



Energy and Sustainability Report

Cowm Top Lane, Castleton

Client: GLP Ltd. and Barratt Homes

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About Environmental Economics

Our team of experienced consultants specialise in construction and building energy. We have qualifications in sustainability, energy, engineering, building physics and construction as well as environmental, quality management and auditing.

Over the last decade, we have provided assessments and consultancy for some of the largest UK house builders, including Barratt Developments, David Wilson Homes, Bellway Homes, Abbey New Homes and Davidsons. We develop flexible, practical, cost-effective specifications for our clients through identifying solutions and delivering design advice. This includes the following disciplines:

- *Overheating Analysis (dynamic thermal modelling)*
- *Daylighting / Sunlight Simulations*
- *Energy Reports*
- *Compliance assessments and advice covering*
 - *Part L (SAP)*
 - *Part F (ventilation)*
 - *Part G (water)*
- *BREEAM*
- *SBEM (existing and new build)*
- *Minimum Energy Efficiency Standards (MEES)*
- *Thermal Bridging (Psi value calculations)*

Contents

1.	Executive Summary	1
2.	Project Overview.....	2
2.1.	Description of Site	2
2.2.	Planning Policy.....	2
2.3.	Building Regulations.....	3
3.	Design Response.....	4
3.1.	Assessment Methodology.....	4
3.2.	Design Philosophy.....	5
3.3.	Fabric Improvements Part L1A 2021	6
3.4.	Building Services & Renewable Energy (LZCT).....	7
4.	Sustainability Appraisal	9
4.1.	Green Guide Specification	9
4.2.	Responsible Sourcing.....	10
4.3.	Waste Management.....	10
4.4.	Flood Risk.....	11
4.5.	Sustainable Urban Drainage.....	11
4.6.	Ecology.....	11
4.7.	Air Quality	11
4.8.	Electric Vehicle Charging	12
4.9.	Water Use.....	13
4.10.	Overheating Risk	14
5.	Conclusion.....	15
	Appendix A – Site Plan.....	17
	Appendix B – Low and Zero Carbon Technologies.....	18
	Appendix C – Responsible Sourcing Certificates	20
	Appendix D – Sustainable Procurement Policy.....	23
	Appendix E – Waste Management Targets	25
	Appendix F – Flood Risk Map (Zone 1).....	26
	Appendix G – Sample SAP Calculations.....	28

1. Executive Summary

- 1.1.1. Environmental Economics Ltd has been commissioned by Barratt Manchester and GLP Ltd. to prepare an energy and sustainability report for the residential site Cowm Top Lane, Castleton. This document sets out how the development proposal presents a positive sustainable development.
- 1.1.2. As part of the sustainable development strategy, the proposed development has been designed to consider sustainability in accordance with the National Planning Policy Framework (NPPF) and the Rochdale Core Strategy.
- 1.1.3. The proposed development is designed to achieve low carbon emissions in line with Part L 2021.
- 1.1.4. The use of smart meters will provide occupiers with real time data which will allow occupiers to manage their energy consumption, save money and reduce Carbon. This is particularly important as the UK migrates towards half-hourly pricing levels and the proposed smart grid system.
- 1.1.5. Potential overheating risk will be assessed in accordance with Approved Document O.
- 1.1.6. Water efficiency has been reviewed as part of the design process and a Part G compliant specification will be adopted, resulting in the higher standard (lower water use) of 110 litres/person/day.
- 1.1.7. The viability of a heat network was considered for this development, however DHNs (District Heating Networks) are generally suited to development with high thermal demand, typically provided by sufficient density or a large anchor load, i.e., high-density flats or leisure centres.
- 1.1.8. The development of highly-insulated, high-efficiency homes such as those proposed limits the heating demand of the site, and therefore, the feasibility and viability of the installation of district heating. For these reasons, DHN is considered unsuitable for this development.
- 1.1.9. It is considered that the proposal meets or exceeds the required level of sustainability across all given criteria.

2. Project Overview

2.1. Description of Site

- 2.1.1. The site consists of 445 plots. These include detached, semi-detached and terraced housing.
- 2.1.2. The site plan for the whole site is shown in Appendix A.
- 2.1.3. This report addresses a domestic development being undertaken by GLP Ltd. and Barratt Homes, and does not include any further proposals for subsequent developments or non-residential parcels.

2.2. Planning Policy

- 2.2.1. The planning authority for this site is the Rochdale Borough Council. The local plan containing the relevant planning policy is the Rochdale Core Strategy (adopted 2016).
- 2.2.2. The relevant policies are set out below:
Policy G1 – Tackling and adapting to climate change

- a) Be zero carbon in line with national targets and definitions;*
- b) Adhere to the 'energy hierarchy' as outlined in policy G2, being designed in such a way that ensures that buildings require the minimum amount of energy to function over their lifetime;*
- c) Reduce CO₂ emissions through the use of renewable and low carbon decentralised energy technologies and networks. This will be through both on-site provision in new developments and through connection to local networks.*

Please note that Policy (a) is no longer relevant, due to the change in national targets.

Policy G2 – Energy and new development

All new development will be expected to adhere to the following energy hierarchy to the extent that policy G2 reflects national policy, targets and requirements for that type of development.

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.

2.3. Building Regulations

- 2.3.1. All newbuild development must comply with Building Regulations. Approved Document L 2021 (AD-L 2021) provides for a 31% reduction in Carbon emissions over the previous 2013 edition.
- 2.3.2. AD-L 2021 came into effect 15th June 2022, with a 12-month transitional arrangement. Sites which have been notified to local authorities prior to this date have 12 months transitional allowance on a plot-by-plot basis. That is to say, if a plot has commenced construction prior to 15th June 2023, it will be built under AD-L 2013. It is understood that Cowm Top Lane, Castleton will be developed in accordance with AD-L 2021.

3. Design Response

3.1. Assessment Methodology

3.1.1. Environmental Economics have modelled a sample of typical housing designs in order to validate the proposed specifications for this site. The Design SAP 10 software by Elmhurst has been used for this. The software provides a number of outputs, and based on the provided specification for this proposed development, we are able to assess the following areas for our calculations:

- *Building regulations compliance, including:*
 - *Carbon emissions (kg CO₂/m²/year)*
 - *Primary Energy Demand (kWh/m²/annum)*
 - *Fabric Energy Efficiency (kWh/m²/annum)*
- *Energy usage per year (kWh/annum)*
- *Energy costs per year (£/annum)*
- *More detailed breakdowns by end use (space heating, water heating, cooking, lighting, appliances)*

3.1.2. Each of these outputs can be used in different ways to analyse the performance of the dwelling. The total regulated carbon emissions for each property is based upon:

- *Space heating*
- *Water heating*
- *Electricity for pumps and fans*
- *Electricity for lighting*

3.1.3. SAP software is issued by independent software suppliers and checked and approved on behalf of government by the Building Research Establishment (BRE). As of 22nd November 2022, SAP 10 has been fully approved.

3.1.4. The dwellings on this proposed development will be assessed using this methodology during the detailed design stage.

3.2. Design Philosophy

3.2.1. The proposed development adopts the good design principles endorsed and promoted by the GLA. This guidance follows the general good principles of energy efficiency as the industry moves towards zero carbon. The principles are illustrated in Figure 1 below.

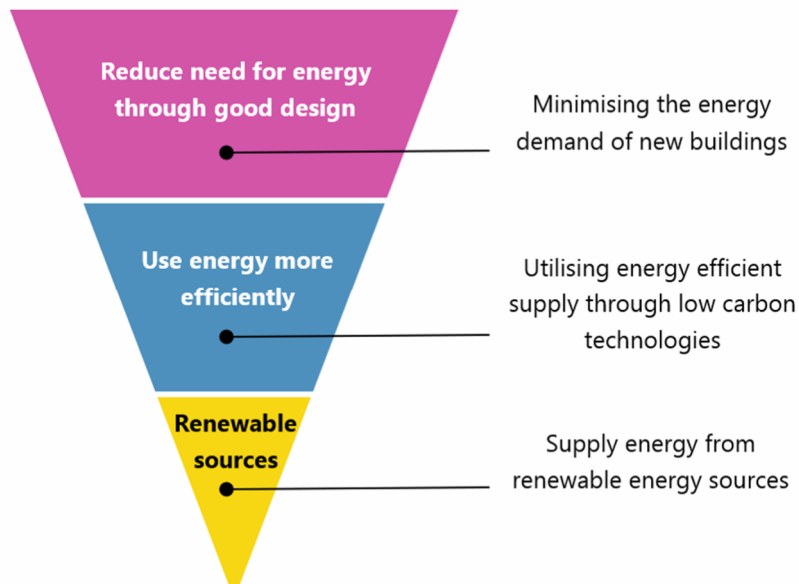


Figure 1

3.2.2. In order to reduce the residual carbon emissions a number of improvements were made to the standard material and product specification. These improvements include:

- *Upgraded heating and hot water controls*
- *Delayed start thermostat*
- *Design air permeability of 4m³/hr/m²*
- *Bespoke thermal bridging details*

3.3. Fabric Improvements Part L1A 2021

- 3.3.1. The building fabric for all dwellings within the proposed development will be improved in comparison to ADL 2013 specifications, and in relation to the ADL 2021 backstop notional specification. These fabric improvements reduce the space heating requirement upon a property. The improvements will be made through a combination of upgraded materials and increased insulation thicknesses. Enhanced glazing with a larger transmittance factor allowing for increased solar gains will also be used.
- 3.3.2. Proposed fabric designs and U-Values can be found in Table 1 below.

Table 1 – Part L 2021 Build Specification

<i>Element</i>	<i>Minimum Standard</i>	<i>Improved Specification</i>	
-	<i>W/m²k</i>	<i>Description</i>	<i>W/m²k</i>
Walls	0.26	Timber Frame, insulation between studs	0.20
Roof	0.16	Loft Space – 500mm Mineral Wool	0.09
		Sloping Ceiling to have 100mm PUR between joists, and 55mm PUR Board underlaid	0.16
Floors	0.18	Beam & Block floor system	0.10 - 0.12
Doors	1.60	Double glazed Low-E, u-PVC frame	1.00 - 1.4
Glazing	1.60	Double glazed Low-E, u-PVC frame	1.30

- 3.3.3. Please note that this specification is not finalised and is subject to change up until detailed design stage.
- 3.3.4. As improvements are made to the thermal conductivity of main elements, thermal bridging and air permeability become increasingly significant in the overall fabric performance. Bespoke thermal bridging designs have been utilised, which achieve much lower heat loss levels in comparison with standard practice.
- 3.3.5. As a result of following these junction details and focusing on build quality, air permeability will also decrease. A target air pressure rating of 4m³/hr.m² has been set for all houses on site which is an improvement on the maximum allowable rating in the 2021 Building Regulations.

3.4. Building Services & Renewable Energy (LZCT)

- 3.4.1. The systems used in a property to supply hot water and heating, as well as to control it, are important to the overall energy demand of a property. AD-L 2021 includes requirements for efficiency and controls of such equipment, including space heating, water heating, ventilation and lighting.
- 3.4.2. The design of building services which provide space heating and domestic hot water, ventilation, and lighting, must be considered in a holistic way in order to avoid unintended consequences and to maximise the benefits from such systems.
- 3.4.3. After due consideration of the potential LZCT available (shown in Appendix B) the design team propose to adopt the following technologies which provide benefits / compliance with national and local policies as listed:
- ***Photovoltaic (PV) panels***
 - Low noise and visual pollution.
 - Efficient low-carbon source of renewable energy.
 - ***Decentralised Mechanical Extract Ventilation (dMEV)***
 - Quieter than standard extractor fans.
 - Technology that manages humidity that is significantly more energy efficient in comparison to standard extractor fans.
 - ***Waste Water Heat Recovery (WWHR)***
 - Passive technology, no maintenance required.
 - Recovers waste heat from shower, pre-heats incoming cold. This reduces the amount of hot water required from the hot water cylinder.
 - Typical systems recover ~60% waste heat.
 - ***Flue Gas Heat Recovery (FGHR)***
 - Recovers waste heat from the flue of a boiler.
 - Reduces energy demand by reducing the temperature increase required for the boiler to operate.
- 3.4.4. It is currently proposed that PV panels will be used to improve dwelling performance to the level required for Part L 2021. Part L 2021 building regulations represent a minimum 31% uplift over Part L 2013 regulations.
- 3.4.5. For Part L 2021 it is proposed to provide heating and hot water via mains gas boilers.
- 3.4.6. For a mains gas fired system, the minimum boiler efficiency required is 92%. Compliant Ideal Logic boilers have been adopted which exceed this requirement.

- 3.4.7. Where installed, hot water cylinders can lose a significant amount of energy. To minimise this energy loss and corresponding carbon emissions, cylinders which have higher levels of insulation in comparison to typical hot water cylinders will be used.
- 3.4.8. Wider scale energy systems such as district heating or combined heat and power were considered as part of the process. While these systems have a number of advantages and disadvantages, the design philosophy has been to provide plot specific energy systems for most of the dwellings on site. This approach has several advantages regarding future proofing. It suits the individual resident needs, such as allowing individual householders to adopt further energy saving technologies in the future such as car charging, extension of PV networks, smart metering, introduction of PV hot water divertors, or introduction of ASHPs.
- 3.4.9. Furthermore, district heat networks are better suited to generally suited to development with high thermal demand, typically provided by sufficient density or a large anchor load, i.e., high-density flats or leisure centres.
- 3.4.10. Hot water distribution pipework will be fully insulated.
- 3.4.11. Lighting provision will be from LED low energy fittings achieving a minimum efficacy of 100 lamp lumens per circuit watt, an improvement of over 50% from AD-L 2013 performance levels.
- 3.4.12. Smart meters will be installed on all properties, providing:
- Real time information on energy use both in terms of consumption and cost
 - Occupier can manage their energy, save money and reduce carbon emissions
 - Smart meters will also allow for easier switching between suppliers
 - Facilitate a more reactive, price driven, demand-response
 - End estimated billing and eliminate the need for meter readers to visit premises

4. Sustainability Appraisal

4.1. Green Guide Specification

- 4.1.1. The Green Guide is used to examine the environmental impact of the construction materials commonly used within dwellings.
- 4.1.2. The standard specification of materials used by Barratt Homes consists of predominantly 'A' and 'A+' Green Guide rated elements. 'A+' rated construction elements include: pitched roof construction, internal upper floors, internal timber partitions and external cavity walls.
- 4.1.3. Table 2 below shows a sample of materials used by Barratt Homes and their Green Guide rating.

Table 2 – Green Guide Ratings

<i>Element</i>	<i>Green Guide Equivalent (online)</i>	<i>Code</i>	<i>Rating</i>
Ground Floor Option A (Beam and Aircrete Block)	Screed on insulation laid on grouted beam and Aircrete block flooring.	820140014	B
Ground Floor Option B (Beam and EPS Block)	Structural topping on beam and expanded polystyrene flooring	820140015	A+
Internal Upper Floors	Chipboard decking on timber I joists	807280024	A+
Wall – External Cavity (single & 2 storey) – Brick	Brickwork outer leaf, insulation, Aircrete blockwork inner leaf, cement mortar, plasterboard on battens, paint	806170615	A+
Wall – External Timber Frame (single and 2 storey)	UK produced natural slate on timber battens, breather membrane, OSB/3 sheathing, timber frame with insulation, vapour control layer, plasterboard on battens, paint	806210566	A+
Wall – Internal Partition (timber) non loadbearing	Timber stud, plasterboard, paint	809760003	A+
Wall – Internal Partitions (masonry) (Used in very small number of cases)	Medium dense solid blockwork, plasterboard, paint	809180008	B
Wall – Party (cavity)	Robust Detail E-WM-20: Twin leaf 100mm min. solid medium dense blocks (1350-1600kg/m ³), with 100mm min. cavity including proprietary glass wool acoustic roll, type A wall ties, with gypsum-based board (9.8kg/m ²) on dabs and paint to each side	1118190007	C
Windows	PVC-U window with steel reinforcement, double glazed	813100009	A
Insulation	Glass wool insulation - density 12 kg/m ³	815320001	A+
Pitched Roof	Timber trussed rafters and joists with insulation, roofing underlay, counterbattens, battens and concrete plain tiles	812410017	A+

4.2. Responsible Sourcing

- 4.2.1. BDW has an established network of responsible sourcing certified suppliers that have been carefully selected to align with sustainability and responsible sourcing policies.
- 4.2.2. Materials used within construction of the proposed development will be at a certified standard, proving the materials sourced have been done so with sustainability in mind.
- 4.2.3. Responsible sourcing of materials can come in a variety of certifications including: BES 6001, FSC, PEFC and EMS.
- 4.2.4. Appendix C shows a wide range of Barratt's suppliers with material responsible sourcing certification including:
 - *Wallboard supplier British Gypsum;*
 - *Aggregate/cement product supplier Tarmac.*
 - *Aircrete block supplier H+H Celcon.*
- 4.2.5. Additionally, the site aims to utilise timber that is procured sustainably and independently accredited by either the FSC or PEFC schemes. The Barratt Homes Sustainable Procurement Policy can be seen in Appendix D. The policy sets a high standard of sustainability when sourcing materials.

4.3. Waste Management

- 4.3.1. Appendix E shows an extract of BDW's Sustainability Framework 2020+ that sets targets for waste management including at least 95% construction waste diverted from landfill as well as continued reductions in construction waste intensity.
- 4.3.2. The scheme aims to use waste reduction procedures to enable waste reduction and diversion of waste from landfill. The goal is to minimise waste and maximise re-use of resources in response to climate change. BDW achieved 97% of construction waste diverted from landfill in 2018 and BDW's Sustainability Framework 2020+ sets targets to continue diversion from landfill and reduce construction waste intensity.

4.4. Flood Risk

- 4.4.1. Appendix F shows the Environment Agency Flood Risk Map for the site location.
- 4.4.2. All residential development on site will be within Flood Zone 1, the lowest probability evaluated by the Environment Agency. Flood Zone 1 is defined as land with less than 1 in 1000 annual probability of river or sea flooding.
- 4.4.3. Zone 1 flood risk is considered best practice for a positive sustainable development and would be well located for a site that is resilient to climate change.

4.5. Sustainable Urban Drainage

- 4.5.1. A full SuDS Assessment has been carried out for the development.
- 4.5.2. The assessments carried out consider any potential drainage and flood risk issues which could arise from the development and put forward recommendations to mitigate these impacts.
- 4.5.3. Full details of the recommendations put forward can be found in the associated report.

4.6. Ecology

- 4.6.1. A full Ecology Report has been carried out for the development.
- 4.6.2. The Ecology Assessment takes into account any habitats and species which could be impacted by the proposed development and puts forth recommendations on how to minimise any potential impacts and protect or improve any habitats.
- 4.6.3. Full details of the recommended approach to ecology can be found in the associated report.

4.7. Air Quality

- 4.7.1. A full Air Quality Assessment has been carried out for the site.
- 4.7.2. The Air Quality Assessment report includes information on potential mitigation measures which could be implemented for the site to reduce impacts on the quality of air in the vicinity of the development.
- 4.7.3. Full details of the Air Quality Assessment can be found in the associated report.

4.8. Electric Vehicle Charging

- 4.8.1. Providing EV charging points or the ability to retrofit EV charging points is an exemplary measure for sustainability and promotes sustainable lifestyles for residents.
- 4.8.2. With the provision of EV charging points, residents would have ready opportunity to purchase / lease EV's and have immediate secure charging infrastructure. This aligns with current government policy to stop the sale of new petrol and diesel cars by 2035 (GOV.UK, November 2020).
- 4.8.3. The BEAMA Guide to Electric Vehicle Infrastructure (BEAMA, 2015) illustrates the various "Modes" of electric car charging, with Mode 1 being the slowest, and Mode 4 the fastest. Mode 1 is not recommended and Mode 4 is only recommended for public and commercial use. Modes 2 to 3 are suitable for dedicated charging of EV's at domestic properties. Please refer to Figure 1 below which shows common infrastructure side connections for Mode 2 and 3.

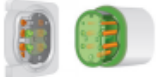
CONNECTOR TYPE	BS 1363	BS EN 60309-2	BS EN 62196-2 TYPE 2	BS EN 62196-2 TYPE 3
				
MODE	2	2	3	3
MAX POWER (kW) (at mains voltage i.e. harmonised EU voltages)	Single phase - 3	Single phase - 28.8 Three phase - 86.6	Single phase - 16.1 Three phase - 43.7	Single phase - 7.4 Three phase - 43.7
NOTES	Standard UK household plug & socket-outlet system	Standard industrial plug & socket-outlet system	Specialist EV	Specialist EV

Figure 2 – Common infrastructure options for Mode 2 and 3 EV charging points (BEAMA, 2015)

- 4.8.4. It is currently proposed that there will be provision of one EV charging point for all plots on the development.
- 4.8.5. The full specification of these charging points will be determined during detailed design stage.
- 4.8.6. The development therefore complies with Approved Document S of the 2021 Building Regulations.

4.9. Water Use

4.9.1. The design team will implement a specification which complies with the optional requirement of 110 litres/person/day as set out in Approved Document G 2015 with 2016 amendments (AD-G).

4.9.2. While the build specifications are not yet set, the table below provides an example of a compliant strategy, delivering reduced water consumption of 110litres/person/day. Alternative component consumption rates are available which can achieve the required water consumption. The rates provided are representative only.

		(1)	(2)	(3)	(4)
Installation type	Unit of measure	Capacity / flow rate	Use factor	Fixed use (litres/person/day)	Litres/person/day = [(1) × (2)] + (3)
WC (dual flush)	Full flush volume (litres)	4	1.46	0.00	5.84
WC (dual flush)	Part flush volume (litres)	2.6	2.96	0.00	7.696
Taps (excluding kitchen/utility room taps)	Flow rate (litres/minute)	5	1.58	1.58	9.48
Bath (where shower also present)	Capacity to overflow (litres)	170	0.11	0.00	18.7
Shower (where bath also present)	Flow rate (litres/minute)	9	4.37	0.00	39.33
Kitchen/utility room sink taps	Flow rate (litres/minute)	5	0.44	10.36	12.56
Washing machine	Litres/kg dry load	8.17	2.1	0.00	17.157
Dishwasher	Litres/place setting	1.25	3.6	0.00	4.5
	(5)	Total calculated use = (Sum column 4)			115.3
	(6)	Contribution from greywater (litres/person/day) from Table 4.6			0
	(7)	Contribution from rainwater (litres/person/day) from Table 5.5			0
	(8)	Normalisation factor			0.91
	(9)	Total water consumption = [(5) – (6) – (7)] × (8)			104.9
	(10)	External water use			5.0
Approved Document G	(11)	Total water consumption = (9) + (10) (litres/person/day)			109.9

4.9.3. The calculated results show that utilisation of the representative component's water consumption can achieve a maximum of 105 litres per person per day internally, and additional external water use of 5 litres per person per day.

4.10. Overheating Risk

- 4.10.1. Extreme temperatures have an adverse effect on health and wellbeing. 'Overheating' occurs when the building temperature exceeds the limits of thermal comfort. Since UK weather data records began in 1884, the ten warmest years have all occurred since 2003, including 2020, 2022 and 2023. Future temperatures should be considered across a building's lifetime to ensure further thermal comfort. Furthermore, advances in air tightness and thermal insulation levels have exacerbated overheating risk.
- 4.10.2. The Building Regulations (Amendment) (England), 2021, requires all residential buildings limit overheating risk by limiting unwanted solar gains in summer and by providing an adequate means of removing excess heat from the indoor environment. This can be assessed either by using the simplified method, which is set out in Section 1 of Approved Document O (ADO), or by using the dynamic thermal modelling method, as set out in Section 2 of ADO, which is based on CIBSE TM59.
- 4.10.3. There are many factors to consider when assessing overheating risk, such as the building orientation, cross ventilation, glazing area, window openable area, total solar transmittance of glazing, building fabric efficiency, solar shading and ventilation provision.
- 4.10.4. Solutions to mitigate overheating risk include improving shading, which limits solar gains, and increasing ventilation, which can help purge habitable rooms of hot air. Shading solutions include low g-factor glazing, brise soleil, shutters and overhangs. Ventilation solutions include low-noise extract fans, mechanical ventilation (if heat recovery is specified, it must include a summer bypass), and ceiling fans. All ventilation systems must meet the noise requirements set out in Approved Document F.
- 4.10.5. The safety and reasonable enjoyment of the residence of all occupants must be considered when designing overheating solutions. If all strategies to passively cool the building are insufficient, then mechanical cooling may be used.

5. Conclusion

- 5.1.1. This energy statement has been produced to accompany the planning application for the proposed residential site of 445 dwellings at Cowm Top Lane, Castleton.
- 5.1.2. The proposed LZC Technologies for the Part L2021 plots are:
- Photovoltaic (PV) panels
 - Waste Water Heat Recovery Systems (WWHRS)
 - Flue Gas Heat Recovery System (FGHRS)
 - Decentralised Mechanical Extract Ventilation (dMEV).
- 5.1.3. The sample SAP calculations presented in Appendix G show the total carbon emissions from typical dwellings, including emissions from fabric and energy use, based on the modelling of representative housing designs using SAP 10 software. The enhanced fabric specifications including better insulation and improved thermal bridging details result in lower carbon emissions from the dwelling.
- 5.1.4. It is anticipated that all the plots of this development will be, at the very least, constructed to comply with the higher standards set out by Part L1A 2021, which is a minimum 31% reduction in carbon emissions in relation to Part L1A 2013 regulations.
- 5.1.5. The viability of a heat network was considered for this development, however DHNs (District Heating Networks) are generally suited to development with high thermal demand, typically provided by sufficient density or a large anchor load, i.e., high-density flats or leisure centres.
- 5.1.6. The development strategy sets a high standard of overall sustainability with measures that include:
- Building elements with highest standard 'A+' Green Guide ratings including upper floors, external cavity walls, internal partitions, insulation and pitched roof;
 - Material suppliers with responsible sourcing certification guided by a high-quality sustainable procurement policy;
 - Effective waste management procedures to minimise waste;
 - The implementation of drainage, ecology and air quality assessments;
 - The provision of EV charging points to all plots;
 - Efficient internal and external water use in line with building regulations;
 - Enhanced building fabric specification with a Fabric-First approach including high efficiency insulation and provision of efficient appliances;
 - Use of PV, WWHR, FGHR and dMEV to achieve the efficiency levels required under Part L 2021.

5.1.7. It can therefore be seen that the proposed development will:

- *Achieve reduced carbon emissions of at least 31% below Part L 1A 2013.*
- *Incorporate recognised LZC technologies.*
- *Achieve a significant reduction in energy demand from these technologies.*

Appendix A – Site Plan



Appendix B – Low and Zero Carbon Technologies

	Description	Advantages	Disadvantages	Adopted?
Solar Hot Water (SHW)	SHW systems generate energy which is used to heat stored water (in a special solar hot water cylinder) which offsets the energy required for the boiler, thereby reducing fuel use and reducing carbon emissions.	Meets approximately 50% hot water demand for a dwelling	PV cells provide more efficient use of roof area compared to SHW	
Waste Water Heat Recovery (WWHR)	Recovers the energy that is lost from the waste water that is generated from showers.	- Reduces load on the main DHW system, leading to greater energy/carbon savings - Passive design requiring very low maintenance		✓
Ground Source Heat Pumps (GSHP)	GSHP provide heating and hot water to a dwelling through geothermal effects.	CoP can be greater than that of ASHPs	- Rely on having appropriate ground conditions - Expensive to install	
Biomass Heating Systems	Biomass heating systems burn fuels, considered carbon neutral, to heat the water required for a dwelling.	- Large variety of systems available - Good carbon savings when replacing electrical hot water system	High maintenance	
Wind Turbines	Wind turbines provide electricity directly to a dwelling. They can be added to a property in two ways: pole mounted or building mounted.	Large-scale pole mounted turbines provide great financial return	- Pole mounted require a lot of space - Building mounted have lower power output	
Photovoltaic (PV) Cells	Generates electricity from solar energy from the sun.	- Provides carbon savings - Excess electricity can be exported to the grid - Low maintenance	May be restricted by roof space	✓

Subject to final SAP calculations, the following technologies could be considered for the scheme:

Description		Advantages	Disadvantages	Adopted?
Air Source Heat Pumps (ASHP)	ASHP provide heating and hot water to a home through thermal energy gathered from air outside the dwelling.	• It is possible for an ASHP unit to provide 100% of the heating and hot water demand. • Typical CoP of 3.5 leading to large energy and carbon savings.	• Dependent on grid electricity • Expensive to run compared to gas	

Appendix C – Responsible Sourcing Certificates



Certificate of Registration

RESPONSIBLE SOURCING OF PRODUCTS

This is to certify that:

Saint-Gobain Construction Products
UK Limited
T/A British Gypsum
Head Office
East Leake,
Loughborough
LE12 6HX
United Kingdom

Holds Certificate Number:

BES 613170

and complies with the requirements of BES 6001: Issue 3.1 - Framework Standard for the Responsible Sourcing of Products for the following scope. This Responsible Sourcing certification has been carried out under licence using BRE's Responsible Sourcing scheme methodology and underpinning processes.

Gyproc plasterboard, Glasroc specialist board, Thistle plaster, Gyproc cove, Gyproc ready-mix joint cement - Performance rating Excellent.

For and on behalf of BSI:

Matt Page, Managing Director Assurance - UK & Ireland

Original Registration Date: 2014-10-13

Latest Revision Date: 2023-09-01

Effective Date: 2023-09-01

Expiry Date: 2026-08-31



Page: 1 of 4

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Information and Contact: BSI, Kitemark Court, Davy Avenue, Knowlhill, Milton Keynes MK5 8PP, Tel: + 44 345 080 9000
BSI Assurance UK Limited, registered in England under number 7805321 at 389 Chiswick High Road, London W4 4AL, UK.
A Member of the BSI Group of Companies.



Certificate of Registration

Responsible Sourcing of Products

This is to certify that:



Tarmac Cement & Lime Limited
Part of Tarmac Holdings Limited
T3, Ground Floor
Trinity Park, Bickenhill Lane
Solihull
Birmingham
B37 7ES
United Kingdom

Holds Certificate Number:

BES 568430

and complies with the requirements of BES 6001: Issue 4.0 – Framework Standard for the Responsible Sourcing of Products for the following scope. This responsible sourcing certification has been carried out under licence using BRE's responsible Sourcing scheme methodology and underpinning processes.

Asphalt - performance rating Excellent.

For and on behalf of BSI:

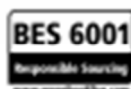
Matt Page, Managing Director Assurance - UK & Ireland

Original Registration Date: 2011-03-10

Latest Revision Date: 2024-02-07

Effective Date: 2024-02-07

Expiry Date: 2027-02-07



Page: 1 of 13

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BSI Assurance UK Limited, registered in England under number 2805321 at 389 Chiswick High Road, London W4 4AL, UK
A Member of the BSI Group of Companies.



Certificate of Registration

Responsible Sourcing of Products

This is to certify that:

H+H UK Limited
Ightham Sandpits
Borough Green Road
Ightham
Sevenoaks
TN15 9JB
United Kingdom

Holds Certificate Number:

BES 636778

and complies with the requirements of BES 6001: Issue 4.0 – Framework Standard for the Responsible Sourcing of Products for the following scope. This responsible sourcing certification has been carried out under licence using BRE's responsible Sourcing scheme methodology and underpinning processes.

Product Group: Solar Aircrete Blocks, Standard Aircrete Blocks, High Strength Aircrete Blocks, Super Strength Aircrete Blocks, Coursing Units.
Overall Assessment Score: Very Good.

For and on behalf of BSI:

Matt Page, Managing Director Assurance - UK & Ireland

Original Registration Date: 2015-07-23

Latest Revision Date: 2024-07-11

Effective Date: 2024-07-23

Expiry Date: 2027-07-22



Page: 1 of 3

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BSI Assurance UK Limited, registered in England under number 7805321 at 389 Chiswick High Road, London W4 4AL, UK.
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Appendix D – Sustainable Procurement Policy

Sustainable Procurement Policy

Introduction

Our purpose is to lead housebuilding by putting customers at the heart of everything we do.

Barratt Developments PLC ('The Group') is determined to be the leading sustainable national housebuilder. We believe that fundamental to building quality homes is building a positive environmental, social and economic legacy for future generations. Being sustainable presents opportunities for business prosperity and growth, encourages innovation and resilience, and improves our products and customer experience. We purchase significant volumes of materials, and work with a large number of sub-contractors across the UK. Sustainable sourcing of materials and labour is therefore critical to the delivery of our strategy.

Objectives

We are committed to continuously safeguarding the environment and maintaining good labour relations by:

- Working with suppliers, contractors and supply chains to minimise the environmental and social impact of the materials, services and labour within our operations and supply chain that are integral to our business; and
- Developing commercial relationships with partners that embrace sustainable practices

and spread best practice through the supply chain.

This Policy sets out a framework that we expect our supply chain partners to apply and relates to both the products/services they provide to us and the operating activities that they and their respective supply chains are engaged in.

The Policy

The key elements of our Policy relating to suppliers and subcontractors are:

- Suppliers must ensure compliance to all mandatory legislation that affects their activities and those of their own supply chain.
- Suppliers must conform to the specific requirements of our health, safety, environmental, quality and responsible sourcing requirements as set out in our Trade Specifications.
- Suppliers must maintain Health and Safety and Environmental Management Systems that are of a suitable standard for the operations they are engaged in. As a preference, organisations should gain certification to ISO45001 and ISO14001.

Suppliers and subcontractors must commit to follow our supplier [code of conduct](#).

Sustainable Procurement Policy

Suppliers must maintain an ethical sourcing policy that aims to ensure as a minimum that:

- All statutory legislation (in their country of operation) is adhered to;
- Working conditions are safe and healthy; No child, forced or slave labour takes place and the requirements of the International Labour Organisation's conventions are complied with;
- All employees are paid a real Living Wage which is the hourly rate set by the [Living Wage Foundation](#), is based on cost of living and is higher than the legal minimum
- No individual is expected to work excessive hours; and
- There is no discrimination on the grounds of ethnicity, skin colour, gender, sexual orientation, age or other criteria.

Our suppliers and subcontractors must be prepared to demonstrate how they monitor compliance with these requirements on request.

We will use sustainability criteria including environmental & social impact, quality and price in the assessment and selection of future supply sources.

We will include appropriate sustainability criteria in our tender and contract documentation. Where materials can be

ethically sourced (and are economically viable and have equivalent quality and technical performance to alternative offerings), a preference will be given to materials that:

- a) Have a recycled content (with reference to WRAP – Recycled Content Product Guide);
- b) Minimise ecological damage;
- c) Have low embodied carbon (against BRE Green Guide);
- d) Utilise less resources and less virgin material by design;
- e) Can be recycled;
- f) Minimise packaging waste;
- g) Minimise use of water;
- h) Use local resources; and
- i) Conform to Responsible Sourcing Standard: BES6001.

We will provide training for our internal procurement teams on a risk basis. This policy underpins our Group Sustainability, Climate Change and Environment Policies, and is supported by our Timber Sourcing Policy.

This policy is reviewed annually and is approved by the Group Board. It is communicated to key stakeholders and is available on our website.

David Thomas, Chief Executive

15 December 2022

Appendix E – Waste Management Targets

Barratt Developments, October 2019

barrattddevelopments.co.uk/sustainability

5

INNOVATIVE EFFICIENT CONSTRUCTION

Our ambition is to minimise our use of materials and energy, reduce waste generation and maximise low carbon opportunities in all aspects of our business through innovation and development.



MODERN METHODS OF CONSTRUCTION (MMC)

OUR TARGET

To apply MMC based products and systems in 20% of our homes by 2020 and 25% by 2025.

ACTIONS

- Increase roll out of low embodied carbon timber frame, offsite ground floor systems and large format blocks.
- Investigate a viable MMC system for apartments.

CONSTRUCTION WASTE

OUR TARGET

To reduce construction waste intensity by 20% from 2015 levels by 2025 (to 5.67t per 100m² legally completed build area).

To maintain diversion from landfill rate at 95% for construction waste.

ACTIONS

- Use the findings from our traditional/timber frame build comparison study to inform our waste reduction plans.
- Increase uptake of suitably sized plasterboards across divisions to avoid off-cuts.
- Work with suppliers and sub-contractors to find ways to reduce waste from chipboard packs and single-use plastics across our supply chain.
- Return 300,000 pallets for repairing, re-use and recycling.



Appendix F – Flood Risk Map (Zone 1)



Flood map for planning

Your reference
Trows Farm

Location (easting/northing)
389192/410326

Created
27 Nov 2024 15:06

Your selected location is in flood zone 1, an area with a low probability of flooding.

You will need to do a flood risk assessment if your site is **any of the following**:

- bigger than 1 hectare (ha)
- In an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

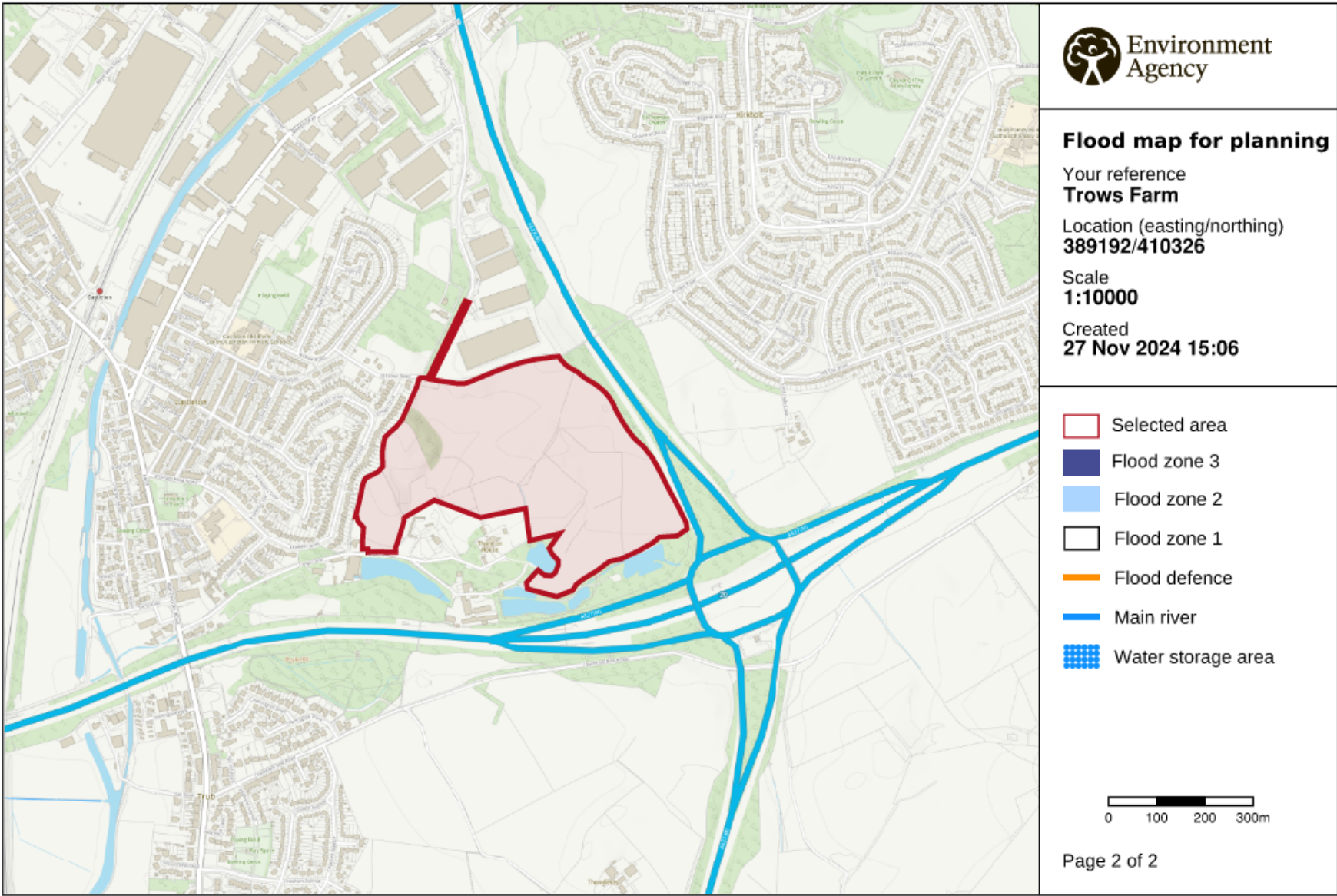
Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

Flood risk data is covered by the Open Government Licence **which** sets out the terms and conditions for using government data. <https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>

Use of the address and mapping data is subject to Ordnance Survey public viewing terms under Crown copyright and database rights 2024 OS AC0000807064. <https://flood-map-for-planning.service.gov.uk/os-terms>

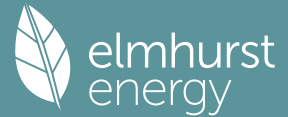


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Appendix G – Sample SAP Calculations

Sample SAP reports can be found on the following pages

Full SAP Calculation Printout



Property Reference	Alfreton Det				Issued on Date	29/11/2024
Assessment Reference	Issue A		Prop Type Ref			
Property						
SAP Rating	81 B	DER	4.16	TER	9.41	
Environmental	96 A	% DER < TER				55.79
CO ₂ Emissions (t/year)	0.54	DFEE	38.50	TFEE	39.37	
Compliance Check	See BREL	% DFEE < TFEE				2.21
% DPER < TPER	13.90	DPER	42.30	TPER	49.13	
Assessor Details	Ms. Ruth Ferguson				Assessor ID	AE69-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	67.4000 (1b)	x 2.3100 (2b)	= 155.6940 (1b) - (3b)
First floor	67.4000 (1c)	x 2.6000 (2c)	= 175.2400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 330.9340 (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											0 * 10 =	0.0000 (7a)	
Number of passive vents											0 * 10 =	0.0000 (7b)	
Number of flueless gas fires											0 * 40 =	0.0000 (7c)	
											Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)	
Pressure test											Yes		
Pressure Test Method											Blower Door		
Measured/design AP50											4.0000 (17)		
Infiltration rate											0.2000 (18)		
Number of sides sheltered											2 (19)		
Shelter factor											(20) = 1 - [0.075 x (19)] = 0.8500 (20)		
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) = 0.1700 (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	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation													0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.5000 (23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)	

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front door type 4			1.9500	1.0000	1.9500		(26)
Window (Uw = 1.30)			15.2100	1.2357	18.7956		(27)
French doors (Uw = 1.20)			10.0800	1.1450	11.5420		(27)
Platinum B&B			67.4000	0.1300	8.7620	135.0000	9099.0000 (28a)
Timber frame	177.3492	27.2400	150.1092	0.1800	27.0197	9.0000	1350.9827 (29a)
400mm Mineral wool	67.4000		67.4000	0.1100	7.4140	10.0000	674.0000 (30)
Total net area of external elements Aum(A, m ²)			312.1492				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	75.4833		(33)
Timber partitions			285.1300			7.0000	1995.9100 (32c)
Internal Floor 1			67.4000			18.0000	1213.2000 (32d)
Internal Ceiling 1			67.4000			18.0000	1213.2000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15546.2928 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							115.3286 (35)
List of Thermal Bridges							

Full SAP Calculation Printout



K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	5.7300	0.0500	0.2865
E3 Sill	11.1400	0.0500	0.5570
E4 Jamb	8.4000	0.0500	0.4200
E6 Intermediate floor within a dwelling	36.1200	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	8.0600	0.0600	0.4836
E12 Gable (insulation at ceiling level)	16.3700	0.0600	0.9822
E16 Corner (normal)	24.5500	0.0900	2.2095
E2 Other lintels (including other steel lintels)	12.0700	0.0500	0.6035
E4 Jamb	4.2000	0.0500	0.2100
E4 Jamb	36.6400	0.0500	1.8320
E5 Ground floor (normal)	36.1200	0.1600	5.7792
E17 Corner (inverted - internal area greater than external area)	4.9100	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	11.6900	0.0600	0.7014
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			14.0649 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	89.5482 (37)

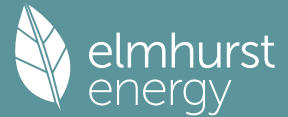
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	54.6041	54.6041	54.6041	54.6041	54.6041	54.6041	54.6041	54.6041	54.6041	54.6041	54.6041	54.6041
Average = Sum(39)m / 12 =	144.1523	144.1523	144.1523	144.1523	144.1523	144.1523	144.1523	144.1523	144.1523	144.1523	144.1523	144.1523
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0694	1.0694	1.0694	1.0694	1.0694	1.0694	1.0694	1.0694	1.0694	1.0694	1.0694	1.0694
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.9065 (42)
Hot water usage for mixer showers												
	72.9515	71.8552	70.2576	67.2010	64.9453	62.4297	60.9999	62.5854	64.3233	67.0243	70.1465	72.6720 (42a)
Hot water usage for baths												
	31.4948	31.0270	30.3683	29.1539	28.2445	27.2361	26.6914	27.3455	28.0577	29.1366	30.3761	31.3883 (42b)
Hot water usage for other uses												
	44.3950	42.7806	41.1663	39.5519	37.9375	36.3232	36.3232	37.9375	39.5519	41.1663	42.7806	44.3950 (42c)
Average daily hot water use (litres/day)												136.8185 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	148.8412	145.6628	141.7922	135.9068	131.1273	125.9890	124.0145	127.8684	131.9329	137.3272	143.3033	148.4553 (44)
Energy conte	235.7281	207.4219	217.9294	186.0496	176.5225	154.9182	149.9848	158.3278	162.6864	186.3517	204.1618	232.4451 (45)
Energy content (annual)										Total =	Sum(45)m =	2272.5272
Distribution loss (46)m = 0.15 x (45)m												
	35.3592	31.1133	32.6894	27.9074	26.4784	23.2377	22.4977	23.7492	24.4030	27.9527	30.6243	34.8668 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												0.7100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.3834 (55)
Total storage loss												
	11.8854	10.7352	11.8854	11.5020	11.8854	11.5020	11.8854	11.8854	11.5020	11.8854	11.5020	11.8854 (56)
If cylinder contains dedicated solar storage												
	11.8854	10.7352	11.8854	11.5020	11.8854	11.5020	11.8854	11.8854	11.5020	11.8854	11.5020	11.8854 (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												
	270.8759	239.1683	253.0772	220.0636	211.6703	188.9322	185.1326	193.4756	196.7004	221.4995	238.1758	267.5929 (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	270.8759	239.1683	253.0772	220.0636	211.6703	188.9322	185.1326	193.4756	196.7004	221.4995	238.1758	267.5929 (64)
12Total per year (kWh/year)												2686.3642 (64)
Electric shower(s)												2686 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												
Heat gains from water heating, kWh/month												
	106.4978	94.3649	100.5798	89.0727	86.8120	78.7215	77.9882	80.7622	81.3044	90.0802	95.0950	105.4062 (65)

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	145.3227	145.3227	145.3227	145.3227	145.3227	145.3227	145.3227	145.3227	145.3227	145.3227	145.3227	145.3227 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	155.3368	171.9800	155.3368	160.5147	155.3368	160.5147	155.3368	155.3368	160.5147	155.3368	160.5147	155.3368 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	303.4176	306.5661	298.6319	281.7410	260.4192	240.3798	226.9922	223.8437	231.7779	248.6688	269.9906	290.0300 (68)
Pumps, fans	37.5323	37.5323	37.5323	37.5323	37.5323	37.5323	37.5323	37.5323	37.5323	37.5323	37.5323	37.5323 (69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Water heating gains (Table 5)	-116.2581	-116.2581	-116.2581	-116.2581	-116.2581	-116.2581	-116.2581	-116.2581	-116.2581	-116.2581	-116.2581	-116.2581 (71)
Total internal gains	143.1423	140.4240	135.1878	123.7121	116.6828	109.3354	104.8228	108.5514	112.9228	121.0755	132.0764	141.6750 (72)
	668.4935	685.5669	655.7534	632.5645	599.0356	576.8267	553.7486	554.3286	571.8122	591.6779	629.1784	653.6386 (73)

6. Solar gains												
[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	W/m2	Specific data	factor	W						
				or Table 6b	or Table 6c							
Northeast	2.4200	11.2829	0.7300	0.7000	0.7700	9.6692 (75)						

Full SAP Calculation Printout



Southeast				0.5700	36.7938		0.7300	0.7000		0.7700		7.4268 (77)
Southwest				5.7800	36.7938		0.7300	0.7000		0.7700		75.3108 (79)
Northwest				6.4400	11.2829		0.7300	0.7000		0.7700		25.7313 (81)
Northeast				5.0400	11.2829		0.7300	0.7000		0.7700		20.1376 (75)
Southeast				5.0400	36.7938		0.7300	0.7000		0.7700		65.6689 (77)

Solar gains	203.9446	365.8406	549.5591	763.0617	929.6584	955.9105	907.8771	778.5472	622.7010	417.5435	247.6381	172.3603 (83)
Total gains	872.4381	1051.4075	1205.3125	1395.6262	1528.6940	1532.7372	1461.6257	1332.8758	1194.5132	1009.2214	876.8165	825.9989 (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	29.9573	29.9573	29.9573	29.9573	29.9573	29.9573	29.9573	29.9573	29.9573	29.9573	29.9573	29.9573
alpha	2.9972	2.9972	2.9972	2.9972	2.9972	2.9972	2.9972	2.9972	2.9972	2.9972	2.9972	2.9972
util living area	0.9690	0.9468	0.9086	0.8263	0.6987	0.5417	0.4131	0.4646	0.6776	0.8744	0.9510	0.9734 (86)
Living	18.7799	19.1161	19.5856	20.1599	20.6126	20.8687	20.9567	20.9377	20.7367	20.1233	19.3371	18.7005
Non living	17.4252	17.8487	18.4355	19.1353	19.6584	19.9261	20.0025	19.9900	19.8058	19.1091	18.1336	17.3249
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	19.8643	19.1161	19.5856	20.1599	20.6126	20.8687	20.9567	20.9377	20.7367	20.1233	19.3371	19.0222 (87)
Th 2	20.0259	20.0259	20.0259	20.0259	20.0259	20.0259	20.0259	20.0259	20.0259	20.0259	20.0259	20.0259 (88)
util rest of house	0.9640	0.9385	0.8942	0.7993	0.6533	0.4746	0.3291	0.3774	0.6141	0.8483	0.9419	0.9691 (89)
MIT 2	18.9891	17.8487	18.4355	19.1353	19.6584	19.9261	20.0025	19.9900	19.8058	19.1091	18.1336	17.8116 (90)
Living area fraction									fLA =	Living area / (4) =		0.1472 (91)
MIT	19.1179	18.0352	18.6047	19.2861	19.7988	20.0649	20.1430	20.1295	19.9428	19.2584	18.3108	17.9898 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1179	18.0352	18.6047	19.2861	19.7988	20.0649	20.1430	20.1295	19.9428	19.2584	18.3108	17.9898 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9584	0.9157	0.8679	0.7755	0.6417	0.4774	0.3395	0.3871	0.6082	0.8231	0.9199	0.9567 (94)
Useful gains	836.1714	962.7770	1046.0333	1082.3213	981.0191	731.7748	496.2925	515.9386	726.4440	830.6538	806.5437	790.2052 (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	2136.0376	1893.4715	1744.9244	1497.1819	1167.4608	787.7720	510.7264	537.6180	842.2566	1248.1247	1616.0578	1987.8314 (97)
Space heating kWh	967.1005	625.4267	519.9749	298.6996	138.7126	0.0000	0.0000	0.0000	0.0000	310.5984	582.8501	891.0339 (98a)
Space heating requirement - total per year (kWh/year)												4334.3967
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	967.1005	625.4267	519.9749	298.6996	138.7126	0.0000	0.0000	0.0000	0.0000	310.5984	582.8501	891.0339 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4334.3967
Space heating per m2										(98c) / (4) =		32.1543 (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 %)												236.2467 (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	967.1005	625.4267	519.9749	298.6996	138.7126	0.0000	0.0000	0.0000	0.0000	310.5984	582.8501	891.0339 (98)
Space heating efficiency (main heating system 1)	236.2467	236.2467	236.2467	236.2467	236.2467	0.0000	0.0000	0.0000	0.0000	236.2467	236.2467	236.2467 (210)
Space heating fuel (main heating system)	409.3604	264.7346	220.0983	126.4355	58.7151	0.0000	0.0000	0.0000	0.0000	131.4720	246.7125	377.1625 (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	270.8759	239.1683	253.0772	220.0636	211.6703	188.9322	185.1326	193.4756	196.7004	221.4995	238.1758	267.5929 (64)
Efficiency of water heater (217)m	172.2189	172.2189	172.2189	172.2189	172.2189	172.2189	172.2189	172.2189	172.2189	172.2189	172.2189	172.2189 (216)
Fuel for water heating, kWh/month	157.2859	138.8746	146.9509	127.7813	122.9077	109.7047	107.4984	112.3428	114.2154	128.6151	138.2983	155.3795 (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	3.5956	3.2476	3.5956	3.4796	3.5956	3.4796	3.5956	3.5956	3.4796	3.5956	3.4796	3.5956 (231)
Lighting	30.2130	24.2380	21.8236	15.9889	12.3503	10.0903	11.2664	14.6444	19.0217	24.9575	28.1894	31.0527 (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)												

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(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												1834.6909	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												172.2189	
Water heating fuel used												1559.8546	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 4.4040, total flow = 42.0000, SFP = 0.1049)													
mechanical ventilation fans (SFP = 0.1049)												42.3350	(230a)
Total electricity for the above, kWh/year												42.3350	(231)
Electricity for lighting (calculated in Appendix L)												243.8363	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3680.7167	(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	1834.6909	0.1554	285.2003	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1559.8546	0.1411	220.1527	(264)
Space and water heating			505.3529	(265)
Pumps, fans and electric keep-hot	42.3350	0.1387	5.8724	(267)
Energy for lighting	243.8363	0.1443	35.1931	(268)
Appendix Q item '' - energy saved	-0.0000	0.0000	-0.0000	(270)
Appendix Q item '' - energy used	14.2500	0.0000	14.2500	(271)
Total CO2, kg/year			560.6684	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.1600	(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	1834.6909	1.5755	2890.4679	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1559.8546	1.5219	2373.9177	(278)
Space and water heating			5264.3856	(279)
Pumps, fans and electric keep-hot	42.3350	1.5128	64.0443	(281)
Energy for lighting	243.8363	1.5338	374.0043	(282)
Total Primary energy kWh/year			5702.4342	(286)
Dwelling Primary energy Rate (DPER)			42.3000	(287)

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

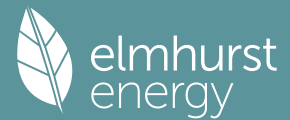
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	67.4000 (1b)	x 2.3100 (2b)	= 155.6940 (1b) - (3b)	
First floor	67.4000 (1c)	x 2.6000 (2c)	= 175.2400 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.8000			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 330.9340	(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)
Air changes per hour	40.0000 / (5) =	0.1209 (8)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		Yes
Pressure test		Blower Door
Pressure Test Method		5.0000 (17)
Measured/design AP50		0.3709 (18)
Infiltration rate		2 (19)
Number of sides sheltered		
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)

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Infiltration rate adjusted to include shelter factor

(21) = (18) x (20) = 0.3152 (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	0.4019	0.3940	0.3862	0.3468	0.3389	0.2995	0.2995	0.2916	0.3152	0.3389	0.3546	0.3704 (22b)
Effective ac	0.5808	0.5776	0.5746	0.5601	0.5574	0.5448	0.5448	0.5425	0.5497	0.5574	0.5629	0.5686 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.20)			25.2900	1.1450	28.9580		(27)
Platinum B&B			67.4000	0.1300	8.7620		(28a)
Timber frame	177.3492	27.2400	150.1092	0.1800	27.0197		(29a)
400mm Mineral wool	67.4000		67.4000	0.1100	7.4140		(30)
Total net area of external elements Aum(A, m2)			312.1492				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 74.1037		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							115.3286 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	5.7300	0.0500	0.2865
E3 Sill	11.1400	0.0500	0.5570
E4 Jamb	8.4000	0.0500	0.4200
E6 Intermediate floor within a dwelling	36.1200	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	8.0600	0.0600	0.4836
E12 Gable (insulation at ceiling level)	16.3700	0.0600	0.9822
E16 Corner (normal)	24.5500	0.0900	2.2095
E2 Other lintels (including other steel lintels)	12.0700	0.0500	0.6035
E4 Jamb	4.2000	0.0500	0.2100
E4 Jamb	36.6400	0.0500	1.8320
E5 Ground floor (normal)	36.1200	0.1600	5.7792
E17 Corner (inverted - internal area greater than external area)	4.9100	-0.0900	-0.4419
E10 Eaves (insulation at ceiling level)	11.6900	0.0600	0.7014
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			13.6230 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 87.7267 (37)

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

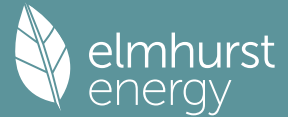
(38)m	Jan 63.4253	Feb 63.0828	Mar 62.7470	Apr 61.1700	May 60.8749	Jun 59.5014	Jul 59.5014	Aug 59.2470	Sep 60.0304	Oct 60.8749	Nov 61.4718	Dec 62.0958 (38)
Heat transfer coeff	151.1520	150.8094	150.4737	148.8966	148.6016	147.2280	147.2280	146.9737	147.7571	148.6016	149.1985	149.8225 (39)
Average = Sum(39)m / 12 =												148.8952
HLP	Jan 1.1213	Feb 1.1188	Mar 1.1163	Apr 1.1046	May 1.1024	Jun 1.0922	Jul 1.0922	Aug 1.0903	Sep 1.0961	Oct 1.1024	Nov 1.1068	Dec 1.1114 (40)
HLP (average)												1.1046
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9065 (42)
Hot water usage for mixer showers												72.6720 (42a)
Hot water usage for baths												31.3883 (42b)
Hot water usage for other uses												44.3950 (42c)
Average daily hot water use (litres/day)												136.8185 (43)
Daily hot water use	Jan 148.8412	Feb 145.6628	Mar 141.7922	Apr 135.9068	May 131.1273	Jun 125.9890	Jul 124.0145	Aug 127.8684	Sep 131.9329	Oct 137.3272	Nov 143.3033	Dec 148.4553 (44)
Energy conte	235.7281	207.4219	217.9294	186.0496	176.5225	154.9182	149.9848	158.3278	162.6864	186.3517	204.1618	232.4451 (45)
Energy content (annual)										Total = Sum(45)m =		2272.5272
Distribution loss (46)m = 0.15 x (45)m	35.3592	31.1133	32.6894	27.9074	26.4784	23.2377	22.4977	23.7492	24.4030	27.9527	30.6243	34.8668 (46)
Water storage loss:												150.0000 (47)
Store volume												1.3938 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.7527 (55)
Enter (49) or (54) in (55)												
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	282.3231	249.5076	264.5243	231.1414	223.1174	200.0100	196.5797	204.9227	207.7783	232.9466	249.2537	279.0400 (62)
WWHRS	-33.3504	-29.4954	-30.8858	-25.5747	-23.8347	-20.3955	-19.1175	-20.3296	-21.1020	-24.8769	-28.1825	-32.7328 (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	248.9727	220.0123	233.6384	205.5667	199.2827	179.6145	177.4621	184.5931	186.6763	208.0697	221.0711	246.3072 (64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2511.2668 (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	115.6555	102.6364	109.7374	97.9349	95.9697	87.5838	87.1459	89.9199	90.1667	99.2378	103.9573	114.5639 (65)

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

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Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.3227	145.3227	145.3227	145.3227	145.3227	145.3227	145.3227	145.3227	145.3227	145.3227	145.3227	145.3227	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	155.3368	171.9800	155.3368	160.5147	155.3368	160.5147	155.3368	155.3368	160.5147	155.3368	160.5147	155.3368	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	303.4176	306.5661	298.6319	281.7410	260.4192	240.3798	226.9922	223.8437	231.7779	248.6688	269.9906	290.0300	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5323	37.5323	37.5323	37.5323	37.5323	37.5323	37.5323	37.5323	37.5323	37.5323	37.5323	37.5323	(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)	-116.2581	-116.2581	-116.2581	-116.2581	-116.2581	-116.2581	-116.2581	-116.2581	-116.2581	-116.2581	-116.2581	-116.2581	(71)
Water heating gains (Table 5)	155.4510	152.7327	147.4966	136.0208	128.9915	121.6441	117.1315	120.8601	125.2315	133.3842	144.3851	153.9837	(72)
Total internal gains	683.8022	700.8756	671.0621	647.8733	614.3443	589.1354	566.0573	566.6373	584.1209	606.9866	644.4871	668.9473	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
Northeast					7.4600	11.2829	0.6300	0.7000	0.7700	25.7237 (75)		
Southeast					5.6100	36.7938	0.6300	0.7000	0.7700	63.0826 (77)		
Southwest					5.7800	36.7938	0.6300	0.7000	0.7700	64.9942 (79)		
Northwest					6.4400	11.2829	0.6300	0.7000	0.7700	22.2065 (81)		
Solar gains	176.0070	315.7255	474.2770	658.5327	802.3079	824.9638	783.5103	671.8969	537.3995	360.3458	213.7151	148.7493 (83)
Total gains	859.8092	1016.6011	1145.3391	1306.4059	1416.6522	1414.0992	1349.5677	1238.5342	1121.5204	967.3323	858.2022	817.6966 (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	28.5700	28.6349	28.6988	29.0028	29.0604	29.3315	29.3315	29.3822	29.2264	29.0604	28.9441	28.8235	
alpha	2.9047	2.9090	2.9133	2.9335	2.9374	2.9554	2.9554	2.9588	2.9484	2.9374	2.9296	2.9216	
util living area	0.9707	0.9522	0.9210	0.8508	0.7367	0.5825	0.4498	0.5004	0.7101	0.8878	0.9544	0.9744	(86)
MIT	18.6383	18.9576	19.4221	20.0301	20.5242	20.8328	20.9425	20.9205	20.6856	20.0344	19.2379	18.5878	(87)
Th 2	19.9835	19.9855	19.9876	19.9971	19.9989	20.0072	20.0072	20.0088	20.0040	19.9989	19.9953	19.9915	(88)
util rest of house	0.9659	0.9445	0.9079	0.8257	0.6922	0.5128	0.3589	0.4076	0.6469	0.8633	0.9457	0.9702	(89)
MIT 2	17.2211	17.6253	18.2096	18.9628	19.5431	19.8787	19.9760	19.9625	19.7385	18.9855	17.9908	17.1619	(90)
Living area fraction									fLA = Living area / (4) =			0.1472	(91)
MIT	17.4296	17.8214	18.3881	19.1198	19.6875	20.0191	20.1182	20.1035	19.8779	19.1399	18.1744	17.3718	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.4296	17.8214	18.3881	19.1198	19.6875	20.0191	20.1182	20.1035	19.8779	19.1399	18.1744	17.3718	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9481	0.9218	0.8811	0.7996	0.6768	0.5136	0.3695	0.4170	0.6379	0.8369	0.9237	0.9539	(94)
Useful gains	815.1892	937.1016	1009.1397	1044.5590	958.8102	726.3504	498.7117	516.4472	715.4415	809.5466	792.6865	780.0011	(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	1984.5707	1948.6639	1788.8407	1521.7006	1186.9591	797.8422	517.9811	544.3119	853.7196	1269.0366	1652.2770	1973.4274	(97)
Space heating kWh	870.0198	679.7698	580.0975	343.5420	169.7428	0.0000	0.0000	0.0000	0.0000	341.8606	618.9051	887.9092	(98a)
Space heating requirement - total per year (kWh/year)												4491.8469	
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	870.0198	679.7698	580.0975	343.5420	169.7428	0.0000	0.0000	0.0000	0.0000	341.8606	618.9051	887.9092	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4491.8469	
Space heating per m2										(98c) / (4) =		33.3223	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													92.3000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	870.0198	679.7698	580.0975	343.5420	169.7428	0.0000	0.0000	0.0000	0.0000	341.8606	618.9051	887.9092	(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)	942.6000	736.4787	628.4913	372.2015	183.9034	0.0000	0.0000	0.0000	0.0000	370.3798	670.5364	961.9818	(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	248.9727	220.0123	233.6384	205.5667	199.2827	179.6145	177.4621	184.5931	186.6763	208.0697	221.0711	246.3072	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.6262	86.4169	86.0147	85.2026	83.7021	79.8000	79.8000	79.8000	79.8000	85.1658	86.2402	86.6771	(217)

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Fuel for water heating, kWh/month	287.4103	254.5941	271.6262	241.2681	238.0856	225.0808	222.3836	231.3196	233.9302	244.3112	256.3436	284.1663	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	(231)
Lighting	32.2759	25.8929	23.3137	17.0806	13.1936	10.7793	12.0356	15.6443	20.3205	26.6615	30.1142	33.1730	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-59.5246	-82.1720	-115.6565	-127.1937	-134.7242	-124.7847	-123.1154	-117.3213	-106.8689	-92.4766	-64.7642	-51.6590	(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	-39.1622	-81.6804	-161.1142	-240.2732	-316.1376	-317.1795	-313.5616	-266.3047	-196.2009	-116.3742	-52.1314	-31.0327	(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												4866.5730	(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												2990.5198	(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)												260.4851	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-3331.4139	(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												4872.1639	(238)

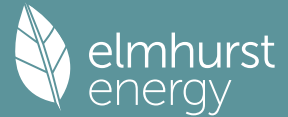
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4866.5730	0.2100	1021.9803	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2990.5198	0.2100	628.0092	(264)
Space and water heating			1649.9895	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	260.4851	0.1443	37.5961	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1200.2612	0.1351	-162.1124	
PV Unit electricity exported	-2131.1528	0.1261	-268.7340	
Total			-430.8464	(269)
Total CO2, kg/year			1268.6684	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.4100	(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	4866.5730	1.1300	5499.2275	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2990.5198	1.1300	3379.2873	(278)
Space and water heating			8878.5148	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	260.4851	1.5338	399.5408	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1200.2612	1.4992	-1799.4331	
PV Unit electricity exported	-2131.1528	0.4629	-986.4568	
Total			-2785.8900	(283)
Total Primary energy kWh/year			6622.2664	(286)
Target Primary Energy Rate (TPER)			49.1300	(287)

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Property Reference	Brandon MT				Issued on Date	29/11/2024
Assessment Reference	Issue A		Prop Type Ref			
Property						
SAP Rating	82 B	DER	4.70	TER	11.17	
Environmental	96 A	% DER < TER				57.92
CO ₂ Emissions (t/year)	0.29	DFEE	28.96	TFEE	30.36	
Compliance Check	See BREL	% DFEE < TFEE				4.59
% DPER < TPER	14.77	DPER	49.67	TPER	58.28	
Assessor Details	Ms. Ruth Ferguson				Assessor ID	AE69-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	31.8800 (1b)	x 2.3100 (2b)	= 73.6428 (1b) - (3b)
First floor	31.8800 (1c)	x 2.5800 (2c)	= 82.2504 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 155.8932 (5)

2. Ventilation rate

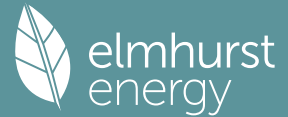
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2000 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1700 (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	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
FD Type 4 IG			1.9700	1.0000	1.9700		(26)
French Door (Uw = 1.20)			3.1500	1.1450	3.6069		(27)
Window (Uw = 1.20)			7.5600	1.1450	8.6565		(27)
TE Platinum GF			31.8800	0.1300	4.1444	135.0000	4303.8000 (28a)
Timber Frame-Single Sheathing	41.0800	12.5800	28.5000	0.1800	5.1300	9.0000	256.5000 (29a)
400mm Mineral Wool	31.8800		31.8800	0.1100	3.5068	10.0000	318.8000 (30)
Total net area of external elements Aum(A, m ²)			104.8400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.9146		(33)
Party Wall E-WT-02			74.6200	0.0000	0.0000	20.0000	1492.4001 (32)
GF Timber			136.5500			7.0000	955.8500 (32c)
FF Floor			31.8800			18.0000	573.8400 (32d)
GF Ceiling			31.8800			18.0000	573.8400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	8475.0301 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							132.9208 (35)

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List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.4320	0.0500	0.1216
E3 Sill	5.4900	0.0500	0.2745
E5 Ground floor (normal)	8.4000	0.1600	1.3440
E6 Intermediate floor within a dwelling	8.4000	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	8.4000	0.0600	0.5040
E2 Other lintels (including other steel lintels)	5.4900	0.0500	0.2745
E4 Jamb	8.2260	0.0500	0.4113
E4 Jamb	13.6500	0.0500	0.6825
E18 Party wall between dwellings	19.5600	0.0600	1.1736
P1 Party wall - Ground floor	15.2600	0.0800	1.2208
P2 Party wall - Intermediate floor within a dwelling	15.2600	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	15.2600	0.1200	1.8312
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			7.8380 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss		(33) + (36) + (36a) =	34.7526 (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	25.7224	25.7224	25.7224	25.7224	25.7224	25.7224	25.7224	25.7224	25.7224	25.7224	25.7224	25.7224	(38)
Heat transfer coeff	60.4749	60.4749	60.4749	60.4749	60.4749	60.4749	60.4749	60.4749	60.4749	60.4749	60.4749	60.4749	(39)
Average = Sum(39)m / 12 =												60.4749	(39)
HLP	0.9485	0.9485	0.9485	0.9485	0.9485	0.9485	0.9485	0.9485	0.9485	0.9485	0.9485	0.9485	(40)
HLP (average)												0.9485	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	(40)

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.0857 (42)
Hot water usage for mixer showers	59.1900	58.3005	57.0043	54.5243	52.6941	50.6531	49.4930	50.7794	52.1895	54.3809	56.9142	58.9633	(42a)
Hot water usage for baths	25.5769	25.1970	24.6621	23.6758	22.9373	22.1184	21.6761	22.2073	22.7856	23.6619	24.6685	25.4904	(42b)
Hot water usage for other uses	35.9897	34.6810	33.3723	32.0636	30.7549	29.4461	29.4461	30.7549	32.0636	33.3723	34.6810	35.9897	(42c)
Average daily hot water use (litres/day)												111.0030	(43)
Daily hot water use	120.7567	118.1786	115.0387	110.2637	106.3863	102.2177	100.6152	103.7415	107.0387	111.4151	116.2637	120.4434	(44)
Energy conte	191.2490	168.2847	176.8103	150.9455	143.2164	125.6885	121.6854	128.4536	131.9894	151.1892	165.6389	188.5853	(45)
Energy content (annual)										Total = Sum(45)m =		1843.7362	(45)
Distribution loss (46)m = 0.15 x (45)m	28.6874	25.2427	26.5215	22.6418	21.4825	18.8533	18.2528	19.2680	19.7984	22.6784	24.8458	28.2878	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.7100	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.3834	(55)
Total storage loss	11.8854	10.7352	11.8854	11.5020	11.8854	11.5020	11.8854	11.8854	11.5020	11.8854	11.5020	11.8854	(56)
If cylinder contains dedicated solar storage	11.8854	10.7352	11.8854	11.5020	11.8854	11.5020	11.8854	11.8854	11.5020	11.8854	11.5020	11.8854	(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	226.3968	200.0311	211.9581	184.9595	178.3642	159.7025	156.8332	163.6014	166.0034	186.3370	199.6529	223.7331	(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	226.3968	200.0311	211.9581	184.9595	178.3642	159.7025	156.8332	163.6014	166.0034	186.3370	199.6529	223.7331	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2257.5732	(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	91.7085	81.3518	86.9077	77.4006	75.7377	69.0026	68.5786	70.8291	71.0977	78.3886	82.2861	90.8228	(65)

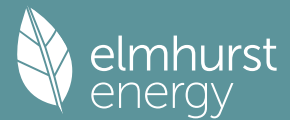
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	104.2853	104.2853	104.2853	104.2853	104.2853	104.2853	104.2853	104.2853	104.2853	104.2853	104.2853	104.2853	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	95.0521	105.2362	95.0521	98.2205	95.0521	98.2205	95.0521	95.0521	98.2205	95.0521	98.2205	95.0521	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	182.3205	184.2124	179.4449	169.2953	156.4832	144.4417	136.3973	134.5054	139.2729	149.4225	162.2345	174.2760	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.4285	33.4285	33.4285	33.4285	33.4285	33.4285	33.4285	33.4285	33.4285	33.4285	33.4285	33.4285	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-83.4283	-83.4283	-83.4283	-83.4283	-83.4283	-83.4283	-83.4283	-83.4283	-83.4283	-83.4283	-83.4283	-83.4283	(71)
Water heating gains (Table 5)	123.2642	121.0592	116.8114	107.5008	101.7980	95.8370	92.1756	95.2004	98.7468	105.3611	114.2863	122.0737	(72)
Total internal gains	454.9223	464.7935	445.5939	429.3022	407.6189	392.7848	377.9105	379.0434	390.5257	404.1213	429.0269	445.6874	(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
Southwest	3.1500	36.7938	0.7300	0.7000	0.7700	41.0431 (79)

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Northeast				3.8600	11.2829		0.7300		0.7000		0.7700		15.4228 (75)
Southwest				3.7000	36.7938		0.7300		0.7000		0.7700		48.2093 (79)

Solar gains	104.6752	183.4234	264.5751	350.6290	413.5516	419.7180	400.8422	352.4992	294.1557	206.3908	126.3097	88.9765 (83)	
Total gains	559.5975	648.2168	710.1690	779.9312	821.1704	812.5028	778.7527	731.5426	684.6815	610.5120	555.3366	534.6639 (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	38.9281	38.9281	38.9281	38.9281	38.9281	38.9281	38.9281	38.9281	38.9281	38.9281	38.9281	38.9281	
alpha	3.5952	3.5952	3.5952	3.5952	3.5952	3.5952	3.5952	3.5952	3.5952	3.5952	3.5952	3.5952	
util living area	0.9428	0.9085	0.8564	0.7568	0.6178	0.4584	0.3369	0.3729	0.5647	0.7939	0.9102	0.9503 (86)	
Living	19.6327	19.9093	20.2384	20.5988	20.8437	20.9587	20.9895	20.9847	20.9132	20.5910	20.0499	19.5602	
Non living	18.5463	18.8881	19.2898	19.7143	19.9841	20.0966	20.1211	20.1182	20.0585	19.7167	19.0688	18.4561	
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	20.3005	19.9093	20.2384	20.5988	20.8437	20.9587	20.9895	20.9847	20.9132	20.5910	20.0499	19.7616 (87)	
Th 2	20.1265	20.1265	20.1265	20.1265	20.1265	20.1265	20.1265	20.1265	20.1265	20.1265	20.1265	20.1265 (88)	
util rest of house	0.9341	0.8953	0.8365	0.7252	0.5729	0.4012	0.2720	0.3050	0.5050	0.7592	0.8950	0.9425 (89)	
MIT 2	19.4965	18.8881	19.2898	19.7143	19.9841	20.0966	20.1211	20.1182	20.0585	19.7167	19.0688	18.7571 (90)	
Living area fraction									fLA = Living area / (4) =			0.2928 (91)	
MIT	19.7320	19.1871	19.5676	19.9733	20.2358	20.3491	20.3754	20.3719	20.3088	19.9727	19.3561	19.0512 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.7320	19.1871	19.5676	19.9733	20.2358	20.3491	20.3754	20.3719	20.3088	19.9727	19.3561	19.0512 (93)	

8. Space heating requirement													

Utilisation	0.9296	0.8787	0.8221	0.7193	0.5787	0.4161	0.2907	0.3243	0.5179	0.7524	0.8791	0.9309 (94)	
Useful gains	520.2161	569.6097	583.8450	560.9862	475.2226	338.0769	226.3502	237.2419	354.5960	459.3785	488.1937	497.7334 (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	933.2470	864.0116	790.2593	669.6587	516.2003	347.6739	228.3165	240.2031	375.4745	566.8156	741.1882	898.1263 (97)	
Space heating kWh	307.2950	197.8381	153.5723	78.2441	30.4874	0.0000	0.0000	0.0000	0.0000	79.9332	182.1560	297.8924 (98a)	
Space heating requirement - total per year (kWh/year)												1327.4185	
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	307.2950	197.8381	153.5723	78.2441	30.4874	0.0000	0.0000	0.0000	0.0000	79.9332	182.1560	297.8924 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												1327.4185	
Space heating per m2										(98c) / (4) =		20.8190 (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 %)													217.1704 (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	307.2950	197.8381	153.5723	78.2441	30.4874	0.0000	0.0000	0.0000	0.0000	79.9332	182.1560	297.8924 (98)	
Space heating efficiency (main heating system 1)	217.1704	217.1704	217.1704	217.1704	217.1704	0.0000	0.0000	0.0000	0.0000	217.1704	217.1704	217.1704 (210)	
Space heating fuel (main heating system)	141.4995	91.0981	70.7151	36.0289	14.0385	0.0000	0.0000	0.0000	0.0000	36.8067	83.8770	137.1699 (211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)	
Water heating													
Water heating requirement	226.3968	200.0311	211.9581	184.9595	178.3642	159.7025	156.8332	163.6014	166.0034	186.3370	199.6529	223.7331 (64)	
Efficiency of water heater	176.7000	176.7000	176.7000	176.7000	176.7000	176.7000	176.7000	176.7000	176.7000	176.7000	176.7000	176.7000 (216)	
Fuel for water heating, kWh/month	128.1250	113.2038	119.9536	104.6743	100.9418	90.3806	88.7567	92.5871	93.9464	105.4539	112.9898	126.6175 (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	1.7869	1.6139	1.7869	1.7292	1.7869	1.7292	1.7869	1.7869	1.7292	1.7869	1.7292	1.7869 (231)	
Lighting	18.3097	14.6887	13.2255	9.6896	7.4845	6.1149	6.8276	8.8748	11.5275	15.1247	17.0833	18.8185 (232)	
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)	
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)	
Annual totals kWh/year													
Space heating fuel - main system 1												611.2337 (211)	

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Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	176.7000	
Water heating fuel used	1277.6305	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.2080, total flow = 29.0000, SFP = 0.1106)		
mechanical ventilation fans (SFP = 0.1106)	21.0389	(230a)
Total electricity for the above, kWh/year	21.0389	(231)
Electricity for lighting (calculated in Appendix L)	147.7694	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2057.6725	(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	611.2337	0.1562	95.4946 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1277.6305	0.1411	180.2134 (264)
Space and water heating			275.7079 (265)
Pumps, fans and electric keep-hot	21.0389	0.1387	2.9184 (267)
Energy for lighting	147.7694	0.1443	21.3277 (268)
Total CO2, kg/year			299.9540 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.7000 (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	611.2337	1.5783	964.7403 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1277.6305	1.5216	1944.0039 (278)
Space and water heating			2908.7442 (279)
Pumps, fans and electric keep-hot	21.0389	1.5128	31.8277 (281)
Energy for lighting	147.7694	1.5338	226.6537 (282)
Total Primary energy kWh/year			3167.2255 (286)
Dwelling Primary energy Rate (DPER)			49.6700 (287)

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

1. Overall dwelling characteristics

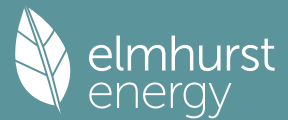
	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	31.8800 (1b)	x 2.3100 (2b)	= 73.6428 (1b) - (3b)
First floor	31.8800 (1c)	x 2.5800 (2c)	= 82.2504 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	155.8932 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1283 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3783 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3215 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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)

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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 infiltr rate												
Effective ac	0.4100	0.4019	0.3939	0.3537	0.3457	0.3055	0.3055	0.2974	0.3215	0.3457	0.3617	0.3778 (22b)
	0.5840	0.5808	0.5776	0.5626	0.5597	0.5467	0.5467	0.5442	0.5517	0.5597	0.5654	0.5714 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			1.8700	1.0000	1.8700		(26)
TER Opening Type (Uw = 1.20)			10.7100	1.1450	12.2634		(27)
TE Platinum GF			31.8800	0.1300	4.1444		(28a)
Timber Frame-Single Sheathing	41.0800	12.5800	28.5000	0.1800	5.1300		(29a)
400mm Mineral Wool	31.8800		31.8800	0.1100	3.5068		(30)
Total net area of external elements Aum(A, m2)			104.8400				(31)
Fabric heat loss, W/K = Sum (A x U)					26.9146		(33)
Party Wall E-WT-02			74.6200	0.0000	0.0000		(32)

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

132.9208 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	2.4320	0.0500	0.1216
E3 Sill	5.4900	0.0500	0.2745
E5 Ground floor (normal)	8.4000	0.1600	1.3440
E6 Intermediate floor within a dwelling	8.4000	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	8.4000	0.0600	0.5040
E2 Other lintels (including other steel lintels)	5.4900	0.0500	0.2745
E4 Jamb	8.2260	0.0500	0.4113
E4 Jamb	13.6500	0.0500	0.6825
E18 Party wall between dwellings	19.5600	0.0600	1.1736
P1 Party wall - Ground floor	15.2600	0.0800	1.2208
P2 Party wall - Intermediate floor within a dwelling	15.2600	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	15.2600	0.1200	1.8312
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			7.8380 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 34.7526 (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	30.0458	29.8779	29.7133	28.9404	28.7958	28.1226	28.1226	27.9979	28.3819	28.7958	29.0883	29.3942 (38)
Heat transfer coeff	64.7983	64.6305	64.4659	63.6930	63.5484	62.8752	62.8752	62.7505	63.1345	63.5484	63.8409	64.1468 (39)
Average = Sum(39)m / 12 =												63.6923

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0163	1.0137	1.0111	0.9989	0.9967	0.9861	0.9861	0.9842	0.9902	0.9967	1.0013	1.0061 (40)
HLP (average)												0.9989
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

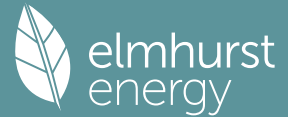
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.0857 (42)
Hot water usage for mixer showers	59.1900	58.3005	57.0043	54.5243	52.6941	50.6531	49.4930	50.7794	52.1895	54.3809	56.9142	58.9633 (42a)	
Hot water usage for baths	25.5769	25.1970	24.6621	23.6758	22.9373	22.1184	21.6761	22.2073	22.7856	23.6619	24.6685	25.4904 (42b)	
Hot water usage for other uses	35.9897	34.6810	33.3723	32.0636	30.7549	29.4461	29.4461	30.7549	32.0636	33.3723	34.6810	35.9897 (42c)	
Average daily hot water use (litres/day)												111.0030 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	120.7567	118.1786	115.0387	110.2637	106.3863	102.2177	100.6152	103.7415	107.0387	111.4151	116.2637	120.4434 (44)	
Energy content (annual)	191.2490	168.2847	176.8103	150.9455	143.2164	125.6885	121.6854	128.4536	131.9894	151.1892	165.6389	188.5853 (45)	
Distribution loss (46)m = 0.15 x (45)m	28.6874	25.2427	26.5215	22.6418	21.4825	18.8533	18.2528	19.2680	19.7984	22.6784	24.8458	28.2878 (46)	
Water storage loss:													
Store volume												150.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)	
Temperature factor from Table 2b												0.5400 (49)	
Enter (49) or (54) in (55)												0.7527 (55)	
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)	
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)	
Total heat required for water heating calculated for each month	237.8439	210.3704	223.4052	196.0374	189.8113	170.7804	168.2803	175.0485	177.0812	197.7841	210.7308	235.1802 (62)	
WWHRS	-27.0592	-23.9314	-25.0596	-20.7503	-19.3386	-16.5481	-15.5112	-16.4946	-17.1213	-20.1842	-22.8662	-26.5581 (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	210.7847	186.4390	198.3456	175.2870	170.4727	154.2322	152.7690	158.5539	159.9599	177.5999	187.8645	208.6220 (64)	
12Total per year (kWh/year)												2140.9306 (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	100.8662	89.6232	96.0653	86.2629	84.8954	77.8649	77.7363	79.9868	79.9599	87.5463	91.1484	99.9805 (65)	

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

Metabolic gains (Table 5), Watts												
(66)m	104.2853	104.2853	104.2853	104.2853	104.2853	104.2853	104.2853	104.2853	104.2853	104.2853	104.2853	104.2853 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
95.0521	105.2362	95.0521	98.2205	95.0521	98.2205	95.0521	95.0521	98.2205	95.0521	98.2205	95.0521	95.0521 (67)

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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	182.3205	184.2124	179.4449	169.2953	156.4832	144.4417	136.3973	134.5054	139.2729	149.4225	162.2345	174.2760 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.4285	33.4285	33.4285	33.4285	33.4285	33.4285	33.4285	33.4285	33.4285	33.4285	33.4285	33.4285 (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)	-83.4283	-83.4283	-83.4283	-83.4283	-83.4283	-83.4283	-83.4283	-83.4283	-83.4283	-83.4283	-83.4283	-83.4283 (71)
Water heating gains (Table 5)	135.5729	133.3679	129.1201	119.8095	114.1067	108.1457	104.4843	107.5091	111.0555	117.6698	126.5950	134.3824 (72)
Total internal gains	470.2311	480.1022	460.9026	444.6109	422.9276	405.0935	390.2192	391.3521	402.8345	419.4300	444.3356	460.9961 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W
Northeast					3.8600	11.2829	0.6300	0.7000			0.7700	13.3101 (75)
Southwest					6.8500	36.7938	0.6300	0.7000			0.7700	77.0260 (79)
Solar gains	90.3361	158.2969	228.3319	302.5977	356.9007	362.2224	345.9323	304.2117	253.8604	178.1181	109.0070	76.7879 (83)
Total gains	560.5672	638.3991	689.2345	747.2085	779.8283	767.3159	736.1516	695.5638	656.6949	597.5480	553.3426	537.7841 (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	36.3308	36.4252	36.5181	36.9613	37.0454	37.4420	37.4420	37.5164	37.2883	37.0454	36.8757	36.6998
alpha	3.4221	3.4283	3.4345	3.4641	3.4697	3.4961	3.4961	3.5011	3.4859	3.4697	3.4584	3.4467
util living area	0.9463	0.9182	0.8755	0.7878	0.6591	0.4968	0.3681	0.4036	0.5999	0.8137	0.9163	0.9522 (86)
MIT	19.4680	19.7372	20.0785	20.4919	20.7850	20.9406	20.9840	20.9778	20.8833	20.5120	19.9390	19.4245 (87)
Th 2	20.0698	20.0720	20.0741	20.0842	20.0861	20.0949	20.0949	20.0965	20.0915	20.0861	20.0823	20.0783 (88)
util rest of house	0.9378	0.9058	0.8568	0.7571	0.6128	0.4346	0.2954	0.3287	0.5370	0.7797	0.9016	0.9445 (89)
MIT 2	18.3017	18.6372	19.0585	19.5589	19.8887	20.0518	20.0868	20.0846	19.9996	19.5953	18.9013	18.2532 (90)
Living area fraction												0.2928 (91)
MIT	18.6433	18.9593	19.3572	19.8321	20.1511	20.3120	20.3495	20.3461	20.2583	19.8637	19.2051	18.5962 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6433	18.9593	19.3572	19.8321	20.1511	20.3120	20.3495	20.3461	20.2583	19.8637	19.2051	18.5962 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	516.4161	566.7927	578.9480	558.8068	480.5519	345.2451	232.7410	243.2913	360.6011	460.3750	489.4346	499.4828 (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	929.4193	908.6601	828.8513	696.2996	537.0546	359.1441	235.7507	247.6208	388.8040	588.6917	772.8018	923.4694 (97)
Space heating kWh	307.2744	229.7349	185.9281	98.9948	42.0380	0.0000	0.0000	0.0000	0.0000	95.4676	204.0243	315.4460 (98a)
Space heating requirement - total per year (kWh/year)												1478.9081
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	307.2744	229.7349	185.9281	98.9948	42.0380	0.0000	0.0000	0.0000	0.0000	95.4676	204.0243	315.4460 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1478.9081
Space heating per m2										(98c) / (4) =		23.1949 (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	307.2744	229.7349	185.9281	98.9948	42.0380	0.0000	0.0000	0.0000	0.0000	95.4676	204.0243	315.4460 (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)	332.9083	248.9002	201.4389	107.2533	45.5450	0.0000	0.0000	0.0000	0.0000	103.4319	221.0448	341.7616 (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	210.7847	186.4390	198.3456	175.2870	170.4727	154.2322	152.7690	158.5539	159.9599	177.5999	187.8645	208.6220 (64)
Efficiency of water heater	84.9039	84.5292	83.9150	82.8299	81.4326	79.8000	79.8000	79.8000	79.8000	82.7315	84.2452	79.8000 (216)
Fuel for water heating, kWh/month	248.2626	220.5617	236.3648	211.6228	209.3420	193.2735	191.4399	198.6891	200.4510	214.6703	222.9972	245.4825 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	19.7499	15.8441	14.2659	10.4518	8.0733	6.5959	7.3647	9.5729	12.4343	16.3145	18.4271	20.2989 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												

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(233a)m	-30.0879	-42.5527	-61.3694	-69.2590	-74.9276	-70.0544	-69.2157	-65.2371	-58.2304	-48.8014	-33.1362	-25.9992	(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	-16.5907	-34.9490	-69.5423	-104.5517	-138.3287	-138.9934	-137.3313	-116.2168	-85.1207	-49.9844	-22.1551	-13.1137	(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												1602.2840	(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												2593.1574	(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)												159.3933	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1575.7488	(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												2865.0859	(238)

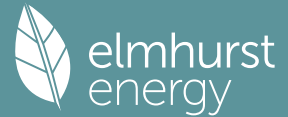
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1602.2840	0.2100	336.4796 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2593.1574	0.2100	544.5631 (264)
Space and water heating			881.0427 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	159.3933	0.1443	23.0054 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-648.8710	0.1345	-87.2753
PV Unit electricity exported	-926.8778	0.1259	-116.6675
Total			-203.9428 (269)
Total CO2, kg/year			712.0345 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.1700 (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	1602.2840	1.1300	1810.5809 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2593.1574	1.1300	2930.2679 (278)
Space and water heating			4740.8487 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	159.3933	1.5338	244.4828 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-648.8710	1.4971	-971.4227
PV Unit electricity exported	-926.8778	0.4620	-428.2493
Total			-1399.6720 (283)
Total Primary energy kWh/year			3715.7603 (286)
Target Primary Energy Rate (TPER)			58.2800 (287)

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Property Reference	Ellerton SD				Issued on Date	29/11/2024
Assessment Reference	Issue A		Prop Type Ref			
Property						
SAP Rating	81 B	DER	4.79	TER	11.47	
Environmental	96 A	% DER < TER				58.24
CO ₂ Emissions (t/year)	0.35	DFEE	34.26	TFEE	35.74	
Compliance Check	See BREL	% DFEE < TFEE				4.13
% DPER < TPER	15.76	DPER	50.42	TPER	59.85	
Assessor Details	Ms. Ruth Ferguson				Assessor ID	AE69-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	37.5100 (1b)	x 2.3100 (2b)	= 86.6481 (1b) - (3b)
First floor	37.5100 (1c)	x 2.6000 (2c)	= 97.5260 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.1741 (5)

2. Ventilation rate

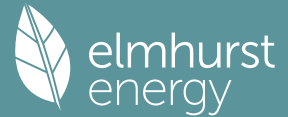
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2000 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1700 (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	0.2167 0.2125 0.2083 0.1870 0.1827 0.1615 0.1615 0.1573 0.1700 0.1827 0.1913 0.1998 (22b)
Mechanical extract ventilation - decentralised	
If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
Effective ac	0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front door Type 4			1.9500	1.0000	1.9500		(26)
Opening Type 2 (Uw = 1.20)			12.6600	1.1450	14.4962		(27)
Platinum B&B			37.5100	0.1300	4.8763	135.0000	5063.8500 (28a)
Timber frame	85.1885	14.6100	70.5785	0.1800	12.7041	9.0000	635.2065 (29a)
400mm Mineral wool	37.5100		37.5100	0.1100	4.1261	10.0000	375.1000 (30)
Total net area of external elements Aum(A, m ²)			160.2085				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.1527		(33)
E-WT-02			40.3100	0.0000	0.0000	20.0000	806.2000 (32)
Timber partitions			166.0400			7.0000	1162.2800 (32c)
Internal Floor 1			37.5100			18.0000	675.1800 (32d)
Internal Ceiling 1			37.5100			18.0000	675.1800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9392.9965 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							125.2066 (35)
List of Thermal Bridges							

SAP 10 Online 2.20.7 Page 2 of 7

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Northeast		1.3200		11.2829		0.7300		0.7000		0.7700		5.2741 (75)
Southeast		6.8900		36.7938		0.7300		0.7000		0.7700		89.7735 (77)
Northwest		4.4500		11.2829		0.7300		0.7000		0.7700		17.7802 (81)

Solar gains	112.8279	199.8453	293.7773	398.0977	477.0215	487.2601	464.0743	403.1010	329.5743	226.3559	136.5363	95.6548 (83)
Total gains	618.6393	717.0939	789.3392	875.6261	930.1100	923.7606	883.7940	823.9161	763.2951	675.2033	613.2979	590.9735 (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	33.5768	33.5768	33.5768	33.5768	33.5768	33.5768	33.5768	33.5768	33.5768	33.5768	33.5768	33.5768
alpha	3.2385	3.2385	3.2385	3.2385	3.2385	3.2385	3.2385	3.2385	3.2385	3.2385	3.2385	3.2385
util living area	0.9503	0.9223	0.8786	0.7905	0.6605	0.5023	0.3757	0.4169	0.6167	0.8276	0.9240	0.9565 (86)
Living	19.2650	19.5585	19.9409	20.3937	20.7351	20.9185	20.9759	20.9659	20.8399	20.3905	19.7449	19.1906
Non living	18.0429	18.4083	18.8804	19.4228	19.8083	19.9937	20.0412	20.0349	19.9253	19.4335	18.6479	17.9497
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	20.1125	19.5585	19.9409	20.3937	20.7351	20.9185	20.9759	20.9659	20.8399	20.3905	19.7449	19.4437 (87)
Th 2	20.0536	20.0536	20.0536	20.0536	20.0536	20.0536	20.0536	20.0536	20.0536	20.0536	20.0536	20.0536 (88)
util rest of house	0.9426	0.9106	0.8604	0.7601	0.6138	0.4381	0.2992	0.3373	0.5525	0.7952	0.9105	0.9496 (89)
MIT 2	19.2520	18.4083	18.8804	19.4228	19.8083	19.9937	20.0412	20.0349	19.9253	19.4335	18.6479	18.3288 (90)
Living area fraction									fLA = Living area / (4) =			0.1750 (91)
MIT	19.4026	18.6096	19.0660	19.5927	19.9705	20.1556	20.2048	20.1978	20.0854	19.6010	18.8399	18.5239 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4026	18.6096	19.0660	19.5927	19.9705	20.1556	20.2048	20.1978	20.0854	19.6010	18.8399	18.5239 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9363	0.8885	0.8380	0.7437	0.6095	0.4453	0.3117	0.3498	0.5548	0.7774	0.8888	0.9352 (94)
Useful gains	579.2464	637.1028	661.5047	651.1680	566.8626	411.3202	275.4487	288.2150	423.4789	524.8759	545.0690	552.6820 (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	1173.5838	1065.3416	976.4736	830.9029	642.6781	431.7091	280.1165	295.1183	465.1068	699.4471	912.2774	1113.0761 (97)
Space heating kWh	442.1870	287.7764	234.3369	129.4091	56.4067	0.0000	0.0000	0.0000	0.0000	129.8810	264.3901	416.9332 (98a)
Space heating requirement - total per year (kWh/year)												1961.3205
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	442.1870	287.7764	234.3369	129.4091	56.4067	0.0000	0.0000	0.0000	0.0000	129.8810	264.3901	416.9332 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1961.3205
Space heating per m2										(98c) / (4) =		26.1440 (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 %)												218.3965 (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	442.1870	287.7764	234.3369	129.4091	56.4067	0.0000	0.0000	0.0000	0.0000	129.8810	264.3901	416.9332 (98)
Space heating efficiency (main heating system 1)	218.3965	218.3965	218.3965	218.3965	218.3965	0.0000	0.0000	0.0000	0.0000	218.3965	218.3965	218.3965 (210)
Space heating fuel (main heating system)	202.4699	131.7679	107.2988	59.2542	25.8277	0.0000	0.0000	0.0000	0.0000	59.4703	121.0597	190.9066 (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	241.3480	213.1867	225.7798	196.7594	189.5597	169.5278	166.3457	173.6433	176.3219	198.1565	212.6020	238.4761 (64)
Efficiency of water heater	176.4809	176.4809	176.4809	176.4809	176.4809	176.4809	176.4809	176.4809	176.4809	176.4809	176.4809	176.4809 (216)
Fuel for water heating, kWh/month	136.7559	120.7987	127.9344	111.4904	107.4109	96.0601	94.2570	98.3921	99.9099	112.2821	120.4674	135.1285 (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	2.0342	1.8373	2.0342	1.9686	2.0342	1.9686	2.0342	2.0342	1.9686	2.0342	1.9686	2.0342 (231)
Lighting	20.9583	16.8135	15.1387	11.0913	8.5672	6.9995	7.8153	10.1586	13.1950	17.3126	19.5545	21.5408 (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)

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Annual totals kWh/year	
Space heating fuel - main system 1	898.0550 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	176.4809
Water heating fuel used	1360.8873 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 3.9440, total flow = 37.0000, SFP = 0.1066)	
mechanical ventilation fans (SFP = 0.1066)	23.9510 (230a)
Total electricity for the above, kWh/year	23.9510 (231)
Electricity for lighting (calculated in Appendix L)	169.1452 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2452.0386 (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	898.0550	0.1557	139.8705 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1360.8873	0.1411	191.9999 (264)
Space and water heating			331.8704 (265)
Pumps, fans and electric keep-hot	23.9510	0.1387	3.3223 (267)
Energy for lighting	169.1452	0.1443	24.4129 (268)
Total CO2, kg/year			359.6056 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.7900 (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	898.0550	1.5766	1415.8407 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1360.8873	1.5217	2070.8457 (278)
Space and water heating			3486.6864 (279)
Pumps, fans and electric keep-hot	23.9510	1.5128	36.2331 (281)
Energy for lighting	169.1452	1.5338	259.4406 (282)
Total Primary energy kWh/year			3782.3600 (286)
Dwelling Primary energy Rate (DPER)			50.4200 (287)

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

1. Overall dwelling characteristics

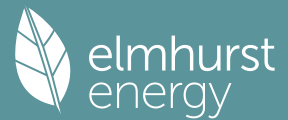
	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	37.5100 (1b)	x 2.3100 (2b)	= 86.6481 (1b) - (3b)
First floor	37.5100 (1c)	x 2.6000 (2c)	= 97.5260 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	184.1741 (5)

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	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1629 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4129 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3510 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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)

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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 infiltr rate												
Effective ac	0.4475	0.4387	0.4299	0.3861	0.3773	0.3334	0.3334	0.3246	0.3510	0.3773	0.3948	0.4124 (22b)
	0.6001	0.5962	0.5924	0.5745	0.5712	0.5556	0.5556	0.5527	0.5616	0.5712	0.5779	0.5850 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.20)			12.6600	1.1450	14.4962		(27)
Platinum B&B			37.5100	0.1300	4.8763		(28a)
Timber frame	85.1885	14.6100	70.5785	0.1800	12.7041		(29a)
400mm Mineral wool	37.5100		37.5100	0.1100	4.1261		(30)
Total net area of external elements Aum(A, m2)			160.2085				(31)
Fabric heat loss, W/K = Sum (A x U)					38.1527		(33)
E-WT-02			40.3100	0.0000	0.0000		(32)

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

125.2066 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	2.4300	0.0500	0.1215
E3 Sill	6.4700	0.0500	0.3235
E4 Jamb	4.2000	0.0500	0.2100
E5 Ground floor (normal)	9.1400	0.1600	1.4624
E6 Intermediate floor within a dwelling	17.3500	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	17.3500	0.0600	1.0410
E16 Corner (normal)	9.8200	0.0900	0.8838
E2 Other lintels (including other steel lintels)	7.4000	0.0500	0.3700
E4 Jamb	19.9800	0.0500	0.9990
E5 Ground floor (normal)	8.2100	0.1600	1.3136
P1 Party wall - Ground floor	8.2100	0.0800	0.6568
P2 Party wall - Intermediate floor within a dwelling	8.2100	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.2100	0.1200	0.9852
E18 Party wall between dwellings	9.8200	0.0600	0.5892
E4 Jamb	4.2000	0.0500	0.2100

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

9.1660 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 47.3187 (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	36.4734	36.2371	36.0055	34.9177	34.7142	33.7668	33.7668	33.5913	34.1317	34.7142	35.1259	35.5564 (38)
Average = Sum(39)m / 12 =	83.7921	83.5558	83.3242	82.2364	82.0329	81.0855	81.0855	80.9100	81.4504	82.0329	82.4446	82.8751 (39)
												82.2355

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1169	1.1138	1.1107	1.0962	1.0935	1.0809	1.0809	1.0785	1.0857	1.0935	1.0990	1.1047 (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												2.3616 (42)
Hot water usage	for mixer showers											
	63.8158	62.8568	61.4593	58.7854	56.8122	54.6117	53.3609	54.7478	56.2681	58.6308	61.3621	63.5713 (42a)
Hot water usage	for baths											
	27.5661	27.1567	26.5802	25.5172	24.7213	23.8387	23.3619	23.9344	24.5578	25.5022	26.5870	27.4729 (42b)
Hot water usage	for other uses											
	38.8151	37.4036	35.9922	34.5807	33.1692	31.7578	31.7578	33.1692	34.5807	35.9922	37.4036	38.8151 (42c)
Average daily hot water use (litres/day)												119.6806 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	130.1970	127.4171	124.0316	118.8834	114.7027	110.2081	108.4806	111.8515	115.4066	120.1251	125.3528	129.8593 (44)
Energy conte	206.2002	181.4403	190.6320	162.7454	154.4119	135.5138	131.1979	138.4955	142.3079	163.0087	178.5880	203.3283 (45)
Energy content (annual)												Total = Sum(45)m = 1987.8698
Distribution loss (46)m = 0.15 x (45)m	30.9300	27.2160	28.5948	24.4118	23.1618	20.3271	19.6797	20.7743	21.3462	24.4513	26.7882	30.4992 (46)

Water storage loss:

Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)

If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)

Total heat required for water heating calculated for each month	252.7951	223.5260	237.2269	207.8372	201.0068	180.6056	177.7928	185.0904	187.3997	209.6036	223.6798	249.9232 (62)
WWHRS	-29.1739	-25.8017	-27.0180	-22.3720	-20.8499	-17.8414	-16.7235	-17.7837	-18.4594	-21.7616	-24.6532	-28.6337 (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	223.6212	197.7243	210.2089	185.4652	180.1569	162.7642	161.0694	167.3067	168.9403	187.8420	199.0266	221.2895 (64)
Total per year (kWh/year) = Sum(64)m =												2265.4153 (64)
												2265 (64)

12Total per year (kWh/year)

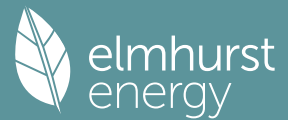
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)

Heat gains from water heating, kWh/month	105.8375	93.9975	100.6611	90.1863	88.6179	81.1318	80.8992	83.3257	83.3908	91.4763	95.4540	104.8826 (65)
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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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(66)m	118.0796	118.0796	118.0796	118.0796	118.0796	118.0796	118.0796	118.0796	118.0796	118.0796	118.0796	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	108.7223	120.3711	108.7223	112.3463	108.7223	112.3463	108.7223	108.7223	112.3463	108.7223	112.3463	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	208.7194	210.8852	205.4273	193.8081	179.1410	165.3560	156.1467	153.9809	159.4387	171.0579	185.7251	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.8080	34.8080	34.8080	34.8080	34.8080	34.8080	34.8080	34.8080	34.8080	34.8080	34.8080	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)	-94.4637	-94.4637	-94.4637	-94.4637	-94.4637	-94.4637	-94.4637	-94.4637	-94.4637	-94.4637	-94.4637	(71)
Water heating gains (Table 5)	142.2547	139.8772	135.2971	125.2588	119.1101	112.6831	108.7355	111.9969	115.8206	122.9520	132.5750	(72)
Total internal gains	521.1202	532.5573	510.8706	492.8371	468.3972	448.8093	432.0284	433.1239	446.0296	464.1561	492.0703	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				1.3200	11.2829	0.6300	0.7000	0.7700	4.5516 (75)			
Southeast				6.8900	36.7938	0.6300	0.7000	0.7700	77.4758 (77)			
Northwest				4.4500	11.2829	0.6300	0.7000	0.7700	15.3446 (81)			
Solar gains	97.3720	172.4692	253.5339	343.5638	411.6761	420.5121	400.5025	347.8817	284.4271	195.3482	117.8327	82.5514 (83)
Total gains	618.4922	705.0266	764.4045	836.4009	880.0733	869.3214	832.5309	781.0056	730.4567	659.5043	609.9030	593.1788 (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	31.1386	31.2266	31.3134	31.7276	31.8063	32.1780	32.1780	32.2477	32.0338	31.8063	31.6475	31.4831		
alpha	3.0759	3.0818	3.0876	3.1152	3.1204	3.1452	3.1452	3.1498	3.1356	3.1204	3.1098	3.0989		
util living area	0.9530	0.9300	0.8944	0.8183	0.7008	0.5431	0.4110	0.4512	0.6516	0.8445	0.9289	0.9579	(86)	
MIT	19.0692	19.3545	19.7471	20.2546	20.6490	20.8872	20.9647	20.9523	20.7928	20.2888	19.6110	19.0280	(87)	
Th 2	19.9870	19.9896	19.9921	20.0039	20.0062	20.0165	20.0165	20.0184	20.0125	20.0062	20.0017	19.9970	(88)	
util rest of house	0.9454	0.9189	0.8774	0.7891	0.6535	0.4742	0.3257	0.3640	0.5852	0.8131	0.9158	0.9511	(89)	
MIT 2	17.7546	18.1127	18.6020	19.2247	19.6788	19.9331	19.9984	19.9922	19.8454	19.2810	18.4479	17.7093	(90)	
Living area fraction	17.9847	18.3300	18.8024	19.4050	19.8486	20.1001	20.1675	20.1602	20.0113	19.4574	18.6514	17.9401	(92)	
MIT	17.9847	18.3300	18.8024	19.4050	19.8486	20.1001	20.1675	20.1602	20.0113	19.4574	18.6514	17.9401	(93)	
Temperature adjustment														
adjusted MIT	17.9847	18.3300	18.8024	19.4050	19.8486	20.1001	20.1675	20.1602	20.0113	19.4574	18.6514	17.9401		

8. Space heating requirement

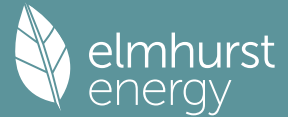
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	0.9250	0.8956	0.8529	0.7691	0.6454	0.4803	0.3392	0.3771	0.5851	0.7927	0.8929	0.9318	(94)	
Ext temp.	572.0847	631.4132	651.9571	643.2710	567.9607	417.5751	282.3944	294.5145	427.4144	522.7567	544.5897	552.7238	(95)	
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)	
Space heating kWh	1146.6693	1122.1568	1025.0909	863.8907	668.4545	445.9759	289.2720	304.2415	481.4740	726.5958	952.3543	1138.7115	(97)	
Space heating requirement - total per year (kWh/year)	427.4909	329.7796	277.6116	158.8462	74.7674	0.0000	0.0000	0.0000	0.0000	151.6563	293.5905	435.9749	(98a)	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)	
Solar heating contribution - total per year (kWh/year)	427.4909	329.7796	277.6116	158.8462	74.7674	0.0000	0.0000	0.0000	0.0000	151.6563	293.5905	435.9749	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)														
Space heating per m2										(98c) / (4) =		28.6553	(99)	

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													92.3000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
427.4909	329.7796	277.6116	158.8462	74.7674	0.0000	0.0000	0.0000	0.0000	0.0000	151.6563	293.5905	435.9749	(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)	463.1538	357.2911	300.7709	172.0978	81.0048	0.0000	0.0000	0.0000	0.0000	164.3080	318.0829	472.3455	(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	223.6212	197.7243	210.2089	185.4652	180.1569	162.7642	161.0694	167.3067	168.9403	187.8420	199.0266	221.2895	(64)	
Efficiency of water heater	85.4886	85.1983	84.6844	83.7143	82.2448	79.8000	79.8000	79.8000	79.8000	83.5842	84.9301	85.5515	(216)	
Fuel for water heating, kWh/month	261.5800	232.0754	248.2263	221.5455	219.0497	203.9652	201.8413	209.6575	211.7046	224.7338	234.3417	258.6625	(219)	
Space cooling fuel requirement														

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2329.0547	1.1300	2631.8318 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2727.3834	1.1300	3081.9432 (278)
Space and water heating			5713.7750 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	182.3170	1.5338	279.6439 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-750.0883	1.4974	-1123.1732
PV Unit electricity exported	-1103.9374	0.4621	-510.1534
Total			-1633.3266 (283)
Total Primary energy kWh/year			4490.1931 (286)
Target Primary Energy Rate (TPER)			59.8500 (287)

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Property Reference	Kenley EOT				Issued on Date	29/11/2024
Assessment Reference	Issue A		Prop Type Ref	Kenley EOT		
Property	BKNL LTGE					
SAP Rating	81 B	DER	5.35	TER	13.13	
Environmental	96 A	% DER < TER				59.25
CO ₂ Emissions (t/year)	0.29	DFEE	35.81	TFEE	37.36	
Compliance Check	See BREL	% DFEE < TFEE				4.15
% DPER < TPER	18.20	DPER	56.34	TPER	68.87	
Assessor Details	Ms. Ruth Ferguson				Assessor ID	AE69-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	28.7700 (1b)	x 2.3100 (2b)	= 66.4587 (1b) - (3b)
First floor	28.7700 (1c)	x 2.6000 (2c)	= 74.8020 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 141.2607 (5)

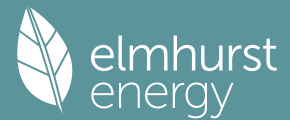
2. Ventilation rate

											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												0 * 10 =	0.0000 (7a)
Number of passive vents												0 * 10 =	0.0000 (7b)
Number of flueless gas fires												0 * 40 =	0.0000 (7c)
											Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =											0.0000 (8)	
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												4.0000 (17)	
Infiltration rate												0.2000 (18)	
Number of sides sheltered												2 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =											0.8500 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =											0.1700 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	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)	
Adj wind rate	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)	
	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation												0.5000 (23a)	
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)	

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door White Type 1			1.9600	1.0000	1.9600		(26)
French Door (Uw = 1.20)			5.0400	1.1450	5.7710		(27)
Window (Uw = 1.20)			5.8600	1.1450	6.7099		(27)
TE Platinum GF			28.7700	0.1300	3.7401	90.0000	2589.3000 (28a)
Timber Frame-Single Sheathing	64.2300	7.8200	56.4100	0.1800	10.1538	9.0000	507.6900 (29a)
Timber Frame - Dble Sheathing	9.2300	5.0400	4.1900	0.1800	0.7542	9.0000	37.7100 (29a)
400mm Mineral Wool	28.7700		28.7700	0.1100	3.1647	9.0000	258.9300 (30)
Total net area of external elements Aum(A, m ²)			131.0000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.2537		(33)
Timber Party			35.3800	0.0000	0.0000	20.0000	707.6000 (32)
GF Timber			54.6400			9.0000	491.7600 (32c)
FF Timber			55.2100			9.0000	496.8900 (32c)
FF Floor			28.7700			18.0000	517.8600 (32d)
GF Ceiling			28.7700			9.0000	258.9300 (32e)

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Heat capacity $C_m = \text{Sum}(A \times k)$
Thermal mass parameter (TMP = C_m / TFA) in $\text{kJ/m}^2\text{K}$
List of Thermal Bridges

(28)...(30) + (32) + (32a)...(32e) = 5866.6700 (34)
101.9581 (35)

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.2500	0.0500	0.4125
E3 Sill	4.9200	0.0500	0.2460
E4 Jamb	20.1000	0.0500	1.0050
E5 Ground floor (normal)	15.1900	0.1600	2.4304
E6 Intermediate floor within a dwelling	15.1900	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	7.9900	0.0600	0.4794
E12 Gable (insulation at ceiling level)	7.2000	0.0600	0.4320
E16 Corner (normal)	9.8200	0.0580	0.5696
E18 Party wall between dwellings	9.8200	0.0600	0.5892
P1 Party wall - Ground floor	7.2000	0.0800	0.5760
P2 Party wall - Intermediate floor within a dwelling	7.2000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	7.2000	0.1200	0.8640
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			7.6041 (36)
Point Thermal bridges			0.0000 (36a)
Total fabric heat loss			39.8578 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	23.3080	23.3080	23.3080	23.3080	23.3080	23.3080	23.3080	23.3080	23.3080	23.3080	23.3080	23.3080	
Average = Sum(39)m / 12 =	63.1658	63.1658	63.1658	63.1658	63.1658	63.1658	63.1658	63.1658	63.1658	63.1658	63.1658	63.1658	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0978	1.0978	1.0978	1.0978	1.0978	1.0978	1.0978	1.0978	1.0978	1.0978	1.0978	1.0978	(40)
HLP (average)												1.0978	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.9113 (42)
Hot water usage for mixer showers	56.2657	55.4201	54.1880	51.8305	50.0907	48.1505	47.0477	48.2706	49.6110	51.6942	54.1023	56.0501	(42a)
Hot water usage for baths	24.3193	23.9581	23.4495	22.5117	21.8095	21.0309	20.6103	21.1154	21.6653	22.4985	23.4556	24.2371	(42b)
Hot water usage for other uses	34.2036	32.9598	31.7161	30.4723	29.2285	27.9848	27.9848	29.2285	30.4723	31.7161	32.9598	34.2036	(42c)
Average daily hot water use (litres/day)												105.5171	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	114.7886	112.3381	109.3536	104.8145	101.1288	97.1662	95.6428	98.6145	101.7486	105.9087	110.5177	114.4908	(44)
Energy content (annual)	181.7971	159.9680	168.0724	143.4858	136.1388	119.4772	115.6717	122.1053	125.4662	143.7171	157.4527	179.2650	(45)
Distribution loss (46)m = $0.15 \times (45)\text{m}$	27.2696	23.9952	25.2109	21.5229	20.4208	17.9216	17.3508	18.3158	18.8199	21.5576	23.6179	26.8897	(46)
Water storage loss:													
Store volume													150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													0.7100 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.3834 (55)
Total storage loss	11.8854	10.7352	11.8854	11.5020	11.8854	11.5020	11.8854	11.8854	11.5020	11.8854	11.5020	11.8854	(56)
If cylinder contains dedicated solar storage	11.8854	10.7352	11.8854	11.5020	11.8854	11.5020	11.8854	11.8854	11.5020	11.8854	11.5020	11.8854	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	216.9449	191.7144	203.2202	177.4998	171.2866	153.4912	150.8195	157.2531	159.4802	178.8649	191.4667	214.4128	(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	216.9449	191.7144	203.2202	177.4998	171.2866	153.4912	150.8195	157.2531	159.4802	178.8649	191.4667	214.4128	(64)
12Total per year (kWh/year)													2166.4541 (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	88.5658	78.5865	84.0023	74.9202	73.3844	66.9374	66.5791	68.7183	68.9287	75.9042	79.5642	87.7238	(65)

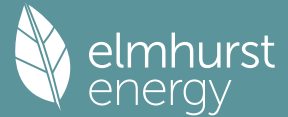
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	95.5648	95.5648	95.5648	95.5648	95.5648	95.5648	95.5648	95.5648	95.5648	95.5648	95.5648	95.5648	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	85.2308	84.3627	85.2308	88.0718	85.2308	88.0718	85.2308	85.2308	88.0718	85.2308	88.0718	85.2308	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	166.7030	168.4328	164.0736	154.7935	143.0789	132.0689	124.7135	122.9836	127.3428	136.6230	148.3376	159.3476	(68)
Pumps, fans	32.5565	32.5565	32.5565	32.5565	32.5565	32.5565	32.5565	32.5565	32.5565	32.5565	32.5565	32.5565	(69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Water heating gains (Table 5)	-76.4519	-76.4519	-76.4519	-76.4519	-76.4519	-76.4519	-76.4519	-76.4519	-76.4519	-76.4519	-76.4519	-76.4519	(71)
Total internal gains	119.0400	116.9442	112.9063	104.0559	98.6349	92.9686	89.4880	92.3632	95.7343	102.0217	110.5059	117.9084	(72)
	422.6432	431.4091	413.8802	398.5906	378.6141	364.7787	351.1018	352.2471	362.8184	375.5450	398.5847	414.1562	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	g Specific data or Table 6c	FF Specific data or Table 6c	Access factor Table 6d	Gains W
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Southeast			5.0400		36.7938		0.7300		0.7000		0.7700		65.6689 (77)
Northeast			1.3200		11.2829		0.7300		0.7000		0.7700		5.2741 (75)
Southeast			1.1000		36.7938		0.7300		0.7000		0.7700		14.3325 (77)
Northwest			3.4400		11.2829		0.7300		0.7000		0.7700		13.7447 (81)

Solar gains	99.0202	174.9853	256.2024	345.5727	412.7420	421.0494	401.2372	349.3996	286.8798	197.9203	119.7538	83.9962 (83)
Total gains	521.6634	606.3944	670.0826	744.1634	791.3560	785.8281	752.3390	701.6468	649.6983	573.4653	518.3385	498.1525 (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	25.7993	25.7993	25.7993	25.7993	25.7993	25.7993	25.7993	25.7993	25.7993	25.7993	25.7993	25.7993
alpha	2.7200	2.7200	2.7200	2.7200	2.7200	2.7200	2.7200	2.7200	2.7200	2.7200	2.7200	2.7200
util living area												
	0.9197	0.8841	0.8331	0.7409	0.6154	0.4697	0.3535	0.3912	0.5745	0.7787	0.8863	0.9278 (86)
Living	18.9489	19.2851	19.7244	20.2404	20.6417	20.8746	20.9573	20.9426	20.7767	20.2498	19.5070	18.8637
Non living	17.6337	18.0500	18.5902	19.2082	19.6652	19.9070	19.9792	19.9692	19.8188	19.2368	18.3353	17.5277
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	19.9507	19.2851	19.7244	20.2404	20.6417	20.8746	20.9573	20.9426	20.7767	20.2498	19.5070	19.1625 (87)
Th 2	20.0027	20.0027	20.0027	20.0027	20.0027	20.0027	20.0027	20.0027	20.0027	20.0027	20.0027	20.0027 (88)
util rest of house												
	0.9091	0.8696	0.8123	0.7091	0.5695	0.4077	0.2789	0.3139	0.5120	0.7439	0.8695	0.9182 (89)
MIT 2	19.0583	18.0500	18.5902	19.2082	19.6652	19.9070	19.9792	19.9692	19.8188	19.2368	18.3353	17.9737 (90)
Living area fraction									fLA = Living area / (4) =			0.2218 (91)
MIT	19.2562	18.3239	18.8417	19.4371	19.8818	20.1215	20.1961	20.1851	20.0312	19.4614	18.5951	18.2373 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2562	18.3239	18.8417	19.4371	19.8818	20.1215	20.1961	20.1851	20.0312	19.4614	18.5951	18.2373 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9000	0.8394	0.7838	0.6892	0.5636	0.4153	0.2937	0.3285	0.5139	0.7223	0.8399	0.8966 (94)
Useful gains	469.4855	509.0216	525.2410	512.8753	446.0335	326.3912	220.9739	230.5016	333.9119	414.1921	435.3594	446.6283 (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												
	944.7181	847.9334	779.5760	665.5851	516.8075	348.7722	227.1488	239.0890	374.6508	559.7390	726.0992	886.6797 (97)
Space heating kWh												
	353.5731	227.7487	189.2252	109.9511	52.6558	0.0000	0.0000	0.0000	0.0000	108.2869	209.3327	327.3982 (98a)
Space heating requirement - total per year (kWh/year)												1578.1717
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												
	353.5731	227.7487	189.2252	109.9511	52.6558	0.0000	0.0000	0.0000	0.0000	108.2869	209.3327	327.3982 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1578.1717
Space heating per m2										(98c) / (4) =		27.4274 (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 %)												217.3158 (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	353.5731	227.7487	189.2252	109.9511	52.6558	0.0000	0.0000	0.0000	0.0000	108.2869	209.3327	327.3982 (98)
Space heating efficiency (main heating system 1)	217.3158	217.3158	217.3158	217.3158	217.3158	0.0000	0.0000	0.0000	0.0000	217.3158	217.3158	217.3158 (210)
Space heating fuel (main heating system)	162.7002	104.8008	87.0739	50.5951	24.2301	0.0000	0.0000	0.0000	0.0000	49.8293	96.3265	150.6555 (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	216.9449	191.7144	203.2202	177.4998	171.2866	153.4912	150.8195	157.2531	159.4802	178.8649	191.4667	214.4128 (64)
Efficiency of water heater (217)m	176.7000	176.7000	176.7000	176.7000	176.7000	176.7000	176.7000	176.7000	176.7000	176.7000	176.7000	176.7000 (216)
Fuel for water heating, kWh/month	122.7758	108.4971	115.0086	100.4527	96.9364	86.8654	85.3534	88.9944	90.2548	101.2252	108.3569	121.3428 (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	1.6191	1.4625	1.6191	1.5669	1.6191	1.5669	1.6191	1.6191	1.5669	1.6191	1.5669	1.6191 (231)
Lighting	16.4178	13.1710	11.8590	8.6884	6.7112	5.4831	6.1222	7.9578	10.3364	13.5619	15.3182	16.8741 (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)												

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(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												726.2113	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												176.7000	
Water heating fuel used												1226.0635	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 3.2080, total flow = 29.0000, SFP = 0.1106)													
mechanical ventilation fans (SFP = 0.1106)												19.0642	(230a)
Total electricity for the above, kWh/year												19.0642	(231)
Electricity for lighting (calculated in Appendix L)												132.5011	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2103.8401	(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	726.2113	0.1555	112.9230	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1226.0635	0.1410	172.9126	(264)
Space and water heating			285.8355	(265)
Pumps, fans and electric keep-hot	19.0642	0.1387	2.6444	(267)
Energy for lighting	132.5011	0.1443	19.1240	(268)
Total CO2, kg/year			307.6040	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.3500	(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	726.2113	1.5756	1144.2372	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1226.0635	1.5215	1865.4394	(278)
Space and water heating			3009.6766	(279)
Pumps, fans and electric keep-hot	19.0642	1.5128	28.8403	(281)
Energy for lighting	132.5011	1.5338	203.2347	(282)
Total Primary energy kWh/year			3241.7516	(286)
Dwelling Primary energy Rate (DPER)			56.3400	(287)

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

1. Overall dwelling characteristics

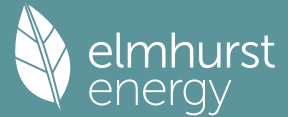
	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	28.7700 (1b)	x 2.3100 (2b)	= 66.4587	(1b) - (3b)
First floor	28.7700 (1c)	x 2.6000 (2c)	= 74.8020	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.5400			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	141.2607	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1416	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3916	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3328	(21)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

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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												
	0.4244	0.4161	0.4077	0.3661	0.3578	0.3162	0.3162	0.3079	0.3328	0.3578	0.3745	0.3911 (22b)
Effective ac	0.5900	0.5866	0.5831	0.5670	0.5640	0.5500	0.5500	0.5474	0.5554	0.5640	0.5701	0.5765 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			1.9600	1.0000	1.9600		(26)
TER Opening Type (Uw = 1.20)			10.9000	1.1450	12.4809		(27)
TE Platinum GF			28.7700	0.1300	3.7401		(28a)
Timber Frame-Single Sheathing	64.2300	7.8200	56.4100	0.1800	10.1538		(29a)
Timber Frame - Dble Sheathing	9.2300	5.0400	4.1900	0.1800	0.7542		(29a)
400mm Mineral Wool	28.7700		28.7700	0.1100	3.1647		(30)
Total net area of external elements Aum(A, m2)			131.0000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.2537		(33)
Timber Party			35.3800	0.0000	0.0000		(32)

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

101.9581 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	8.2500	0.0500	0.4125
E3 Sill	4.9200	0.0500	0.2460
E4 Jamb	20.1000	0.0500	1.0050
E5 Ground floor (normal)	15.1900	0.1600	2.4304
E6 Intermediate floor within a dwelling	15.1900	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	7.9900	0.0600	0.4794
E12 Gable (insulation at ceiling level)	7.2000	0.0600	0.4320
E16 Corner (normal)	9.8200	0.0900	0.8838
E18 Party wall between dwellings	9.8200	0.0600	0.5892
P1 Party wall - Ground floor	7.2000	0.0800	0.5760
P2 Party wall - Intermediate floor within a dwelling	7.2000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	7.2000	0.1200	0.8640

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

7.9183 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 40.1720 (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	27.5057	27.3427	27.1829	26.4325	26.2921	25.6384	25.6384	25.5174	25.8902	26.2921	26.5761	26.8731 (38)
Heat transfer coeff	67.6777	67.5147	67.3549	66.6045	66.4641	65.8105	65.8105	65.6894	66.0622	66.4641	66.7481	67.0451 (39)
Average = Sum(39)m / 12 =												66.6038

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1762	1.1734	1.1706	1.1575	1.1551	1.1437	1.1437	1.1416	1.1481	1.1551	1.1600	1.1652 (40)
HLP (average)												1.1575
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

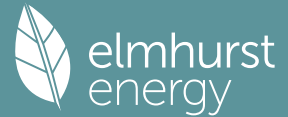
Assumed occupancy												1.9113 (42)
Hot water usage for mixer showers												
56.2657	55.4201	54.1880	51.8305	50.0907	48.1505	47.0477	48.2706	49.6110	51.6942	54.1023	56.0501 (42a)	
Hot water usage for baths												
24.3193	23.9581	23.4495	22.5117	21.8095	21.0309	20.6103	21.1154	21.6653	22.4985	23.4556	24.2371 (42b)	
Hot water usage for other uses												
34.2036	32.9598	31.7161	30.4723	29.2285	27.9848	27.9848	29.2285	30.4723	31.7161	32.9598	34.2036 (42c)	
Average daily hot water use (litres/day)												105.5171 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.7886	112.3381	109.3536	104.8145	101.1288	97.1662	95.6428	98.6145	101.7486	105.9087	110.5177	114.4908 (44)
Energy content (annual)	181.7971	159.9680	168.0724	143.4858	136.1388	119.4772	115.6717	122.1053	125.4662	143.7171	157.4527	179.2650 (45)
Distribution loss (46)m = 0.15 x (45)m	27.2696	23.9952	25.2109	21.5229	20.4208	17.9216	17.3508	18.3158	18.8199	21.5576	23.6179	26.8897 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	228.3920	202.0537	214.6673	188.5777	182.7337	164.5690	162.2666	168.7002	170.5580	190.3120	202.5445	225.8599 (62)
WWHRS	-25.7223	-22.7490	-23.8215	-19.7251	-18.3831	-15.7306	-14.7449	-15.6797	-16.2754	-19.1870	-21.7365	-25.2460 (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	202.6697	179.3046	190.8458	168.8526	164.3506	148.8384	147.5217	153.0205	154.2826	171.1250	180.8081	200.6139 (64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2062.2334 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												0.0000 (64a)
Heat gains from water heating, kWh/month	97.7235	86.8579	93.1600	83.7825	82.5421	75.7996	75.7368	77.8759	77.7910	85.0619	88.4265	96.8815 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	95.5648	95.5648	95.5648	95.5648	95.5648	95.5648	95.5648	95.5648	95.5648	95.5648	95.5648	95.5648 (66)

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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	85.2308	94.3627	85.2308	88.0718	85.2308	88.0718	85.2308	88.0718	85.2308	88.0718	85.2308 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	166.7030	168.4328	164.0736	154.7935	143.0789	132.0689	124.7135	122.9836	127.3428	136.6230	148.3376 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.5565	32.5565	32.5565	32.5565	32.5565	32.5565	32.5565	32.5565	32.5565	32.5565	32.5565 (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 (70)
Losses e.g. evaporation (negative values) (Table 5)	-76.4519	-76.4519	-76.4519	-76.4519	-76.4519	-76.4519	-76.4519	-76.4519	-76.4519	-76.4519	-76.4519 (71)
Water heating gains (Table 5)	131.3487	129.2529	125.2150	116.3646	110.9436	105.2773	101.7967	104.6720	108.0430	114.3304	122.8146 (72)
Total internal gains	437.9520	446.7178	429.1889	413.8993	393.9228	377.0874	363.4105	364.5559	375.1271	390.8537	413.8934 (73)

6. Solar gains

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

Northeast					1.3200	11.2829	0.6300	0.7000				0.7700	4.5516 (75)
Southeast					6.1400	36.7938	0.6300	0.7000				0.7700	69.0423 (77)
Northwest					3.4400	11.2829	0.6300	0.7000				0.7700	11.8619 (81)

Solar gains	85.4558	151.0147	221.1062	298.2340	356.2020	363.3714	346.2732	301.5367	247.5812	170.8080	103.3492	72.4899	(83)
Total gains	523.4077	597.7325	650.2951	712.1333	750.1248	740.4588	709.6837	666.0925	622.7084	561.6617	517.2426	501.9548	(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	24.0793	24.1374	24.1947	24.4673	24.5190	24.7625	24.7625	24.8081	24.6681	24.5190	24.4146	24.3065
alpha	2.6053	2.6092	2.6130	2.6312	2.6346	2.6508	2.6508	2.6539	2.6445	2.6346	2.6276	2.6204
util living area	0.9229	0.8931	0.8500	0.7678	0.6516	0.5058	0.3847	0.4214	0.6054	0.7952	0.8917	0.9295 (86)
MIT	18.7534	19.0778	19.5257	20.0946	20.5478	20.8363	20.9419	20.9246	20.7237	20.1448	19.3713	18.7010 (87)
Th 2	19.9391	19.9414	19.9436	19.9541	19.9561	19.9653	19.9653	19.9670	19.9617	19.9561	19.9521	19.9479 (88)
util rest of house	0.9124	0.8789	0.8299	0.7366	0.6046	0.4393	0.3021	0.3372	0.5405	0.7607	0.8750	0.9198 (89)
MIT 2	17.3514	17.7558	18.3109	19.0049	19.5289	19.8400	19.9335	19.9232	19.7339	19.0829	18.1367	17.2914 (90)
Living area fraction	fLA = Living area / (4) = 0.2218 (91)											
MIT	17.6623	18.0489	18.5803	19.2466	19.7548	20.0610	20.1571	20.1453	19.9534	19.3184	18.4105	17.6040 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.6623	18.0489	18.5803	19.2466	19.7548	20.0610	20.1571	20.1453	19.9534	19.3184	18.4105	17.6040 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8823	0.8469	0.7986	0.7126	0.5948	0.4458	0.3180	0.3523	0.5399	0.7361	0.8438	0.8908 (94)
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	904.3315	887.7472	813.6681	689.1286	535.3579	359.3887	234.0960	246.0265	386.6881	579.4584	754.9554	898.6718 (97)
Space heating kWh	329.2555	256.3964	218.9937	130.7944	66.3717	0.0000	0.0000	0.0000	0.0000	123.5293	229.3218	335.9451 (98a)
Space heating requirement - total per year (kWh/year)	1690.6079											
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	329.2555	256.3964	218.9937	130.7944	66.3717	0.0000	0.0000	0.0000	0.0000	123.5293	229.3218	335.9451 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1690.6079											
Space heating per m2	(98c) / (4) = 29.3814 (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	329.2555	256.3964	218.9937	130.7944	66.3717	0.0000	0.0000	0.0000	0.0000	123.5293	229.3218	335.9451 (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)	356.7232	277.7860	237.2629	141.7057	71.9086	0.0000	0.0000	0.0000	0.0000	133.8346	248.4527	363.9708 (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	202.6697	179.3046	190.8458	168.8526	164.3506	148.8384	147.5217	153.0205	154.2826	171.1250	180.8081	200.6139 (64)
Efficiency of water heater (217)m	85.1414	84.8613	84.3691	83.4937	82.1965	79.8000	79.8000	79.8000	79.8000	83.3412	84.5939	79.8000 (216)
Fuel for water heating, kWh/month	238.0390	211.2914	226.2034	202.2339	199.9484	186.5143	184.8643	191.7550	193.3366	205.3307	213.7364	235.4430 (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)

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Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	17.7093	14.2070	12.7919	9.3719	7.2391	5.9144	6.6038	8.5838	11.1495	14.6288	16.5232	18.2015	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-27.2670	-38.6245	-55.7994	-63.0954	-68.3779	-63.9888	-63.2345	-59.5455	-53.0608	-44.3613	-30.0555	-23.5555	(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	-14.8579	-31.3167	-62.3414	-93.7595	-124.0746	-124.6657	-123.1631	-104.2070	-76.3060	-44.7876	-19.8419	-11.7418	(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												1831.6445	(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												2488.6964	(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)												142.9240	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1422.0294	(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												3127.2356	(238)

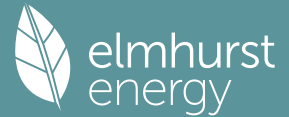
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1831.6445	0.2100	384.6453	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2488.6964	0.2100	522.6262	(264)
Space and water heating			907.2716	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	142.9240	0.1443	20.6284	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-590.9661	0.1345	-79.4615	
PV Unit electricity exported	-831.0633	0.1259	-104.6005	
Total			-184.0620	(269)
Total CO2, kg/year			755.7672	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.1300	(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	1831.6445	1.1300	2069.7583	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2488.6964	1.1300	2812.2269	(278)
Space and water heating			4881.9852	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	142.9240	1.5338	219.2216	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-590.9661	1.4969	-884.6382	
PV Unit electricity exported	-831.0633	0.4620	-383.9551	
Total			-1268.5933	(283)
Total Primary energy kWh/year			3962.7144	(286)
Target Primary Energy Rate (TPER)			68.8700	(287)

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Property Reference	Kennford Det				Issued on Date	29/11/2024	
Assessment Reference	Issue A			Prop Type Ref			
Property							
SAP Rating	78 C	DER	5.06	TER	11.19		
Environmental	95 A	% DER < TER				54.78	
CO ₂ Emissions (t/year)	0.51	DFEE	44.22	TFEE	44.23		
Compliance Check	See BREL	% DFEE < TFEE				0.01	
% DPER < TPER	9.69	DPER	52.90	TPER	58.58		
Assessor Details	Ms. Ruth Ferguson				Assessor ID	AE69-0001	
Client							

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.9600 (1b)	x 2.6000 (2b)	= 114.2960 (1b) - (3b)
First floor	58.9200 (1c)	x 2.3100 (2c)	= 136.1052 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 250.4012 (5)

2. Ventilation rate

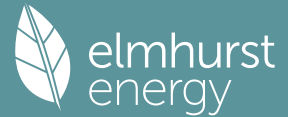
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	1 * 10 =	10.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	10.0000 / (5) =	0.0399 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	4.0000	(17)
Infiltration rate	0.2399	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2039 (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	0.2600	0.2549	0.2498	0.2243	0.2192	0.1937	0.1937	0.1886	0.2039	0.2192	0.2294	0.2396 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
Effective ac	0.5100	0.5049	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Type 4 Front Door			2.0600	1.0000	2.0600		(26)
French Door (Uw = 1.20)			5.1200	1.1450	5.8626		(27)
Window (Uw = 1.20)			13.4400	1.1450	15.3893		(27)
TE PGF B&B			43.9600	0.1300	5.7148	135.0000	5934.6000 (28a)
240mm FoG			15.1400	0.1887	2.8566	20.0000	302.8000 (28b)
327mm TF with Steel Beam	108.9100	18.1000	90.8100	0.1800	16.3458	9.0000	817.2900 (29a)
Garage	14.5300		14.5300	0.3000	4.3590	9.0000	130.7700 (29a)
336mm x2OSB TF	8.4500	2.5200	5.9300	0.1800	1.0674	9.0000	53.3700 (29a)
340mm TF	14.7100		14.7100	0.1800	2.6478	9.0000	132.3900 (29a)
Garage x2 OSB	6.6700		6.6700	0.2700	1.8009	9.0000	60.0300 (29a)
400mm (0.044)	57.4800		57.4800	0.1100	6.3228	9.0000	517.3200 (30)
250mm 0.044MW, PV Platform	1.4400		1.4400	0.1700	0.2448	9.0000	12.9600 (30)
GF Porch, 400mm 0.044MW	1.3200		1.3200	0.1100	0.1452	9.0000	11.8800 (30)
Total net area of external elements Aum(A, m ²)			272.6100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		64.8170		(33)

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GF/FF Timber	201.5000	9.0000	1813.5000 (32c)
FF Floor	42.6500	18.0000	767.7000 (32d)
GF Ceiling	42.6500	9.0000	383.8500 (32e)

Heat capacity $C_m = \text{Sum}(A \times k)$ (28)...(30) + (32) + (32a)...(32e) = 10938.4600 (34)
Thermal mass parameter (TMP = C_m / TFA) in kJ/m²K 106.3225 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	11.3700	0.0500	0.5685
E3 Sill	7.9500	0.0500	0.3975
E4 Jamb	25.9500	0.0500	1.2975
E5 Ground floor (normal)	14.5900	0.1600	2.3344
E6 Intermediate floor within a dwelling	12.2500	0.0000	0.0000
E16 Corner (normal)	2.6000	0.0900	0.2340
E5 Ground floor (normal)	9.1700	0.1600	1.4672
E20 Exposed floor (normal)	8.3500	0.3200	2.6720
E21 Exposed floor (inverted)	9.1700	0.3200	2.9344
E10 Eaves (insulation at ceiling level)	15.2400	0.0600	0.9144
E10 Eaves (insulation at ceiling level)	15.4600	0.0600	0.9276
E12 Gable (insulation at ceiling level)	1.1100	0.0600	0.0666
E16 Corner (normal)	5.2000	0.0900	0.4680
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0900	-0.2340
E2 Other lintels (including other steel lintels)	1.8700	0.0500	0.0935
E3 Sill	1.8700	0.0500	0.0935
E4 Jamb	2.7000	0.0500	0.1350
E5 Ground floor (normal)	3.2500	0.1600	0.5200
E5 Ground floor (normal)	5.6600	0.1600	0.9056
E6 Intermediate floor within a dwelling	3.2500	0.0000	0.0000
E6 Intermediate floor within a dwelling	5.6600	0.0000	0.0000
E16 Corner (normal)	2.6000	0.0900	0.2340
E16 Corner (normal)	2.3100	0.0900	0.2079
E16 Corner (normal)	9.2500	0.0900	0.8325
E2 Other lintels (including other steel lintels)	0.6700	0.0500	0.0335
E3 Sill	0.6700	0.0500	0.0335
E4 Jamb	2.2500	0.0500	0.1125
E24 Eaves (insulation at ceiling level - inverted)	1.1900	0.1500	0.1785
E12 Gable (insulation at ceiling level)	1.1100	0.0600	0.0666
E10 Eaves (insulation at ceiling level)	1.1900	0.0600	0.0714
E16 Corner (normal)	2.3100	0.0900	0.2079

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 17.7740 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 82.5910 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.1450	41.7237	41.3162	41.3162	41.3162	41.3162	41.3162	41.3162	41.3162	41.3162	41.3162	41.3162
Heat transfer coeff	124.7361	124.3147	123.9072	123.9072	123.9072	123.9072	123.9072	123.9072	123.9072	123.9072	123.9072	123.9072
Average = Sum(39)m / 12 =												124.0102

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2124	1.2083	1.2044	1.2044	1.2044	1.2044	1.2044	1.2044	1.2044	1.2044	1.2044	1.2044
HLP (average)												1.2054
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

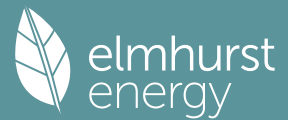
Assumed occupancy												2.7646 (42)
Hot water usage for mixer showers												
70.5736	69.5130	67.9676	65.0106	62.8284	60.3948	59.0116	60.5454	62.2267	64.8396	67.8601	70.3032	(42a)
Hot water usage for baths												
30.4722	30.0196	29.3823	28.2073	27.3274	26.3518	25.8248	26.4576	27.1467	28.1906	29.3899	30.3692	(42b)
Hot water usage for other uses												
42.9426	41.3811	39.8195	38.2580	36.6964	35.1349	35.1349	36.6964	38.2580	39.8195	41.3811	42.9426	(42c)
Average daily hot water use (litres/day)												132.3578 (43)
Daily hot water use												
143.9885	140.9138	137.1694	131.4758	126.8522	121.8815	119.9713	123.6994	127.6313	132.8498	138.6311	143.6150	(44)
Energy conte	228.0425	200.6593	210.8243	179.9839	170.7675	149.8675	145.0949	153.1658	157.3822	180.2759	197.5054	224.8664 (45)
Energy content (annual)												Total = Sum(45)m = 2198.4355
Distribution loss (46)m = $0.15 \times (45)\text{m}$												
34.2064	30.0989	31.6236	26.9976	25.6151	22.4801	21.7642	22.9749	23.6073	27.0414	29.6258	33.7300	(46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												0.7100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.3834 (55)
Total storage loss												
11.8854	10.7352	11.8854	11.5020	11.8854	11.5020	11.8854	11.8854	11.5020	11.8854	11.5020	11.8854	(56)
If cylinder contains dedicated solar storage												
11.8854	10.7352	11.8854	11.5020	11.8854	11.5020	11.8854	11.8854	11.5020	11.8854	11.5020	11.8854	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month												
263.1903	232.4057	245.9721	213.9979	205.9153	183.8815	180.2427	188.3136	191.3962	215.4237	231.5194	260.0142	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h												
263.1903	232.4057	245.9721	213.9979	205.9153	183.8815	180.2427	188.3136	191.3962	215.4237	231.5194	260.0142	(64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 2612.2725 (64)
Electric shower(s)												2612 (64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
103.9424	92.1163	98.2173	87.0558	84.8984	77.0422	76.3623	79.0459	79.5408	88.0600	92.8817	102.8863	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	138.2317	138.2317	138.2317	138.2317	138.2317	138.2317	138.2317	138.2317	138.2317	138.2317	138.2317	138.2317 (66)

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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	134.3571	148.7525	134.3571	138.8357	134.3571	138.8357	134.3571	134.3571	138.8357	134.3571	138.8357	134.3571 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	260.9014	263.6087	256.7863	242.2622	223.9281	206.6967	195.1850	192.4777	199.3001	213.8242	232.1583	249.3897 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8232	36.8232	36.8232	36.8232	36.8232	36.8232	36.8232	36.8232	36.8232	36.8232	36.8232	36.8232 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-110.5854	-110.5854	-110.5854	-110.5854	-110.5854	-110.5854	-110.5854	-110.5854	-110.5854	-110.5854	-110.5854	-110.5854 (71)
Water heating gains (Table 5)	139.7075	137.0779	132.0125	120.9109	114.1108	107.0030	102.6375	106.2444	110.4733	118.3602	129.0024	138.2881 (72)
Total internal gains	599.4355	613.9086	587.6254	566.4783	536.8655	517.0049	496.6491	497.5487	513.0786	531.0110	564.4659	586.5044 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W
Northeast					5.1200	11.2829	0.7300	0.7000			0.7700	20.4572 (75)
Northeast					6.5700	11.2829	0.7300	0.7000			0.7700	26.2508 (75)
Southwest					6.1200	36.7938	0.7300	0.7000			0.7700	79.7408 (79)
Northwest					0.7500	11.2829	0.7300	0.7000			0.7700	2.9967 (81)
Solar gains	129.4454	237.0033	368.1315	529.6373	660.3296	685.0657	648.1952	546.1812	423.3496	273.7631	158.0524	108.8328 (83)
Total gains	728.8809	850.9119	955.7569	1096.1156	1197.1951	1202.0706	1144.8443	1043.7299	936.4282	804.7741	722.5182	695.3372 (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	24.3591	24.4417	24.5221	24.5221	24.5221	24.5221	24.5221	24.5221	24.5221	24.5221	24.5221	24.5221
alpha	2.6239	2.6294	2.6348	2.6348	2.6348	2.6348	2.6348	2.6348	2.6348	2.6348	2.6348	2.6348
util living area	0.9577	0.9365	0.9013	0.8267	0.7109	0.5635	0.4383	0.4895	0.6911	0.8674	0.9385	0.9623 (86)
Living	18.4093	18.7438	19.2461	19.8876	20.4350	20.7830	20.9187	20.8891	20.6104	19.8925	19.0416	18.3508
Non living	16.9005	17.3230	17.9534	18.7389	19.3792	19.7510	19.8728	19.8527	19.5900	18.7648	17.7073	16.8303
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	19.6747	18.7438	19.2461	19.8876	20.4350	20.7830	20.9187	20.8891	20.6104	19.8925	19.0416	18.7214 (87)
Th 2	19.9101	19.9133	19.9165	19.9165	19.9165	19.9165	19.9165	19.9165	19.9165	19.9165	19.9165	19.9165 (88)
util rest of house	0.9511	0.9268	0.8859	0.7989	0.6639	0.4908	0.3431	0.3921	0.6248	0.8398	0.9274	0.9563 (89)
MIT 2	18.7102	17.3230	17.9534	18.7389	19.3792	19.7510	19.8728	19.8527	19.5900	18.7648	17.7073	17.3864 (90)
Living area fraction	fLA = Living area / (4) = 0.1688 (91)											
MIT	18.8731	17.5629	18.1716	18.9328	19.5575	19.9252	20.0494	20.0277	19.7623	18.9552	17.9326	17.6118 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.8731	17.5629	18.1716	18.9328	19.5575	19.9252	20.0494	20.0277	19.7623	18.9552	17.9326	17.6118 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9435	0.8979	0.8537	0.7688	0.6465	0.4914	0.3554	0.4027	0.6141	0.8088	0.8991	0.9389 (94)
Ext temp.	687.6879	764.0395	815.8868	842.6797	773.9718	590.7441	406.8608	420.3261	575.0721	650.8931	649.6040	652.8243 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating	1817.7871	1574.1806	1446.1987	1243.1373	973.5984	659.8364	427.4050	449.4957	701.5996	1035.2668	1342.2368	1661.8196 (97)
Space heating requirement - total per year (kWh/year)	840.7938	544.4148	468.9521	288.3295	148.5221	0.0000	0.0000	0.0000	0.0000	285.9740	498.6956	750.6925 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Space heating kWh	840.7938	544.4148	468.9521	288.3295	148.5221	0.0000	0.0000	0.0000	0.0000	285.9740	498.6956	750.6925 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	840.7938	544.4148	468.9521	288.3295	148.5221	0.0000	0.0000	0.0000	0.0000	285.9740	498.6956	750.6925 (98c)
Space heating per m2	(98c) / (4) = 37.1926 (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 %)	220.3971 (206)											
Efficiency of main space heating system 2 (in %)	0.0000 (207)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating efficiency (main heating system 1)	840.7938	544.4148	468.9521	288.3295	148.5221	0.0000	0.0000	0.0000	0.0000	285.9740	498.6956	750.6925 (98)
Space heating fuel (main heating system)	220.3971	220.3971	220.3971	220.3971	220.3971	0.0000	0.0000	0.0000	0.0000	220.3971	220.3971	220.3971 (210)
Space heating efficiency (main heating system 2)	381.4905	247.0155	212.7760	130.8228	67.3884	0.0000	0.0000	0.0000	0.0000	129.7540	226.2714	340.6091 (211)
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 (212)
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 (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	263.1903	232.4057	245.9721	213.9979	205.9153	183.8815	180.2427	188.3136	191.3962	215.4237	231.5194	260.0142 (64)

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Efficiency of water heater													170.8302	(216)
(217)m	170.8302	170.8302	170.8302	170.8302	170.8302	170.8302	170.8302	170.8302	170.8302	170.8302	170.8302	170.8302	170.8302	(217)
Fuel for water heating, kWh/month														
	154.0655	136.0449	143.9863	125.2693	120.5380	107.6399	105.5098	110.2344	112.0389	126.1040	135.5260	152.2063	(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	0.0000	(221)
Pumps and Fa	3.3210	2.9997	3.3210	3.2139	3.3210	3.2139	3.3210	3.3210	3.2139	3.3210	3.2139	3.3210	3.2139	(231)
Lighting	26.1406	20.9710	18.8821	13.8338	10.6856	8.7302	9.7478	12.6705	16.4578	21.5935	24.3898	26.8672	(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	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	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	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	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	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	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	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	0.0000	(235d)
Annual totals kWh/year														
Space heating fuel - main system 1													1736.1278	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													170.8302	
Water heating fuel used													1529.1633	(219)
Space cooling fuel													0.0000	(221)

Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 5.7600, total flow = 45.0000, SFP = 0.1280)														
mechanical ventilation fans (SFP = 0.1280)													39.1026	(230a)
Total electricity for the above, kWh/year													39.1026	(231)
Electricity for lighting (calculated in Appendix L)													210.9700	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													0.0000	(233)
Wind generation													0.0000	(234)
Hydro-electric generation (Appendix N)													0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)													0.0000	(235)
Appendix Q - special features														
Energy saved or generated													-0.0000	(236)
Energy used													0.0000	(237)
Total delivered energy for all uses													3515.3637	(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	1736.1278	0.1551	269.1959	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1529.1633	0.1411	215.8019	(264)
Space and water heating			484.9978	(265)
Pumps, fans and electric keep-hot	39.1026	0.1387	5.4240	(267)
Energy for lighting	210.9700	0.1443	30.4495	(268)
Total CO2, kg/year			520.8713	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.0600	(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	1736.1278	1.5740	2732.6596	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1529.1633	1.5218	2327.1373	(278)
Space and water heating			5059.7970	(279)
Pumps, fans and electric keep-hot	39.1026	1.5128	59.1545	(281)
Energy for lighting	210.9700	1.5338	323.5928	(282)
Total Primary energy kWh/year			5442.5443	(286)
Dwelling Primary energy Rate (DPER)			52.9000	(287)

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

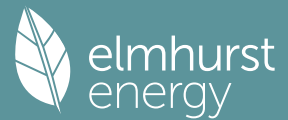
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	43.9600 (1b)	x 2.6000 (2b)	= 114.2960 (1b) - (3b)	
First floor	58.9200 (1c)	x 2.3100 (2c)	= 136.1052 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	102.8800		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)... (3n)	= 250.4012 (5)	

2. Ventilation rate

m3 per hour

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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	Air changes per hour	0.1597 (8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			5.0000	(17)
Infiltration rate			0.4097	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3483	(21)	

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	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)
Adj infilt rate	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)
Effective ac	0.4441	0.4354	0.4266	0.3831	0.3744	0.3309	0.3309	0.3222	0.3483	0.3744	0.3918	0.4092	(22b)
	0.5986	0.5948	0.5910	0.5734	0.5701	0.5547	0.5547	0.5519	0.5607	0.5701	0.5768	0.5837	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.0600	1.0000	2.0600			(26)
TER Opening Type (Uw = 1.20)			18.5600	1.1450	21.2519			(27)
TE PGF B&B			43.9600	0.1300	5.7148			(28a)
240mm FoG			15.1400	0.1300	1.9682			(28b)
327mm TF with Steel Beam	108.9100	18.1000	90.8100	0.1800	16.3458			(29a)
Garage	14.5300		14.5300	0.1800	2.6154			(29a)
336mm x20SB TF	8.4500	2.5200	5.9300	0.1800	1.0674			(29a)
340mm TF	14.7100		14.7100	0.1800	2.6478			(29a)
Garage x2 OSB	6.6700		6.6700	0.1800	1.2006			(29a)
400mm (0.044)	57.4800		57.4800	0.1100	6.3228			(30)
250mm 0.044MW, PV Platform	1.4400		1.4400	0.1100	0.1584			(30)
GF Porch, 400mm 0.044MW	1.3200		1.3200	0.1100	0.1452			(30)
Total net area of external elements Aum(A, m2)			272.6100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	61.4983			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 106.3225 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	11.3700	0.0500	0.5685
E3 Sill	7.9500	0.0500	0.3975
E4 Jamb	25.9500	0.0500	1.2975
E5 Ground floor (normal)	14.5900	0.1600	2.3344
E6 Intermediate floor within a dwelling	12.2500	0.0000	0.0000
E16 Corner (normal)	2.6000	0.0900	0.2340
E5 Ground floor (normal)	9.1700	0.1600	1.4672
E20 Exposed floor (normal)	8.3500	0.3200	2.6720
E21 Exposed floor (inverted)	9.1700	0.3200	2.9344
E10 Eaves (insulation at ceiling level)	15.2400	0.0600	0.9144
E10 Eaves (insulation at ceiling level)	15.4600	0.0600	0.9276
E12 Gable (insulation at ceiling level)	1.1100	0.0600	0.0666
E16 Corner (normal)	5.2000	0.0900	0.4680
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0900	-0.2340
E2 Other lintels (including other steel lintels)	1.8700	0.0500	0.0935
E3 Sill	1.8700	0.0500	0.0935
E4 Jamb	2.7000	0.0500	0.1350
E5 Ground floor (normal)	3.2500	0.1600	0.5200
E5 Ground floor (normal)	5.6600	0.1600	0.9056
E6 Intermediate floor within a dwelling	3.2500	0.0000	0.0000
E6 Intermediate floor within a dwelling	5.6600	0.0000	0.0000
E16 Corner (normal)	2.6000	0.0900	0.2340
E16 Corner (normal)	2.3100	0.0900	0.2079
E16 Corner (normal)	9.2500	0.0900	0.8325
E2 Other lintels (including other steel lintels)	0.6700	0.0500	0.0335
E3 Sill	0.6700	0.0500	0.0335
E4 Jamb	2.2500	0.0500	0.1125
E24 Eaves (insulation at ceiling level - inverted)	1.1900	0.2400	0.2856
E12 Gable (insulation at ceiling level)	1.1100	0.0600	0.0666
E10 Eaves (insulation at ceiling level)	1.1900	0.0600	0.0714
E16 Corner (normal)	2.3100	0.0900	0.2079

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 17.8811 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 79.3794 (37)

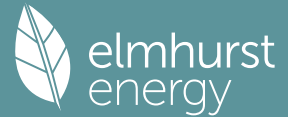
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)
(38)m Jan 49.4633 Feb 49.1469 Mar 48.8368 Apr 47.3803 May 47.1078 Jun 45.8392 Jul 45.8392 Aug 45.6043 Sep 46.3279 Oct 47.1078 Nov 47.6591 Dec 48.2354 (38)
Heat transfer coeff 128.8427 128.5263 128.2162 126.7597 126.4872 125.2186 125.2186 124.9837 125.7073 126.4872 127.0385 127.6148 (39)
Average = Sum(39)m / 12 = 126.7584

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.2524	1.2493	1.2463	1.2321	1.2295	1.2171	1.2171	1.2148	1.2219	1.2295	1.2348	1.2404	(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													2.7646 (42)
Hot water usage for mixer showers													
	70.5736	69.5130	67.9676	65.0106	62.8284	60.3948	59.0116	60.5454	62.2267	64.8396	67.8601	70.3032	(42a)
Hot water usage for baths													

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Hot water usage for other uses	30.4722	30.0196	29.3823	28.2073	27.3274	26.3518	25.8248	26.4576	27.1467	28.1906	29.3899	30.3692 (42b)
Average daily hot water use (litres/day)	42.9426	41.3811	39.8195	38.2580	36.6964	35.1349	35.1349	36.6964	38.2580	39.8195	41.3811	42.9426 (42c)
												132.3578 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	143.9885	140.9138	137.1694	131.4758	126.8522	121.8815	119.9713	123.6994	127.6313	132.8498	138.6311	143.6150 (44)
Energy content (annual)	228.0425	200.6593	210.8243	179.9839	170.7675	149.8675	145.0949	153.1658	157.3822	180.2759	197.5054	224.8664 (45)
Distribution loss (46)m = 0.15 x (45)m	34.2064	30.0989	31.6236	26.9976	25.6151	22.4801	21.7642	22.9749	23.6073	27.0414	29.6258	33.7300 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	274.6374	242.7450	257.4192	225.0757	217.3624	194.9594	191.6898	199.7607	202.4741	226.8708	242.5972	271.4613 (62)
WWHRS	-32.2633	-28.5339	-29.8791	-24.7411	-23.0578	-19.7307	-18.4944	-19.6669	-20.4142	-24.0660	-27.2639	-31.6658 (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	242.3741	214.2111	227.5401	200.3346	194.3046	175.2286	173.1954	180.0937	182.0599	202.8047	215.3333	239.7955 (64)
12Total per year (kWh/year)												2447.2757 (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	113.1001	100.3878	107.3750	95.9181	94.0561	85.9044	85.5200	88.2035	88.4031	97.2176	101.7440	112.0440 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	138.2317	138.2317	138.2317	138.2317	138.2317	138.2317	138.2317	138.2317	138.2317	138.2317	138.2317	138.2317 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	134.3571	148.7525	134.3571	138.8357	134.3571	138.8357	134.3571	134.3571	138.8357	134.3571	138.8357	134.3571 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	260.9014	263.6087	256.7863	242.2622	223.9281	206.6967	195.1850	192.4777	199.3001	213.8242	232.1583	249.3897 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8232	36.8232	36.8232	36.8232	36.8232	36.8232	36.8232	36.8232	36.8232	36.8232	36.8232	36.8232 (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)	-110.5854	-110.5854	-110.5854	-110.5854	-110.5854	-110.5854	-110.5854	-110.5854	-110.5854	-110.5854	-110.5854	-110.5854 (71)
Water heating gains (Table 5)	152.0162	149.3866	144.3212	133.2196	126.4195	119.3117	114.9462	118.5531	122.7820	130.6689	141.3111	150.5968 (72)
Total internal gains	614.7442	629.2173	602.9342	581.7870	552.1742	529.3136	508.9578	509.8574	525.3873	546.3197	579.7746	601.8131 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
Northeast				11.6900		11.2829	0.6300	0.7000	0.7700		40.3096 (75)	
Southwest				6.1200		36.7938	0.6300	0.7000	0.7700		68.8174 (79)	
Northwest				0.7500		11.2829	0.6300	0.7000	0.7700		2.5862 (81)	
Solar gains	111.7132	204.5371	317.7025	457.0843	569.8734	591.2211	559.4013	471.3618	365.3565	236.2613	136.4014	93.9242 (83)
Total gains	726.4574	833.7544	920.6366	1038.8712	1122.0477	1120.5347	1068.3592	981.2193	890.7438	782.5810	716.1759	695.7373 (84)

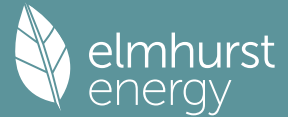
7. Mean internal temperature (heating season)

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	23.5827	23.6408	23.6979	23.9702	24.0219	24.2652	24.2652	24.3109	24.1709	24.0219	23.9176	23.8096
alpha	2.5722	2.5761	2.5799	2.5980	2.6015	2.6177	2.6177	2.6207	2.6114	2.6015	2.5945	2.5873
util living area	0.9586	0.9403	0.9104	0.8444	0.7392	0.5946	0.4672	0.5161	0.7134	0.8760	0.9405	0.9626 (86)
MIT	18.3129	18.6244	19.1111	19.7798	20.3546	20.7477	20.9031	20.8719	20.5676	19.8282	18.9717	18.2675 (87)
Th 2	19.8783	19.8808	19.8832	19.8944	19.8965	19.9063	19.9063	19.9081	19.9025	19.8965	19.8922	19.8878 (88)
util rest of house	0.9520	0.9309	0.8958	0.8181	0.6932	0.5206	0.3670	0.4152	0.6477	0.8492	0.9296	0.9567 (89)
MIT 2	16.7614	17.1550	17.7674	18.5977	19.2785	19.7119	19.8538	19.8337	19.5376	18.6761	17.6062	16.7092 (90)
Living area fraction	17.0233	17.4031	17.9943	18.7973	19.4601	19.8868	20.0310	20.0090	19.7115	18.8706	17.8368	16.9723 (92)
MIT	17.0233	17.4031	17.9943	18.7973	19.4601	19.8868	20.0310	20.0090	19.7115	18.8706	17.8368	0.0000
Temperature adjustment	17.0233	17.4031	17.9943	18.7973	19.4601	19.8868	20.0310	20.0090	19.7115	18.8706	17.8368	16.9723 (93)
adjusted MIT	17.0233	17.4031	17.9943	18.7973	19.4601	19.8868	20.0310	20.0090	19.7115	18.8706	17.8368	16.9723 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9274	0.9019	0.8631	0.7863	0.6725	0.5192	0.3791	0.4252	0.6345	0.8174	0.9010	0.9335 (94)
Ext temp.	673.7090	751.9232	794.6091	816.8476	754.5707	581.7368	405.0489	417.2419	565.2211	639.6870	645.2398	649.4877 (95)
	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)

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Heat loss rate W	1639.3059	1606.9813	1473.7528	1254.5807	981.5598	662.0083	429.6212	451.0603	705.4019	1046.1275	1363.9851	1629.9330 (97)
Space heating kWh	718.4041	574.5990	505.2829	315.1678	168.8799	0.0000	0.0000	0.0000	0.0000	302.3917	517.4966	729.4513 (98a)
Space heating requirement - total per year (kWh/year)												3831.6733
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	718.4041	574.5990	505.2829	315.1678	168.8799	0.0000	0.0000	0.0000	0.0000	302.3917	517.4966	729.4513 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3831.6733
Space heating per m2											(98c) / (4) =	37.2441 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
718.4041	574.5990	505.2829	315.1678	168.8799	0.0000	0.0000	0.0000	0.0000	0.0000	302.3917	517.4966	729.4513 (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)	778.3359	622.5342	547.4355	341.4603	182.9685	0.0000	0.0000	0.0000	0.0000	327.6183	560.6681	790.3047 (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	242.3741	214.2111	227.5401	200.3346	194.3046	175.2286	173.1954	180.0937	182.0599	202.8047	215.3333	239.7955 (64)
Efficiency of water heater	86.3434	86.1611	85.7956	85.0714	83.7468	79.8000	79.8000	79.8000	79.8000	84.9537	85.9516	79.8000 (216)
Fuel for water heating, kWh/month	280.7094	248.6169	265.2120	235.4900	232.0143	219.5848	217.0368	225.6813	228.1452	238.7237	250.5286	277.5748 (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	27.9168	22.3959	20.1650	14.7737	11.4117	9.3234	10.4101	13.5314	17.5760	23.0607	26.0470	28.6926 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-52.0673	-71.8121	-100.9987	-111.0125	-117.5717	-108.9370	-107.5230	-102.4932	-93.3775	-80.8358	-56.6454	-45.1989 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-34.4668	-71.8627	-141.6889	-211.2024	-277.7686	-278.6014	-275.3793	-233.8910	-172.3706	-102.2960	-45.8550	-27.3097 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												4151.3253 (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												2919.3179 (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)												225.3042 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2921.1655 (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												4460.7819 (238)

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

Space heating - main system 1	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Total CO2 associated with community systems	4151.3253	0.2100	871.7783 (261)
Water heating (other fuel)			0.0000 (373)
Space and water heating	2919.3179	0.2100	613.0568 (264)
Pumps, fans and electric keep-hot	86.0000	0.1387	1484.8351 (265)
Energy for lighting	225.3042	0.1443	11.9293 (267)
			32.5184 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1048.4731	0.1351	-141.6173
PV Unit electricity exported	-1872.6924	0.1261	-236.1767
Total			-377.7940 (269)
Total CO2, kg/year			1151.4887 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.1900 (273)

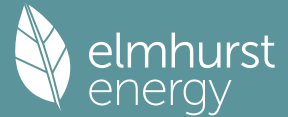
13a. Primary energy - Individual heating systems including micro-CHP

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	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4151.3253	1.1300	4690.9976 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2919.3179	1.1300	3298.8292 (278)
Space and water heating			7989.8269 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	225.3042	1.5338	345.5791 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1048.4731	1.4992	-1571.8949
PV Unit electricity exported	-1872.6924	0.4629	-866.9490
Total			-2438.8439 (283)
Total Primary energy kWh/year			6026.6628 (286)
Target Primary Energy Rate (TPER)			58.5800 (287)

Full SAP Calculation Printout



Property Reference	Radleigh Det				Issued on Date	29/11/2024	
Assessment Reference	Issue A			Prop Type Ref			
Property							
SAP Rating	80 C	DER	4.30	TER	9.64		
Environmental	96 A	% DER < TER				55.39	
CO ₂ Emissions (t/year)	0.5	DFEE	36.61	TFEE	37.73		
Compliance Check	See BREL	% DFEE < TFEE				2.98	
% DPER < TPER	10.65	DPER	44.94	TPER	50.29		
Assessor Details	Ms. Ruth Ferguson				Assessor ID	AE69-0001	
Client							

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	60.1700 (1b)	x 2.3100 (2b)	= 138.9927 (1b) - (3b)
First floor	60.1700 (1c)	x 2.6000 (2c)	= 156.4420 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 295.4347 (5)

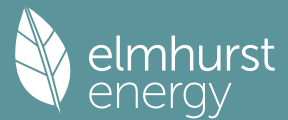
2. Ventilation rate

	m ³ per hour											
Number of open chimneys	0 * 80 = 0.0000 (6a)											
Number of open flues	0 * 20 = 0.0000 (6b)											
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)											
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)											
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)											
Number of blocked chimneys	0 * 20 = 0.0000 (6f)											
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)											
Number of passive vents	0 * 10 = 0.0000 (7b)											
Number of flueless gas fires	0 * 40 = 0.0000 (7c)											
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)											
Pressure test	Yes											
Pressure Test Method	Blower Door											
Measured/design AP50	4.0000 (17)											
Infiltration rate	0.2000 (18)											
Number of sides sheltered	2 (19)											
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)											
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1700 (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	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
FD Type 4 Ian Firth			1.9600	1.1000	2.1560		(26)
French Door (Uw = 1.20)			4.4100	1.1450	5.0496		(27)
SD Type 6 Ian Firth			1.9600	1.4000	2.7440		(26a)
Window (Uw = 1.20)			14.0700	1.1450	16.1107		(27)
B&B TE Platinum GF			60.1700	0.1300	7.8221	135.0000	8122.9500 (28a)
Timber Frame-Single Sheathing	133.5200	14.6900	118.8300	0.1800	21.3894	9.0000	1069.4700 (29a)
Timber Frame-Double Sheathing	18.6400	7.7100	10.9300	0.1800	1.9674	9.0000	98.3700 (29a)
400mm Mineral Wool	60.1700		60.1700	0.1100	6.6187	9.0000	541.5300 (30)
Total net area of external elements Aum (A, m ²)			272.5000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.8579		(33)
GF Timber			106.9500			9.0000	962.5500 (32c)
FF Timber			130.9500			9.0000	1178.5500 (32c)
FF Floor			60.1700			18.0000	1083.0600 (32d)
GF Ceiling			60.1700			18.0000	1083.0600 (32e)

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Heat capacity $C_m = \text{Sum}(A \times k)$
Thermal mass parameter (TMP = C_m / TFA) in $\text{kJ/m}^2\text{K}$
List of Thermal Bridges

(28)...(30) + (32) + (32a)...(32e) = 14139.5400 (34)
117.4966 (35)

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	1.8640	0.0500	0.0932
E4 Jamb	4.2000	0.0500	0.2100
E5 Ground floor (normal)	30.9900	0.1600	4.9584
E6 Intermediate floor within a dwelling	30.9900	0.0000	0.0000
E3 Sill	8.5850	0.0500	0.4293
E10 Eaves (insulation at ceiling level)	11.9900	0.0600	0.7194
E10 Eaves (insulation at ceiling level)	14.8600	0.0600	0.8916
E12 Gable (insulation at ceiling level)	4.1400	0.0600	0.2484
E16 Corner (normal)	24.5600	0.0900	2.2104
E17 Corner (inverted - internal area greater than external area)	4.9100	-0.0900	-0.4419
E2 Other lintels (including other steel lintels)	2.1000	0.0500	0.1050
E2 Other lintels (including other steel lintels)	8.5800	0.0500	0.4290
E2 Other lintels (including other steel lintels)	2.7450	0.0500	0.1373
E3 Sill	2.7450	0.0500	0.1373
E4 Jamb	4.2000	0.0500	0.2100
E4 Jamb	22.2000	0.0500	1.1100
E4 Jamb	9.0000	0.0500	0.4500
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			11.8972 (36)
Point Thermal bridges			0.0000 (36a)
Total fabric heat loss			75.7552 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	48.7467	48.7467	48.7467	48.7467	48.7467	48.7467	48.7467	48.7467	48.7467	48.7467	48.7467	48.7467	
Average = Sum(39)m / 12 =	124.5019	124.5019	124.5019	124.5019	124.5019	124.5019	124.5019	124.5019	124.5019	124.5019	124.5019	124.5019	(39)
													124.5019
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0346	1.0346	1.0346	1.0346	1.0346	1.0346	1.0346	1.0346	1.0346	1.0346	1.0346	1.0346	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

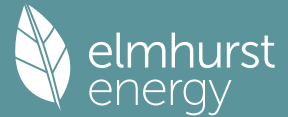
Assumed occupancy													2.8646 (42)
Hot water usage for mixer showers													
72.2501	71.1643	69.5821	66.5549	64.3208	61.8295	60.4134	61.9836	63.7048	66.3798	69.4721	71.9732	(42a)	
Hot water usage for baths													
31.1931	30.7298	30.0775	28.8746	27.9739	26.9752	26.4358	27.0836	27.7889	28.8576	30.0852	31.0877	(42b)	
Hot water usage for other uses													
43.9666	42.3678	40.7690	39.1702	37.5714	35.9726	35.9726	37.5714	39.1702	40.7690	42.3678	43.9666	(42c)	
Average daily hot water use (litres/day)													135.5027 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	147.4097	144.2619	140.4286	134.5997	129.8662	124.7773	122.8218	126.6386	130.6640	136.0064	141.9250	147.0275	(44)
Energy content (annual)	233.4610	205.4270	215.8335	184.2602	174.8249	153.4283	148.5423	156.8050	161.1217	184.5594	202.1983	230.2095	(45)
Distribution loss (46)m = 0.15 x (45)m													
35.0191	30.8141	32.3750	27.6390	26.2237	23.0142	22.2813	23.5208	24.1683	27.6839	30.3297	34.5314	(46)	
Water storage loss:													
Store volume													150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													0.7100 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.3834 (55)
Total storage loss													
11.8854	10.7352	11.8854	11.5020	11.8854	11.5020	11.8854	11.8854	11.5020	11.8854	11.5020	11.8854	(56)	
If cylinder contains dedicated solar storage													
11.8854	10.7352	11.8854	11.5020	11.8854	11.5020	11.8854	11.8854	11.5020	11.8854	11.5020	11.8854	(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													
268.6088	237.1734	250.9813	218.2742	209.9727	187.4423	183.6901	191.9528	195.1357	219.7072	236.2123	265.3573	(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													
268.6088	237.1734	250.9813	218.2742	209.9727	187.4423	183.6901	191.9528	195.1357	219.7072	236.2123	265.3573	(64)	
12Total per year (kWh/year)													2664.5080 (64)
Electric shower(s)													2665 (64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month													
105.7440	93.7016	99.8829	88.4777	86.2475	78.2261	77.5086	80.2559	80.7842	89.4842	94.4421	104.6629	(65)	

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

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.2309	143.2309	143.2309	143.2309	143.2309	143.2309	143.2309	143.2309	143.2309	143.2309	143.2309	143.2309	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	151.5656	167.8047	151.5656	156.6177	151.5656	156.6177	151.5656	151.5656	156.6177	151.5656	156.6177	151.5656	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	285.6551	288.6193	281.1496	265.2475	245.1740	226.3076	213.7038	210.7396	218.2093	234.1114	254.1849	273.0513	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3231	37.3231	37.3231	37.3231	37.3231	37.3231	37.3231	37.3231	37.3231	37.3231	37.3231	37.3231	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-114.5847	-114.5847	-114.5847	-114.5847	-114.5847	-114.5847	-114.5847	-114.5847	-114.5847	-114.5847	-114.5847	-114.5847	(71)
Water heating gains (Table 5)	142.1291	139.4369	134.2512	122.8857	115.9241	108.6474	104.1782	107.8709	112.2002	120.2745	131.1696	140.6759	(72)
Total internal gains	645.3190	661.8303	632.9356	610.7203	578.6329	557.5420	535.4168	536.1453	552.9965	571.9207	607.9416	631.2620	(73)

6. Solar gains

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[Jan]	Area m2				Solar flux Table 6a W/m2	Specific data or Table 6b	g or Table 6b	Specific data or Table 6c	FF or Table 6c	Access factor Table 6d	Gains W
Southeast	4.4100				36.7938		0.7300		0.7000	0.7700	57.4603 (77)
Northeast	0.6600				11.2829		0.7300		0.7000	0.7700	2.6371 (75)
Southeast	6.2600				36.7938		0.7300		0.7000	0.7700	81.5649 (77)
Northwest	7.1500				11.2829		0.7300		0.7000	0.7700	28.5682 (81)

Solar gains	170.2305	300.3305	438.4570	589.4166	702.3168	715.7656	682.3641	595.3030	490.2890	339.3525	205.7844	144.4604 (83)
Total gains	815.5495	962.1608	1071.3926	1200.1369	1280.9496	1273.3076	1217.7809	1131.4482	1043.2855	911.2732	813.7260	775.7224 (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	31.5469	31.5469	31.5469	31.5469	31.5469	31.5469	31.5469	31.5469	31.5469	31.5469	31.5469	31.5469
alpha	3.1031	3.1031	3.1031	3.1031	3.1031	3.1031	3.1031	3.1031	3.1031	3.1031	3.1031	3.1031
util living area	0.9660	0.9439	0.9087	0.8344	0.7168	0.5617	0.4283	0.4740	0.6786	0.8695	0.9466	0.9705 (86)
Living	18.9457	19.2561	19.6771	20.1966	20.6188	20.8703	20.9582	20.9421	20.7597	20.2008	19.4725	18.8704
Non living	17.6499	18.0402	18.5661	19.2002	19.6905	19.9551	20.0318	20.0209	19.8534	19.2200	18.3186	17.5547
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	19.9491	19.2561	19.6771	20.1966	20.6188	20.8703	20.9582	20.9421	20.7597	20.2008	19.4725	19.1683 (87)
Th 2	20.0546	20.0546	20.0546	20.0546	20.0546	20.0546	20.0546	20.0546	20.0546	20.0546	20.0546	20.0546 (88)
util rest of house	0.9606	0.9353	0.8945	0.8084	0.6728	0.4950	0.3440	0.3876	0.6161	0.8430	0.9369	0.9658 (89)
MIT 2	19.0959	18.0402	18.5661	19.2002	19.6905	19.9551	20.0318	20.0209	19.8534	19.2200	18.3186	18.0052 (90)
Living area fraction									fLA = Living area / (4) =			0.1433 (91)
MIT	19.2182	18.2145	18.7253	19.3430	19.8236	20.0863	20.1646	20.1530	19.9833	19.3606	18.4840	18.1719 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2182	18.2145	18.7253	19.3430	19.8236	20.0863	20.1646	20.1530	19.9833	19.3606	18.4840	18.1719 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9548	0.9131	0.8695	0.7857	0.6610	0.4974	0.3542	0.3970	0.6109	0.8195	0.9152	0.9531 (94)
Useful gains	778.7163	878.5560	931.5830	942.9005	846.6833	633.3540	431.3002	449.1374	637.3876	746.7588	744.7102	739.3294 (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	1857.3474	1657.6780	1522.0790	1300.1729	1011.4004	683.0515	443.8016	467.2525	732.4801	1090.7097	1417.3253	1739.5253 (97)
Space heating kWh	802.5015	523.5700	439.3290	257.2361	122.5495	0.0000	0.0000	0.0000	0.0000	255.8995	484.2828	744.1458 (98a)
Space heating requirement - total per year (kWh/year)												3629.5142
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	802.5015	523.5700	439.3290	257.2361	122.5495	0.0000	0.0000	0.0000	0.0000	255.8995	484.2828	744.1458 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3629.5142
Space heating per m2										(98c) / (4) =		30.1605 (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 %)												220.8157 (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	802.5015	523.5700	439.3290	257.2361	122.5495	0.0000	0.0000	0.0000	0.0000	255.8995	484.2828	744.1458 (98)
Space heating efficiency (main heating system 1)	220.8157	220.8157	220.8157	220.8157	220.8157	0.0000	0.0000	0.0000	0.0000	220.8157	220.8157	220.8157 (210)
Space heating fuel (main heating system)	363.4259	237.1072	198.9573	116.4936	55.4985	0.0000	0.0000	0.0000	0.0000	115.8883	219.3154	336.9985 (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	268.6088	237.1734	250.9813	218.2742	209.9727	187.4423	183.6901	191.9528	195.1357	219.7072	236.2123	265.3573 (64)
Efficiency of water heater	170.8691	170.8691	170.8691	170.8691	170.8691	170.8691	170.8691	170.8691	170.8691	170.8691	170.8691	170.8691 (216)
Fuel for water heating, kWh/month	157.2015	138.8041	146.8851	127.7435	122.8851	109.6993	107.5034	112.3391	114.2019	128.5821	138.2416	155.2985 (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	3.9183	3.5391	3.9183	3.7919	3.9183	3.7919	3.9183	3.9183	3.7919	3.9183	3.7919	3.9183 (231)
Lighting	30.3295	24.3314	21.9078	16.0506	12.3979	10.1292	11.3098	14.7009	19.0950	25.0537	28.2981	31.1724 (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)

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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	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	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	0.0000	(235d)
Annual totals kWh/year														
Space heating fuel - main system 1													1643.6847	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													170.8691	
Water heating fuel used													1559.3853	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
(MEVDecentralised, Database: total watage = 5.7600, total flow = 45.0000, SFP = 0.1280)														
mechanical ventilation fans (SFP = 0.1280)													46.1351	(230a)
Total electricity for the above, kWh/year													46.1351	(231)
Electricity for lighting (calculated in Appendix L)													244.7763	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													0.0000	(233)
Wind generation													0.0000	(234)
Hydro-electric generation (Appendix N)													0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)													0.0000	(235)
Appendix Q - special features														
Energy saved or generated													-0.0000	(236)
Energy used													0.0000	(237)
Total delivered energy for all uses													3493.9814	(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	1643.6847	0.1554	255.4086	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1559.3853	0.1411	220.0808	(264)
Space and water heating			475.4894	(265)
Pumps, fans and electric keep-hot	46.1351	0.1387	6.3995	(267)
Energy for lighting	244.7763	0.1443	35.3288	(268)
Total CO2, kg/year			517.2177	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.3000	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1643.6847	1.5752	2589.1816	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1559.3853	1.5219	2373.1823	(278)
Space and water heating			4962.3639	(279)
Pumps, fans and electric keep-hot	46.1351	1.5128	69.7931	(281)
Energy for lighting	244.7763	1.5338	375.4461	(282)
Total Primary energy kWh/year			5407.6031	(286)
Dwelling Primary energy Rate (DPER)			44.9400	(287)

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

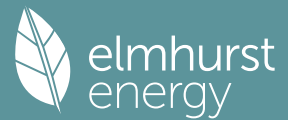
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	60.1700 (1b)	x 2.3100 (2b)	= 138.9927 (1b) - (3b)	
First floor	60.1700 (1c)	x 2.6000 (2c)	= 156.4420 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.3400		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 295.4347 (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)
Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1354 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3854 (18)
Number of sides sheltered		2 (19)

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Shelter factor
Infiltration rate adjusted to include shelter factor

(20) = 1 - [0.075 x (19)] = 0.8500 (20)
(21) = (18) x (20) = 0.3276 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
Effective ac	0.4177	0.4095	0.4013	0.3603	0.3522	0.3112	0.3112	0.3030	0.3276	0.3522	0.3685	0.3849	(22b)
	0.5872	0.5838	0.5805	0.5649	0.5620	0.5484	0.5484	0.5459	0.5537	0.5620	0.5679	0.5741	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.9600	1.0000	1.9600			(26)
TER Semi-glazed door			1.9600	1.0000	1.9600			(26a)
TER Opening Type (Uw = 1.20)			18.4800	1.1450	21.1603			(27)
B&B TE Platinum GF			60.1700	0.1300	7.8221			(28a)
Timber Frame-Single Sheathing	133.5200	14.6900	118.8300	0.1800	21.3894			(29a)
Timber Frame-Double Sheathing	18.6400	7.7100	10.9300	0.1800	1.9674			(29a)
400mm Mineral Wool	60.1700		60.1700	0.1100	6.6187			(30)
Total net area of external elements Aum(A, m2)			272.5000					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	62.8779		(33)

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

117.4966 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	1.8640	0.0500	0.0932	
E4 Jamb	4.2000	0.0500	0.2100	
E5 Ground floor (normal)	30.9900	0.1600	4.9584	
E6 Intermediate floor within a dwelling	30.9900	0.0000	0.0000	
E3 Sill	8.5850	0.0500	0.4293	
E10 Eaves (insulation at ceiling level)	11.9900	0.0600	0.7194	
E10 Eaves (insulation at ceiling level)	14.8600	0.0600	0.8916	
E12 Gable (insulation at ceiling level)	4.1400	0.0600	0.2484	
E16 Corner (normal)	24.5600	0.0900	2.2104	
E17 Corner (inverted - internal area greater than external area)	4.9100	-0.0900	-0.4419	
E2 Other lintels (including other steel lintels)	2.1000	0.0500	0.1050	
E2 Other lintels (including other steel lintels)	8.5800	0.0500	0.4290	
E2 Other lintels (including other steel lintels)	2.7450	0.0500	0.1373	
E3 Sill	2.7450	0.0500	0.1373	
E4 Jamb	4.2000	0.0500	0.2100	
E4 Jamb	22.2000	0.0500	1.1100	
E4 Jamb	9.0000	0.0500	0.4500	

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

Point Thermal Bridges		(36a) =	11.8972 (36)
Total fabric heat loss	(33) + (36) + (36a) =		74.7752 (37)

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

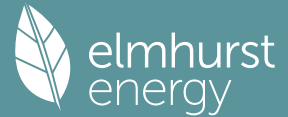
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	57.2505	56.9203	56.5966	55.0763	54.7919	53.4678	53.4678	53.2226	53.9778	54.7919	55.3673	55.9689	(38)
Heat transfer coeff	132.0257	131.6955	131.3718	129.8515	129.5671	128.2429	128.2429	127.9977	128.7530	129.5671	130.1425	130.7441	(39)
Average = Sum(39)m / 12 =													129.8501

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0971	1.0944	1.0917	1.0790	1.0767	1.0657	1.0657	1.0636	1.0699	1.0767	1.0815	1.0865	(40)
HLP (average)													1.0790
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8646 (42)
Hot water usage for mixer showers	72.2501	71.1643	69.5821	66.5549	64.3208	61.8295	60.4134	61.9836	63.7048	66.3798	69.4721	71.9732	(42a)
Hot water usage for baths	31.1931	30.7298	30.0775	28.8746	27.9739	26.9752	26.4358	27.0836	27.7889	28.8576	30.0852	31.0877	(42b)
Hot water usage for other uses	43.9666	42.3678	40.7690	39.1702	37.5714	35.9726	35.9726	37.5714	39.1702	40.7690	42.3678	43.9666	(42c)
Average daily hot water use (litres/day)													135.5027 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	147.4097	144.2619	140.4286	134.5997	129.8662	124.7773	122.8218	126.6386	130.6640	136.0064	141.9250	147.0275	(44)
Energy conte	233.4610	205.4270	215.8335	184.2602	174.8249	153.4283	148.5423	156.8050	161.1217	184.5594	202.1983	230.2095	(45)
Energy content (annual)										Total = Sum(45)m =			2250.6710
Distribution loss (46)m = 0.15 x (45)m	35.0191	30.8141	32.3750	27.6390	26.2237	23.0142	22.2813	23.5208	24.1683	27.6839	30.3297	34.5314	(46)
Water storage loss:													
Store volume													150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.3938 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	280.0559	247.5127	262.4284	229.3521	221.4198	198.5201	195.1372	203.3999	206.2136	231.1543	247.2901	276.8044	(62)
WWHRS	-33.0297	-29.2117	-30.5889	-25.3288	-23.6055	-20.1994	-18.9337	-20.1341	-20.8991	-24.6377	-27.9115	-32.4180	(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	247.0262	218.3010	231.8395	204.0233	197.8142	178.3207	176.2035	183.2658	185.3145	206.5166	219.3785	244.3863	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =			2492.3902 (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													

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114.9017 101.9731 109.0405 97.3400 95.4052 87.0884 86.6662 89.4136 89.6465 98.6419 103.3044 113.8206 (65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.2309	143.2309	143.2309	143.2309	143.2309	143.2309	143.2309	143.2309	143.2309	143.2309	143.2309	143.2309	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	151.5656	167.8047	151.5656	156.6177	151.5656	156.6177	151.5656	151.5656	156.6177	151.5656	156.6177	151.5656	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	285.6551	288.6193	281.1496	265.2475	245.1740	226.3076	213.7038	210.7396	218.2093	234.1114	254.1849	273.0513	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3231	37.3231	37.3231	37.3231	37.3231	37.3231	37.3231	37.3231	37.3231	37.3231	37.3231	37.3231	(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)	-114.5847	-114.5847	-114.5847	-114.5847	-114.5847	-114.5847	-114.5847	-114.5847	-114.5847	-114.5847	-114.5847	-114.5847	(71)
Water heating gains (Table 5)	154.4378	151.7456	146.5599	135.1944	128.2328	120.9561	116.4869	120.1796	124.5090	132.5832	143.4783	152.9846	(72)
Total internal gains	660.6277	677.1390	648.2443	626.0290	593.9416	569.8507	547.7255	548.4540	565.3053	587.2294	623.2503	646.5707	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c				Access factor Table 6d	Gains W
Northeast					0.6600	11.2829	0.6300	0.7000				0.7700	2.2758 (75)
Southeast					10.6700	36.7938	0.6300	0.7000				0.7700	119.9807 (77)
Northwest					7.1500	11.2829	0.6300	0.7000				0.7700	24.6547 (81)
Solar gains	146.9112	259.1894	378.3944	508.6746	606.1090	617.7155	588.8896	513.7546	423.1261	292.8658	177.5948	124.6713 (83)	
Total gains	807.5389	936.3283	1026.6387	1134.7036	1200.0506	1187.5663	1136.6150	1062.2086	988.4314	880.0953	800.8451	771.2420 (84)	

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)													21.0000	(85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	29.7491	29.8237	29.8972	30.2472	30.3136	30.6266	30.6266	30.6853	30.5053	30.3136	30.1796	30.0408		
alpha	2.9833	2.9882	2.9931	3.0165	3.0209	3.0418	3.0418	3.0457	3.0337	3.0209	3.0120	3.0027		
util living area	0.9677	0.9495	0.9208	0.8573	0.7528	0.6016	0.4649	0.5092	0.7106	0.8831	0.9502	0.9716	(86)	
MIT	18.7810	19.0788	19.5014	20.0617	20.5268	20.8326	20.9435	20.9245	20.7075	20.1051	19.3579	18.7361	(87)	
Th 2	20.0032	20.0054	20.0076	20.0180	20.0199	20.0290	20.0290	20.0306	20.0255	20.0199	20.0160	20.0119	(88)	
util rest of house	0.9625	0.9414	0.9077	0.8330	0.7097	0.5322	0.3734	0.4169	0.6480	0.8580	0.9409	0.9669	(89)	
MIT 2	17.4105	17.7872	18.3190	19.0150	19.5641	19.8993	19.9980	19.9865	19.7784	19.0828	18.1513	17.3590	(90)	
Living area fraction	17.6070	17.9724	18.4885	19.1651	19.7021	20.0331	20.1335	20.1209	19.9116	19.2294	18.3243	17.5564	(91)	
MIT	17.6070	17.9724	18.4885	19.1651	19.7021	20.0331	20.1335	20.1209	19.9116	19.2294	18.3243	17.5564	(92)	
Temperature adjustment												0.0000		
adjusted MIT	17.6070	17.9724	18.4885	19.1651	19.7021	20.0331	20.1335	20.1209	19.9116	19.2294	18.3243	17.5564	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9443	0.9189	0.8819	0.8079	0.6940	0.5325	0.3837	0.4260	0.6398	0.8329	0.9188	0.9501	(94)	
Useful gains	762.5754	860.4370	905.3933	916.6828	832.8211	632.4225	436.1172	452.5140	632.4392	732.9967	735.8240	732.7670	(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	1756.8617	1721.5700	1574.9479	1332.9346	1036.8139	696.7526	453.1477	476.2698	748.2638	1118.0800	1460.7574	1746.2691	(97)	
Space heating kWh	739.7490	578.6814	498.1486	299.7013	151.7706	0.0000	0.0000	0.0000	0.0000	286.5020	521.9520	754.0455	(98a)	
Space heating requirement - total per year (kWh/year)												3830.5505		
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	739.7490	578.6814	498.1486	299.7013	151.7706	0.0000	0.0000	0.0000	0.0000	286.5020	521.9520	754.0455	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												3830.5505		
Space heating per m ²												31.8311	(99)	

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

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

Fraction of space heat from main system(s)													0.0000	(201)
Efficiency of main space heating system 1 (in %)													1.0000	(202)
Efficiency of main space heating system 2 (in %)													92.3000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(207)
													0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	739.7490	578.6814	498.1486	299.7013	151.7706	0.0000	0.0000	0.0000	0.0000	286.5020	521.9520	754.0455	(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)	801.4616	626.9571	539.7060	324.7034	164.4319	0.0000	0.0000	0.0000	0.0000	310.4031	565.4952	816.9507	(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)	

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Water heating													
Water heating requirement	247.0262	218.3010	231.8395	204.0233	197.8142	178.3207	176.2035	183.2658	185.3145	206.5166	219.3785	244.3863	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.3617	86.1390	85.7293	84.9208	83.4729	79.8000	79.8000	79.8000	79.8000	84.7941	85.9320	86.4145	(217)
Fuel for water heating, kWh/month	286.0367	253.4288	270.4321	240.2512	236.9802	223.4596	220.8064	229.6564	232.2237	243.5505	255.2931	282.8072	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	31.4923	25.2643	22.7477	16.6660	12.8733	10.5176	11.7434	15.2645	19.8271	26.0143	29.3831	32.3676	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-53.9556	-74.8914	-105.9750	-117.1941	-124.6789	-115.6929	-114.1797	-108.5685	-98.4852	-84.6350	-58.8660	-46.7800	(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	-34.1451	-71.3845	-141.1065	-210.8545	-277.8190	-278.8618	-275.6550	-233.9059	-172.0743	-101.8124	-45.4902	-27.0414	(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												4150.1089	(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												2974.9259	(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)												254.1611	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2974.0529	(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												4491.1430	(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	4150.1089	0.2100	871.5229	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2974.9259	0.2100	624.7344	(264)
Space and water heating			1496.2573	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	254.1611	0.1443	36.6833	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1103.9022	0.1349	-148.9641	
PV Unit electricity exported	-1870.1507	0.1260	-235.7147	
Total			-384.6788	(269)
Total CO2, kg/year			1160.1910	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.6400	(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	4150.1089	1.1300	4689.6230	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2974.9259	1.1300	3361.6663	(278)
Space and water heating			8051.2893	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	254.1611	1.5338	389.8408	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1103.9022	1.4987	-1654.4706	
PV Unit electricity exported	-1870.1507	0.4627	-865.2463	
Total			-2519.7168	(283)
Total Primary energy kWh/year			6051.5141	(286)
Target Primary Energy Rate (TPER)			50.2900	(287)