	403.9140	(73)

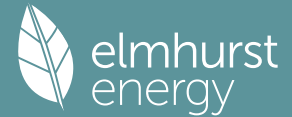
6. Solar gains

[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							
Northeast		9.2700	11.2829	0.6300	0.7000	0.7700	31.9649 (75)						
Northwest		0.7700	11.2829	0.6300	0.7000	0.7700	2.6551 (81)						
South		2.9000	26.0000	0.6300	0.7000	1.0000	29.9263 (82)						
Solar gains	64.5463	132.6247	237.4617	381.1641	501.2758	529.0122	497.0717	403.5538	287.0747	162.0868	81.5443	52.4437	(83)
Total gains	477.1643	554.1432	641.1519	769.2153	868.9127	879.2337	833.0616	741.1827	635.4819	526.5309	469.5125	456.3577	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)
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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	21.7392	21.7788	21.8178	22.0029	22.0379	22.2022	22.2022	22.2329	22.1386	22.0379	21.9672	21.8939
alpha	2.4493	2.4519	2.4545	2.4669	2.4692	2.4801	2.4801	2.4822	2.4759	2.4692	2.4645	2.4596
util living area	0.9408	0.9154	0.8678	0.7672	0.6290	0.4791	0.3677	0.4212	0.6332	0.8337	0.9179	0.9463 (86)
MIT	18.3109	18.6581	19.2239	19.9544	20.5073	20.8216	20.9328	20.9046	20.6312	19.8788	18.9774	18.2511 (87)
Th 2	19.8583	19.8601	19.8619	19.8704	19.8719	19.8793	19.8793	19.8807	19.8765	19.8719	19.8687	19.8654 (88)
util rest of house	0.9321	0.9032	0.8486	0.7346	0.5791	0.4102	0.2822	0.3311	0.5646	0.8017	0.9039	0.9383 (89)
MIT 2	16.7556	17.1910	17.8945	18.7813	19.4140	19.7466	19.8441	19.8271	19.5736	18.7200	17.6056	16.6844 (90)
Living area fraction										FLA = Living area / (4) =		
MIT	17.3678	17.7685	18.4178	19.2431	19.8443	20.1698	20.2726	20.2512	19.9899	19.1761	18.1456	17.3011 (92)
Temperature adjustment												0.0000
adjusted MIT	17.3678	17.7685	18.4178	19.2431	19.8443	20.1698	20.2726	20.2512	19.9899	19.1761	18.1456	17.3011 (93)

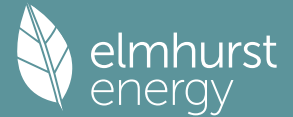
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9058	0.8738	0.8187	0.7140	0.5778	0.4288	0.3131	0.3621	0.5721	0.7780	0.8757	0.9132 (94)
Useful gains	432.2078	484.1972	524.9320	549.2384	502.0858	377.0466	260.8507	268.3880	363.5817	409.6367	411.1754	416.7469 (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	990.5061	973.6249	900.0828	774.5828	608.9531	413.3710	272.5729	285.4321	438.3881	641.2407	828.5390	986.0140 (97)
Space heating kWh	415.3739	328.8954	279.1122	162.2480	79.5092	0.0000	0.0000	0.0000	0.0000	172.3134	300.5018	423.5347 (98a)
Space heating requirement - total per year (kWh/year)												2161.4885
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	415.3739	328.8954	279.1122	162.2480	79.5092	0.0000	0.0000	0.0000	0.0000	172.3134	300.5018	423.5347 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2161.4885
Space heating per m2												(98c) / (4) = 36.4378 (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 %)												92.4000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	415.3739	328.8954	279.1122	162.2480	79.5092	0.0000	0.0000	0.0000	0.0000	172.3134	300.5018	423.5347 (98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000 (210)
Space heating fuel (main heating system)	449.5388	355.9474	302.0695	175.5930	86.0489	0.0000	0.0000	0.0000	0.0000	186.4863	325.2184	458.3709 (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	209.4088	185.3345	197.4049	174.9591	170.5064	153.9720	151.9428	159.0040	160.1675	177.3841	187.0966	207.3218 (64)
Efficiency of water heater (217)m	85.8194	85.5960	85.1233	84.2201	82.8488	80.3000	80.3000	80.3000	80.3000	84.3193	85.3909	80.3000 (216)
Fuel for water heating, kWh/month	244.0110	216.5222	231.9046	207.7403	205.8044	191.7459	189.2189	198.0125	199.4613	210.3719	219.1061	241.4159 (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	17.9414	14.3932	12.9595	9.4947	7.3340	5.9919	6.6903	8.6963	11.2956	14.8205	16.7397	18.4400 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.9848	-23.7324	-35.9089	-42.5792	-47.8686	-45.4124	-44.8714	-41.3929	-35.5945	-28.1065	-17.9976	-13.6846 (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	-5.7292	-12.3200	-24.9889	-38.2744	-51.3344	-51.8328	-51.2105	-43.0163	-31.0898	-17.8468	-7.7229	-4.5100 (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												2339.2733 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												80.3000
Water heating fuel used												2555.3152 (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)												144.7970 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-733.0099 (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)

Full SAP Calculation Printout



Total delivered energy for all uses

4392.3755 (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	2339.2733	0.2100	491.2474 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2555.3152	0.2100	536.6162 (264)
Space and water heating			1027.8636 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	144.7970	0.1443	20.8987 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-393.1338	0.1335	-52.4837
PV Unit electricity exported	-339.8761	0.1253	-42.5974
Total			-95.0812 (269)
Total CO2, kg/year			965.6104 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			16.2800 (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	2339.2733	1.1300	2643.3788 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2555.3152	1.1300	2887.5061 (278)
Space and water heating			5530.8849 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	144.7970	1.5338	222.0945 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-393.1338	1.4933	-587.0804
PV Unit electricity exported	-339.8761	0.4600	-156.3530
Total			-743.4334 (283)
Total Primary energy kWh/year			5139.6468 (286)
Target Primary Energy Rate (TPER)			86.6400 (287)