

Energy Statement

Ginnell Farm, Rochdale

Job number: 13240

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Contents

1	Executive Summary	3
2	Existing and Proposed Development	4
3	Planning Policy	5
4	Methodology	7
5	Baseline Energy & CO ₂	8
6	Low Carbon Design – Fabric First – Be Lean	9
7	Building Form and Heat Loss Envelope	11
8	Low Carbon Technology Review & Recommendations	12
9	Low Carbon Technology – Renewable Energy Generation - Be Green	17
10	Conclusion	18
11	Appendix 1 Greater Manchester Combined Authority – Energy and Carbon Proforma Spreadsheet	19
12	Appendix 2 Be Lean DER/TER SAP Worksheets	20
13	Appendix 2 Be Green DER/TER SAP Worksheets	21

1 Executive Summary

This report has been produced by Base Energy on behalf of Fairway Building & Remedial Contractors Ltd and in support of the planning application for the development named as Ginnell Farm comprising the construction of 9 new build dwellings falling under the requirements of The Greater Manchester Combined Local Authority and Rochdale Borough Council.

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

- National Planning Policy
- The Greater Manchester Combined Local Authority, Places for everyone joint development plan, JP-S2 Carbon and Energy
- Rochdale Borough Council - Policy G3 Renewable and low carbon energy developments

The above policies require:

- A reduction in CO2 over Part L 2021
- A contribution to energy and carbon savings from renewable technology

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 3
- A design which limits thermal bridging
- Energy saving building services including low energy lighting, heating controls and mechanical ventilation with heat recovery
- Low carbon Air Source Heat Pumps and Solar PV Panels

This results in a 103% reduction in CO2 emissions over Part L 2021.

2 Existing and Proposed Development

The development site is located on land at Ginnell Farm on Broad Lane in Rochdale.

The development proposals are for construction of 9 new build dwellings.

The development proposals constitute a minor development.

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



Figure 2.1: Site Location and proposals

3 Planning Policy

National Planning Policy Framework 2025

The NPPF was updated in February 2025 to place greater emphasis on beauty, place-making, the environment, and sustainable development. The strengthened environmental objectives aim to protect and enhance the natural, built, and historic environment, and encourage effective land use, greater biodiversity, prudent use of natural resources, minimisation of waste and pollution, and adaptation to climate change alongside a move to a low carbon economy.

Local Planning Policy

The relevant Rochdale Local Planning Policy requirements are as follows.

The development should target:

- Policy G3 – Renewable and Low Carbon Energy Developments

The Council will promote renewable, low and zero carbon energy generating developments, including wind power, biomass, Combined Heat and Power (CHP), hydro and heat pumps in order to help meet CO2 reduction targets and contribute towards energy security for Greater Manchester and the North West.

The above requires properties to follow the energy hierarchy and install renewable technologies where feasible.

The Greater Manchester Combined Authority

The relevant Local Planning Policy requirements are as follows.

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

The development should target:

- Be Net Zero Carbon where feasible
 - From adoption to regulated operational carbon emissions
 - From 2028 to all emissions in construction
- As an interim measure, development should be consistent with 2022 Part L building regulations (this would be the current Part L 2021)
- From 2025 development should also calculate and minimise carbon emissions from unregulated emissions alongside regulated emissions.

Development proposals should set out how this has been achieved in an energy statement in accordance with the energy hierarchy.

Achieve energy demand reductions in terms of space heat demand; hot water energy demand and the delivery of on-site renewable energy generation, in accordance with Table 5.1.

Achieve the targets set for minor development 2-9 properties in the 'Energy and Carbon Proforma' Spreadsheet (Appendix 1) as set out below:

- Space heating demand <20 kWh/m²GIA/yr
- Energy Use Intensity <35 kWh/m²GIA/yr
- Solar PV is required were feasible to meet 40% of the ground floor area
- Fossil Fuel Free
- Reduce over heating risk
- Minimise embodied carbon

Include a detailed energy statement to demonstrate via site relevant evidence how the development has sought to maximize reductions in carbon emissions in line with relevant policy targets, including the minimisation of overheating risks and appropriate measures for post occupancy evaluation. Whole life cycle emissions should be considered where possible.

Based on the above the properties are aiming to go beyond Part L 2021 building regulations were feasible.

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

	CO ₂ Emission Rate (kg CO ₂ /m ² /year)	Floor Area (m ²)	Total Baseline Emissions (kg CO ₂ /year)
Baseline	10.90	897	9,769

The **Total Baseline CO₂ Emissions** for the development are shown to be 9,769 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	0.15
Ground Floor	0.18	0.13	0.10
Roof	0.16	0.11	0.10
Windows	1.6	1.2	1.00 Triple
Doors	1.6	1.0	1.00
Air permeability	8.00	5.00	3.00

- **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 0.05

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

- **Lighting:** Low energy LED lighting throughout with a minimum efficacy of 80 lumens per watt
- **Space & Water Heating:** Condensing gas boiler 89.5% efficiency for new build baseline for the Be Lean element of the report
- **Heating Controls:** Comprising delayed start and time & temperature zone control
- **Ventilation:** Hybrid mechanical ventilation with heat recovery and cooling, having an of SFP 1.01 and 79% efficiency

The specifications outlined above, and with the heating provided by a gas system (only for the Be Lean calculation), have been incorporated into the calculation to generate a dwelling emission rate to be measured against the baseline data.

Table 6.1: Baseline vs Be Lean CO₂

	CO ₂ Emission Rate (kg CO ₂ /m ² /year)	Floor Area (m ²)	Total Baseline Emissions (kg CO ₂ /year)	Reduction in CO ₂
Baseline	10.90	897	9,769	N/A
Be Lean	9.38	897	8,412 (11,309 minus PV -1,357)	14%

The **CO₂ Emissions reduction** as a result of energy efficient fabric and services is shown to be 8,412 kg/year which is 14% saving. The notional PV for the dwelling is -1.357 and this is deducted from the be lean figure to give 8,412kgCO₂/year.

7 Building Form and Heat Loss Envelope

Building Form – GMCA Net Zero Design Guidance

The GMCA emphasizes that **building form** plays a critical role in achieving Net Zero Carbon outcomes. Key principles include:

- **Compactness:** More compact building shapes (e.g. cubes or rectangles) reduce the surface area exposed to external conditions, which minimizes heat loss and improves energy efficiency
- **Orientation:** Buildings should be oriented to maximize solar gain and natural daylight, especially in colder months. This reduces reliance on artificial heating and lighting
- **Window Placement and Size:** Thoughtful window design—balancing daylight access with heat retention—is essential. Oversized or poorly placed windows can increase heat loss
- **Early Design Decisions:** GMCA guidance stresses that decisions about building form should be made early in the design process. These choices are more cost-effective than retrofitting or relying solely on high-spec materials
- **Integration with Energy Hierarchy:** Building form supports the GMCA's energy hierarchy: first minimize energy demand, then maximize efficiency, followed by renewable and low-carbon energy use

These strategies align with GMCA's **Places for Everyone** policies JP-S2 and JP-S3, and the **Truly Affordable Net Zero (TANZ)** standard, which aims for all new buildings to be Net Zero Carbon in operation by 2028

Within the development there are 9 dwellings, one detached two storey dwelling with a room in roof over the garage area. The other 8 dwellings are all two storey semi-detached dwellings with insulation at ceiling level. The image below shows the form factor results for each dwelling taken from the 'Energy and Carbon Proforma' in Appendix 1.

Building name		1	2	3	4	5	6	7	8	9
Form factor per building	≤ 2	2.38	2.2	2.05	2.05	2.2	2.06	2.06	2.06	2.06

8 Low Carbon Technology Review & Recommendations

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

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

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

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

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

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

WIND TURBINES

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

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

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

GROUND SOURCE HEAT PUMP (GSHP)

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

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

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

AIR SOURCE HEAT PUMP (ASHP)

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

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

Air source heat pump technology **is recommended** for this development

BIOMASS

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

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

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

COMBINED HEAT AND POWER (CHP)

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

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

CHP **is not recommended** for this development

DISTRICT HEATING

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

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

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

SOLAR PHOTOVOLTAIC (PV)

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

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

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

SOLAR HOT WATER

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

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

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

Low and Zero Carbon Technology Summary

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

- **ASHP wet system for heating and hot water such as the Mitsubishi Ecodan 8.5kW PUZ-WM85VAA with a SCOP 3.47 (high temperature heating 55°C)**
- **Solar PV in line with the councils 40% of the footprint target, see allocation below.**

Plot	Floor area	Solar PV area	Solar PV vs Floor area %	Proposed solar PV panel *	Proposed solar PV kWp**
1	76	36	47	18	2.4 South 4.8 East
2	44	24	54	12	4.8 West
3	49	20	41	10	4.0 South
4	49	20	41	10	4.0 South
5	44	24	54	12	4.8 West
6	48	20	42	10	4.0 south
7	48	20	42	10	4.0 South
8	48	20	42	10	4.0 south
9	48	20	42	10	4.0 South

*Assuming each panel is 1mx2m

**Assuming each panel produces 0.4kWp

These technologies are deemed optimal for meeting the needs of the development and achieving policy compliance. It has been incorporated into the energy model and the results are presented in the next section. The ASHP system and solar PV would need to be checked with an installer on their suitability.

9 Low Carbon Technology – Renewable Energy Generation - Be Green

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

Table 9.1: Baseline vs Be Green CO₂

	CO ₂ Emission Rate (kg CO ₂ /m ² /year)	Floor Area (m ²)	Total Baseline Emissions (kg CO ₂ /year)	Reduction in CO ₂
Baseline	10.90	897	9,769	N/A
Be Lean & Green Design	-0.30	897	-304	-104%

The **CO₂ Emissions reduction** as a result of energy efficient fabric and services is shown to be -304 kg/year.

Table 9.2: Fabric Energy Efficiency

	Fabric Energy Efficiency (kWh/m ² /year)
Baseline	38.3
Be Lean	33.3

10 Conclusion

Proposals are for the development named as Ginnell Farm comprising the construction of 9 new build dwellings falling under the requirements of The Greater Manchester Combined Local Authority and Rochdale Borough Council.

Under the local planning policy the proposed development is required to install low or zero carbon technologies were feasible.

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

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

Low and zero carbon technology will be incorporated and is to comprise ASHP and solar PV.

This results in a 104% CO2 reduction over Part L 2021.

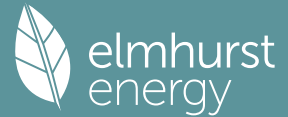
This Energy Statement and the calculations on which it is based demonstrate that the proposed development complies with the local planning policy requirements.

11 Appendix 1 Greater Manchester Combined Authority – Energy and Carbon Proforma Spreadsheet

		Ref. name	Detached	Semi detached	Semi detached	Semi detached	Semi detached	Semi detached	Semi detached	Semi detached	Semi detached
		No. dwellings	1	1	1	1	1	1	1	1	1
		area(m ² GIA)	142.68	87.66	97.87	98.8	87.66	95.88	95.88	95.76	95.76
		Target values	Building 1	Building 2	Building 3	Building 4	Building 5	Building 6	Building 7	Building 8	Building 9
Minimise energy demand	Space heating demand (kWh/m ² GIA/yr)	≤ 35 (floor) – 20	11.36	17.44	12.48	13.13	13.54	13	13.2	13.14	13.14
	Calculation methodology used to calculate space heating demand and confirmation that this covers all homes/black	Predictive energy model	SAP10	SAP10	SAP10	SAP10	SAP10	SAP10	SAP10	SAP10	SAP10
	Fair factor per building	≤ 2	2.38	2.2	2.05	2.05	2.2	2.06	2.06	2.06	2.06
	Average external wall U-value (W/m ² K)	≤ 0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
	Average window U-value (W/m ² K)	≤ 1 (triple)	1	1	1	1	1	1	1	1	1
	Air permeability rate (m ³ /h/m ² @ 50 Pa)	≤ 1	3	3	3	3	3	3	3	3	3
Maximise energy efficiency	Energy use intensity (kWh/m ² GIA/yr)	≤ 35	17.38	25.01	25.01	31.51	31.51	30.12	30.12	31.1	31.1
	Calculation methodology used to calculate energy use intensity and confirmation that this covers all homes/black	Predictive energy model	Design Builder	Design Builder	Design Builder	Design Builder	Design Builder	Design Builder	Design Builder	Design Builder	Design Builder
Use renewable energy	PV footprint area (% of ground floor space)	≥ 40	47	54	41	41	54	42	42	42	42
	Annual renewable energy generation (kWh/m ² building footprint/yr)	-	92	59	63	62	68	64	64	64	64
	Renewable energy balance (%)	-	71	63	72	70	71	71	71	71	71
	Total energy used (kWh/yr)	-	4323	4102	4288	4355	4161	4310	4330	4322	4322
	Total energy generated on-site (kWh/yr)	-	3064	2573	3068	3071	2974	3064	3064	3064	3064
Use low carbon energy	Fossil fuel free (year/ann)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Heat source – Where the energy for generating space heating and hot water is a heat pump and it achieves a SCOP of 3.5 or higher (Where a Low Carbon Heat Approval not required)	Electric	Electric	Electric	Electric	Electric	Electric	Electric	Electric	Electric	Electric
Reduce overheating risk	Have Part O overheating requirements been met without the use of mechanical cooling?	Yes	No	No	No	No	No	No	No	No	No
Minimise embodied carbon	Confirmation that a summary of the efforts made to design a low, low carbon structure and building design has been submitted?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

12 **Appendix 2 Be Lean DER/TER SAP Worksheets**

Full SAP Calculation Printout



Property Reference	S13240 01			Issued on Date	21/08/2025
Assessment Reference	Be lean	Prop Type Ref			
Property	Ginnell Farm, Plot 1, Broad Lane, OL16 4				
SAP Rating	84 B	DER	11.84	TER	9.04
Environmental	88 B	% DER < TER			-30.97
CO ₂ Emissions (t/year)	1.7	DFEE	35.96	TFEE	39.80
Compliance Check	See BREL	% DFEE < TFEE			9.63
% DPER < TPER	-46.52	DPER	69.23	TPER	47.25
Assessor Details	Mr. Peter Kinsella			Assessor ID	L770-0002
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	66.7000 (1b)	x 2.4000 (2b)	= 160.0800 (1b) - (3b)
First floor	75.9800 (1c)	x 2.6400 (2c)	= 200.5872 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.6800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 360.6672 (5)

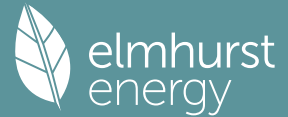
2. Ventilation rate

	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	3.0000 (17)											
Infiltration rate	0.1500 (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) = 0.1388 (21)											
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	0.1769	0.1734	0.1700	0.1526	0.1492	0.1318	0.1318	0.1283	0.1388	0.1492	0.1561	0.1630 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												63.2000 (23c)
Effective ac	0.3609	0.3574	0.3540	0.3366	0.3332	0.3158	0.3158	0.3123	0.3227	0.3332	0.3401	0.3470 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Door			2.8800	1.0000	2.8800		(26)
Windows			29.7900	0.9615	28.6442		(27)
Garage			1.8900	1.4000	2.6460		(26)
Roof lights			1.5000	0.9615	1.4423		(27a)
Heat Loss Floor 1			66.7000	0.1000	6.6700		(28a)
Heat Loss Floor 2			9.2900	0.1000	0.9290		(28b)
External Wall 1	161.9000	32.6700	129.2300	0.1500	19.3845		(29a)
Garage wall	13.3200	1.8900	11.4300	0.1400	1.6002		(29a)
Sud wall1	11.3200		11.3200	0.1500	1.6980		(29a)
Pitched roof	11.3400	1.5000	9.8400	0.1000	0.9840		(30)
Ceiling joists	66.7000		66.7000	0.1000	6.6700		(30)
Total net area of external elements Aum(A, m ²)			340.5700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	73.5482		(33)

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Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 17.0285 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 90.5767 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.9551	42.5423	42.1294	40.0652	39.6523	37.5881	37.5881	37.1752	38.4138	39.6523	40.4780	41.3037 (38)
Heat transfer coeff	133.5319	133.1190	132.7062	130.6419	130.2291	128.1648	128.1648	127.7519	128.9905	130.2291	131.0548	131.8805 (39)
Average = Sum(39)m / 12 =												130.5387
HLP	0.9359	0.9330	0.9301	0.9156	0.9127	0.8983	0.8983	0.8954	0.9041	0.9127	0.9185	0.9243 (40)
HLP (average)												0.9149
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9220 (42)											
Hot water usage for mixer showers	129.3504	127.4065	124.5739	119.1542	115.1546	110.6942	108.1590	110.9702	114.0517	118.8408	124.3769	128.8548 (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	44.5544	42.9343	41.3141	39.6939	38.0738	36.4536	36.4536	38.0738	39.6939	41.3141	42.9343	44.5544 (42c)
Average daily hot water use (litres/day)												159.7607 (43)
Daily hot water use	173.9048	170.3408	165.8880	158.8481	153.2283	147.1478	144.6126	149.0439	153.7457	160.1549	167.3112	173.4092 (44)
Energy conte	275.4227	242.5630	254.9636	217.4551	206.2748	180.9354	174.8964	184.5475	189.5838	217.3286	238.3654	271.5169 (45)
Energy content (annual)										Total = Sum(45)m =		2653.8533
Distribution loss (46)m = 0.15 x (45)m	41.3134	36.3844	38.2445	32.6183	30.9412	27.1403	26.2345	27.6821	28.4376	32.5993	35.7548	40.7275 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	12.1095	10.9245	12.0665	11.6158	11.9642	11.5391	11.8984	11.9186	11.5572	11.9875	11.6597	12.1013 (61)
Total heat required for water heating calculated for each month	287.5321	253.4875	267.0301	229.0709	218.2390	192.4745	186.7947	196.4661	201.1410	229.3161	250.0251	283.6182 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	287.5321	253.4875	267.0301	229.0709	218.2390	192.4745	186.7947	196.4661	201.1410	229.3161	250.0251	283.6182 (64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2795.1954 (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	94.6054	83.3833	87.7920	75.2078	71.5774	63.0458	61.1276	64.3417	65.9259	75.2586	82.1714	93.3047 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	146.1010	146.1010	146.1010	146.1010	146.1010	146.1010	146.1010	146.1010	146.1010	146.1010	146.1010	146.1010 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	159.2733	176.3383	159.2733	164.5824	159.2733	164.5824	159.2733	159.2733	164.5824	159.2733	164.5824	159.2733 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	312.4391	315.6812	307.5111	290.1180	268.1622	247.5270	233.7413	230.4992	238.6693	256.0624	278.0181	298.6534 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6101	37.6101	37.6101	37.6101	37.6101	37.6101	37.6101	37.6101	37.6101	37.6101	37.6101	37.6101 (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)	-116.8808	-116.8808	-116.8808	-116.8808	-116.8808	-116.8808	-116.8808	-116.8808	-116.8808	-116.8808	-116.8808	-116.8808 (71)
Water heating gains (Table 5)	127.1578	124.0823	118.0000	104.4552	96.2062	87.5636	82.1608	86.4808	91.5638	101.1541	114.1270	125.4095 (72)
Total internal gains	668.7005	685.9321	654.6148	628.9859	593.4721	566.5033	542.0057	543.0836	561.6458	586.3201	626.5578	653.1666 (73)

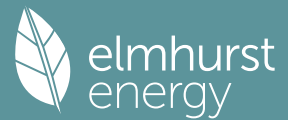
6. Solar gains

[Jan]			Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
North			7.8400	10.6334	0.5700	0.7000	0.7700	23.0512 (74)				
East			3.5700	19.6403	0.5700	0.7000	0.7700	19.3875 (76)				
South			18.3800	46.7521	0.5700	0.7000	0.7700	237.6033 (78)				
South			1.5000	43.9921	0.5700	0.7000	1.0000	23.6963 (82)				
Solar gains	303.7383	514.3490	698.3478	860.5379	962.6618	956.0009	921.5004	844.7138	754.1339	566.7523	363.1928	260.3698 (83)
Total gains	972.4388	1200.2811	1352.9626	1489.5238	1556.1339	1522.5042	1463.5061	1387.7974	1315.7796	1153.0724	989.7506	913.5364 (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	74.2020	74.4321	74.6637	75.8435	76.0839	77.3093	77.3093	77.5592	76.8144	76.0839	75.6045	75.1312

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alpha	5.9468	5.9621	5.9776	6.0562	6.0723	6.1540	6.1540	6.1706	6.1210	6.0723	6.0403	6.0087
util living area	0.9959	0.9859	0.9605	0.8825	0.7329	0.5332	0.3847	0.4222	0.6551	0.9177	0.9884	0.9971 (86)
MIT	20.5968	20.6561	20.7220	20.7940	20.8327	20.8469	20.8484	20.8487	20.8423	20.7885	20.6804	20.5894 (87)
Th 2	20.1371	20.1395	20.1420	20.1542	20.1567	20.1690	20.1690	20.1714	20.1641	20.1567	20.1518	20.1469 (88)
util rest of house	0.9947	0.9817	0.9490	0.8526	0.6800	0.4664	0.3124	0.3468	0.5842	0.8892	0.9842	0.9962 (89)
MIT 2	19.6484	19.7257	19.8099	19.9065	19.9490	19.9738	19.9747	19.9776	19.9654	19.9046	19.7686	19.6481 (90)
Living area fraction	MIT	19.8877	19.9605	20.0400	20.1304	20.1720	20.1941	20.1951	20.1974	20.1866	20.1276	19.9987
Temperature adjustment	adjusted MIT	19.8877	19.9605	20.0400	20.1304	20.1720	20.1941	20.1951	20.1974	20.1866	20.1276	19.9987
adjusted MIT												0.0000
												19.8856 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9942	0.9806	0.9474	0.8517	0.6810	0.4685	0.3147	0.3492	0.5862	0.8880	0.9833	0.9959 (94)
Useful gains	966.7999	1177.0107	1281.8415	1268.6385	1059.6846	713.2682	460.5112	484.6413	771.3430	1023.9847	973.1933	909.7673 (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	2081.4526	2004.8346	1796.8459	1467.1605	1103.2957	716.9692	460.7687	485.1228	785.1177	1240.7735	1690.4338	2068.6294 (97)
Space heating kWh	829.3016	556.2976	383.1633	142.9359	32.4467	0.0000	0.0000	0.0000	0.0000	161.2909	516.4131	862.1934 (98a)
Space heating requirement - total per year (kWh/year)												3484.0424
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	829.3016	556.2976	383.1633	142.9359	32.4467	0.0000	0.0000	0.0000	0.0000	161.2909	516.4131	862.1934 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3484.0424
Space heating per m2										(98c) / (4) =		24.4186 (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 %)												83.8000 (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	829.3016	556.2976	383.1633	142.9359	32.4467	0.0000	0.0000	0.0000	0.0000	161.2909	516.4131	862.1934 (98)
Space heating efficiency (main heating system 1)	83.8000	83.8000	83.8000	83.8000	83.8000	0.0000	0.0000	0.0000	0.0000	83.8000	83.8000	83.8000 (210)
Space heating fuel (main heating system)	989.6200	663.8397	457.2354	170.5678	38.7192	0.0000	0.0000	0.0000	0.0000	192.4712	616.2448	1028.8704 (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	287.5321	253.4875	267.0301	229.0709	218.2390	192.4745	186.7947	196.4661	201.1410	229.3161	250.0251	283.6182 (64)
Efficiency of water heater (217)m	88.2497	88.1318	87.9254	87.4950	86.9662	86.7000	86.7000	86.7000	86.7000	87.5550	88.1039	88.2708 (217)
Fuel for water heating, kWh/month	325.8166	287.6233	303.7009	261.8102	250.9470	222.0006	215.4495	226.6045	231.9966	261.9110	283.7845	321.3047 (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	60.1468	54.3261	60.1468	58.2066	60.1468	58.2066	60.1468	60.1468	58.2066	60.1468	58.2066	60.1468 (231)
Lighting	40.4456	32.4470	29.2149	21.4041	16.5331	13.5077	15.0821	19.6043	25.4640	33.4101	37.7367	41.5697 (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												4157.5685 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												86.7000
Water heating fuel used												3192.9494 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4140)												
mechanical ventilation fans (SFP = 1.4140)												622.1798 (230a)
central heating pump												41.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												708.1798 (231)
Electricity for lighting (calculated in Appendix L)												326.4193 (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)

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Energy used 0.0000 (237)
Total delivered energy for all uses 8385.1170 (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	4157.5685	0.2100	873.0894 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3192.9494	0.2100	670.5194 (264)
Space and water heating			1543.6087 (265)
Pumps, fans and electric keep-hot	708.1798	0.1387	98.2333 (267)
Energy for lighting	326.4193	0.1443	47.1124 (268)
Total CO2, kg/year			1688.9544 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			11.8400 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4157.5685	1.1300	4698.0524 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3192.9494	1.1300	3608.0328 (278)
Space and water heating			8306.0852 (279)
Pumps, fans and electric keep-hot	708.1798	1.5128	1071.3344 (281)
Energy for lighting	326.4193	1.5338	500.6729 (282)
Total Primary energy kWh/year			9878.0924 (286)
Dwelling Primary energy Rate (DPER)			69.2300 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	66.7000 (1b)	x 2.4000 (2b)	= 160.0800 (1b) - (3b)
First floor	75.9800 (1c)	x 2.6400 (2c)	= 200.5872 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.6800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	360.6672 (5)

2. Ventilation rate

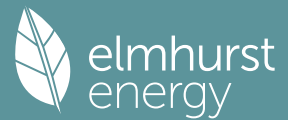
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number 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) = 0.1109 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3609 (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) = 0.3338 (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	0.4256	0.4173	0.4090	0.3672	0.3589	0.3171	0.3171	0.3088	0.3338	0.3589	0.3756	0.3923 (22b)
Effective ac	0.5906	0.5871	0.5836	0.5674	0.5644	0.5503	0.5503	0.5477	0.5557	0.5644	0.5705	0.5769 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
TER Opaque door			4.7700	1.0000	4.7700		(26)
TER Opening Type			29.4000	1.1450	33.6641		(27)
TER Roof Window			1.4800	1.1450	2.2256		(27a)
Heat Loss Floor 1			66.7000	0.1300	8.6710		(28a)
Heat Loss Floor 2			9.2900	0.1300	1.2077		(28b)
External Wall 1	161.9000	32.2800	129.6200	0.1800	23.3316		(29a)
Garage wall	13.3200	1.8900	11.4300	0.1800	2.0574		(29a)
Sud wall1	11.3200		11.3200	0.1800	2.0376		(29a)

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Pitched roof	11.3400	1.4800	9.8600	0.1100	1.0846	(30)
Ceiling joists	66.7000		66.7000	0.1100	7.3370	(30)
Total net area of external elements Aum(A, m2)			340.5700			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		86.3866	(33)

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

List of Thermal Bridges						
K1 Element	Length	Psi-value	Total			
E2 Other lintels (including other steel lintels)	20.3400	0.0500	1.0170			
E3 Sill	18.0700	0.0500	0.9035			
E4 Jamb	52.2200	0.0500	2.6110			
E5 Ground floor (normal)	35.2200	0.1600	5.6352			
E6 Intermediate floor within a dwelling	41.9000	0.0000	0.0000			
E16 Corner (normal)	20.1600	0.0900	1.8144			
R1 Head of roof window	1.5000	0.0800	0.1200			
R2 Sill of roof window	1.5000	0.0600	0.0900			
R3 Jamb of roof window	4.0000	0.0800	0.3200			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			12.5111			(36)
Point Thermal bridges			(36a) =		0.0000	
Total fabric heat loss			(33) + (36) + (36a) =		98.8977	(37)

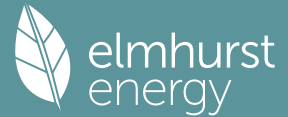
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	70.2917	69.8730	69.4626	67.5351	67.1745	65.4957	65.4957	65.1848	66.1423	67.1745	67.9040	68.6667	(38)
Average = Sum(39)m / 12 =	169.1893	168.7707	168.3603	166.4328	166.0722	164.3934	164.3934	164.0825	165.0400	166.0722	166.8017	167.5644	(39)
												166.4311	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1858	1.1829	1.1800	1.1665	1.1639	1.1522	1.1522	1.1500	1.1567	1.1639	1.1691	1.1744	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)													
Assumed occupancy													2.9220 (42)
Hot water usage for mixer showers													
	94.0730	92.6593	90.5992	86.6576	83.7488	80.5049	78.6611	80.7056	82.9467	86.4297	90.4559	93.7126	(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													
	44.5544	42.9343	41.3141	39.6939	38.0738	36.4536	36.4536	38.0738	39.6939	41.3141	42.9343	44.5544	(42c)
Average daily hot water use (litres/day)													127.2362 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	138.6274	135.5935	131.9133	126.3515	121.8225	116.9585	115.1147	118.7793	122.6407	127.7437	133.3902	138.2670	(44)
Energy content (annual)	219.5519	193.0834	202.7458	172.9689	163.9966	143.8141	139.2212	147.0736	151.2282	173.3471	190.0388	216.4927	(45)
Distribution loss (46)m = 0.15 x (45)m													
	32.9328	28.9625	30.4119	25.9453	24.5995	21.5721	20.8832	22.0610	22.6842	26.0021	28.5058	32.4739	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
WWHRS	270.5109	239.1108	253.7047	222.2840	214.9555	193.1292	190.1801	198.0325	200.5433	224.3060	239.3538	267.4516	(62)
PV diverter	-43.0062	-38.0351	-39.8281	-32.9793	-30.7355	-26.3006	-24.6526	-26.2156	-27.2116	-32.0795	-36.3422	-42.2098	(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	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)
12Total per year (kWh/year)	227.5046	201.0757	213.8766	189.3047	184.2200	166.8286	165.5275	171.8170	173.3317	192.2265	203.0117	225.2418	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains from water heating, kWh/month													
	85.7407	75.7071	80.1527	69.8409	67.2686	60.1470	59.0308	61.6417	62.6121	70.3776	75.5167	84.7235	(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	146.1010	146.1010	146.1010	146.1010	146.1010	146.1010	146.1010	146.1010	146.1010	146.1010	146.1010	146.1010	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	157.6800	174.5743	157.6800	162.9360	157.6800	162.9360	157.6800	157.6800	162.9360	157.6800	162.9360	157.6800	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	312.4391	315.6812	307.5111	290.1180	268.1622	247.5270	233.7413	230.4992	238.6693	256.0624	278.0181	298.6534	(68)
Pumps, fans	37.6101	37.6101	37.6101	37.6101	37.6101	37.6101	37.6101	37.6101	37.6101	37.6101	37.6101	37.6101	(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)	-116.8808	-116.8808	-116.8808	-116.8808	-116.8808	-116.8808	-116.8808	-116.8808	-116.8808	-116.8808	-116.8808	-116.8808	(71)
Total internal gains	115.2429	112.6593	107.7321	97.0013	90.4148	83.5375	79.3425	82.8518	86.9613	94.5936	104.8842	113.8757	(72)
	655.1924	672.7452	642.7536	619.8856	586.0874	560.8308	537.5941	537.8613	555.3969	578.1664	615.6687	640.0395	(73)

6. Solar gains													
[Jan]		Area	Solar flux	g	FF	Access	Gains						
		m2	Table 6a	Specific data	Specific data	factor	W						
			W/m2	or Table 6b	or Table 6c	Table 6d							
North		7.7400	10.6334	0.6300	0.7000	0.7700	25.1527	(74)					
East		3.5200	19.6403	0.6300	0.7000	0.7700	21.1282	(76)					

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South				18.1400		46.7521		0.6300		0.7000		0.7700	259.1850 (78)
South				1.4800		43.9921		0.6300		0.7000		1.0000	25.8415 (82)

Solar gains	331.3074	561.0296	761.7191	938.6190	1050.0065	1042.7412	1005.1103	921.3577	822.5641	618.1862	396.1573	284.0031 (83)	
Total gains	986.4997	1233.7748	1404.4727	1558.5046	1636.0939	1603.5720	1542.7044	1459.2190	1377.9611	1196.3526	1011.8260	924.0426 (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	58.5636	58.7089	58.8520	59.5335	59.6628	60.2721	60.2721	60.3863	60.0359	59.6628	59.4019	59.1315	
alpha	4.9042	4.9139	4.9235	4.9689	4.9775	5.0181	5.0181	5.0258	5.0024	4.9775	4.9601	4.9421	
util living area	0.9963	0.9886	0.9710	0.9192	0.8078	0.6265	0.4632	0.5080	0.7453	0.9444	0.9907	0.9973 (86)	
MIT	19.6246	19.8816	20.1949	20.5647	20.8330	20.9644	20.9935	20.9898	20.9161	20.5524	20.0146	19.5836 (87)	
Th 2	19.9314	19.9337	19.9360	19.9469	19.9489	19.9584	19.9584	19.9602	19.9548	19.9489	19.9448	19.9405 (88)	
util rest of house	0.9950	0.9849	0.9614	0.8931	0.7512	0.5367	0.3566	0.3979	0.6610	0.9206	0.9871	0.9963 (89)	
MIT 2	18.3384	18.6667	19.0618	19.5176	19.8135	19.9390	19.9565	19.9568	19.9013	19.5150	18.8460	18.2927 (90)	
Living area fraction									fLA = Living area / (4) =			0.2523 (91)	
MIT	18.6629	18.9733	19.3477	19.7818	20.0708	20.1977	20.2181	20.2175	20.1574	19.7767	19.1408	18.6184 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.6629	18.9733	19.3477	19.7818	20.0708	20.1977	20.2181	20.2175	20.1574	19.7767	19.1408	18.6184 (93)	

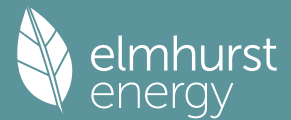
8. Space heating requirement													

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9928	0.9804	0.9547	0.8883	0.7585	0.5582	0.3836	0.4257	0.6787	0.9157	0.9832	0.9946 (94)	
Useful gains	979.4213	1209.5478	1340.7852	1384.4415	1240.8979	895.1805	591.7253	621.2474	935.1960	1095.5392	994.7946	919.0890 (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	2430.0560	2375.1557	2163.0381	1811.0908	1390.1530	920.2263	594.7955	626.3768	999.7120	1524.0022	2008.4295	2416.0089 (97)	
Space heating kWh	1079.2722	783.2885	611.7562	307.1875	111.0458	0.0000	0.0000	0.0000	0.0000	318.7764	729.8171	1113.7084 (98a)	
Space heating requirement - total per year (kWh/year)												5054.8521	
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	1079.2722	783.2885	611.7562	307.1875	111.0458	0.0000	0.0000	0.0000	0.0000	318.7764	729.8171	1113.7084 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												5054.8521	
Space heating per m2										(98c) / (4) =		35.4279 (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	1079.2722	783.2885	611.7562	307.1875	111.0458	0.0000	0.0000	0.0000	0.0000	318.7764	729.8171	1113.7084 (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)	1168.0435	847.7148	662.0738	332.4540	120.1794	0.0000	0.0000	0.0000	0.0000	344.9961	789.8453	1205.3122 (211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)	
Water heating requirement	227.5046	201.0757	213.8766	189.3047	184.2200	166.8286	165.5275	171.8170	173.3317	192.2265	203.0117	225.2418 (64)	
Efficiency of water heater (217)m	87.2728	86.9968	86.5002	85.4122	83.3318	80.3000	80.3000	80.3000	80.3000	85.4571	86.8751	87.3267 (217)	
Fuel for water heating, kWh/month	260.6822	231.1300	247.2556	221.6366	221.0681	207.7567	206.1364	213.9688	215.8551	224.9391	233.6822	257.9300 (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	32.7628	26.2835	23.6654	17.3383	13.3926	10.9419	12.2172	15.8803	20.6270	27.0637	30.5684	33.6734 (232)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-65.4246	-89.5159	-124.8901	-136.1050	-143.1380	-132.2033	-130.4097	-124.7500	-114.4192	-100.1144	-70.8846	-56.8741 (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	-45.7372	-95.0490	-186.8671	-277.8131	-364.7170	-365.6293	-361.4675	-307.3700	-226.9615	-135.1371	-60.7877	-36.2706 (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												5470.6191 (211)	
Space heating fuel - main system 2												0.0000 (213)	
Space heating fuel - secondary												0.0000 (215)	
Efficiency of water heater												80.3000	
Water heating fuel used												2742.0409 (219)	
Space cooling fuel												0.0000 (221)	

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Electricity for pumps and fans:	
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	264.4146 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-3752.5361 (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	4810.5385 (238)

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

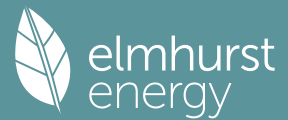
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5470.6191	0.2100	1148.8300 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2742.0409	0.2100	575.8286 (264)
Space and water heating			1724.6586 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	264.4146	0.1443	38.1632 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1288.7290	0.1353	-174.3128
PV Unit electricity exported	-2463.8071	0.1262	-310.9097
Total			-485.2225 (269)
Total CO2, kg/year			1289.5286 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.0400 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	5470.6191	1.1300	6181.7996 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2742.0409	1.1300	3098.5062 (278)
Space and water heating			9280.3058 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	264.4146	1.5338	405.5679 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1288.7290	1.4999	-1933.0078
PV Unit electricity exported	-2463.8071	0.4632	-1141.2835
Total			-3074.2912 (283)
Total Primary energy kWh/year			6741.6832 (286)
Target Primary Energy Rate (TPER)			47.2500 (287)

13 **Appendix 2 Be Green DER/TER SAP Worksheets**

Full SAP Calculation Printout



Property Reference	S13240 01			Issued on Date	21/08/2025
Assessment Reference	Be Green	Prop Type Ref			
Property	Ginnell Farm, Plot 1, Broad Lane, OL16 4				
SAP Rating	96 A	DER	-0.46	TER	8.84
Environmental	101 A	% DER < TER			105.20
CO ₂ Emissions (t/year)	-0.01	DFEE	35.96	TFEE	39.80
Compliance Check	See BREL	% DFEE < TFEE			9.63
% DPER < TPER	75.39	DPER	11.36	TPER	46.18
Assessor Details	Mr. Peter Kinsella			Assessor ID	L770-0002
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	66.7000 (1b)	x 2.4000 (2b)	= 160.0800 (1b) - (3b)
First floor	75.9800 (1c)	x 2.6400 (2c)	= 200.5872 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.6800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 360.6672 (5)

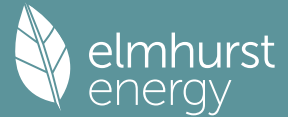
2. Ventilation rate

	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	3.0000 (17)											
Infiltration rate	0.1500 (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) = 0.1388 (21)											
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	0.1769	0.1734	0.1700	0.1526	0.1492	0.1318	0.1318	0.1283	0.1388	0.1492	0.1561	0.1630 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												63.2000 (23c)
Effective ac	0.3609	0.3574	0.3540	0.3366	0.3332	0.3158	0.3158	0.3123	0.3227	0.3332	0.3401	0.3470 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Door			2.8800	1.0000	2.8800		(26)
Windows			29.7900	0.9615	28.6442		(27)
Garage			1.8900	1.4000	2.6460		(26)
Roof lights			1.5000	0.9615	1.4423		(27a)
Heat Loss Floor 1			66.7000	0.1000	6.6700		(28a)
Heat Loss Floor 2			9.2900	0.1000	0.9290		(28b)
External Wall 1	161.9000	32.6700	129.2300	0.1500	19.3845		(29a)
Garage wall	13.3200	1.8900	11.4300	0.1400	1.6002		(29a)
Sud wall1	11.3200		11.3200	0.1500	1.6980		(29a)
Pitched roof	11.3400	1.5000	9.8400	0.1000	0.9840		(30)
Ceiling joists	66.7000		66.7000	0.1000	6.6700		(30)
Total net area of external elements Aum (A, m ²)			340.5700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	73.5482		(33)

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Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 17.0285 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 90.5767 (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
	42.9551	42.5423	42.1294	40.0652	39.6523	37.5881	37.5881	37.1752	38.4138	39.6523	40.4780	41.3037
Heat transfer coeff												
	133.5319	133.1190	132.7062	130.6419	130.2291	128.1648	128.1648	127.7519	128.9905	130.2291	131.0548	131.8805
Average = Sum(39)m / 12 =												130.5387
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9359	0.9330	0.9301	0.9156	0.9127	0.8983	0.8983	0.8954	0.9041	0.9127	0.9185	0.9243
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9220
Hot water usage for mixer showers												(42)
	129.3504	127.4065	124.5739	119.1542	115.1546	110.6942	108.1590	110.9702	114.0517	118.8408	124.3769	128.8548
Hot water usage for baths												(42a)
	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												(42b)
	44.5544	42.9343	41.3141	39.6939	38.0738	36.4536	36.4536	38.0738	39.6939	41.3141	42.9343	44.5544
Average daily hot water use (litres/day)												159.7607
												(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	173.9048	170.3408	165.8880	158.8481	153.2283	147.1478	144.6126	149.0439	153.7457	160.1549	167.3112	173.4092
Energy conte	275.4227	242.5630	254.9636	217.4551	206.2748	180.9354	174.8964	184.5475	189.5838	217.3286	238.3654	271.5169
Energy content (annual)												(44)
Distribution loss (46)m = 0.15 x (45)m												2653.8533
	41.3134	36.3844	38.2445	32.6183	30.9412	27.1403	26.2345	27.6821	28.4376	32.5993	35.7548	40.7275
Water storage loss:												(45)
Store volume												200.0000
a) If manufacturer declared loss factor is known (kWh/day):												1.8900
Temperature factor from Table 2b												0.5400
Enter (49) or (54) in (55)												1.0206
Total storage loss												(47)
	31.6386	28.5768	31.6386	30.6180	31.6386	30.6180	31.6386	31.6386	30.6180	31.6386	30.6180	31.6386
If cylinder contains dedicated solar storage												(48)
	31.6386	28.5768	31.6386	30.6180	31.6386	30.6180	31.6386	31.6386	30.6180	31.6386	30.6180	31.6386
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
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												(49)
	330.3237	292.1510	309.8646	270.5851	261.1758	234.0654	229.7974	239.4485	242.7138	272.2296	291.4954	326.4179
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												(60)
	330.3237	292.1510	309.8646	270.5851	261.1758	234.0654	229.7974	239.4485	242.7138	272.2296	291.4954	326.4179
12Total per year (kWh/year)												3300.2683
Electric shower(s)												3300
	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
Heat gains from water heating, kWh/month												(61)
	135.4988	120.3226	128.6962	114.8078	112.5072	102.6650	102.0739	105.2829	105.5406	116.1826	121.7605	134.2002

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

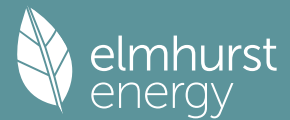
Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	146.1010	146.1010	146.1010	146.1010	146.1010	146.1010	146.1010	146.1010	146.1010	146.1010	146.1010	146.1010
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												(67)
	159.2733	176.3383	159.2733	164.5824	159.2733	164.5824	159.2733	159.2733	164.5824	159.2733	164.5824	159.2733
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												(68)
	312.4391	315.6812	307.5111	290.1180	268.1622	247.5270	233.7413	230.4992	238.6693	256.0624	278.0181	298.6534
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												(69)
	37.6101	37.6101	37.6101	37.6101	37.6101	37.6101	37.6101	37.6101	37.6101	37.6101	37.6101	37.6101
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)												(70)
	-116.8808	-116.8808	-116.8808	-116.8808	-116.8808	-116.8808	-116.8808	-116.8808	-116.8808	-116.8808	-116.8808	-116.8808
Water heating gains (Table 5)												(71)
	182.1221	179.0515	172.9788	159.4553	151.2193	142.5903	137.1960	141.5092	146.5842	156.1594	169.1118	180.3766
Total internal gains												(72)
	720.6648	737.9013	706.5935	680.9860	645.4852	621.5300	597.0410	598.1120	616.6662	638.3254	678.5427	705.1336

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		7.8400	10.6334	0.5700	0.7000	0.7700	23.0512
East		3.5700	19.6403	0.5700	0.7000	0.7700	19.3875
South		18.3800	46.7521	0.5700	0.7000	0.7700	237.6033
South		1.5000	43.9921	0.5700	0.7000	1.0000	23.6963
Solar gains	303.7383	514.3490	698.3478	860.5379	962.6618	956.0009	921.5004
Total gains	1024.4031	1252.2503	1404.9413	1541.5239	1608.1470	1577.5309	1518.5413

7. Mean internal temperature (heating season)

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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	74.2020	74.4321	74.6637	75.8435	76.0839	77.3093	77.3093	77.5592	76.8144	76.0839	75.6045	75.1312
alpha	5.9468	5.9621	5.9776	6.0562	6.0723	6.1540	6.1540	6.1706	6.1210	6.0723	6.0403	6.0087
util living area	0.9947	0.9827	0.9537	0.8688	0.7147	0.5155	0.3708	0.4064	0.6323	0.9035	0.9851	0.9962 (86)
Living	20.6067	20.6653	20.7299	20.7988	20.8345	20.8472	20.8485	20.8488	20.8432	20.7945	20.6898	20.5994
Non living	19.6609	19.7373	19.8194	19.9116	19.9504	19.9740	19.9747	19.9776	19.9660	19.9111	19.7804	19.6608
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.7988	20.6653	20.7299	20.7988	20.8345	20.8472	20.8485	20.8488	20.8432	20.7945	20.6898	20.6554 (87)
Th 2	20.1371	20.1395	20.1420	20.1542	20.1567	20.1690	20.1690	20.1714	20.1641	20.1567	20.1518	20.1469 (88)
util rest of house	0.9930	0.9777	0.9407	0.8372	0.6616	0.4506	0.3011	0.3337	0.5626	0.8721	0.9798	0.9949 (89)
MIT 2	19.9473	19.7373	19.8194	19.9116	19.9504	19.9740	19.9747	19.9776	19.9660	19.9111	19.7804	19.7484 (90)
Living area fraction									fLA = Living area / (4) =			0.2523 (91)
MIT	20.1621	19.9714	20.0491	20.1355	20.1735	20.1943	20.1951	20.1974	20.1873	20.1340	20.0098	19.9773 (92)
Temperature adjustment												0.0000
adjusted MIT	20.1621	19.9714	20.0491	20.1355	20.1735	20.1943	20.1951	20.1974	20.1873	20.1340	20.0098	19.9773 (93)

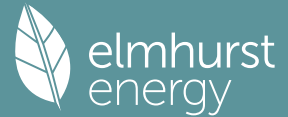
8. Space heating requirement												

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9931	0.9765	0.9391	0.8364	0.6627	0.4526	0.3033	0.3360	0.5646	0.8711	0.9788	0.9947 (94)
Useful gains	1017.3211	1222.8161	1319.3422	1289.3581	1065.6794	713.9287	460.5624	484.7405	773.9178	1049.7322	1019.6172	960.3484 (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	2118.0987	2006.2943	1798.0481	1467.8259	1103.4946	716.9932	460.7710	485.1270	785.2077	1241.5995	1691.8940	2080.7147 (97)
Space heating kWh	818.9785	526.4974	356.1572	128.4968	28.1345	0.0000	0.0000	0.0000	0.0000	142.7492	484.0393	833.5526 (98a)
Space heating requirement - total per year (kWh/year)												3318.6054
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	818.9785	526.4974	356.1572	128.4968	28.1345	0.0000	0.0000	0.0000	0.0000	142.7492	484.0393	833.5526 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3318.6054
Space heating per m2										(98c) / (4) =		23.2591 (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 %)												383.4385 (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	818.9785	526.4974	356.1572	128.4968	28.1345	0.0000	0.0000	0.0000	0.0000	142.7492	484.0393	833.5526 (98)
Space heating efficiency (main heating system 1)	383.4385	383.4385	383.4385	383.4385	383.4385	0.0000	0.0000	0.0000	0.0000	383.4385	383.4385	383.4385 (210)
Space heating fuel (main heating system)	213.5880	137.3095	92.8851	33.5117	7.3374	0.0000	0.0000	0.0000	0.0000	37.2287	126.2365	217.3888 (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	330.3237	292.1510	309.8646	270.5851	261.1758	234.0654	229.7974	239.4485	242.7138	272.2296	291.4954	326.4179 (64)
Efficiency of water heater	177.4052	177.4052	177.4052	177.4052	177.4052	177.4052	177.4052	177.4052	177.4052	177.4052	177.4052	177.4052 (216)
Fuel for water heating, kWh/month	186.1973	164.6801	174.6650	152.5238	147.2200	131.9384	129.5325	134.9727	136.8133	153.4508	164.3106	183.9957 (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	52.8427	47.7289	52.8427	51.1381	52.8427	51.1381	52.8427	52.8427	51.1381	52.8427	51.1381	52.8427 (231)
Lighting	40.4456	32.4470	29.2149	21.4041	16.5331	13.5077	15.0821	19.6043	25.4640	33.4101	37.7367	41.5697 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-80.8048	-118.9434	-177.1697	-199.0738	-212.9022	-198.0601	-195.3908	-184.4270	-161.5163	-133.9214	-89.3987	-68.9239 (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	-36.3108	-85.4596	-192.8035	-325.2177	-457.1364	-469.2585	-459.5330	-373.3482	-255.0323	-133.5112	-51.3343	-27.8297 (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												865.4856 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												177.4052
Water heating fuel used												1860.3001 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4140)												622.1798 (230a)
mechanical ventilation fans (SFP = 1.4140)												622.1798 (231)
Total electricity for the above, kWh/year												326.4193 (232)
Electricity for lighting (calculated in Appendix L)												

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

PV generation	-4687.3075 (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	-1012.9226 (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	865.4856	0.1575	136.3157 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1860.3001	0.1410	262.3570 (264)
Space and water heating			398.6727 (265)
Pumps, fans and electric keep-hot	622.1798	0.1387	86.3040 (267)
Energy for lighting	326.4193	0.1443	47.1124 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1820.5322	0.1344	-244.6433
PV Unit electricity exported	-2866.7752	0.1232	-353.1996
Total			-597.8429 (269)
Total CO2, kg/year			-65.7538 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			-0.4600 (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	865.4856	1.5830	1370.0894 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1860.3001	1.5215	2830.4136 (278)
Space and water heating			4200.5030 (279)
Pumps, fans and electric keep-hot	622.1798	1.5128	941.2336 (281)
Energy for lighting	326.4193	1.5338	500.6729 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1820.5322	1.4966	-2724.6899
PV Unit electricity exported	-2866.7752	0.4521	-1296.1702
Total			-4020.8601 (283)
Total Primary energy kWh/year			1621.5494 (286)
Dwelling Primary energy Rate (DPER)			11.3600 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	66.7000 (1b)	x 2.4000 (2b)	= 160.0800 (1b) - (3b)
First floor	75.9800 (1c)	x 2.6400 (2c)	= 200.5872 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.6800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	360.6672 (5)

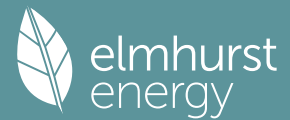
2. Ventilation rate

	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) =	0.1109 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3609	(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) =		0.3338 (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	0.4256	0.4173	0.4090	0.3672	0.3589	0.3171	0.3171	0.3088	0.3338	0.3589	0.3756	0.3923 (22b)
Effective ac	0.5906	0.5871	0.5836	0.5674	0.5644	0.5503	0.5503	0.5477	0.5557	0.5644	0.5705	0.5769 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Main dwelling													
TER Opaque door			4.7700	1.0000	4.7700			(26)					
TER Opening Type			29.4000	1.1450	33.6641			(27)					
TER Roof Window			1.4800	1.1450	2.2256			(27a)					
Heat Loss Floor 1			66.7000	0.1300	8.6710			(28a)					
Heat Loss Floor 2			9.2900	0.1300	1.2077			(28b)					
External Wall 1	161.9000	32.2800	129.6200	0.1800	23.3316			(29a)					
Garage wall	13.3200	1.8900	11.4300	0.1800	2.0574			(29a)					
Sud wall1	11.3200		11.3200	0.1800	2.0376			(29a)					
Pitched roof	11.3400	1.4800	9.8600	0.1100	1.0846			(30)					
Ceiling joists	66.7000		66.7000	0.1100	7.3370			(30)					
Total net area of external elements Aum(A, m2)			340.5700					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)... (30) + (32) =	86.3866			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value		Total						
E2 Other lintels (including other steel lintels)				20.3400	0.0500		1.0170						
E3 Sill				18.0700	0.0500		0.9035						
E4 Jamb				52.2200	0.0500		2.6110						
E5 Ground floor (normal)				35.2200	0.1600		5.6352						
E6 Intermediate floor within a dwelling				41.9000	0.0000		0.0000						
E16 Corner (normal)				20.1600	0.0900		1.8144						
R1 Head of roof window				1.5000	0.0800		0.1200						
R2 Sill of roof window				1.5000	0.0600		0.0900						
R3 Jamb of roof window				4.0000	0.0800		0.3200						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.5111	(36)					
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss						(33) + (36) + (36a) =	98.8977	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 70.2917	Feb 69.8730	Mar 69.4626	Apr 67.5351	May 67.1745	Jun 65.4957	Jul 65.4957	Aug 65.1848	Sep 66.1423	Oct 67.1745	Nov 67.9040	Dec 68.6667	(38)
Heat transfer coeff	169.1893	168.7707	168.3603	166.4328	166.0722	164.3934	164.3934	164.0825	165.0400	166.0722	166.8017	167.5644	(39)
Average = Sum(39)m / 12 =												166.4311	
HLP	Jan 1.1858	Feb 1.1829	Mar 1.1800	Apr 1.1665	May 1.1639	Jun 1.1522	Jul 1.1522	Aug 1.1500	Sep 1.1567	Oct 1.1639	Nov 1.1691	Dec 1.1744	(40)
HLP (average)												1.1665	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

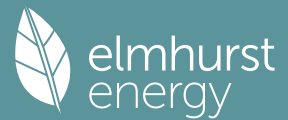
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9220	(42)
Hot water usage for mixer showers	94.0730	92.6593	90.5992	86.6576	83.7488	80.5049	78.6611	80.7056	82.9467	86.4297	90.4559	93.7126	(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	44.5544	42.9343	41.3141	39.6939	38.0738	36.4536	36.4536	38.0738	39.6939	41.3141	42.9343	44.5544	(42c)	
Average daily hot water use (litres/day)													127.2362	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy content	138.6274	135.5935	131.9133	126.3515	121.8225	116.9585	115.1147	118.7793	122.6407	127.7437	133.3902	138.2670	(44)	
Energy content (annual)	219.5519	193.0834	202.7458	172.9689	163.9966	143.8141	139.2212	147.0736	151.2282	173.3471	190.0388	216.4927	(45)	
Distribution loss (46)m = 0.15 x (45)m	32.9328	28.9625	30.4119	25.9453	24.5995	21.5721	20.8832	22.0610	22.6842	26.0021	28.5058	32.4739	(46)	
Water storage loss:														
Store volume													200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6525	(48)
Temperature factor from Table 2b													0.5400	(49)
Enter (49) or (54) in (55)													0.8924	(55)
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)	
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(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														
WWHRS	270.4780	239.0811	253.6719	222.2522	214.9226	193.0974	190.1473	197.9997	200.5115	224.2731	239.3221	267.4188	(62)	
PV diverter	-43.0062	-38.0351	-39.8281	-32.9793	-30.7355	-26.3006	-24.6526	-26.2156	-27.2116	-32.0795	-36.3422	-42.2098	(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	227.4718	201.0460	213.8437	189.2729	184.1871	166.7968	165.4947	171.7841	173.2999	192.1937	202.9799	225.2089	(64)	
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2313.5796	(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														
	113.7419	100.9984	108.1538	96.9388	95.2697	87.2448	87.0319	89.6428	89.7100	98.3788	102.6145	112.7247	(65)	

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

Metabolic gains (Table 5), Watts													
(66)m	Jan 146.1010	Feb 146.1010	Mar 146.1010	Apr 146.1010	May 146.1010	Jun 146.1010	Jul 146.1010	Aug 146.1010	Sep 146.1010	Oct 146.1010	Nov 146.1010	Dec 146.1010	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
157.6800	174.5743	157.6800	162.9360	157.6800	162.9360	157.6800	157.6800	157.6800	162.9360	157.6800	162.9360	157.6800	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
312.4391	315.6812	307.5111	290.1180	268.1622	247.5270	233.7413	230.4992	238.6693	256.0624	278.0181	298.6534	298.6534	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													

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Pumps, fans	37.6101 3.0000	37.6101 3.0000	37.6101 3.0000	37.6101 3.0000	37.6101 3.0000	37.6101 0.0000	37.6101 0.0000	37.6101 0.0000	37.6101 0.0000	37.6101 3.0000	37.6101 3.0000	37.6101 3.0000	(69) 3.0000 (70)
Losses e.g. evaporation	(negative values) (Table 5)												
	-116.8808	-116.8808	-116.8808	-116.8808	-116.8808	-116.8808	-116.8808	-116.8808	-116.8808	-116.8808	-116.8808	-116.8808	(71)
Water heating gains	(Table 5)												
	152.8789	150.2953	145.3681	134.6372	128.0507	121.1734	116.9784	120.4877	124.5972	132.2295	142.5202	151.5117	(72)
Total internal gains	692.8283	710.3811	680.3895	657.5216	623.7233	598.4667	575.2301	575.4972	593.0329	615.8023	653.3047	677.6755	(73)

6. Solar gains

[Jan]													
					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					7.7400	10.6334		0.6300	0.7000	0.7700		25.1527 (74)	
East					3.5200	19.6403		0.6300	0.7000	0.7700		21.1282 (76)	
South					18.1400	46.7521		0.6300	0.7000	0.7700		259.1850 (78)	
South					1.4800	43.9921		0.6300	0.7000	1.0000		25.8415 (82)	
Solar gains	331.3074	561.0296	761.7191	938.6190	1050.0065	1042.7412	1005.1103	921.3577	822.5641	618.1862	396.1573	284.0031 (83)	
Total gains	1024.1357	1271.4108	1442.1087	1596.1406	1673.7298	1641.2079	1580.3403	1496.8550	1415.5970	1233.9885	1049.4620	961.6786 (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	58.5636	58.7089	58.8520	59.5335	59.6628	60.2721	60.2721	60.3863	60.0359	59.6628	59.4019	59.1315
alpha	4.9042	4.9139	4.9235	4.9689	4.9775	5.0181	5.0181	5.0258	5.0024	4.9775	4.9601	4.9421
util living area	0.9956	0.9871	0.9679	0.9129	0.7976	0.6145	0.4527	0.4961	0.7318	0.9382	0.9892	0.9967 (86)
MIT	19.6520	19.9080	20.2189	20.5830	20.8429	20.9673	20.9941	20.9908	20.9228	20.5732	20.0413	19.6113 (87)
Th 2	19.9314	19.9337	19.9360	19.9469	19.9489	19.9584	19.9584	19.9602	19.9548	19.9489	19.9448	19.9405 (88)
util rest of house	0.9941	0.9830	0.9575	0.8854	0.7399	0.5255	0.3482	0.3882	0.6469	0.9124	0.9850	0.9956 (89)
MIT 2	18.3734	18.6999	19.0911	19.5381	19.8225	19.9407	19.9567	19.9572	19.9061	19.5386	18.8795	18.3280 (90)
Living area fraction	FLA = Living area / (4) =											
MIT	18.6960	19.0047	19.3757	19.8018	20.0800	20.1997	20.2184	20.2180	20.1627	19.7996	19.1727	18.6518 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.6960	19.0047	19.3757	19.8018	20.0800	20.1997	20.2184	20.2180	20.1627	19.7996	19.1727	18.6518 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9917	0.9781	0.9506	0.8810	0.7478	0.5469	0.3747	0.4154	0.6651	0.9079	0.9807	0.9937 (94)
Useful gains	1015.6090	1243.5548	1370.8414	1406.1906	1251.6052	897.6443	592.0852	621.8648	941.5118	1120.3142	1029.2182	955.6124 (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	2435.6580	2380.4626	2167.7488	1814.4091	1391.6853	920.5576	594.8464	626.4626	1000.5831	1527.8047	2013.7414	2421.6078 (97)
Space heating kWh	1056.5165	764.0020	592.8991	293.9173	104.2196	0.0000	0.0000	0.0000	0.0000	303.1729	708.8567	1090.7006 (98a)
Space heating requirement - total per year (kWh/year)	4914.2846											
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	1056.5165	764.0020	592.8991	293.9173	104.2196	0.0000	0.0000	0.0000	0.0000	303.1729	708.8567	1090.7006 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	4914.2846											
Space heating per m ²	(98c) / (4) = 34.4427 (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	1056.5165	764.0020	592.8991	293.9173	104.2196	0.0000	0.0000	0.0000	0.0000	303.1729	708.8567	1090.7006 (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)	1144.6549	827.7378	642.3609	318.4369	112.9139	0.0000	0.0000	0.0000	0.0000	328.4647	767.9921	1181.6908 (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	227.4718	201.0460	213.8437	189.2729	184.1871	166.7968	165.4947	171.7841	173.2999	192.1937	202.9799	225.2089 (64)
Efficiency of water heater (217)m	87.0605	86.7615	86.2224	85.0429	82.8338	79.8000	79.8000	79.8000	79.8000	85.0772	86.6252	79.8000 (216)
Fuel for water heating, kWh/month	261.2801	231.7227	248.0142	222.5616	222.3576	209.0186	207.3868	215.2683	217.1678	225.9049	234.3197	258.5089 (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	32.7628	26.2835	23.6654	17.3383	13.3926	10.9419	12.2172	15.8803	20.6270	27.0637	30.5684	33.6734 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-65.4246	-89.5159	-124.8901	-136.1050	-143.1380	-132.2033	-130.4097	-124.7500	-114.4192	-100.1144	-70.8846	-56.8741 (233a)

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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	-45.7372	-95.0490	-186.8671	-277.8131	-364.7170	-365.6293	-361.4675	-307.3700	-226.9615	-135.1371	-60.7877	-36.2706	(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												5324.2520	(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												2753.5112	(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)												264.4146	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-3752.5361	(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												4675.6417	(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	5324.2520	0.2100	1118.0929	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2753.5112	0.2100	578.2374	(264)
Space and water heating			1696.3303	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	264.4146	0.1443	38.1632	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1288.7290	0.1353	-174.3128	
PV Unit electricity exported	-2463.8071	0.1262	-310.9097	
Total			-485.2225	(269)
Total CO2, kg/year			1261.2002	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.8400	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	5324.2520	1.1300	6016.4048	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2753.5112	1.1300	3111.4677	(278)
Space and water heating			9127.8724	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	264.4146	1.5338	405.5679	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1288.7290	1.4999	-1933.0078	
PV Unit electricity exported	-2463.8071	0.4632	-1141.2835	
Total			-3074.2912	(283)
Total Primary energy kWh/year			6589.2499	(286)
Target Primary Energy Rate (TPER)			46.1800	(287)