

Energy Statement

Land adjacent to No. 63 Netherhall Gardens

Job number: S12134

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BASE ENERGY LIVERPOOL
Head Office

T: +44 (0)151 933 0328

E: north@baseenergy.co.uk

BASE ENERGY LONDON
London Office

T: +44 (0)203 286 2016

E: south@baseenergy.co.uk

BASE ENERGY SHEFFIELD
Sheffield Office

T: +44 (0)114 303 4986

E: north@baseenergy.co.uk

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Contents

1	Executive Summary	3
2	Existing and Proposed Development	5
3	Planning Policy	6
4	Methodology	7
5	Baseline Energy & CO2	8
6	Low Carbon Design – Fabric First – Be Lean	9
7	Low Carbon Technology Review & Recommendations	11
8	Low Carbon Technology – Renewable Energy Generation - Be Green	16
9	SAP 10 and Current Part L 2021 Building Regulations Compliance	17
10	Conclusion.....	18
11	Appendix 1 Be Lean DER/TER SAP Worksheets	19
12	Appendix 2 Be Green (no PV) DER/TER SAP Worksheets	20
13	Appendix 3 Be Green DER/TER SAP Worksheets.....	21

1 Executive Summary

This report has been produced by Base Energy on behalf of Newview Properties Limited and in support of the planning application for the development named as Land adjacent to No.63 Netherhall Gardens. The development is comprising the demolition of a garage and the construction of a new build two storey dwelling plus heated basement falling under the requirements of Camden council.

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

- National Planning Policy
- The London Plan
- The Camden Council Local Plan Policy CC1 Climate Change Mitigation.

The above policies require:

- A 35 per cent reduction in CO₂ over Part L 2021
- A 20 per cent reduction in CO₂ emissions from onsite renewable technology alone

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

- Thermal specification meeting and exceeding Part L 2021 notional U-values
- A design which limits air permeability, targeting 4
- A design which limits thermal bridging
- Energy saving building services including low energy lighting, heating controls, heat recovery ventilation
- Underfloor heating and large radiators with have a flow temperature of 35°C and time temperature and zone control
- Low carbon Internal Air Source Heat Pumps and Solar PV Panels

This results in a 89% CO2 reduction over Part L 2021 with a 65% CO2 reduction from onsite renewable technology alone.

2 Existing and Proposed Development

The development site is located on Land adjacent to No.63 Netherhall Gardens in London.

The development proposals are for the demolition of a garage and the construction of a new build two storey dwelling plus heated basement

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 2023

The NPPF was updated in December 2023 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 Camden Council Local Planning Policy requirements are as follows.

The development should target:

- Policy CC1 Climate Change Mitigation
- A 35 per cent reduction in CO2 over Part L 2021
- A 20 per cent reduction in CO2 emissions from onsite renewable technology alone
- Comply with current Part L 2021 Building Regulations

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	12.03	134	1,617

The **Total Baseline CO2 Emissions** for the development are shown to be 1,617 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	Part L 2021 Notional Targets	Proposed Development
Walls	0.26	0.18	0.18
Ground Floor	0.18	0.13	0.11
Roof	0.16	0.11	0.11
Windows	1.60	1.20	1.2 G-value 0.45
Roof light	2.20	1.70	1.40
Doors	1.60	1.00	1.00
Air permeability	8.00	5.00	4.00

- Insulation: The specified building envelope is designed to meet and exceed the notional Part L targets and will help to limit the energy demand of the dwelling for space heating
- Thermal bridging: The design will seek to limit heat loss through thermal bridging targeting a global 'y-value' of 0.04

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 90 lumens per watt
- Space & Water Heating: Internal Air Source Heat Pump with underfloor heating and large radiators
- Heating Controls: Comprising time & temperature zone control
- Ventilation: Natural ventilation with localised extract fans / Mechanical ventilation with heat recovery combined within the ASHP

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	12.03	134	1,617	N/A
Be Lean	11.83	134	1,586	2%

The **CO2 Emissions reduction** as a result of energy efficient fabric and services is shown to be 31 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. Due to the development being in a conservation area an internal exhaust air source heat pump is recommended

BIOMASS

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

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

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

COMBINED HEAT AND POWER (CHP)

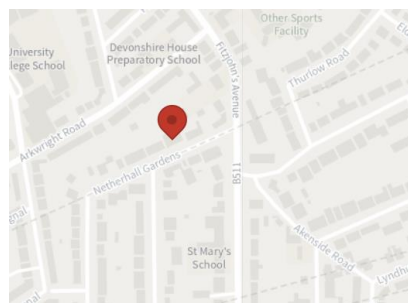
CHP is effectively an on-site small power plant providing both electrical power and thermal heat energy. It is an energy efficiency and low carbon measure rather than a renewable energy technology. A CHP system operates by burning a primary fuel (normally natural gas) by use of either a reciprocating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

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

CHP **is not recommended** for this development

DISTRICT HEATING

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



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

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

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

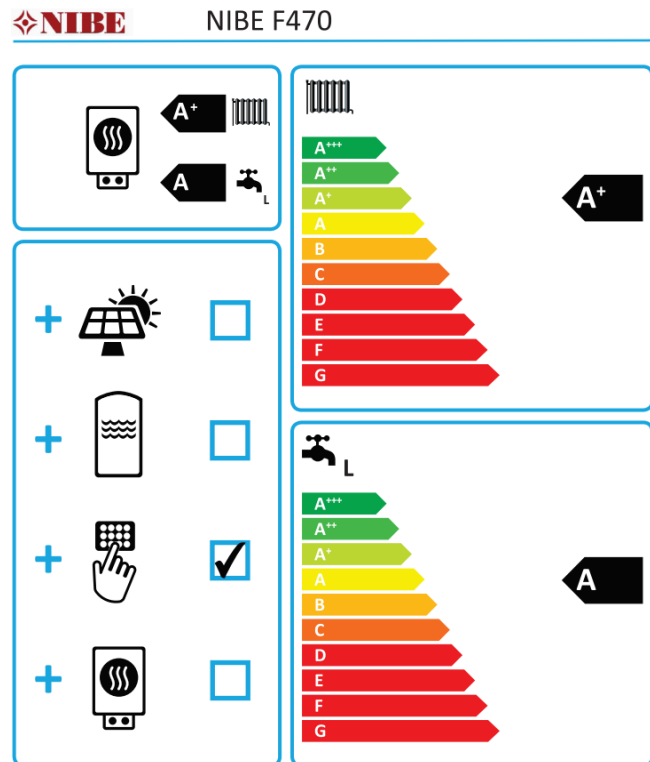
Low Carbon Technology Summary

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

- **Internal Air Source Heat Pump with a winter efficiency 332% and summer efficiency 221%, such as an A+ (see image 7.1) rated Nibe 470. Due to the development being in a conservation area and having other dwellings in close proximity an internal exhaust air source heat pump is recommended. The council have requested a performance of 4.0 COP, however due to the availability of internal ASHP models being limited, this also limits the coefficient of performance the air source heat pump can achieve.**
- **Solar PV to be displayed close to 30 degrees with modest shading. Totalling 1.6kWp southwest and 3.2kWp northeast facing with an export cable.**

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.

Image 7.1



8 Low Carbon Technology – Renewable Energy Generation - Be Green

The internal ASHP and solar PV 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	12.03	134	1,617	N/A
Lean & Green Design	1.3	134	175	87%

The **CO2 Emissions reduction** as a result of energy efficient fabric and services is shown to be 1,375 kg/year.

The table below shows the CO2 reduction through the incorporation of the onsite renewable technology in the form of 1.6kWp worth of solar PV.

Table 8.2: Be Green vs Be Green with solar PV added CO2 reduction

	CO2 Emission Rate (kg CO2/m2/year)	Floor Area (m2)	Total Baseline Emissions (kg CO2/year)	Reduction in CO2
Be Green Design without solar PV	3.76	134	505	N/A
Be Green Design with solar PV	1.3	134	175	65%

The **CO2 Emissions reduction** as a result of on-site renewable technology is shown to be 330 kg/year.

9 SAP 10 and Current Part L 2021 Building Regulations Compliance

To show compliance with current building regulations the Be Green development has been assessed using SAP 10 software. As the final construction has not been finalised the thermal bridging Y-value 0.040 has been used within the calculations. Due to this, when a full SAP assessment and the thermal junctions are assessed, results may vary.

The below table show the developments block compliance results.

Table 9.1 SAP 10 Developments Compliance - DER/TER Variance

	SAP 10 Calculation
Dwelling Emission Rate (DER) (kg CO ₂ /m ² /year)	1.30
Target Emission Rate (TER) (kg CO ₂ /m ² /year)	11.61
DER/TER Variance	-89%

Table 9.2 SAP 10 Developments Compliance – DFEE/TFEE variance

	SAP 10 Calculation
Dwelling Fabric Energy Efficiency (DFEE) (kW/m ² /yr)	42.48
Target Fabric Energy Efficiency (TFEE) (kW/m ² /yr)	46.38
DFEE/TFEE Variance	-8.4%

Table 9.3 SAP 10 Developments Compliance – DPER/TPER Variance

	SAP 10 Calculation
Dwelling Primary Energy Rate (DPER) (kW/m ² /yr)	21.4
Target Primary Energy Rate (DPER) (kW/m ² /yr)	60.88
DPER/TFER Variance	-65%

10 Conclusion

Proposals are for the development named as No.63 Netherhall Gardens. The development is comprising the demolition of a garage and the construction of a new build two storey dwelling plus heated basement falling under the requirements of Camden council.

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

- A 35 per cent reduction in CO2 over Part L 2021
- A 20 per cent reduction in CO2 emissions from onsite renewable technology alone

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.

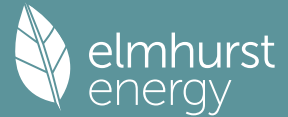
Low carbon technology will be incorporated and is to comprise Solar PV totalling 4.8kWp and an internal Exhausts Air Source Heat Pump with no outside condensing unit.

This results in an 89% CO2 reduction over Part L 2021 with a 65% CO2 reduction from onsite renewable technology alone.

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

11 Appendix 1 Be Lean DER/TER SAP Worksheets

Full SAP Calculation Printout



Property Reference	S12134 01				Issued on Date	06/06/2024	
Assessment Reference	Be Lean New			Prop Type Ref			
Property	63, Netherhall Gardens, London, NW3 5RE						
SAP Rating	83 B	DER	13.96	TER	11.88		
Environmental	86 B	% DER < TER				-17.51	
CO ₂ Emissions (t/year)	1.66	DFEE	42.48	TFEE	46.38		
Compliance Check	See BREL	% DFEE < TFEE				8.40	
% DPER < TPER	-27.86	DPER	79.71	TPER	62.34		
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)	
Basement floor	45.5500 (1a)	x	2.5000 (2a)	=	113.8750 (1a)	- (3a)
Ground floor	44.4300 (1b)	x	2.7500 (2b)	=	122.1825 (1b)	- (3b)
First floor	44.4300 (1c)	x	2.9800 (2c)	=	132.4014 (1c)	- (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.4100					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	368.4589	(5)

2. Ventilation rate

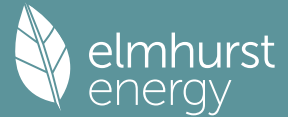
	m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (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) =	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	4.0000	(17)
Infiltration rate	0.2000	(18)
Number of sides sheltered	1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1850 (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	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174	(22b)
Mechanical extract ventilation - centralised													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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	
Opening Type 1 (Uw = 1.20)			19.8700	1.1450	22.7519			(27)
Door			2.7600	1.0000	2.7600			(26)
W10			1.0000	1.3258	1.3258			(27a)
RL11			3.7200	1.3258	4.9318			(27a)
RL12			1.1800	1.3258	1.5644			(27a)
W13			1.1800	1.3258	1.5644			(27a)
Heat Loss Floor 1			45.5500	0.1100	5.0105			(28a)
External Wall 1	141.1700	7.8000	133.3700	0.1800	24.0066			(29a)
Basement wall	68.7900	14.8300	53.9600	0.1800	9.7128			(29a)
Pitched roof	51.7700	6.0800	45.6900	0.1100	5.0259			(30)
Flat roof (glazing)	1.1300	1.0000	0.1300	0.1100	0.0143			(30)
Total net area of external elements Aum(A, m ²)			308.4100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.6684			(33)

Full SAP Calculation Printout



Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 200.0000 (35)
Thermal bridges (User defined value 0.040 * total exposed area) 12.3364 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 91.0048 (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	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957
Average = Sum(39)m / 12 =	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9056 (42)											
Hot water usage for mixer showers	117.1474	115.3869	112.8215	107.9131	104.2908	100.2512	97.9552	100.5011	103.2920	107.6292	112.6431	116.6985
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hot water usage for other uses	44.3861	42.7721	41.1580	39.5440	37.9300	36.3159	36.3159	37.9300	39.5440	41.1580	42.7721	44.3861
Average daily hot water use (litres/day)	38.3744	33.7824	35.4991	30.2792	28.7185	25.1888	24.3584	25.7110	26.4197	30.2854	33.2126	37.8329
Daily hot water use	161.5335	158.1590	153.9795	147.4571	142.2207	136.5672	134.2711	138.4311	142.8360	148.7873	155.4152	161.0846
Energy conte	255.8296	225.2162	236.6608	201.8614	191.4565	167.9253	162.3893	171.4066	176.1311	201.9029	221.4174	252.2196
Energy content (annual)	Total = Sum(45)m =											2464.4166
Distribution loss (46)m = 0.15 x (45)m	38.3744	33.7824	35.4991	30.2792	28.7185	25.1888	24.3584	25.7110	26.4197	30.2854	33.2126	37.8329
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
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
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
Combi loss	19.7718	17.7993	19.5782	18.6723	19.1217	18.3295	18.8281	18.9192	18.4124	19.2272	18.8698	19.7354
Total heat required for water heating calculated for each month	275.6014	243.0155	256.2390	220.5337	210.5781	186.2548	181.2173	190.3258	194.5435	221.1301	240.2872	271.9550
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
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
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
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
Output from w/h	275.6014	243.0155	256.2390	220.5337	210.5781	186.2548	181.2173	190.3258	194.5435	221.1301	240.2872	271.9550
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											2691.6815
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
Heat gains from water heating, kWh/month	90.0063	79.3342	83.5843	71.7870	68.4397	60.4175	58.7014	61.7225	63.1667	71.9395	78.3387	88.7969

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	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	153.1643	169.5748	153.1643	158.2698	153.1643	158.2698	153.1643	153.1643	158.2698	153.1643	158.2698	153.1643
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	302.9610	306.1047	298.1825	281.3170	260.0273	240.0180	226.6506	223.5068	231.4290	248.2945	269.5842	289.5935
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279
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
Losses e.g. evaporation (negative values) (Table 5)	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235
Water heating gains (Table 5)	120.9762	118.0569	112.3444	99.7041	91.9888	83.9132	78.8998	82.9603	87.7315	96.6929	108.8038	119.3506
Total internal gains	646.6853	663.3202	633.2751	608.8747	574.7643	548.7849	525.2985	526.2152	544.0141	567.7356	606.2416	631.6923

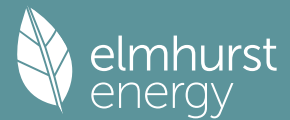
6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m ²	Table 6a	Specific data	Specific data	factor	W
		W/m ²	or Table 6b	or Table 6c	Table 6d	
North	10.1600	10.6334	0.4500	0.0000	0.7700	37.4342
Southeast	2.4400	36.7938	0.4500	0.0000	0.7700	31.1077
South	3.5100	46.7521	0.4500	0.0000	0.7700	56.8606
Northwest	3.7600	11.2829	0.4500	0.0000	0.7700	14.6999
Northeast	3.7200	18.0708	0.6300	0.7000	1.0000	26.6810
Southwest	2.3600	37.0308	0.6300	0.7000	1.0000	34.6862
Horizontal	1.0000	26.0000	0.6300	0.7000	1.0000	10.3194
Solar gains	211.7890	390.8888	614.3439	893.6144	1121.1582	1165.7714
Total gains	858.4742	1054.2090	1247.6189	1502.4892	1695.9225	1714.5562

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	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	
alpha	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	
util living area	0.9936	0.9842	0.9598	0.8822	0.7298	0.5439	0.4050	0.4702	0.7315	0.9392	0.9869	0.9950	(86)
MIT	19.7273	19.9241	20.2115	20.5628	20.8036	20.9000	20.9215	20.9162	20.8348	20.4856	20.0314	19.6825	(87)
Th 2	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	(88)
util rest of house	0.9918	0.9801	0.9493	0.8532	0.6739	0.4654	0.3135	0.3708	0.6542	0.9175	0.9827	0.9936	(89)
MIT 2	18.4846	18.7345	19.0953	19.5183	19.7803	19.8676	19.8819	19.8796	19.8184	19.4387	18.8730	18.4275	(90)
Living area fraction									FLA = Living area /	(4) =		0.2912	(91)
MIT	18.8465	19.0809	19.4204	19.8225	20.0783	20.1682	20.1847	20.1814	20.1144	19.7436	19.2103	18.7929	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.6965	18.9309	19.2704	19.6725	19.9283	20.0182	20.0347	20.0314	19.9644	19.5936	19.0603	18.6429	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9888	0.9745	0.9401	0.8432	0.6711	0.4687	0.3187	0.3763	0.6531	0.9072	0.9776	0.9911	(94)
Useful gains	848.8451	1027.2988	1172.8714	1266.9569	1138.0645	803.6377	518.6587	545.7800	818.9154	926.4871	846.0204	802.1575	(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	2185.3965	2129.9026	1938.5475	1635.2713	1249.0570	822.4838	521.3822	551.2537	890.2158	1365.2297	1815.5820	2192.4425	(97)
Space heating kWh	994.3943	740.9497	569.6630	265.1864	82.5785	0.0000	0.0000	0.0000	0.0000	326.4245	698.0843	1034.3720	(98a)
Space heating requirement - total per year (kWh/year)												4711.6527	
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	994.3943	740.9497	569.6630	265.1864	82.5785	0.0000	0.0000	0.0000	0.0000	326.4245	698.0843	1034.3720	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4711.6527	
Space heating per m2										(98c) / (4) =		35.0543	(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 %)													88.5000	(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	994.3943	740.9497	569.6630	265.1864	82.5785	0.0000	0.0000	0.0000	0.0000	326.4245	698.0843	1034.3720	(98)	
Space heating efficiency (main heating system 1)	88.5000	88.5000	88.5000	88.5000	88.5000	0.0000	0.0000	0.0000	0.0000	88.5000	88.5000	88.5000	(210)	
Space heating fuel (main heating system)	1123.6094	837.2313	643.6870	299.6456	93.3090	0.0000	0.0000	0.0000	0.0000	368.8412	788.7959	1168.7820	(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	275.6014	243.0155	256.2390	220.5337	210.5781	186.2548	181.2173	190.3258	194.5435	221.1301	240.2872	271.9550	(64)	
Efficiency of water heater (217)m	88.1701	88.1247	88.0291	87.8126	87.4174	87.0000	87.0000	87.0000	87.0000	87.8880	88.1110	88.1835	(216)	
Fuel for water heating, kWh/month	312.5792	275.7631	291.0844	251.1413	240.8882	214.0860	208.2958	218.7653	223.6132	251.6043	272.7097	308.3968	(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	47.5060	42.9086	47.5060	45.9735	47.5060	45.9735	47.5060	47.5060	45.9735	47.5060	45.9735	47.5060	(231)	
Lighting	30.9564	24.8344	22.3606	16.3824	12.6542	10.3386	11.5436	15.0048	19.4897	25.5716	28.8830	31.8168	(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												5323.9013	(211)	
Space heating fuel - main system 2												0.0000	(213)	
Space heating fuel - secondary												0.0000	(215)	
Efficiency of water heater												87.0000		
Water heating fuel used												3068.9272	(219)	
Space cooling fuel												0.0000	(221)	
Electricity for pumps and fans:														
(MEV)Centralised, Database: in-use factor = 1.3000, SFP = 1.0530)														
mechanical ventilation fans (SFP = 1.0530)												473.3444	(230a)	
central heating pump												41.0000	(230c)	
main heating flue fan												45.0000	(230e)	
Total electricity for the above, kWh/year												559.3444	(231)	
Electricity for lighting (calculated in Appendix L)												249.8361	(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)	

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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	9202.0091 (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	5323.9013	0.2100	1118.0193 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3068.9272	0.2100	644.4747 (264)
Space and water heating			1762.4940 (265)
Pumps, fans and electric keep-hot	559.3444	0.1387	77.5880 (267)
Energy for lighting	249.8361	0.1443	36.0591 (268)
Total CO2, kg/year			1876.1410 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			13.9600 (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	5323.9013	1.1300	6016.0085 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3068.9272	1.1300	3467.8878 (278)
Space and water heating			9483.8963 (279)
Pumps, fans and electric keep-hot	559.3444	1.5128	846.1762 (281)
Energy for lighting	249.8361	1.5338	383.2070 (282)
Total Primary energy kWh/year			10713.2795 (286)
Dwelling Primary energy Rate (DPER)			79.7100 (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)
Basement floor	45.5500 (1a)	x 2.5000 (2a)	= 113.8750 (1a) - (3a)
Ground floor	44.4300 (1b)	x 2.7500 (2b)	= 122.1825 (1b) - (3b)
First floor	44.4300 (1c)	x 2.9800 (2c)	= 132.4014 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	368.4589 (5)

2. Ventilation rate

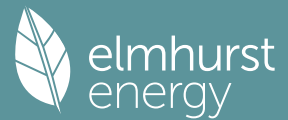
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (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) =	40.0000 / (5) = 0.1086 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3586 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3317 (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	0.4229	0.4146	0.4063	0.3648	0.3565	0.3151	0.3151	0.3068	0.3317	0.3565	0.3731	0.3897 (22b)
Effective ac	0.5894	0.5859	0.5825	0.5666	0.5636	0.5496	0.5496	0.5471	0.5550	0.5636	0.5696	0.5759 (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			2.7600	1.0000	2.7600		(26)
TER Opening Type (Uw = 1.20)			19.8700	1.1450	22.7519		(27)
W10			1.0000	1.5918	1.5918		(27a)
RL11			3.7200	1.5918	5.9213		(27a)

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R112				1.1800	1.5918	1.8783	(27a)
W13				1.1800	1.5918	1.8783	(27a)
Heat Loss Floor 1				45.5500	0.1300	5.9215	(28a)
External Wall 1	141.1700	7.8000	133.3700	0.1800	24.0066		(29a)
Basement wall	68.7900	14.8300	53.9600	0.1800	9.7128		(29a)
Pitched roof	51.7700	6.0800	45.6900	0.1100	5.0259		(30)
Flat roof (glazing)	1.1300	1.0000	0.1300	0.1100	0.0143		(30)
Total net area of external elements Aum(A, m2)			308.4100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	81.4627			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 200.0000 (35)

List of Thermal Bridges												
K1 Element												
E2 Other lintels (including other steel lintels)												
E3 Sill												
E4 Jamb												
E5 Ground floor (normal)												
E6 Intermediate floor within a dwelling												
E16 Corner (normal)												
R1 Head of roof window												
R2 Sill of roof window												
R3 Jamb of roof window												
E14 Flat roof												

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 15.6868 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 97.1495 (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	71.6675	71.2453	70.8315	68.8879	68.5243	66.8314	66.8314	66.5179	67.4835	68.5243	69.2599	70.0290
Average = Sum(39)m / 12 =	168.8170	168.3948	167.9810	166.0374	165.6737	163.9809	163.9809	163.6674	164.6330	165.6737	166.4094	167.1785

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2560	1.2528	1.2498	1.2353	1.2326	1.2200	1.2200	1.2177	1.2249	1.2326	1.2381	1.2438
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

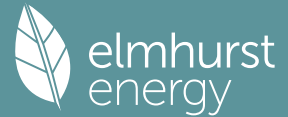
Assumed occupancy													2.9056 (42)
Hot water usage for mixer showers													
Hot water usage for baths													
Hot water usage for other uses													
Average daily hot water use (litres/day)													
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	138.1040	135.0816	131.4152	125.8745	121.3626	116.5169	114.6801	118.3309	122.1776	127.2614	132.8866	137.7449	(44)
Energy content (annual)	218.7230	192.3544	201.9803	172.3158	163.3774	143.2711	138.6956	146.5183	150.6572	172.6926	189.3213	215.6753	(45)
Distribution loss (46)m = 0.15 x (45)m													
Water storage loss:													
Total storage loss													
If cylinder contains dedicated solar storage													
Primary loss													
Combi loss													
Total heat required for water heating calculated for each month													
WWHRS	269.6819	238.3818	252.9392	221.6309	214.3363	192.5862	189.6545	197.4773	199.9723	223.6515	238.6363	266.6342	(62)
PV diverter	-42.8439	-37.8915	-39.6778	-32.8548	-30.6195	-26.2013	-24.5595	-26.1166	-27.1089	-31.9584	-36.2050	-42.0505	(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													
12Total per year (kWh/year)	226.8380	200.4903	213.2614	188.7761	183.7168	166.3849	165.0950	171.3606	172.8634	191.6931	202.4314	224.5837	(64)
Electric shower(s)													
Heat gains from water heating, kWh/month													

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	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	153.1643	169.5748	153.1643	158.2698	153.1643	158.2698	153.1643	153.1643	158.2698	153.1643	158.2698	153.1643	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	302.9610	306.1047	298.1825	281.3170	260.0273	240.0180	226.6506	223.5068	231.4290	248.2945	269.5842	289.5935	(68)
Pumps, fans	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	(69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	(71)
Total internal gains	114.8725	112.2986	107.3900	96.6997	90.1380	83.2867	79.1075	82.6036	86.6976	94.3011	104.5529	113.5104	(72)
	640.5816	657.5619	628.3206	605.8703	572.9135	548.1583	525.5062	525.8585	542.9802	565.3437	601.9907	625.8521	(73)

6. Solar gains

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[Jan]	Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W	
North	10.1600		10.6334		0.6300		0.7000		0.7700		33.0170 (74)	
Southeast	2.4400		36.7938		0.6300		0.7000		0.7700		27.4370 (77)	
South	3.5100		46.7521		0.6300		0.7000		0.7700		50.1510 (78)	
Northwest	3.7600		11.2829		0.6300		0.7000		0.7700		12.9653 (81)	
Northeast	3.7200		18.0708		0.6300		0.7000		1.0000		26.6810 (82)	
Southwest	2.3600		37.0308		0.6300		0.7000		1.0000		34.6862 (82)	
Horizontal	1.0000		26.0000		0.6300		0.7000		1.0000		10.3194 (82)	

Solar gains	195.2569	361.6753	571.0857	833.7064	1047.7188	1089.9208	1030.1081	863.0475	660.9765	420.3790	239.1933	163.6431 (83)
Total gains	835.8384	1019.2373	1199.4064	1439.5767	1620.6322	1638.0791	1555.6143	1388.9060	1203.9568	985.7228	841.1840	789.4951 (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	44.2326	44.3435	44.4528	44.9731	45.0719	45.5371	45.5371	45.6244	45.3568	45.0719	44.8726	44.6662
alpha	3.9488	3.9562	3.9635	3.9982	4.0048	4.0358	4.0358	4.0416	4.0238	4.0048	3.9915	3.9777
util living area	0.9942	0.9869	0.9684	0.9078	0.7795	0.5980	0.4524	0.5202	0.7770	0.9513	0.9887	0.9954 (86)
MIT	19.1587	19.4197	19.8185	20.3469	20.7417	20.9347	20.9834	20.9716	20.8131	20.2692	19.6229	19.1219 (87)
Th 2	19.8755	19.8780	19.8804	19.8919	19.8940	19.9040	19.9040	19.9059	19.9002	19.8940	19.8897	19.8851 (88)
util rest of house	0.9926	0.9833	0.9595	0.8822	0.7239	0.5108	0.3451	0.4062	0.6993	0.9324	0.9850	0.9941 (89)
MIT 2	17.7368	18.0705	18.5753	19.2294	19.6738	19.8644	19.8980	19.8944	19.7650	19.1528	18.3392	17.6960 (90)
Living area fraction									fLA =	Living area /	(4) =	0.2912 (91)
MIT	18.1508	18.4634	18.9373	19.5548	19.9848	20.1761	20.2141	20.2081	20.0702	19.4779	18.7130	18.1113 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1508	18.4634	18.9373	19.5548	19.9848	20.1761	20.2141	20.2081	20.0702	19.4779	18.7130	18.1113 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9889	0.9768	0.9496	0.8730	0.7289	0.5334	0.3761	0.4389	0.7127	0.9232	0.9793	0.9910 (94)
Useful gains	826.5385	995.6175	1138.9349	1256.6837	1181.2602	873.8118	585.1153	609.5457	858.0594	910.0541	823.7357	782.3682 (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	2338.2552	2284.0010	2089.2319	1769.0954	1372.5695	914.3742	592.6389	623.2622	982.8905	1470.8334	1932.5162	2325.6634 (97)
Space heating kWh	1124.7172	865.7937	707.0210	368.9364	142.3342	0.0000	0.0000	0.0000	0.0000	417.2198	798.3220	1148.2116 (98a)
Space heating requirement - total per year (kWh/year)												5572.5559
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	1124.7172	865.7937	707.0210	368.9364	142.3342	0.0000	0.0000	0.0000	0.0000	417.2198	798.3220	1148.2116 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5572.5559
Space heating per m2										(98c) / (4) =		41.4594 (99)

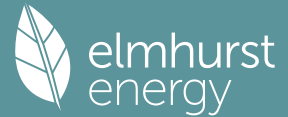
9a. Energy requirements - Individual heating systems, including micro-CHP

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	1124.7172	865.7937	707.0210	368.9364	142.3342	0.0000	0.0000	0.0000	0.0000	417.2198	798.3220	1148.2116	(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)	1217.2264	937.0062	765.1742	399.2819	154.0413	0.0000	0.0000	0.0000	0.0000	451.5366	863.9848	1242.6533	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	226.8380	200.4903	213.2614	188.7761	183.7168	166.3849	165.0950	171.3606	172.8634	191.6931	202.4314	224.5837	(64)
Efficiency of water heater	87.3303	87.1451	86.7471	85.7900	83.8406	80.3000	80.3000	80.3000	80.3000	86.0004	87.0149	80.3000	(216)
Fuel for water heating, kWh/month	259.7473	230.0648	245.8428	220.0444	219.1263	207.2041	205.5977	213.4005	215.2720	222.8979	232.6398	257.0513	(217)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	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	31.8245	25.5308	22.9877	16.8417	13.0090	10.6285	11.8673	15.4256	20.0363	26.2887	29.6930	32.7090	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-44.0699	-62.8997	-91.4990	-104.1143	-113.2528	-105.9806	-104.5869	-98.2037	-87.1761	-72.3942	-48.6892	-38.0045	(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)	-22.6242	-47.8344	-95.5471	-144.2257	-191.4468	-192.7059	-190.5264	-161.0569	-117.6434	-68.7505	-30.3107	-17.8799	(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)

13a. Primary energy - Individual heating systems including micro-CHP			
	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year
Space heating - main system 1	6030.9047	1.1300	6814.9223 (275)
Total CO ₂ associated with community systems			0.0000 (473)
Water heating (other fuel)	2728.8889	1.1300	3083.6445 (278)
Space and water heating			9898.5668 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	256.8421	1.5338	393.9529 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-970.8709	1.4965	-1452.9349
PV Unit electricity exported	-1280.5520	0.4615	-591.0197
Total			-2043.9545 (283)
Total Primary energy kWh/year			8378.6660 (286)
Target Primary Energy Rate (TPER)			62.3400 (287)

12 Appendix 2 Be Green (no PV) DER/TER SAP Worksheets

Full SAP Calculation Printout



Property Reference	S12134 01				Issued on Date	06/06/2024		
Assessment Reference	Be Green no PV New			Prop Type Ref				
Property	63, Netherhall Gardens, London, NW3 5RE							
SAP Rating	82 B		DER	3.76		TER	11.61	
Environmental	96 A		% DER < TER				67.61	
CO ₂ Emissions (t/year)	0.46		DFEE	42.48		TFEE	46.38	
Compliance Check	See BREL		% DFEE < TFEE				8.40	
% DPER < TPER	35.53		DPER	39.25		TPER	60.88	
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)	
Basement floor	45.5500 (1a)	x	2.5000 (2a)	=	113.8750 (1a)	- (3a)
Ground floor	44.4300 (1b)	x	2.7500 (2b)	=	122.1825 (1b)	- (3b)
First floor	44.4300 (1c)	x	2.9800 (2c)	=	132.4014 (1c)	- (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.4100					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	368.4589	(5)

2. Ventilation rate

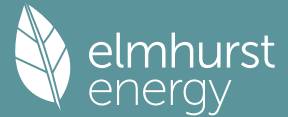
	m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (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) =	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	4.0000	(17)
Infiltration rate	0.2000	(18)
Number of sides sheltered	1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1850 (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	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174	(22b)
Mechanical extract ventilation - centralised													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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	
Opening Type 1 (Uw = 1.20)			19.8700	1.1450	22.7519			(27)
Door			2.7600	1.0000	2.7600			(26)
W10			1.0000	1.3258	1.3258			(27a)
RL11			3.7200	1.3258	4.9318			(27a)
RL12			1.1800	1.3258	1.5644			(27a)
W13			1.1800	1.3258	1.5644			(27a)
Heat Loss Floor 1			45.5500	0.1100	5.0105			(28a)
External Wall 1	141.1700	7.8000	133.3700	0.1800	24.0066			(29a)
Basement wall	68.7900	14.8300	53.9600	0.1800	9.7128			(29a)
Pitched roof	51.7700	6.0800	45.6900	0.1100	5.0259			(30)
Flat roof (glazing)	1.1300	1.0000	0.1300	0.1100	0.0143			(30)
Total net area of external elements Aum(A, m ²)			308.4100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.6684			(33)

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Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 200.0000 (35)
Thermal bridges (User defined value 0.040 * total exposed area) 12.3364 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 91.0048 (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	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957
Average = Sum(39)m / 12 =	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9056 (42)											
Hot water usage for mixer showers	117.1474	115.3869	112.8215	107.9131	104.2908	100.2512	97.9552	100.5011	103.2920	107.6292	112.6431	116.6985
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hot water usage for other uses	44.3861	42.7721	41.1580	39.5440	37.9300	36.3159	36.3159	37.9300	39.5440	41.1580	42.7721	44.3861
Average daily hot water use (litres/day)	38.3744	33.7824	35.4991	30.2792	28.7185	25.1888	24.3584	25.7110	26.4197	30.2854	33.2126	37.8329
Daily hot water use	161.5335	158.1590	153.9795	147.4571	142.2207	136.5672	134.2711	138.4311	142.8360	148.7873	155.4152	161.0846
Energy content (annual)	255.8296	225.2162	236.6608	201.8614	191.4565	167.9253	162.3893	171.4066	176.1311	201.9029	221.4174	252.2196
Distribution loss (46)m = 0.15 x (45)m	38.3744	33.7824	35.4991	30.2792	28.7185	25.1888	24.3584	25.7110	26.4197	30.2854	33.2126	37.8329
Water storage loss:	170.0000 (47)											
Store volume	1.5600 (48)											
a) If manufacturer declared loss factor is known (kWh/day):	0.5400 (49)											
Enter (49) or (54) in (55)	0.8424 (55)											
Total storage loss	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144
If cylinder contains dedicated solar storage	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144
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
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
Total heat required for water heating calculated for each month	281.9440	248.8034	262.7752	227.1334	217.5709	193.1973	188.5037	197.5210	201.4031	228.0173	246.6894	278.3340
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
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
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
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
Output from w/h	281.9440	248.8034	262.7752	227.1334	217.5709	193.1973	188.5037	197.5210	201.4031	228.0173	246.6894	278.3340
12Total per year (kWh/year)	2771.8926 (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
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000 (64a)											
Heat gains from water heating, kWh/month	85.0633	74.8844	78.6897	67.1189	63.6593	55.8352	53.9944	56.9927	58.5636	67.1327	73.6213	83.8630

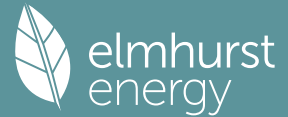
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	153.1643	169.5748	153.1643	158.2698	153.1643	158.2698	153.1643	153.1643	158.2698	153.1643	158.2698	153.1643
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	302.9610	306.1047	298.1825	281.3170	260.0273	240.0180	226.6506	223.5068	231.4290	248.2945	269.5842	289.5935
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Losses e.g. evaporation (negative values) (Table 5)	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235
Water heating gains (Table 5)	114.3324	111.4351	105.7657	93.2207	85.5635	77.5488	72.5732	76.6031	81.3383	90.2322	102.2518	112.7191
Total internal gains	637.0415	653.6984	623.6964	599.3913	565.3390	542.4204	518.9718	519.8580	537.6209	558.2748	596.6896	622.0608

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m ²	Table 6a	Specific data	Specific data	factor	W
		W/m ²	or Table 6b	or Table 6c	Table 6d	
North	10.1600	10.6334	0.4500	0.0000	0.7700	37.4342 (74)
Southeast	2.4400	36.7938	0.4500	0.0000	0.7700	31.1077 (77)
South	3.5100	46.7521	0.4500	0.0000	0.7700	56.8606 (78)
Northwest	3.7600	11.2829	0.4500	0.0000	0.7700	14.6999 (81)
Northeast	3.7200	18.0708	0.6300	0.7000	1.0000	26.6810 (82)
Southwest	2.3600	37.0308	0.6300	0.7000	1.0000	34.6862 (82)
Horizontal	1.0000	26.0000	0.6300	0.7000	1.0000	10.3194 (82)
Solar gains	211.7890	390.8888	614.3439	893.6144	1121.1582	1165.7714
Total gains	848.8305	1044.5872	1238.0402	1493.0057	1686.4972	1708.1918

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	21.0000 (85)
alpha	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	
util living area	0.9938	0.9848	0.9608	0.8841	0.7325	0.5456	0.4065	0.4721	0.7339	0.9409	0.9874	0.9952	(86)
Living	19.7206	19.9177	20.2059	20.5589	20.8018	20.8996	20.9214	20.9160	20.8336	20.4805	20.0250	19.6757	
Non living	18.4762	18.7265	19.0884	19.5140	19.7787	19.8673	19.8819	19.8795	19.8174	19.4328	18.8649	18.4189	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	31	28	31	30	31	30	31	31	30	31	30	31	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	(87)
Th 2	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	(88)
util rest of house	0.9922	0.9807	0.9505	0.8554	0.6767	0.4670	0.3147	0.3724	0.6567	0.9196	0.9834	0.9939	(89)
MIT 2	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	(90)
Living area fraction									FLA = Living area / (4) =				0.2912 (91)
MIT	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	(92)
Temperature adjustment													0.0000
adjusted MIT	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9927	0.9820	0.9538	0.8645	0.6938	0.4906	0.3418	0.4021	0.6808	0.9266	0.9847	0.9943	(94)
Useful gains	842.6291	1025.8203	1180.8386	1290.6532	1170.1062	838.0002	554.0184	580.6707	849.2930	937.5054	842.7622	795.1872	(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	2424.9872	2333.9069	2091.0261	1726.7050	1301.6636	861.4422	557.8412	588.2013	937.3424	1468.6441	1999.9458	2440.1673	(97)
Space heating kWh	1177.2744	879.0342	677.1796	313.9573	97.8787	0.0000	0.0000	0.0000	0.0000	395.1672	833.1722	1223.8652	(98a)
Space heating requirement - total per year (kWh/year)												5597.5288	
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	1177.2744	879.0342	677.1796	313.9573	97.8787	0.0000	0.0000	0.0000	0.0000	395.1672	833.1722	1223.8652	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5597.5288	
Space heating per m2										(98c) / (4) =		41.6452	(99)

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

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

Fraction of space heat from main system(s)

Efficiency of main space heating system 1 (in %)

Efficiency of main space heating system 2 (in %)

Efficiency of secondary/supplementary heating system, %

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1177.2744	879.0342	677.1796	313.9573	97.8787	0.0000	0.0000	0.0000	0.0000	395.1672	833.1722	1223.8652	(98)
Space heating efficiency (main heating system 1)	332.2552	332.2552	332.2552	332.2552	332.2552	0.0000	0.0000	0.0000	0.0000	332.2552	332.2552	332.2552	(210)
Space heating fuel (main heating system)	354.3283	264.5660	203.8131	94.4928	29.4589	0.0000	0.0000	0.0000	0.0000	118.9348	250.7627	368.3509	(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	281.9440	248.8034	262.7752	227.1334	217.5709	193.1973	188.5037	197.5210	201.4031	228.0173	246.6894	278.3340	(64)
Efficiency of water heater	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	(216)
Fuel for water heating, kWh/month	127.7586	112.7414	119.0725	102.9220	98.5889	87.5444	85.4175	89.5036	91.2627	103.3225	111.7835	126.1228	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	18.1146	16.3616	18.1146	17.5303	18.1146	17.5303	18.1146	18.1146	17.5303	18.1146	17.5303	18.1146	(231)
Lighting	30.9564	24.8344	22.3606	16.3824	12.6542	10.3386	11.5436	15.0048	19.4897	25.5716	28.8830	31.8168	(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												1684.7075	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												220.6850	
Water heating fuel used												1256.0403	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:

(MEVCentralised, Database: in-use factor = 1.3000, SFP = 1.0530)
mechanical ventilation fans (SFP = 1.0530)

213.2852 (230a)

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Total electricity for the above, kWh/year	213.2852	(231)
Electricity for lighting (calculated in Appendix L)	249.8361	(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	3403.8692	(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	1684.7075	0.1560	262.7520 (261)
Total CO2 associated with community systems			0.0000 (273)
Water heating (other fuel)	1256.0403	0.1413	177.4472 (264)
Space and water heating			440.1993 (265)
Pumps, fans and electric keep-hot	213.2852	0.1387	29.5853 (267)
Energy for lighting	249.8361	0.1443	36.0591 (268)
Total CO2, kg/year			505.8436 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.7600 (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	1684.7075	1.5774	2657.4470 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1256.0403	1.5224	1912.1994 (278)
Space and water heating			4569.6463 (279)
Pumps, fans and electric keep-hot	213.2852	1.5128	322.6578 (281)
Energy for lighting	249.8361	1.5338	383.2070 (282)
Total Primary energy kWh/year			5275.5112 (286)
Dwelling Primary energy Rate (DPER)			39.2500 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Basement floor	45.5500 (1a)	x 2.5000 (2a)	= 113.8750 (1a) - (3a)
Ground floor	44.4300 (1b)	x 2.7500 (2b)	= 122.1825 (1b) - (3b)
First floor	44.4300 (1c)	x 2.9800 (2c)	= 132.4014 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	368.4589 (5)

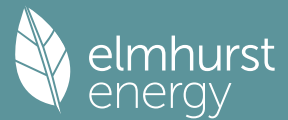
2. Ventilation rate

	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	4 * 10 = 40.0000 (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) =	40.0000 / (5) = 0.1086 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3586 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3317 (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	0.4229	0.4146	0.4063	0.3648	0.3565	0.3151	0.3151	0.3068	0.3317	0.3565	0.3731	0.3897 (22b)
Effective ac	0.5894	0.5859	0.5825	0.5666	0.5636	0.5496	0.5496	0.5471	0.5550	0.5636	0.5696	0.5759 (25)

3. Heat losses and heat loss parameter

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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			2.7600	1.0000	2.7600			(26)					
TER Opening Type (Uw = 1.20)			19.8700	1.1450	22.7519			(27)					
W10			1.0000	1.5918	1.5918			(27a)					
RL11			3.7200	1.5918	5.9213			(27a)					
RL12			1.1800	1.5918	1.8783			(27a)					
W13			1.1800	1.5918	1.8783			(27a)					
Heat Loss Floor 1			45.5500	0.1300	5.9215			(28a)					
External Wall 1	141.1700	7.8000	133.3700	0.1800	24.0066			(29a)					
Basement wall	68.7900	14.8300	53.9600	0.1800	9.7128			(29a)					
Pitched roof	51.7700	6.0800	45.6900	0.1100	5.0259			(30)					
Flat roof (glazing)	1.1300	1.0000	0.1300	0.1100	0.0143			(30)					
Total net area of external elements Aum(A, m2)			308.4100					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		81.4627			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							200.0000	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value	Total							
E2 Other lintels (including other steel lintels)				11.6700	0.0500	0.5835							
E3 Sill				10.4700	0.0500	0.5235							
E4 Jamb				33.3400	0.0500	1.6670							
E5 Ground floor (normal)				27.5200	0.1600	4.4032							
E6 Intermediate floor within a dwelling				53.2800	0.0000	0.0000							
E16 Corner (normal)				32.9200	0.0900	2.9628							
R1 Head of roof window				5.0600	0.0800	0.4048							
R2 Sill of roof window				5.0600	0.0600	0.3036							
R3 Jamb of roof window				7.2000	0.0800	0.5760							
E14 Flat roof				53.2800	0.0800	4.2624							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.6868	(36)					
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss						(33) + (36) + (36a) =	97.1495	(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	71.6675	71.2453	70.8315	68.8879	68.5243	66.8314	66.8314	66.5179	67.4835	68.5243	69.2599	70.0290	(38)
Average = Sum(39)m / 12 =	168.8170	168.3948	167.9810	166.0374	165.6737	163.9809	163.9809	163.6674	164.6330	165.6737	166.4094	167.1785	(39)
												166.0356	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.2560	1.2528	1.2498	1.2353	1.2326	1.2200	1.2200	1.2177	1.2249	1.2326	1.2381	1.2438	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
												1.2353	
												31	

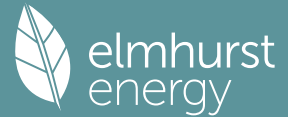
4. Water heating energy requirements (kWh/year)													

Assumed occupancy													2.9056 (42)
Hot water usage for mixer showers													
	93.7179	92.3095	90.2572	86.3305	83.4326	80.2010	78.3641	80.4009	82.6336	86.1034	90.1145	93.3588	(42a)
Hot water usage for baths													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses													
	44.3861	42.7721	41.1580	39.5440	37.9300	36.3159	36.3159	37.9300	39.5440	41.1580	42.7721	44.3861	(42c)
Average daily hot water use (litres/day)													126.7558 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	138.1040	135.0816	131.4152	125.8745	121.3626	116.5169	114.6801	118.3309	122.1776	127.2614	132.8866	137.7449	(44)
Energy conte	218.7230	192.3544	201.9803	172.3158	163.3774	143.2711	138.6956	146.5183	150.6572	172.6926	189.3213	215.6753	(45)
Energy content (annual)										Total = Sum(45)m =		2105.5823	
Distribution loss (46)m = 0.15 x (45)m													
	32.8085	28.8532	30.2970	25.8474	24.5066	21.4907	20.8043	21.9778	22.5986	25.9039	28.3982	32.3513	(46)
Water storage loss:													
Store volume													150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.3938 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.7527 (55)
Total storage loss													
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage													
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	265.3179	234.4401	248.5752	217.4077	209.9723	188.3630	185.2905	193.1132	195.7491	219.2875	234.4131	262.2702	(62)
WWHRS	-42.8439	-37.8915	-39.6778	-32.8548	-30.6195	-26.2013	-24.5595	-26.1166	-27.1089	-31.9584	-36.2050	-42.0505	(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													
	222.4740	196.5486	208.8974	184.5529	179.3528	162.1617	160.7310	166.9966	168.6402	187.3291	198.2081	220.2197	(64)
													Total per year (kWh/year) = Sum(64)m = 2256.1121 (64)
12Total per year (kWh/year)													2256 (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													
	110.0013	97.6264	104.4344	93.3685	91.5989	83.7111	83.3922	85.9933	86.1670	94.6962	99.0228	108.9880	(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	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	(66)
	153.1643	169.5748	153.1643	158.2698	153.1643	158.2698	153.1643	153.1643	158.2698	153.1643	158.2698	153.1643	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	302.9610	306.1047	298.1825	281.3170	260.0273	240.0180	226.6506	223.5068	231.4290	248.2945	269.5842	289.5935	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	(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)													
	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	(71)

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Water heating gains (Table 5)	147.8512	145.2774	140.3688	129.6785	123.1168	116.2655	112.0863	115.5824	119.6764	127.2798	137.5317	146.4892 (72)
Total internal gains	673.5603	690.5407	661.2994	638.8490	605.8922	581.1371	558.4850	558.8373	575.9590	598.3225	634.9695	658.8308 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d			Gains W
North					10.1600	10.6334	0.6300	0.7000	0.7700			33.0170 (74)
Southeast					2.4400	36.7938	0.6300	0.7000	0.7700			27.4370 (77)
South					3.5100	46.7521	0.6300	0.7000	0.7700			50.1510 (78)
Northwest					3.7600	11.2829	0.6300	0.7000	0.7700			12.9653 (81)
Northeast					3.7200	18.0708	0.6300	0.7000	1.0000			26.6810 (82)
Southwest					2.3600	37.0308	0.6300	0.7000	1.0000			34.6862 (82)
Horizontal					1.0000	26.0000	0.6300	0.7000	1.0000			10.3194 (82)
Solar gains	195.2569	361.6753	571.0857	833.7064	1047.7188	1089.9208	1030.1081	863.0475	660.9765	420.3790	239.1933	163.6431 (83)
Total gains	868.8172	1052.2160	1232.3851	1472.5554	1653.6110	1671.0579	1588.5931	1421.8848	1236.9355	1018.7015	874.1627	822.4739 (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	44.2326	44.3435	44.4528	44.9731	45.0719	45.5371	45.5371	45.6244	45.3568	45.0719	44.8726	44.6662
alpha	3.9488	3.9562	3.9635	3.9982	4.0048	4.0358	4.0358	4.0416	4.0238	4.0048	3.9915	3.9777
util living area	0.9934	0.9854	0.9656	0.9022	0.7710	0.5885	0.4437	0.5096	0.7655	0.9463	0.9871	0.9946 (86)
MIT	19.1884	19.4484	19.8449	20.3670	20.7525	20.9383	20.9845	20.9736	20.8237	20.2936	19.6519	19.1518 (87)
Th 2	19.8755	19.8780	19.8804	19.8919	19.8940	19.9040	19.9040	19.9059	19.9002	19.8940	19.8897	19.8851 (88)
util rest of house	0.9915	0.9814	0.9560	0.8755	0.7146	0.5019	0.3381	0.3973	0.6866	0.9259	0.9829	0.9932 (89)
MIT 2	17.7745	18.1067	18.6079	19.2524	19.6841	19.8668	19.8984	19.8953	19.7738	19.1816	18.3758	17.7342 (90)
Living area fraction	18.1863	18.4974	18.9681	19.5769	19.9952	20.1789	20.2147	20.2093	20.0795	19.5054	18.7474	0.2912 (91)
MIT	18.1863	18.4974	18.9681	19.5769	19.9952	20.1789	20.2147	20.2093	20.0795	19.5054	18.7474	18.1470 (92)
Temperature adjustment	18.1863	18.4974	18.9681	19.5769	19.9952	20.1789	20.2147	20.2093	20.0795	19.5054	18.7474	0.0000
adjusted MIT	18.1863	18.4974	18.9681	19.5769	19.9952	20.1789	20.2147	20.2093	20.0795	19.5054	18.7474	18.1470 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9874	0.9745	0.9458	0.8666	0.7203	0.5246	0.3687	0.4295	0.7009	0.9167	0.9767	0.9897 (94)
Ext temp.	857.8824	1025.4097	1165.5871	1276.0670	1191.0621	876.5928	585.7406	610.7568	866.9275	933.8736	853.7889	813.9910 (95)
Heat loss rate W	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)
Space heating kWh	2344.2366	2289.7326	2094.4015	1772.7712	1374.2980	914.8260	592.7418	623.4597	984.4261	1475.3940	1938.2368	2331.6409 (97)
Space heating requirement - total per year (kWh/year)	1105.8475	849.6250	691.0379	357.6270	136.3275	0.0000	0.0000	0.0000	0.0000	402.8912	780.8025	1129.1316 (98a)
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)	1105.8475	849.6250	691.0379	357.6270	136.3275	0.0000	0.0000	0.0000	0.0000	402.8912	780.8025	1129.1316 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1105.8475	849.6250	691.0379	357.6270	136.3275	0.0000	0.0000	0.0000	0.0000	402.8912	780.8025	1129.1316 (98c)
Space heating per m ²	(98c) / (4) =											40.5721 (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	1105.8475	849.6250	691.0379	357.6270	136.3275	0.0000	0.0000	0.0000	0.0000	402.8912	780.8025	1129.1316 (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)	1198.1013	920.5038	748.6868	387.4616	147.7004	0.0000	0.0000	0.0000	0.0000	436.5018	845.9399	1223.3278 (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	222.4740	196.5486	208.8974	184.5529	179.3528	162.1617	160.7310	166.9966	168.6402	187.3291	198.2081	220.2197 (64)
Efficiency of water heater (217)m	87.1537	86.9575	86.5346	85.5170	83.4526	79.8000	79.8000	79.8000	79.8000	85.7312	86.8176	79.8000 (216)
Fuel for water heating, kWh/month	255.2662	226.0284	241.4034	215.8084	214.9157	203.2101	201.4172	209.2690	211.3285	218.5075	228.3040	252.5599 (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	31.8245	25.5308	22.9877	16.8417	13.0090	10.6285	11.8673	15.4256	20.0363	26.2887	29.6930	32.7090 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-44.0699	-62.8997	-91.4990	-104.1143	-113.2528	-105.9806	-104.5869	-98.2037	-87.1761	-72.3942	-48.6892	-38.0045 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												

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(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	-22.6242	-47.8344	-95.5471	-144.2257	-191.4468	-192.7059	-190.5264	-161.0569	-117.6434	-68.7505	-30.3107	-17.8799	(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												5908.2234	(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												2678.0183	(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)												256.8421	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2251.4229	(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												6677.6610	(238)

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

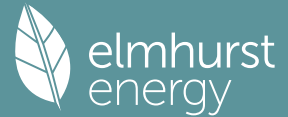
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5908.2234	0.2100	1240.7269 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2678.0183	0.2100	562.3839 (264)
Space and water heating			1803.1108 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	256.8421	0.1443	37.0702 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-970.8709	0.1344	-130.4379
PV Unit electricity exported	-1280.5520	0.1257	-161.0135
Total			-291.4515 (269)
Total CO2, kg/year			1560.6588 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.6100 (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	5908.2234	1.1300	6676.2925 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2678.0183	1.1300	3026.1607 (278)
Space and water heating			9702.4532 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	256.8421	1.5338	393.9529 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-970.8709	1.4965	-1452.9349
PV Unit electricity exported	-1280.5520	0.4615	-591.0197
Total			-2043.9545 (283)
Total Primary energy kWh/year			8182.5524 (286)
Target Primary Energy Rate (TPER)			60.8800 (287)

13 Appendix 3 Be Green DER/TER SAP Worksheets

Full SAP Calculation Printout



Property Reference	S12134 01				Issued on Date	06/06/2024	
Assessment Reference	Be Green PV New			Prop Type Ref			
Property	63, Netherhall Gardens, London, NW3 5RE						
SAP Rating	91 B		DER	1.30		TER	11.61
Environmental	99 A		% DER < TER				88.80
CO ₂ Emissions (t/year)	0.11		DFEE	42.48		TFEE	46.38
Compliance Check	See BREL		% DFEE < TFEE				8.40
% DPER < TPER	65.12		DPER	21.24		TPER	60.88
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)	
Basement floor	45.5500 (1a)	x	2.5000 (2a)	=	113.8750 (1a)	- (3a)
Ground floor	44.4300 (1b)	x	2.7500 (2b)	=	122.1825 (1b)	- (3b)
First floor	44.4300 (1c)	x	2.9800 (2c)	=	132.4014 (1c)	- (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.4100					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	368.4589	(5)

2. Ventilation rate

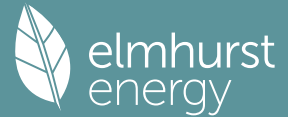
		m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)	
Number of open flues	0 * 20 =	0.0000 (6b)	
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)	
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)	
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)	
Number of blocked chimneys	0 * 20 =	0.0000 (6f)	
Number of intermittent extract fans	0 * 10 =	0.0000 (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) =	0.0000 / (5) =	0.0000 (8)	
Pressure test	Yes		
Pressure Test Method	Blower Door		
Measured/design AP50	4.0000	(17)	
Infiltration rate	0.2000	(18)	
Number of sides sheltered	1	(19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1850 (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	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174	(22b)
Mechanical extract ventilation - centralised													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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	
Opening Type 1 (Uw = 1.20)			19.8700	1.1450	22.7519			(27)
Door			2.7600	1.0000	2.7600			(26)
W10			1.0000	1.3258	1.3258			(27a)
RL11			3.7200	1.3258	4.9318			(27a)
RL12			1.1800	1.3258	1.5644			(27a)
W13			1.1800	1.3258	1.5644			(27a)
Heat Loss Floor 1			45.5500	0.1100	5.0105			(28a)
External Wall 1	141.1700	7.8000	133.3700	0.1800	24.0066			(29a)
Basement wall	68.7900	14.8300	53.9600	0.1800	9.7128			(29a)
Pitched roof	51.7700	6.0800	45.6900	0.1100	5.0259			(30)
Flat roof (glazing)	1.1300	1.0000	0.1300	0.1100	0.0143			(30)
Total net area of external elements Aum(A, m ²)			308.4100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.6684			(33)

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Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 200.0000 (35)
Thermal bridges (User defined value 0.040 * total exposed area) 12.3364 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 91.0048 (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	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957
Average = Sum(39)m / 12 =	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9056 (42)											
Hot water usage for mixer showers	117.1474	115.3869	112.8215	107.9131	104.2908	100.2512	97.9552	100.5011	103.2920	107.6292	112.6431	116.6985
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hot water usage for other uses	44.3861	42.7721	41.1580	39.5440	37.9300	36.3159	36.3159	37.9300	39.5440	41.1580	42.7721	44.3861
Average daily hot water use (litres/day)	38.3744	33.7824	35.4991	30.2792	28.7185	25.1888	24.3584	25.7110	26.4197	30.2854	33.2126	37.8329
Daily hot water use	161.5335	158.1590	153.9795	147.4571	142.2207	136.5672	134.2711	138.4311	142.8360	148.7873	155.4152	161.0846
Energy content (annual)	255.8296	225.2162	236.6608	201.8614	191.4565	167.9253	162.3893	171.4066	176.1311	201.9029	221.4174	252.2196
Distribution loss (46)m = 0.15 x (45)m	38.3744	33.7824	35.4991	30.2792	28.7185	25.1888	24.3584	25.7110	26.4197	30.2854	33.2126	37.8329
Water storage loss:	170.0000 (47)											
Store volume	1.5600 (48)											
a) If manufacturer declared loss factor is known (kWh/day):	0.5400 (49)											
Enter (49) or (54) in (55)	0.8424 (55)											
Total storage loss	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144
If cylinder contains dedicated solar storage	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144
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
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
Total heat required for water heating calculated for each month	281.9440	248.8034	262.7752	227.1334	217.5709	193.1973	188.5037	197.5210	201.4031	228.0173	246.6894	278.3340
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
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
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
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
Output from w/h	281.9440	248.8034	262.7752	227.1334	217.5709	193.1973	188.5037	197.5210	201.4031	228.0173	246.6894	278.3340
12Total per year (kWh/year)	2771.8926 (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
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000 (64a)											
Heat gains from water heating, kWh/month	85.0633	74.8844	78.6897	67.1189	63.6593	55.8352	53.9944	56.9927	58.5636	67.1327	73.6213	83.8630

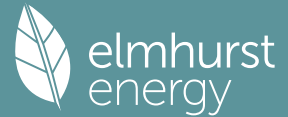
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	153.1643	169.5748	153.1643	158.2698	153.1643	158.2698	153.1643	153.1643	158.2698	153.1643	158.2698	153.1643
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	302.9610	306.1047	298.1825	281.3170	260.0273	240.0180	226.6506	223.5068	231.4290	248.2945	269.5842	289.5935
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Losses e.g. evaporation (negative values) (Table 5)	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235
Water heating gains (Table 5)	114.3324	111.4351	105.7657	93.2207	85.5635	77.5488	72.5732	76.6031	81.3383	90.2322	102.2518	112.7191
Total internal gains	637.0415	653.6984	623.6964	599.3913	565.3390	542.4204	518.9718	519.8580	537.6209	558.2748	596.6896	622.0608

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	
North	10.1600	10.6334	0.4500	0.0000	0.7700	37.4342 (74)
Southeast	2.4400	36.7938	0.4500	0.0000	0.7700	31.1077 (77)
South	3.5100	46.7521	0.4500	0.0000	0.7700	56.8606 (78)
Northwest	3.7600	11.2829	0.4500	0.0000	0.7700	14.6999 (81)
Northeast	3.7200	18.0708	0.6300	0.7000	1.0000	26.6810 (82)
Southwest	2.3600	37.0308	0.6300	0.7000	1.0000	34.6862 (82)
Horizontal	1.0000	26.0000	0.6300	0.7000	1.0000	10.3194 (82)
Solar gains	211.7890	390.8888	614.3439	893.6144	1121.1582	1165.7714
Total gains	848.8305	1044.5872	1238.0402	1493.0057	1686.4972	1708.1918

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910
alpha	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794
util living area	0.9938	0.9848	0.9608	0.8841	0.7325	0.5456	0.4065	0.4721	0.7339	0.9409	0.9874	0.9952 (86)
Living	19.7206	19.9177	20.2059	20.5589	20.8018	20.8996	20.9214	20.9160	20.8336	20.4805	20.0250	19.6757
Non living	18.4762	18.7265	19.0884	19.5140	19.7787	19.8673	19.8819	19.8795	19.8174	19.4328	18.8649	18.4189
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	31	28	31	30	31	30	31	31	30	31	30	31
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000 (87)
Th 2	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769 (88)
util rest of house	0.9922	0.9807	0.9505	0.8554	0.6767	0.4670	0.3147	0.3724	0.6567	0.9196	0.9834	0.9939 (89)
MIT 2	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769 (90)
Living area fraction									FLA = Living area / (4) =			0.2912 (91)
MIT	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748 (92)
Temperature adjustment												0.0000
adjusted MIT	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9927	0.9820	0.9538	0.8645	0.6938	0.4906	0.3418	0.4021	0.6808	0.9266	0.9847	0.9943 (94)
Useful gains	842.6291	1025.8203	1180.8386	1290.6532	1170.1062	838.0002	554.0184	580.6707	849.2930	937.5054	842.7622	795.1872 (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	2424.9872	2333.9069	2091.0261	1726.7050	1301.6636	861.4422	557.8412	588.2013	937.3424	1468.6441	1999.9458	2440.1673 (97)
Space heating kWh	1177.2744	879.0342	677.1796	313.9573	97.8787	0.0000	0.0000	0.0000	0.0000	395.1672	833.1722	1223.8652 (98a)
Space heating requirement - total per year (kWh/year)												5597.5288
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	1177.2744	879.0342	677.1796	313.9573	97.8787	0.0000	0.0000	0.0000	0.0000	395.1672	833.1722	1223.8652 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5597.5288
Space heating per m2										(98c) / (4) =		41.6452 (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 %)												332.2552 (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	1177.2744	879.0342	677.1796	313.9573	97.8787	0.0000	0.0000	0.0000	0.0000	395.1672	833.1722	1223.8652 (98)
Space heating efficiency (main heating system 1)	332.2552	332.2552	332.2552	332.2552	332.2552	0.0000	0.0000	0.0000	0.0000	332.2552	332.2552	332.2552 (210)
Space heating fuel (main heating system)	354.3283	264.5660	203.8131	94.4928	29.4589	0.0000	0.0000	0.0000	0.0000	118.9348	250.7627	368.3509 (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	281.9440	248.8034	262.7752	227.1334	217.5709	193.1973	188.5037	197.5210	201.4031	228.0173	246.6894	278.3340 (64)
Efficiency of water heater	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850 (216)
Fuel for water heating, kWh/month	127.7586	112.7414	119.0725	102.9220	98.5889	87.5444	85.4175	89.5036	91.2627	103.3225	111.7835	126.1228 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	18.1146	16.3616	18.1146	17.5303	18.1146	17.5303	18.1146	18.1146	17.5303	18.1146	17.5303	18.1146 (231)
Lighting	30.9564	24.8344	22.3606	16.3824	12.6542	10.3386	11.5436	15.0048	19.4897	25.5716	28.8830	31.8168 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-43.4198	-69.5002	-114.1620	-139.7281	-154.0209	-142.2115	-139.1852	-126.5002	-103.8860	-81.9184	-49.6958	-36.4535 (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)	-12.3271	-31.1106	-79.2824	-154.6571	-242.4984	-261.6928	-253.3933	-194.1226	-120.2427	-52.5084	-17.8796	-9.2425 (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												1684.7075 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												220.6850
Water heating fuel used												1256.0403 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(MEVCentralised, Database: in-use factor = 1.3000, SFP = 1.0530)												
mechanical ventilation fans (SFP = 1.0530)												213.2852 (230a)

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Total electricity for the above, kWh/year	213.2852 (231)
Electricity for lighting (calculated in Appendix L)	249.8361 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2629.6391 (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	774.2301 (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	1684.7075	0.1560	262.7520 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1256.0403	0.1413	177.4472 (264)
Space and water heating			440.1993 (265)
Pumps, fans and electric keep-hot	213.2852	0.1387	29.5853 (267)
Energy for lighting	249.8361	0.1443	36.0591 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1200.6817	0.1332	-159.9201
PV Unit electricity exported	-1428.9574	0.1201	-171.5667
Total			-331.4867 (269)
Total CO2, kg/year			174.3569 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.3000 (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	1684.7075	1.5774	2657.4470 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1256.0403	1.5224	1912.1994 (278)
Space and water heating			4569.6463 (279)
Pumps, fans and electric keep-hot	213.2852	1.5128	322.6578 (281)
Energy for lighting	249.8361	1.5338	383.2070 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1200.6817	1.4922	-1791.6479
PV Unit electricity exported	-1428.9574	0.4404	-629.2935
Total			-2420.9414 (283)
Total Primary energy kWh/year			2854.5698 (286)
Dwelling Primary energy Rate (DPER)			21.2400 (287)

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

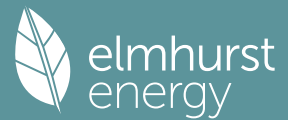
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Basement floor	45.5500 (1a)	x 2.5000 (2a)	= 113.8750 (1a) - (3a)
Ground floor	44.4300 (1b)	x 2.7500 (2b)	= 122.1825 (1b) - (3b)
First floor	44.4300 (1c)	x 2.9800 (2c)	= 132.4014 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	368.4589 (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	4 * 10 = 40.0000 (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) =	40.0000 / (5) = 0.1086 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3586 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3317 (21)

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Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.4229	0.4146	0.4063	0.3648	0.3565	0.3151	0.3151	0.3068	0.3317	0.3565	0.3731	0.3897 (22b)
	0.5894	0.5859	0.5825	0.5666	0.5636	0.5496	0.5496	0.5471	0.5550	0.5636	0.5696	0.5759 (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			2.7600	1.0000	2.7600		(26)
TER Opening Type (Uw = 1.20)			19.8700	1.1450	22.7519		(27)
W10			1.0000	1.5918	1.5918		(27a)
RL11			3.7200	1.5918	5.9213		(27a)
RL12			1.1800	1.5918	1.8783		(27a)
W13			1.1800	1.5918	1.8783		(27a)
Heat Loss Floor 1			45.5500	0.1300	5.9215		(28a)
External Wall 1	141.1700	7.8000	133.3700	0.1800	24.0066		(29a)
Basement wall	68.7900	14.8300	53.9600	0.1800	9.7128		(29a)
Pitched roof	51.7700	6.0800	45.6900	0.1100	5.0259		(30)
Flat roof (glazing)	1.1300	1.0000	0.1300	0.1100	0.0143		(30)
Total net area of external elements Aum(A, m2)			308.4100				(31)
Fabric heat loss, W/K = Sum (A x U)					81.4627		(33)
					(26)...(30) + (32) =		

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

200.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	11.6700	0.0500	0.5835
E3 Sill	10.4700	0.0500	0.5235
E4 Jamb	33.3400	0.0500	1.6670
E5 Ground floor (normal)	27.5200	0.1600	4.4032
E6 Intermediate floor within a dwelling	53.2800	0.0000	0.0000
E16 Corner (normal)	32.9200	0.0900	2.9628
R1 Head of roof window	5.0600	0.0800	0.4048
R2 Sill of roof window	5.0600	0.0600	0.3036
R3 Jamb of roof window	7.2000	0.0800	0.5760
E14 Flat roof	53.2800	0.0800	4.2624

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

15.6868 (36)

Point Thermal Bridges

Total fabric heat loss (33) + (36) + (36a) = 97.1495 (37)

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

(38)m	Jan 71.6675	Feb 71.2453	Mar 70.8315	Apr 68.8879	May 68.5243	Jun 66.8314	Jul 66.8314	Aug 66.5179	Sep 67.4835	Oct 68.5243	Nov 69.2599	Dec 70.0290 (38)
Heat transfer coeff	168.8170	168.3948	167.9810	166.0374	165.6737	163.9809	163.9809	163.6674	164.6330	165.6737	166.4094	167.1785 (39)
Average = Sum(39)m / 12 =												166.0356

HLP	Jan 1.2560	Feb 1.2528	Mar 1.2498	Apr 1.2353	May 1.2326	Jun 1.2200	Jul 1.2200	Aug 1.2177	Sep 1.2249	Oct 1.2326	Nov 1.2381	Dec 1.2438 (40)
HLP (average)												1.2353
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

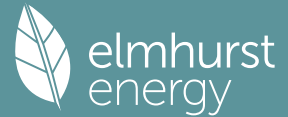
4. Water heating energy requirements (kWh/year)

Assumed occupancy											2.9056 (42)
Hot water usage for mixer showers											
93.7179	92.3095	90.2572	86.3305	83.4326	80.2010	78.3641	80.4009	82.6336	86.1034	90.1145	93.3588 (42a)
Hot water usage for baths											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses											
44.3861	42.7721	41.1580	39.5440	37.9300	36.3159	36.3159	37.9300	39.5440	41.1580	42.7721	44.3861 (42c)
Average daily hot water use (litres/day)											126.7558 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	138.1040	135.0816	131.4152	125.8745	121.3626	116.5169	114.6801	118.3309	122.1776	127.2614	132.8866	137.7449 (44)
Energy content (annual)	218.7230	192.3544	201.9803	172.3158	163.3774	143.2711	138.6956	146.5183	150.6572	172.6926	189.3213	215.6753 (45)
Distribution loss (46)m = 0.15 x (45)m	32.8085	28.8532	30.2970	25.8474	24.5066	21.4907	20.8043	21.9778	22.5986	25.9039	28.3982	32.3513 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	265.3179	234.4401	248.5752	217.4077	209.9723	188.3630	185.2905	193.1132	195.7491	219.2875	234.4131	262.2702 (62)
WWHRS	-42.8439	-37.8915	-39.6778	-32.8548	-30.6195	-26.2013	-24.5595	-26.1166	-27.1089	-31.9584	-36.2050	-42.0505 (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	222.4740	196.5486	208.8974	184.5529	179.3528	162.1617	160.7310	166.9966	168.6402	187.3291	198.2081	220.2197 (64)
12Total per year (kWh/year)												2256.1121 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												0.0000 (64a)
Heat gains from water heating, kWh/month	110.0013	97.6264	104.4344	93.3685	91.5989	83.7111	83.3922	85.9933	86.1670	94.6962	99.0228	108.9880 (65)

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

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Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	153.1643	169.5748	153.1643	158.2698	153.1643	158.2698	153.1643	153.1643	158.2698	153.1643	158.2698	153.1643	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	302.9610	306.1047	298.1825	281.3170	260.0273	240.0180	226.6506	223.5068	231.4290	248.2945	269.5842	289.5935	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	(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)	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	(71)
Water heating gains (Table 5)	147.8512	145.2774	140.3688	129.6785	123.1168	116.2655	112.0863	115.5824	119.6764	127.2798	137.5317	146.4892	(72)
Total internal gains	673.5603	690.5407	661.2994	638.8490	605.8922	581.1371	558.4850	558.8373	575.9590	598.3225	634.9695	658.8308	(73)

6. Solar gains

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

North					10.1600	10.6334		0.6300	0.7000	0.7700		33.0170 (74)				
Southeast					2.4400	36.7938		0.6300	0.7000	0.7700		27.4370 (77)				
South					3.5100	46.7521		0.6300	0.7000	0.7700		50.1510 (78)				
Northwest					3.7600	11.2829		0.6300	0.7000	0.7700		12.9653 (81)				
Northeast					3.7200	18.0708		0.6300	0.7000	1.0000		26.6810 (82)				
Southwest					2.3600	37.0308		0.6300	0.7000	1.0000		34.6862 (82)				
Horizontal					1.0000	26.0000		0.6300	0.7000	1.0000		10.3194 (82)				

Solar gains					195.2569	361.6753	571.0857	833.7064	1047.7188	1089.9208	1030.1081	863.0475	660.9765	420.3790	239.1933	163.6431 (83)
Total gains					868.8172	1052.2160	1232.3851	1472.5554	1653.6110	1671.0579	1588.5931	1421.8848	1236.9355	1018.7015	874.1627	822.4739 (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	44.2326	44.3435	44.4528	44.9731	45.0719	45.5371	45.5371	45.6244	45.3568	45.0719	44.8726	44.6662	
alpha	3.9488	3.9562	3.9635	3.9982	4.0048	4.0358	4.0358	4.0416	4.0238	4.0048	3.9915	3.9777	
util living area	0.9934	0.9854	0.9656	0.9022	0.7710	0.5885	0.4437	0.5096	0.7655	0.9463	0.9871	0.9946	(86)
MIT	19.1884	19.4484	19.8449	20.3670	20.7525	20.9383	20.9845	20.9736	20.8237	20.2936	19.6519	19.1518	(87)
Th 2	19.8755	19.8780	19.8804	19.8919	19.8940	19.9040	19.9040	19.9059	19.9002	19.8940	19.8897	19.8851	(88)
util rest of house	0.9915	0.9814	0.9560	0.8755	0.7146	0.5019	0.3381	0.3973	0.6866	0.9259	0.9829	0.9932	(89)
MIT 2	17.7745	18.1067	18.6079	19.2524	19.6841	19.8668	19.8984	19.8953	19.7738	19.1816	18.3758	17.7342	(90)
Living area fraction									fLA = Living area / (4) =			0.2912	(91)
MIT	18.1863	18.4974	18.9681	19.5769	19.9952	20.1789	20.2147	20.2093	20.0795	19.5054	18.7474	18.1470	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1863	18.4974	18.9681	19.5769	19.9952	20.1789	20.2147	20.2093	20.0795	19.5054	18.7474	18.1470	(93)

8. Space heating requirement

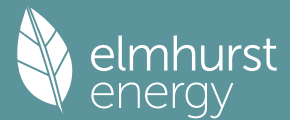
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9874	0.9745	0.9458	0.8666	0.7203	0.5246	0.3687	0.4295	0.7009	0.9167	0.9767	0.9897	(94)
Useful gains	857.8824	1025.4097	1165.5871	1276.0670	1191.0621	876.5928	585.7406	610.7568	866.9275	933.8736	853.7889	813.9910	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	14.1000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2344.2366	2289.7326	2094.4015	1772.7712	1374.2980	914.8260	592.7418	623.4597	984.4261	1475.3940	1938.2368	2331.6409	(97)
Space heating kWh	1105.8475	849.6250	691.0379	357.6270	136.3275	0.0000	0.0000	0.0000	0.0000	402.8912	780.8025	1129.1316	(98a)
Space heating requirement - total per year (kWh/year)												5453.2902	
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	1105.8475	849.6250	691.0379	357.6270	136.3275	0.0000	0.0000	0.0000	0.0000	402.8912	780.8025	1129.1316	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5453.2902	
Space heating per m2										(98c) / (4) =		40.5721	(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)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	1105.8475	849.6250	691.0379	357.6270	136.3275	0.0000	0.0000	0.0000	0.0000	402.8912	780.8025	1129.1316	(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)	1198.1013	920.5038	748.6868	387.4616	147.7004	0.0000	0.0000	0.0000	0.0000	436.5018	845.9399	1223.3278	(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

Full SAP Calculation Printout



Efficiency of water heater (217)m	222.4740	196.5486	208.8974	184.5529	179.3528	162.1617	160.7310	166.9966	168.6402	187.3291	198.2081	220.2197 (64)
Fuel for water heating, kWh/month	87.1537	86.9575	86.5346	85.5170	83.4526	79.8000	79.8000	79.8000	79.8000	85.7312	86.8176	79.8000 (216)
Space cooling fuel requirement (221)m	255.2662	226.0284	241.4034	215.8084	214.9157	203.2101	201.4172	209.2690	211.3285	218.5075	228.3040	252.5599 (219)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Lighting	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041 (231)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	31.8245	25.5308	22.9877	16.8417	13.0090	10.6285	11.8673	15.4256	20.0363	26.2887	29.6930	32.7090 (232)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	-44.0699	-62.8997	-91.4990	-104.1143	-113.2528	-105.9806	-104.5869	-98.2037	-87.1761	-72.3942	-48.6892	-38.0045 (233a)
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 (234a)
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 (235a)
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 (235c)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	-22.6242	-47.8344	-95.5471	-144.2257	-191.4468	-192.7059	-190.5264	-161.0569	-117.6434	-68.7505	-30.3107	-17.8799 (233b)
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 (234b)
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 (235b)
Annual totals kWh/year												
Space heating fuel - main system 1												5908.2234 (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												2678.0183 (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)												256.8421 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2251.4229 (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												6677.6610 (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	5908.2234	0.2100	1240.7269 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2678.0183	0.2100	562.3839 (264)
Space and water heating			1803.1108 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	256.8421	0.1443	37.0702 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-970.8709	0.1344	-130.4379
PV Unit electricity exported	-1280.5520	0.1257	-161.0135
Total			-291.4515 (269)
Total CO2, kg/year			1560.6588 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.6100 (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	5908.2234	1.1300	6676.2925 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2678.0183	1.1300	3026.1607 (278)
Space and water heating			9702.4532 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	256.8421	1.5338	393.9529 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-970.8709	1.4965	-1452.9349
PV Unit electricity exported	-1280.5520	0.4615	-591.0197
Total			-2043.9545 (283)
Total Primary energy kWh/year			8182.5524 (286)
Target Primary Energy Rate (TPER)			60.8800 (287)