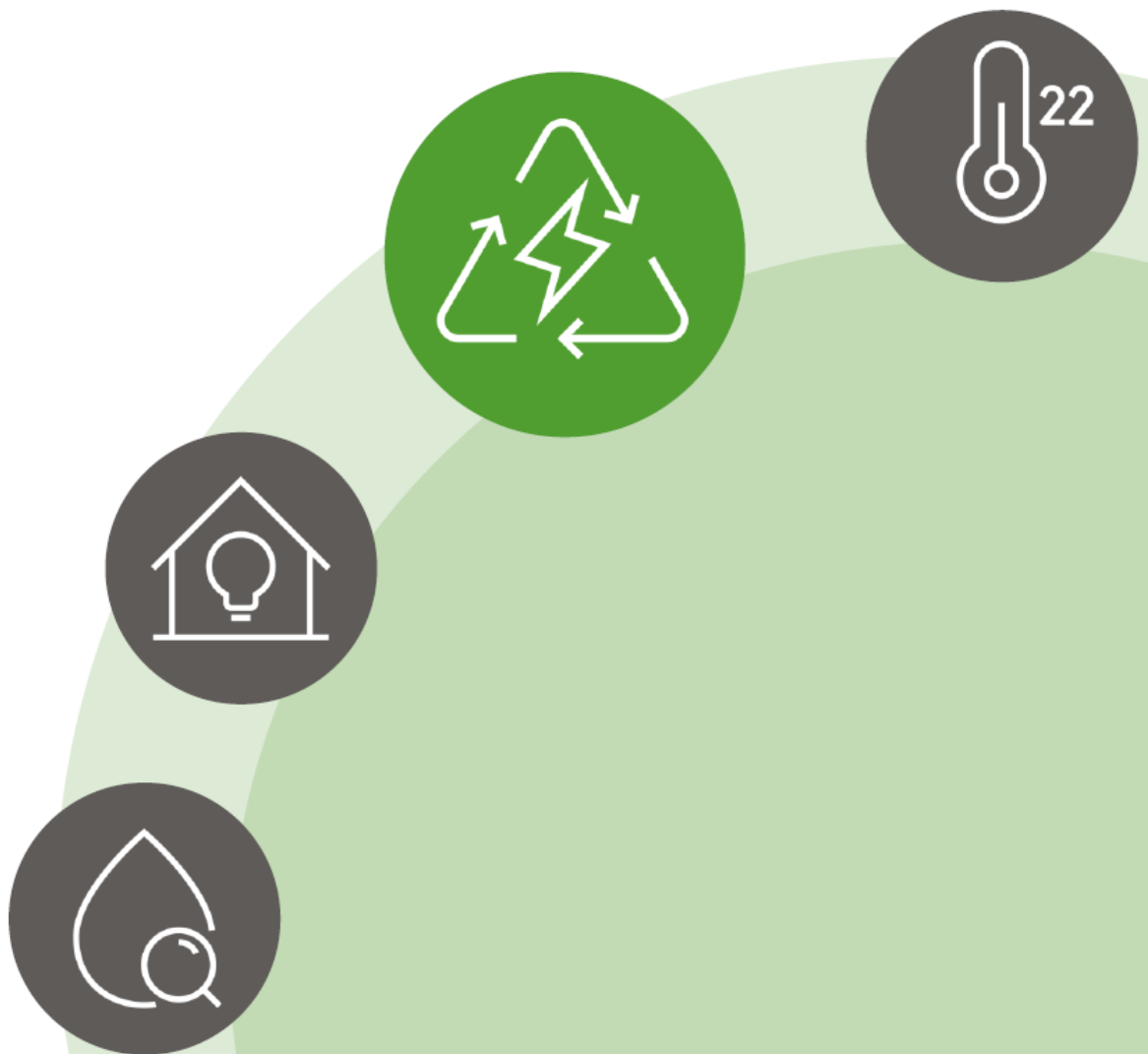




Energy Report

Latimer Road, Wokingham

REPORT STATUS: 1.0



Document Control Sheet

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Development	Latimer Road, Wokingham
Report Title	Energy Report
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About Sadler Energy and Environmental Services Ltd.

Our team of technical specialists offer advanced levels of expertise and experience to our clients. We have a wide experience of the construction and development industry from the concept and planning stage through to the completion of the project.

Our emphasis is to provide innovative and cost-effective solutions that respond to increasing demands for energy efficiency, quality and practical on-site applications.

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1. Executive Summary

The proposed development consists of multiple four-story blocks comprising 42 new flats located on Latimer Road in Wokingham. Falling under the jurisdiction of Wokingham Borough Council, the project must adhere to their planning conditions and sustainability policies, including compliance with the Local Plan.

The council requires the site to be assessed against Part L 2005 regulations, but as the project is registered under Part L 2021, many of the strategies and technologies proposed are incompatible with the outdated 2005 framework. The previous strategy for a communal heating system was reconsidered after modelling under Part O methodology revealed a significant overheating risk due to limitations in window operability. Consequently, the decision was made to move away from a communal system in favour of individual systems better suited to the flats and aligned with Part L 2021.

Furthermore, certain technologies central to the updated strategy, such as heat pump cylinders and Kelda showers, cannot be accurately modelled in SAP 2005 as these innovations were developed after its publication.

This report evaluates the energy performance and carbon emission reductions of the proposed development under SAP 2021 regulations, demonstrating alignment with the Future Homes Standard and 2021 Building Regulations Part L while meeting the council's sustainability goals.

Key Findings:

1. Option 1: Using a combination of Heat Pump Water Cylinders, Solar PV Panels, and Electric Panel Heating, the development achieves a 54% improvement in Dwelling Emission Rate (DER) compared to the Target Emission Rate (TER) outlined in Part L 2021.
2. Option 2: Adding Kelda showers further increases emissions reductions, achieving 393.33 kgCO₂/yr/m², enhancing sustainability outcomes.
3. The development employs a Fabric First Approach, incorporating:
 - High-performance thermal envelopes to reduce heat loss.
 - Reduced thermal bridging with bespoke design and compliance with Constructive Details.
 - High levels of airtightness, minimizing energy demand for heating and cooling.

SAP 2021 provides a significantly more accurate and effective framework for assessing energy performance compared to SAP 2005. The outdated SAP 2005 methodology uses carbon factors that no longer reflect the UK's current energy mix, which has shifted towards renewable sources like wind and solar. SAP 2021 accounts for these changes, ensuring alignment with modern energy trends and decarbonization goals.

The development aligns with Wokingham Borough Council's "**CP1 - Sustainable Development**" policy by:

- Supporting decarbonisation efforts and achieving near net-zero emissions.
- Minimising energy and water usage through advanced technologies and sustainable design.
- Addressing overheating risks through passive solutions in line with **Part O guidelines**, prioritising resident comfort without over-reliance on active cooling systems.

This report confirms the proposed development surpasses the sustainability and regulatory requirements set by both Wokingham Borough Council and **Part L 2021**, presenting a pathway toward a future-proof, energy-efficient, and environmentally responsible housing solution.

2. Introduction and Background

This Energy Strategy aims to outline the measures and technologies essential for surpassing the standards set by Wokingham Borough Council. Its primary goal is to guarantee that homes not only fulfil the local requirements but

also contribute to diminishing dependence on fossil fuels. The strategy further strives to minimise carbon emissions associated with new developments, thereby slowing the progression of climate change. The specified site encompasses 42 flats.



Image 1: Site Plan

2.1 Planning Targets

The Wokingham Borough Local Plan was adopted in January 2010 and sets measures to respond to the declared climate emergency. Policy CP1 details what measures developments should incorporate for Sustainable Development:

CP1 – Sustainable Development

Planning permission will be granted for development proposals that:

- 1) Maintain or enhance the high quality of the environment;
- 2) Minimise the emission of pollutants into the wider environment;
- 3) Limit any adverse effects on water quality (including ground water);
- 4) Ensure the provision of adequate drainage;
- 5) Minimise the consumption and use of resources and provide for recycling;
- 6) Incorporate facilities for recycling of water and waste to help reduce per capita water consumption;
- 7) Avoid areas of best and most versatile agricultural land;
- 8) Avoid areas where pollution (including noise) may impact upon the amenity of future occupiers;
- 9) Avoid increasing (and where possible reduce) risks of or from all forms of flooding (including from groundwater);
- 10) Provide attractive, functional, accessible, safe, secure and adaptable schemes;
- 11) Demonstrate how they support opportunities for reducing the need to travel, particularly by private car in line with CP6; and
- 12) Contribute towards the goal of reaching zero-carbon developments as soon as possible by:
 - a) Including appropriate on-site renewable energy features; and
 - b) Minimising energy and water consumption by measures including the use of appropriate layout and orientation, building form, design and construction, and design to take account of microclimate so as to minimise carbon dioxide emissions through giving careful consideration to how all aspects of development form.

2.2 CO₂ Emission Factors

Measuring development using SAP 2021 is far more effective than SAP 2005 due to the significant improvements in how CO₂ emissions are calculated. The SAP methodology and Part L of the Building Regulations use carbon emission factors to assess the environmental impact of different fuel sources, but the 2005 approach is based on outdated assumptions that no longer reflect current energy trends.

Part L, last updated in 2013, does not account for the significant changes in the UK's energy mix over recent years. The contribution of renewable energy sources such as wind, solar, and hydro has increased steadily, while older, high-emission coal power plants have been decommissioned. Consequently, the carbon emission factors used in SAP 2005 are now severely outdated and no longer represent the lower-carbon electricity available today.

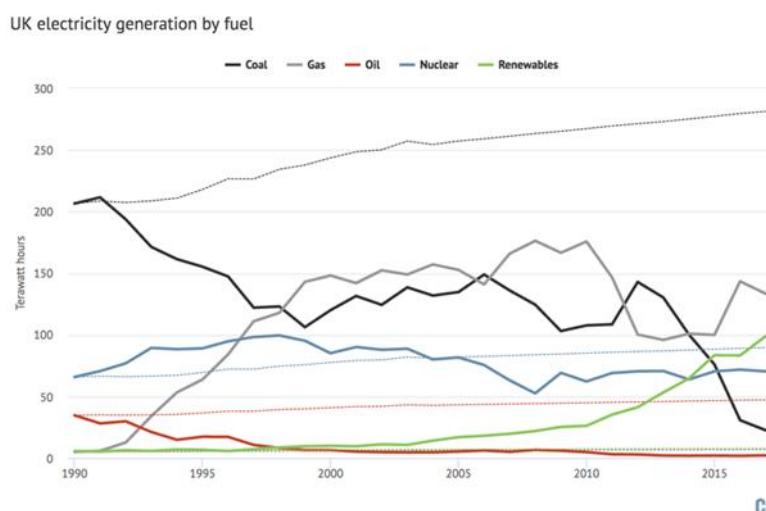


Figure 1: UK electricity generation by fuel (source: Carbon Brief 2019)

The updated Part L proposals and SAP 2021 address this by basing carbon factors on projected energy generation and emissions over a five-year period. While most carbon factors remain stable, electricity's carbon factor has decreased significantly due to the ongoing greening of the grid. Aside from biofuels, electricity now has the lowest carbon factor of the primary heat sources, making it the most environmentally favourable choice.

The 2021 Building Regulations also strongly favor electricity for space heating, especially through technologies like heat pumps, which are far more efficient than traditional boilers or heaters. Measuring developments using SAP 2021 aligns with these advancements, providing a more accurate assessment of carbon emissions and supporting the transition to low-carbon energy solutions.

Fuel	CO ₂ (SAP 2012)	CO ₂ (SAP 10.1)	
Mains Gas	0.216	0.21	-3%
Oil	0.298	0.298	0%
LPG	0.241	0.241	0%
Electric	0.519	0.136	-74%
Electric sold to grid	0.519	0.136	-74%
Wood logs	0.019	0.028	47%

Table 1: Carbon emissions factors for fuels in SAP 10.1

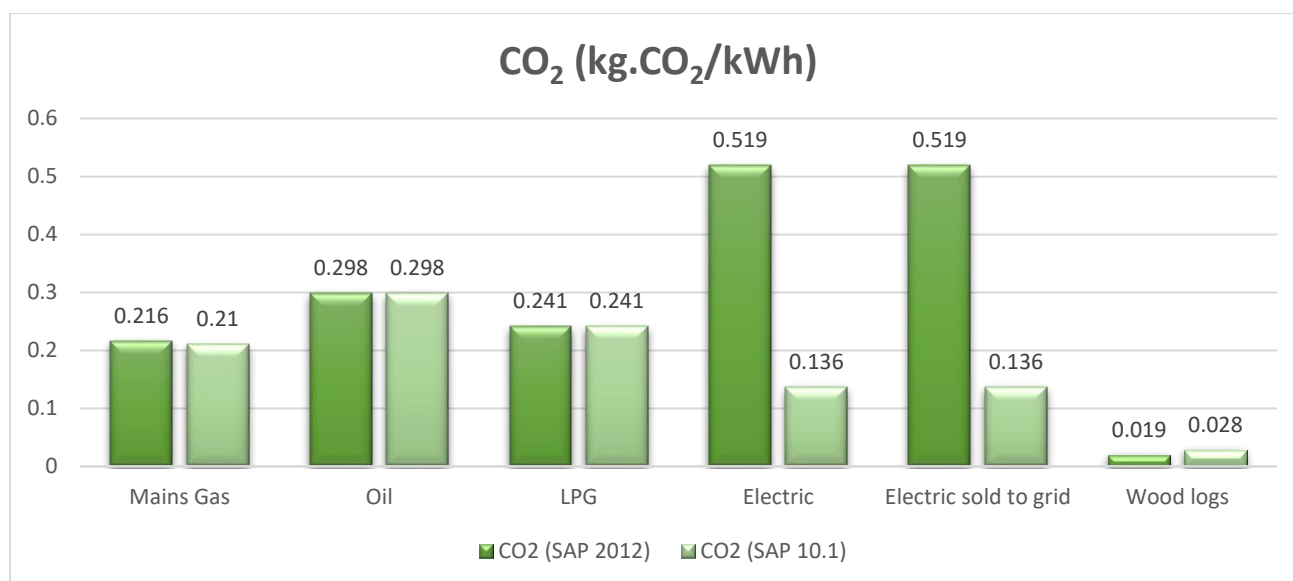


Figure 2: Carbon emissions factors for fuels in SAP 10.1

3. Energy Efficiency – Demand Reduction

Energy efficiency and carbon emission rates have been calculated using SAP 2021, which produces metrics used for Building Regulations compliance, based on the predicted annual energy use per square meter of floor area for a dwelling. The metrics used in this report are:

- ✦ Dwelling Emissions Rate (DER): the predicted carbon dioxide emissions based on the fuels used to heat, light, cool and ventilate a dwelling, expressed in kgCO₂/m²/yr.
- ✦ Dwelling Fabric Energy Efficiency: the predicted energy used to heat and cool a dwelling expressed in kWh/m²/yr.

For each metric, a “target” is calculated by SAP based on a notional dwelling specification set in the Building Regulations. The dwelling energy metrics must be lower than these targets to achieve Building Regulation Part L compliance.

This energy strategy will outline carbon emission savings through fabric-first approaches and renewable technology options, with the aim to achieve low and zero carbon dwellings. Each option will be modelled in SAP and produce percentage savings on dwelling emission rates (DER) for properties vs target emission rates (TER).

3.1 Methodology

This report uses the energy hierarchy to minimise onsite carbon emissions, the stages are:

- ✎ Use Renewable Energy - assess the feasibility of renewable energy systems.
- ✎ Supply Energy Efficiently – Use low-carbon technology to significantly reduce energy consumption.
- ✎ Use less Energy – the incorporation of low energy design and passive measures to promise the reduction of energy use.



3.2 Building Energy Modelling

The site was modelled using SAP2021 calculations (see SAP summary), to predict energy demands and CO2 emissions for compliance with the Wokingham Borough council planning policy.

3.3 Energy Efficiency

To deliver the energy demand reduction required to meet and exceed Part L 2021 compliance, improvements to the fabric specification and heating systems of the dwellings forms the first stage of the energy hierarchy.

A fabric first approach has been adopted to minimise energy demand as much as practical. Energy efficiency features that were proposed include: Built form, Insulation standards, Glazing, Heating systems, Ventilation, Lighting, Controls, Heat recovery, Free cooling, and Equipment. In this chapter we have detailed the most effective energy efficient measures.

Three main sources of heat loss:

- ✎ Thermal Envelope
- ✎ Thermal Bridging
- ✎ Uncontrolled Air Leakage

3.4 Thermal Envelope

The dwellings on this development aim for fabric efficiency well above Part L 2021 standards, see Table 2.

Thermal Element	BR U-value (Part L 2021) W/m ² K	Proposed Design U-values W/m ² K
Ground Floors	0.18	0.10
External wall	0.26	0.16
Flat Roof	0.16	0.11
External Doors	1.6	1.1
Windows & Glazed Doors	1.6	1.0

Table 2 – Proposed Fabric Standard

3.5 Thermal Bridging

Thermal bridging occurs at the junctions between fabric elements where the continuity of the insulation layer is interrupted. By carefully designing and detailing these junctions, the impact of thermal bridging can be significantly reduced.

RHB is committed to minimising unnecessary thermal bridging by ensuring junction designs maintain the integrity of the insulation layers, thereby reducing avoidable heat loss wherever possible. Accurate calculations of these heat losses are a critical component of the SAP assessments used to evaluate the energy performance of the dwellings.

To support this, thermal modelling has been conducted to assess the performance of all key building junctions. Table 2 below provides site-specific thermal bridging values. Notably, up to 30% of the total heat loss through the building fabric is attributed to thermal bridging, underscoring the importance of effective design in mitigating its impact.

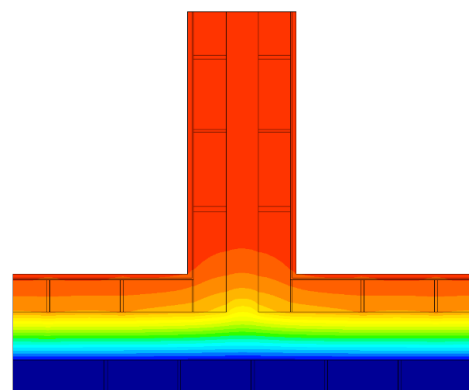


Image 2: Party Wall Thermal Bridge – Temperature Analysis,

THERMAL BRIDGING 2021		
Non-repeating junctions have been designed and built to the following details:	Default	Independently Assessed (Please provided details)
E2 Other Lintels	1.00	0.028
E3 Sill	0.10	0.024
E4 Jamb	0.10	0.019
E7 Party floor between dwellings	0.28	0.036
E23 Balcony within or between dwellings - balcony support penetrates wall insulation	1.00	1.00
E15 Flat roof with parapet	0.3	0.3
E16 Corner	0.18	0.037
E17 Corner (Inverted)	0.00	-0.079
E18 Party wall between dwellings	0.24	0.041
P1 Party wall to ground floor	0.32	0.110
P3 Party wall to intermediate floor between dwellings	0.00	0.00
P4 Party wall to insulation at ceiling level	0.48	0.033

Table 3 – Thermal Bridging

3.6 Lighting

Low energy fittings are defined as fittings that can only be used with lamps having a luminous efficacy greater than 120 lumens per circuit watt. All buildings will have 100% low energy lights fitted internally.

Externally, property will have low energy light fitting or standards with light and motion sensors.

3.7 Primary Energy

Heat generation and distribution systems will be designed to give the occupants a high level of control over their use, encouraging and allowing energy-efficient behaviour.

The heating system will be designed, at a maximum flow temperature of 45°C or lower with full zone control to occupants.

The heating system considered for this report is:

- ✦ Air Source Heat Pumps. Time and temperature zoning controls will be included with fully insulated primary pipework being installed throughout.
- ✦ Electric Panel Heaters with Programmer and Room Thermostats

Further information about the heating system is discussed in Section 4.

3.8 Passive Design Measures and Overheating Risk Mitigation

In order to further reduce energy demand, where practical dwellings have been designed with regard to the principles of passive design, including consideration of building orientation and site placement to maximise the potential for solar gain.

Materials with high thermal inertia – including traditional masonry construction – take a number of hours to warm up in the conditions normally associated with the interior of domestic properties. By slowly extracting heat from the air inside a dwelling, they offer a heat sink and reduce overheating risk. The heat absorbed is then emitted during the night, offering a small amount of passive heating. The overall effect serves to smooth out the heat profile within the dwelling thus reducing the need for instantaneous heating and cooling.

Further passive and active design measures to reduce energy demand and balance internal and external heat gains include:

- ✦ Specifying glazing with a solar transmittance value (g-value) that has been carefully considered to strike the balance between useful solar gain in the winter and unwanted solar gain in the summer, 0.30 G-Value has been specified on this development within the overheating Part O assessment.
- ✦ Minimising overshadowing from adjacent dwellings and vegetation.
- ✦ Specifying highly insulated hot water cylinders where required, with low heat loss values.
- ✦ Fully insulating all primary pipework.
- ✦ Installing energy efficient lighting, a minimum of 120 l/w is specified on this development.
- ✦ Due to the measures described to reduce internal heat gain, natural ventilation provided through window openings and the opportunity for cross ventilation will allow sufficient air exchange rates to purge any heat build-up. Active cooling systems are therefore not proposed.

These measures will serve to ensure that the development builds in resilience to a potentially changing climate over the lifetime of the buildings and minimises the overheating risk that can be exacerbated by the drive to better insulated, more airtight homes if not considered within the design and construction process.

3.9 Water Efficiency

It is proposed that all dwellings achieve a minimum water efficiency standard of 110 litres/person/day as the Local Plan requires minimum water consumption. It is recommended that maximum water consumption criteria, as stated in Table 2 of approved document Part G is followed, see Table 4 below.

Water Fitting	Maximum Consumption
WC	4/2.6 litres dual flush
Shower	8 l/min
Bath	170 litres
Basin Taps	5 l/min
Sink Taps	6 l/min
Dishwasher	1.25 l/place setting
Washing Machine	8.17 l/kilogram dry load

Table 4: (Part G2 Table 2) Maximum fittings consumption optional requirement level



4. Low and Zero Carbon (LZC) Energy Generation Options

The energy hierarchy requires that the feasibility of on-site renewables technology be investigated. This section reviews each of the technologies that are to be considered on a new development, with the most feasible method being selected.

Technology	Checklist	Comments	Suitable Technology
Solar Photovoltaic 	Will the buildings have an east to west (through south) facing roof or flat roof?	Building has a flat roof hence orientation will not be an issue.	Suitable,
	Are roofs free from overshadowing for most of the day from buildings or other structures?	Surrounding dwelling heights do not exceed the height of the proposed dwellings. Sufficient distance from the existing established trees which are to be retained.	
	Is the building in a conservation area?	No	
Solar thermal 	Will the buildings have a year-round demand for hot water?	Yes	Unsuitable as these are blocks of flats, so not enough room on the roof for all flats.
	Will the buildings have an open aspect south east to south west facing roof of at least 4m²?	Since this is a 4 storey building of multiple flats, there is not enough roof space to provide hot water via solar thermal for all the flats.	
	Is there space for hot water cylinder near the panels?		
	Is the building in a conservation area?	No	
Biomass 	Is there a local supply and space for storage of biomass fuel or can one be set up?	Storage space is likely to be an issue mainly due to the size of the development. For residential developments, a biomass boiler system is generally more viable for developments with at least 50-100 units. Smaller developments may not generate sufficient heat demand to justify the investment in a biomass boiler system.	Unsuitable
	Is a room heater or boiler required	A boiler room is provided, but it will need to be larger to accommodate the storage of biomass fuel, such as wood pellets or chips. Additionally, the storage space must be accessible for delivery vehicles.	
CHP 	Is a communal heat network proposed?	There is no district system available/proposed.	Unsuitable
Ground Source Heating 	Will there be room for a horizontal buried pipe?	Require a substantial amount of land for the installation of horizontal ground loops. This can be a constraint in urban or densely populated areas where space is limited.	Block of flats hence not enough space
	Is the ground suitable for vertical pipe system?	Further assessment of ground conditions required. Local regulations may restrict drilling or excavation needed for GSHP installations. Permits may be required.	
Air Source 	Is there sufficient room within the dwelling to accommodate internal unit. Is a low temperature heat emitter (i.e. underfloor heating) proposed? Other problems?	The units could be installed to the rear of the buildings, a cylinder would also be required within the dwelling. No, radiators are currently proposed, oversized radiators required to maintain heat output with low flow temperatures Building is already at risk of overheating and since these are a block of flats, ASHP would have to be a communal system and would contribute further to overheating, hence ASHP is not recommended.	Unsuitable as a communal system due to the overheating to the apartments.
District Heating 	Is there district heating situated close the site.	Currently there is no district heating or cooling systems	Unsuitable

4.1 Air Source Heat Pumps

Air Source Heat Pumps (ASHPs) utilise an external heat exchanger to extract heat from the ambient air and can operate even at sub-zero temperatures, though their efficiency, measured by the Coefficient of Performance (CoP), decreases as external temperatures drop. The heat exchanger must be installed in an unobstructed external location, typically on a ground-mounted plinth or wall-mounted, where it can function effectively. Additionally, the units fan produces a low audible hum during operation, so careful consideration is needed to select a suitable installation site.



Since the development consists of a block of flats, an ASHP would require a communal system to provide heating for all units. Overheating assessments identified a risk of overheating within the building, primarily because the windows cannot be modelled as openable due to noise constraints at the site. A communal ASHP system would exacerbate this issue by increasing heat buildup in communal areas due to heat loss from pipework running through the building.

To address this, passive measures to mitigate cooling requirements are prioritised. Individual room heaters within each apartment, without relying on communal systems, were found to be more appropriate for this development.

4.2 Heat Pump Hot Water Cylinder

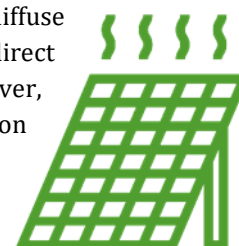
Similar in efficiency to an Air Source Heat Pump (ASHP), heat pump water heaters can be installed individually within each apartment, eliminating the need for communal pipework. These systems, which are relatively new to the market, use the same technology as ASHPs to provide stored hot water for domestic use. They absorb energy from external air and use a vapor compression cycle to increase the heat output. Typically, heat pump water heaters achieve a Coefficient of Performance (CoP) of 3, meaning they generate 3kW of heat output for every 1kW of electrical input.



A system like the Dimplex Edel is an excellent example, offering high efficiency and lower operating costs compared to a conventional hot water cylinder heated by an immersion heater. Installation requirements are straightforward, needing only an electrical connection, two ducts to an external wall for air intake and exhaust, and a cupboard space similar in size to a traditional hot water cylinder. Careful placement of the duct outlets is necessary to maintain standard clearances from other openings or service penetrations.

4.3 Photovoltaic Panels

Photovoltaic (PV) panels convert sunlight into electricity and can generate power even in diffuse daylight, making them suitable for the UK's cloudy climate. While they don't require direct sunlight to operate, their energy output increases significantly under direct sunlight. However, performance is hindered in heavily shaded areas, where the panels may not function effectively.



The efficiency of PV panels depends on several factors, including property orientation, roof pitch, and weather conditions. Although the upfront cost of PV systems can be a significant barrier, government grants are available to help offset these expenses. It's essential to carefully select the buildings where PV panels are installed to maximise their efficiency and justify the initial investment. PV

systems operate most efficiently during daylight hours throughout the year, providing a consistent source of renewable energy.

To meet Abri's minimum EPC requirements, it is proposed that PV panels be installed for each dwelling, helping to lower residents' energy costs. A 0.7 kW peak system is planned for all flats within the development. This capacity is sufficient to offset a significant portion of emissions associated with fossil fuel use. When combined with heat pump cylinders and Kelda showers, these measures will help the flats move closer to net-zero emissions, supporting environmental decarbonisation efforts.

5. Water Consumption and Reduction

As the thermal efficiency of a dwelling improves, water consumption and heating become increasingly significant contributors to energy use and carbon emissions. Household water supply and use are responsible for approximately 6% of the UK's total greenhouse gas emissions, equating to over 2.6 kg CO₂e per home per day. Even modest reductions in household water use—between 5% and 6%—can deliver annual emission savings of around 1.33 MtCO₂e. This reduction is greater than the total savings achieved in the UK housing sector during the entire years of 2017-18 or 2018-19.

To meet planning conditions, each dwelling within the development must limit its water usage. To achieve this, a combination of strategies and technologies will be employed, and compliance will be verified using the Part G Water Efficiency Calculator tool.

The recommendations for water efficiency outlined in the Part G document will be adhered to. Based on the recommended values provided in Table 3, and with the addition of Kelda Showers, the total water consumption is estimated at 92.4 litres per person per day, meeting the planning requirements.

For a detailed breakdown, please refer to the Part G water efficiency calculations included in Appendix D. This approach ensures the development not only complies with local planning policies but also contributes to broader sustainability and carbon reduction goals.

5.1 Kelda Showers

Kelda showers are engineered to reduce water usage while delivering a satisfying and effective shower experience. They incorporate features such as air-powered showerheads and flow restrictors to minimise water consumption without sacrificing performance. These showers can reduce water and energy use by up to 50%, also lowering carbon emissions associated with showering.

It is proposed to include Kelda showers in the development alongside the selected heating system to reduce both water usage and the energy required to heat it. These savings, calculated using SAP Appendix Q, demonstrate the additional reductions in carbon emissions.

6. Emission Reductions

All flats have been modelled in accordance with SAP 2021 regulations. This report will analyse the complete SAP calculations for the nine different house types included in the development. Target emissions for each house type will be calculated based on the 2021 Part L regulations, followed by the calculation of actual modelled emissions. The percentage improvement achieved for each house type will also be documented.

Additionally, two sets of SAP results will be reviewed: one considering only PV integration and the second option including both PV and Kelda showers.

The first set of results focuses exclusively on the impact of PV modelling within the SAP calculations:

House Type	Target Emission Rate (kgCO ₂ /yr/m ²)	Dwelling Emission Rate (kgCO ₂ /yr/m ²)	Percentage Improvement over Target
1 (GF Mid Terrace)	11.46	4.73	58.73%
2 (GF Mid Terrace)	12.44	3.4	72.67%
3 (GF Detached)	13.58	4.33	68.11%
4 (Mid Floor Mid Terrace)	12.58	4.61	64.55%
5 (Mid Floor Mid Terrace)	13.28	4.47	67.47%
6 (Mid Floor End Terrace)	13.61	4.98	64.51%
7 (Top Floor Mid Terrace)	15.67	5.08	67.58%
8 (Top Floor End Terrace)	13.49	6.08	54.93%
9 (Top Floor End Terrace)	16.25	5.5	66.15%

Table 5: DER/TER with PV included

The second set of results include the addition of Kelda showers along with PV:

House Type	Target Emission Rate (kgCO ₂ /yr/m ²)	Dwelling Emission Rate (kgCO ₂ /yr/m ²)	Percentage Improvement over Target
1 (GF Mid Terrace)	11.46	4.62	59.69%
2 (GF Mid Terrace)	12.44	3.26	73.79%
3 (GF Detached)	13.58	4.19	69.15%
4 (Mid Floor Mid Terrace)	12.58	4.46	64.55%
5 (Mid Floor Mid Terrace)	13.28	4.32	67.47%
6 (Mid Floor End Terrace)	13.61	4.83	63.41%
7 (Top Floor Mid Terrace)	15.67	4.92	68.60%
8 (Top Floor End Terrace)	13.49	5.94	55.97%
9 (Top Floor End Terrace)	16.25	5.35	67.08%

Table 6: DER/TER with PV + Kelda Showers

6.1 Sitewide Reductions

House Type	Qty	Total Target Emission Rate	Sitewide Emission Rate (PV Option 1)	Sitewide Emission Rate (PV + Kelda Option 2)	Total Savings (PV Option)	Total Savings (PV + Kelda Option)
GF Mid Terrace (End)	3	34.38	14.19	13.86	20.19	20.52
GF Mid Terrace	7	87.08	23.80	22.82	63.28	64.26
GF Detached	1	13.58	4.33	4.19	9.25	9.39
MF Mid Terrace (End)	3 + 2	62.9	23.05	22.3	39.85	40.6
MF Mid Terrace	9 + 8	225.76	75.99	73.44	149.77	152.32
MF End Terrace	1 + 1	27.22	9.96	9.66	17.26	17.56
TF Mid Terrace	4	62.68	20.32	19.68	42.63	43.00
TF End Terrace (Room + Hall border)	2	26.98	12.16	11.88	14.82	15.10
TF End Terrace	1	16.25	5.5	5.35	10.75	10.9
Total	42	556.83 (kgCO2/yr/m2)	189.3 (kgCO2/yr/m2)	163.5 (kgCO2/yr/m2)	367.53 (kgCO2/yr/m2)	393.33 (kgCO2/yr/m2)

Table 7: Sitewide emissions for both options

7. Conclusion

The SAP 2021 modelling results highlight the potential for the proposed development to achieve a significant improvement of over 54% in emissions reduction (Option 1) compared to the baseline requirements of Part L 2021 of the Building Regulations. This improvement is made possible through the implementation of the following technologies:

- **Heat Pump Water Cylinders:** With a typical Coefficient of Performance (CoP) of 3, these systems provide 3kW of heat output for every 1kW of electrical input, ensuring high efficiency.
- **Solar PV Panels:** Enhanced with time and temperature zoning controls and fully insulated primary pipework to maximise energy savings.
- **Electric Panel Heating:** Used in combination with Solar PV panels to reduce emissions further.

A second set of simulations included the additional integration of Kelda showers alongside the above technologies. These results demonstrated an even greater emissions reduction, as shown in Tables 5 and 6.

Additionally, the development incorporates Abri's enhanced fabric specification, which exceeds the minimum standards of Part L 2021 by adopting a **Fabric First Approach** to minimize energy demand for space heating. Key measures include:

- High-performance thermal envelopes to reduce heat loss.
- Detailed thermal bridging design in compliance with Constructive Details and bespoke calculations.
- High levels of airtightness to prevent unwanted heat loss.

These combined strategies achieve a **minimum 54% improvement** in Dwelling Emission Rate (DER) over the Target Emission Rate (TER) in Part L1A 2021. The sitewide emission reductions achieved with Heat Pump Water Cylinders, Solar PV, and Electric Panel Heaters amounted to **367.53 kgCO₂/yr/m²** (Table 7). With the addition of Kelda showers, the reductions increased to **393.33 kgCO₂/yr/m²**, further highlighting the effectiveness of this approach.

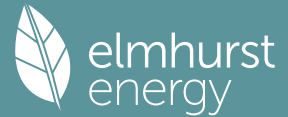
Using SAP 2021 for development assessment over SAP 2005 due to advancements in CO₂ emissions calculations align with the councils' aspirations of decarbonisation. The 2005 methodology relied on outdated carbon emission factors that no longer reflect the UK's current energy mix, which has seen a significant shift towards renewable sources like wind, solar, and hydro. The ongoing decommissioning of coal power plants and the greening of the electricity grid have drastically lowered electricity's carbon factor, making it the most environmentally favourable energy source.

This report demonstrates that the proposed development exceeds the council's SAP 2005-based requirements by adopting an electric heating strategy aligned with the Future Homes Standard. The measures also consider Part O guidelines to prioritise passive solutions for reducing overheating, enhancing resident comfort, and minimising reliance on cooling strategies.

The full SAP calculations for all house types and options are detailed in **Appendices A and B**, while the Part G water calculations are included in **Appendix C**.

APPENDIX A – Full SAP Calculation for Option 1

Full SAP Calculation Printout



Property Reference	P0.03 Latimer			Issued on Date	03/12/2024
Assessment Reference	P0.03 Latimer 3B5P	Prop Type Ref	Grd Mid 3B5P		
Property	0.03, Latimer Road, Wokingham				
SAP Rating	78 C	DER	4.73	TER	11.46
Environmental	96 A	% DER < TER			58.73
CO ₂ Emissions (t/year)	0.45	DFEE	37.52	TFEE	38.61
Compliance Check	See BREL	% DFEE < TFEE			2.82
% DPER < TPER	18.37	DPER	49.28	TPER	60.37
Assessor Details	Mrs. Rebecca Lennon			Assessor ID	P627-0001
Client	RHB, RHB				

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	114.9000 (1b)	2.7000 (2b)	310.2300 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.9000		310.2300 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	310.2300 (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)

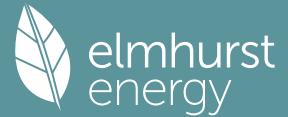
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.2000 (23c)
Effective ac	0.3207	0.3165	0.3123	0.2910	0.2867	0.2655	0.2655	0.2612	0.2740	0.2867	0.2953	0.3037 (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
Flat ent door			1.9500	1.0000	1.9500		(26)
Windows (Uw = 1.20)			33.6100	1.1450	38.4847		(27)
Heat Loss Floor 1			114.9000	0.1200	13.7880	0.0000	0.0000 (28a)
External Wall 1	61.5600	33.6100	27.9500	0.1200	3.3540	0.0000	0.0000 (29a)
Sheltered wall	30.2400	1.9500	28.2900	0.2100	5.9409	0.0000	0.0000 (29a)
Total net area of external elements Aum(A, m ²)			206.7000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.5176		(33)
Party Wall 1			36.4500	0.0000	0.0000	0.0000	0.0000 (32)
Party Ceiling 1			114.9000			30.0000	3447.0000 (32b)
Internal Wall 1			109.7800			9.0000	988.0200 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	4435.0200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							38.5990 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	

Solar gains	119.1126	231.2302	384.7477	580.0436	735.8457	766.2394	724.0342	603.7799	452.5034	274.6592	147.9972	98.3976 (83)
Total gains	698.3865	825.9327	952.4151	1129.0246	1254.2901	1262.5202	1196.8128	1080.3860	944.1930	785.6376	693.3857	665.0979 (84)

Full SAP Calculation Printout



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	12.1771	12.2297	12.2828	12.5551	12.6110	12.8982	12.8982	12.9573	12.7818	12.6110	12.4997	12.3903
alpha	1.8118	1.8153	1.8189	1.8370	1.8407	1.8599	1.8599	1.8638	1.8521	1.8407	1.8333	1.8260
util living area	0.8709	0.8305	0.7706	0.6637	0.5405	0.4101	0.3169	0.3565	0.5322	0.7275	0.8342	0.8790 (86)
MIT	17.4569	17.9252	18.6270	19.5377	20.2282	20.6824	20.8609	20.8225	20.4513	19.5122	18.3644	17.4041 (87)
Th 2	20.1841	20.1873	20.1906	20.2068	20.2100	20.2263	20.2263	20.2296	20.2198	20.2100	20.2035	20.1971 (88)
util rest of house	0.8618	0.8190	0.7552	0.6418	0.5107	0.3710	0.2683	0.3062	0.4919	0.7040	0.8212	0.8706 (89)
MIT 2	16.0629	16.6362	17.4935	18.5954	19.4087	19.9319	20.1186	20.0873	19.6883	18.5900	17.1892	15.9994 (90)
Living area fraction	fLA = Living area / (4) = 0.3168 (91)											
MIT	16.5045	17.0446	17.8526	18.8940	19.6683	20.1697	20.3538	20.3202	19.9301	18.8821	17.5615	16.4444 (92)
Temperature adjustment	0.0000											
adjusted MIT	16.5045	17.0446	17.8526	18.8940	19.6683	20.1697	20.3538	20.3202	19.9301	18.8821	17.5615	16.4444 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8063	0.7620	0.7012	0.6011	0.4888	0.3680	0.2765	0.3124	0.4758	0.6575	0.7656	0.8163 (94)
Useful gains	563.0909	629.4003	667.8281	678.7056	613.0394	464.6004	330.9731	337.4605	449.2776	516.5243	530.8527	542.9222 (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	1234.7214	1223.3724	1138.6522	980.6431	778.4092	531.9785	358.5346	372.7227	561.9203	809.0676	1031.0707	1217.4511 (97)
Space heating kWh	499.6931	399.1492	350.2931	217.3950	123.0352	0.0000	0.0000	0.0000	0.0000	217.6522	360.1570	501.8495 (98a)
Space heating requirement - total per year (kWh/year)	2669.2243											
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	499.6931	399.1492	350.2931	217.3950	123.0352	0.0000	0.0000	0.0000	0.0000	217.6522	360.1570	501.8495 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	2669.2243											
Space heating per m2	(98c) / (4) = 23.2308 (99)											
9a. Energy requirements - Individual heating systems, including micro-CHP												
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Fraction of main heating from main system 2												0.0000 (203)
Fraction of total heating from main system 1												1.0000 (204)
Fraction of total heating from main system 2												0.0000 (205)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	499.6931	399.1492	350.2931	217.3950	123.0352	0.0000	0.0000	0.0000	0.0000	217.6522	360.1570	501.8495 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	499.6931	399.1492	350.2931	217.3950	123.0352	0.0000	0.0000	0.0000	0.0000	217.6522	360.1570	501.8495 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Space heating fuel used, main system 2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Water heating												
Water heating requirement												
Efficiency of water heater (217)m	339.1968	339.1968	339.1968	339.1968	339.1968	339.1968	339.1968	339.1968	339.1968	339.1968	339.1968	339.1968 (216)
Fuel for water heating, kWh/month	70.4889	62.1739	65.7293	58.5859	56.3890	49.1715	46.4985	50.9292	51.2794	58.5766	63.1758	70.2982 (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	31.9521	28.8599	31.9521	30.9213	31.9521	30.9213	31.9521	31.9521	30.9213	31.9521	30.9213	31.9521 (231)
Lighting	32.7388	26.2642	23.6480	17.3256	13.3828	10.9338	12.2082	15.8687	20.6119	27.0439	30.5460	33.6487 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-9.7276	-17.2859	-31.6999	-43.5662	-52.4351	-47.6857	-46.7368	-40.7224	-31.2349	-22.0266	-11.6291	-7.9402 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-1.1050	-3.0354	-8.2976	-16.9138	-27.5598	-32.9543	-32.0082	-24.6900	-15.1331	-5.4716	-1.6765	-0.8093 (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	2669.2243 (211)											
Space heating fuel - main system 2	0.0000 (213)											
Space heating fuel - secondary	0.0000 (215)											
Efficiency of water heater	339.1968											
Water heating fuel used	703.2963 (219)											
Space cooling fuel	0.0000 (221)											
Electricity for pumps and fans:												

Full SAP Calculation Printout



(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9940)	
mechanical ventilation fans (SFP = 0.9940)	376.2097 (230a)
Total electricity for the above, kWh/year	376.2097 (231)
Electricity for lighting (calculated in Appendix L)	264.2205 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-532.3450 (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	3480.6058 (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 (high-rate cost)	2669.2243	0.1620	432.3352 (261)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000 (261)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000 (262)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating - high rate cost	38.9930	0.1481	5.7766 (264)
Water heating - low rate cost	664.3033	0.1243	82.5978 (264)
Space and water heating			520.7097 (265)
Pumps, fans and electric keep-hot	376.2097	0.1432	52.2018 (267)
Energy for lighting	264.2205	0.1490	39.3741 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-362.6903	0.1357	-49.2147
PV Unit electricity exported	-169.6547	0.1178	-19.9850
Total			-69.1997 (269)
Total CO2, kg/year			543.0859 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.7300 (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 (high-rate cost)	2669.2243	1.6040	4281.4557 (275)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000 (275)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000 (276)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating - high rate cost	38.9930	1.5538	60.5855 (278)
Water heating - low rate cost	664.3033	1.4450	959.9466 (278)
Space and water heating			5301.9877 (279)
Pumps, fans and electric keep-hot	376.2097	1.5335	569.1885 (281)
Energy for lighting	264.2205	1.5547	410.7954 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-362.6903	1.5061	-546.2431
PV Unit electricity exported	-169.6547	0.4318	-73.2606
Total			-619.5037 (283)
Total Primary energy kWh/year			5662.4679 (286)
Dwelling Primary energy Rate (DPER)			49.2800 (287)

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

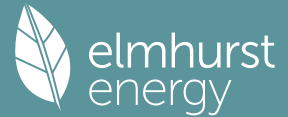
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	114.9000 (1b)	x 2.7000 (2b)	= 310.2300 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 310.2300 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1289 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3789 (18)

Full SAP Calculation Printout



Number of sides sheltered

2 (19)

Shelter factor

$$(20) = 1 - [0.075 \times (19)] = 0.8500 \quad (20)$$

Infiltration rate adjusted to include shelter factor

$$(21) = (18) \times (20) = 0.3221 \quad (21)$$

	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	0.4107	0.4026	0.3946	0.3543	0.3463	0.3060	0.3060	0.2979	0.3221	0.3463	0.3624	0.3785	(22b)
	0.5843	0.5811	0.5778	0.5628	0.5599	0.5468	0.5468	0.5444	0.5519	0.5599	0.5657	0.5716	(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)			26.7800	1.1450	30.6641			(27)
Heat Loss Floor 1			114.9000	0.1300	14.9370			(28a)
External Wall 1	61.5600	26.7800	34.7800	0.1800	6.2604			(29a)
Sheltered wall	30.2400	1.9500	28.2900	0.1800	5.0922			(29a)
Total net area of external elements Aum(A, m2)			206.7000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	58.9037			(33)
Party Wall 1			36.4500	0.0000	0.0000			(32)

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

48.5990 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element	15.4300	0.0500	0.7715	
E2 Other lintels (including other steel lintels)	14.5000	0.0500	0.7250	
E3 Sill	44.3000	0.0500	2.2150	
E4 Jamb	34.0000	0.1600	5.4400	
E5 Ground floor (normal)	5.4000	0.0900	0.4860	
E16 Corner (normal)	2.7000	-0.0900	-0.2430	
E17 Corner (inverted - internal area greater than external area)	5.4000	0.0600	0.3240	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
E25 Staggered party wall between dwellings	13.5000	0.0800	1.0800	
P1 Party wall - Ground floor				

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

11.1225 (36)

Point Thermal bridges

$$(36a) = 0.0000$$

Total fabric heat loss

$$(33) + (36) + (36a) = 70.0262 \quad (37)$$

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	59.8209	59.4857	59.1571	57.6137	57.3249	55.9807	55.9807	55.7318	56.4985	57.3249	57.9091	58.5198	(38)
Heat transfer coeff	129.8471	129.5119	129.1833	127.6399	127.3512	126.0069	126.0069	125.7580	126.5247	127.3512	127.9353	128.5460	(39)
Average = Sum(39)m / 12 =												127.6385	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1301	1.1272	1.1243	1.1109	1.1084	1.0967	1.0967	1.0945	1.1012	1.1084	1.1134	1.1188	(40)
HLP (average)												1.1109	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8413 (42)
Hot water usage for mixer showers												
71.8583	70.7784	69.2048	66.1940	63.9721	61.4942	60.0858	61.6475	63.3594	66.0199	69.0954	71.5830	(42a)
Hot water usage for baths												
31.0247	30.5639	29.9150	28.7187	27.8229	26.8296	26.2930	26.9373	27.6389	28.7017	29.9227	30.9198	(42b)
Hot water usage for other uses												
43.7273	42.1372	40.5471	38.9570	37.3670	35.7769	35.7769	37.3670	38.9570	40.5471	42.1372	43.7273	(42c)
Average daily hot water use (litres/day)												134.7678 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	146.6103	143.4795	139.6670	133.8697	129.1619	124.1007	122.1557	125.9518	129.9553	135.2688	141.1553	146.2301	(44)
Energy conte	232.1948	204.3129	214.6630	183.2610	173.8768	152.5962	147.7367	155.9546	160.2479	183.5584	201.1017	228.9609	(45)
Energy content (annual)										Total = Sum(45)m =		2238.4651	
Distribution loss (46)m = 0.15 x (45)m	34.8292	30.6469	32.1994	27.4891	26.0815	22.8894	22.1605	23.3932	24.0372	27.5338	30.1652	34.3441	(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)

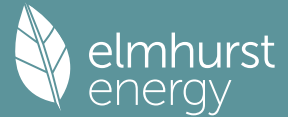
If cylinder contains dedicated solar storage												
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	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												
	278.7897	246.3987	261.2579	228.3528	220.4717	197.6881	194.3316	202.5495	205.3398	230.1533	246.1935	275.5558 (62)
WWHRS	-32.8506	-29.0534	-30.4230	-25.1915	-23.4775	-20.0899	-18.8311	-20.0250	-20.7858	-24.5041	-27.7602	-32.2423 (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												

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	114.4807	101.6026	108.6514	97.0077	95.0899	86.8117	86.3984	89.1308	89.3559	98.3091	102.9398	113.4054	(65)
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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	142.0628	142.0628	142.0628	142.0628	142.0628	142.0628	142.0628	142.0628	142.0628	142.0628	142.0628	142.0628	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	140.4292	155.4752	140.4292	145.1102	140.4292	145.1102	140.4292	140.4292	145.1102	140.4292	145.1102	140.4292	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	278.4166	281.3056	274.0252	258.5261	238.9612	220.5729	208.2885	205.3994	212.6798	228.1789	247.7438	266.1321	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2063	37.2063	37.2063	37.2063	37.2063	37.2063	37.2063	37.2063	37.2063	37.2063	37.2063	37.2063	(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)	-113.6502	-113.6502	-113.6502	-113.6502	-113.6502	-113.6502	-113.6502	-113.6502	-113.6502	-113.6502	-113.6502	-113.6502	(71)
Water heating gains (Table 5)	153.8719	151.1944	146.0368	134.7330	127.8091	120.5718	116.1269	119.7995	124.1054	132.1359	142.9719	152.4267	(72)
Total internal gains	641.3365	656.5940	629.1100	606.9880	575.8183	551.8738	530.4633	531.2469	547.5142	569.3628	604.4447	627.6067	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North				12.7800	10.6334	0.6300	0.7000		0.7700		41.5312 (74)	
East				14.0000	19.6403	0.6300	0.7000		0.7700		84.0325 (76)	
Solar gains	125.5637	243.7536	405.5853	611.4574	775.6962	807.7353	763.2447	636.4788	477.0104	289.5346	156.0127	103.7267 (83)
Total gains	766.9002	900.3476	1034.6953	1218.4454	1351.5144	1359.6091	1293.7080	1167.7257	1024.5246	858.8975	760.4574	731.3334 (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	11.9457	11.9766	12.0071	12.1523	12.1798	12.3098	12.3098	12.3341	12.2594	12.1798	12.1242	12.0666
alpha	1.7964	1.7984	1.8005	1.8102	1.8120	1.8207	1.8207	1.8223	1.8173	1.8120	1.8083	1.8044
util living area	0.8943	0.8613	0.8102	0.7175	0.6012	0.4722	0.3709	0.4148	0.5925	0.7723	0.8643	0.9015 (86)
MIT	17.1876	17.6267	18.3305	19.2579	20.0322	20.5691	20.8046	20.7531	20.3049	19.2791	18.0905	17.1178 (87)
Th 2	19.9763	19.9787	19.9810	19.9920	19.9940	20.0036	20.0036	20.0053	19.9999	19.9940	19.9899	19.9855 (88)
util rest of house	0.8845	0.8488	0.7928	0.6914	0.5631	0.4181	0.3004	0.3428	0.5401	0.7447	0.8500	0.8924 (89)
MIT 2	15.6154	16.1522	17.0104	18.1273	19.0323	19.6344	19.8717	19.8307	19.3681	18.1808	16.7345	15.5312 (90)
Living area fraction									fLA = Living area / (4) =			0.3168 (91)
MIT	16.1135	16.6193	17.4286	18.4855	19.3491	19.9305	20.1672	20.1229	19.6649	18.5288	17.1641	16.0338 (92)
Temperature adjustment												0.0000
adjusted MIT	16.1135	16.6193	17.4286	18.4855	19.3491	19.9305	20.1672	20.1229	19.6649	18.5288	17.1641	16.0338 (93)

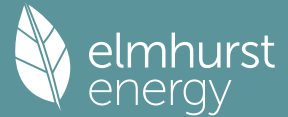
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.8319	0.7929	0.7373	0.6455	0.5360	0.4138	0.3126	0.3518	0.5206	0.6952	0.7954	0.8411	(94)
Ext temp.	637.9587	713.9292	762.9183	786.4779	724.3945	562.6361	404.4090	410.7966	533.3665	597.0794	604.8611	615.1500	(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	1533.9441	1517.7947	1411.7948	1223.4869	974.1193	671.6861	449.4969	468.1858	704.0989	1009.7391	1287.5496	1521.1894	(97)
Space heating requirement - total per year (kWh/year)	666.6131	540.1976	482.7641	314.6465	185.7953	0.0000	0.0000	0.0000	0.0000	307.0188	491.5357	674.0934	(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)	666.6131	540.1976	482.7641	314.6465	185.7953	0.0000	0.0000	0.0000	0.0000	307.0188	491.5357	674.0934	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3662.6645	
Space heating per m2										(98c) / (4) =		31.8770	(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	
Space heating efficiency (main heating system 1)	666.6131	540.1976	482.7641	314.6465	185.7953	0.0000	0.0000	0.0000	0.0000	307.0188	491.5357	674.0934	(98)
Space heating fuel (main heating system)	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 efficiency (main heating system 2)	722.2244	585.2629	523.0380	340.8954	201.2950	0.0000	0.0000	0.0000	0.0000	332.6315	532.5414	730.3287	(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 requirement	245.9391	217.3453	230.8349	203.1614	196.9941	177.5982	175.5006	182.5246	184.5540	205.6492	218.4333	243.3136	(64)
Efficiency of water heater (217)m	86.1805	86.0167	85.6744	85.0371	83.9287	79.8000	79.8000	79.8000	79.8000	84.9565	85.8220	86.2210	(216)
Fuel for water heating, kWh/month	285.3767	252.6781	269.4328	238.9090	234.7160	222.5541	219.9255	228.7276	231.2707	242.0641	254.5189	282.1977	(219)

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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	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	29.1784	23.4080	21.0763	15.4414	11.9274	9.7448	10.8806	14.1430	18.3703	24.1028	27.2241	29.9894	29.9894	(232)
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-29.9091	-43.8484	-65.5017	-76.6112	-85.1544	-80.3649	-79.3363	-73.6157	-63.9979	-51.4036	-33.4583	-25.6623	-25.6623	(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	-12.1499	-25.9834	-52.4544	-79.9984	-106.9970	-107.9944	-106.7698	-89.8807	-65.1665	-37.6058	-16.3610	-9.5798	-9.5798	(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													3968.2172	(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													2962.3713	(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)													235.4865	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-1419.8051	(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													5832.2699	(238)

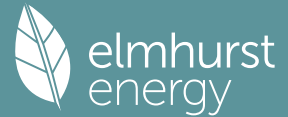
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3968.2172	0.2100	833.3256	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2962.3713	0.2100	622.0980	(264)
Space and water heating			1455.4236	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	235.4865	0.1443	33.9880	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-708.8640	0.1338	-94.8374	
PV Unit electricity exported	-710.9411	0.1254	-89.1794	
Total			-184.0168	(269)
Total CO2, kg/year			1317.3241	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.4600	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3968.2172	1.1300	4484.0855	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2962.3713	1.1300	3347.4795	(278)
Space and water heating			7831.5650	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	235.4865	1.5338	361.1970	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-708.8640	1.4944	-1059.3349	
PV Unit electricity exported	-710.9411	0.4604	-327.3335	
Total			-1386.6684	(283)
Total Primary energy kWh/year			6936.1944	(286)
Target Primary Energy Rate (TPER)			60.3700	(287)

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Property Reference	P0.05 Latimer			Issued on Date	03/12/2024
Assessment Reference	P0.05 Latimer 2B4P	Prop Type Ref	Grd Mid 3B5P		
Property	0.05, Latimer Road, Wokingham				
SAP Rating	87 B	DER	3.40	TER	12.44
Environmental	97 A	% DER < TER			72.67
CO ₂ Emissions (t/year)	0.19	DFEE	28.59	TFEE	31.38
Compliance Check	See BREL	% DFEE < TFEE			8.88
% DPER < TPER	43.41	DPER	37.33	TPER	65.97
Assessor Details	Mrs. Rebecca Lennon			Assessor ID	P627-0001
Client	RHB, RHB				

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	73.4000 (1b)	2.7000 (2b)	198.1800 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	198.1800 (5)

2. Ventilation rate

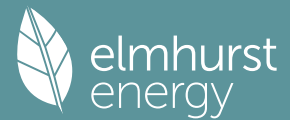
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
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)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.2000 (23c)
Effective ac	0.3207	0.3165	0.3123	0.2910	0.2867	0.2655	0.2655	0.2612	0.2740	0.2867	0.2953	0.3037 (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
Flat ent door			1.9500	1.0000	1.9500		(26)
Windows (Uw = 1.20)			9.6400	1.1450	11.0382		(27)
Heat Loss Floor 1			73.4000	0.1200	8.8080	0.0000	0.0000 (28a)
External Wall 1	28.6200	11.5900	17.0300	0.1600	2.7248	0.0000	0.0000 (29a)
Sheltered wall	4.0500		4.0500	0.1500	0.6075	0.0000	0.0000 (29a)
Total net area of external elements Aum(A, m ²)			106.0700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.1285		(33)
Party Wall 1			69.9300	0.0000	0.0000	0.0000	0.0000 (32)
Party Ceiling 1			73.4000			30.0000	2202.0000 (32b)
Internal Wall 1			136.6200			9.0000	1229.5800 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	3431.5800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							46.7518 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	

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7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.3476	19.4574	19.5684	20.1431	20.2621	20.8789	20.8789	21.0068	20.6277	20.2621	20.0255	19.7943
alpha	2.2898	2.2972	2.3046	2.3429	2.3508	2.3919	2.3919	2.4005	2.3752	2.3508	2.3350	2.3196
util living area	0.8453	0.8113	0.7652	0.6718	0.5590	0.4194	0.3170	0.3438	0.5085	0.6964	0.8015	0.8519 (86)
MIT	18.8274	19.1304	19.5540	20.1452	20.5693	20.8507	20.9445	20.9316	20.7485	20.2079	19.4872	18.8228 (87)
Th 2	20.3663	20.3697	20.3731	20.3899	20.3933	20.4102	20.4102	20.4136	20.4035	20.3933	20.3865	20.3798 (88)
util rest of house	0.8359	0.8002	0.7512	0.6529	0.5336	0.3869	0.2781	0.3044	0.4751	0.6749	0.7884	0.8430 (89)
MIT 2	17.7631	18.1436	18.6748	19.4142	19.9271	20.2646	20.3640	20.3551	20.1495	19.5035	18.6067	17.7653 (90)
Living area fraction	fLA = Living area / (4) = 0.3760 (91)											
MIT	18.1633	18.5147	19.0054	19.6891	20.1686	20.4850	20.5823	20.5719	20.3748	19.7683	18.9378	18.1630 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.1633	18.5147	19.0054	19.6891	20.1686	20.4850	20.5823	20.5719	20.3748	19.7683	18.9378	18.1630 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.7967	0.7623	0.7170	0.6296	0.5238	0.3911	0.2896	0.3152	0.4735	0.6508	0.7528	0.8045 (94)
Useful gains	396.7553	417.0553	412.5618	391.1432	336.8390	247.6212	174.4523	180.1695	254.8225	323.1355	362.7082	387.6358 (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	683.0171	666.9829	609.1626	510.5640	398.3989	268.6760	181.8108	189.3050	289.9599	431.3183	563.4811	672.4018 (97)
Space heating kWh	212.9788	167.9513	146.2710	85.9830	45.8005	0.0000	0.0000	0.0000	0.0000	80.4881	144.5565	211.8659 (98a)
Space heating requirement - total per year (kWh/year)	1095.8951											
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	212.9788	167.9513	146.2710	85.9830	45.8005	0.0000	0.0000	0.0000	0.0000	80.4881	144.5565	211.8659 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1095.8951											
Space heating per m2	(98c) / (4) = 14.9305 (99)											
9a. Energy requirements - Individual heating systems, including micro-CHP												
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Fraction of main heating from main system 2												0.0000 (203)
Fraction of total heating from main system 1												1.0000 (204)
Fraction of total heating from main system 2												0.0000 (205)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	212.9788	167.9513	146.2710	85.9830	45.8005	0.0000	0.0000	0.0000	0.0000	80.4881	144.5565	211.8659 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	212.9788	167.9513	146.2710	85.9830	45.8005	0.0000	0.0000	0.0000	0.0000	80.4881	144.5565	211.8659 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Space heating fuel used, main system 2	0.0000 (213)											
Water heating												
Water heating requirement												
Efficiency of water heater (217)m	344.2432	344.2432	344.2432	344.2432	344.2432	344.2432	344.2432	344.2432	344.2432	344.2432	344.2432	344.2432 (216)
Fuel for water heating, kWh/month	62.0408	54.7425	57.9155	51.6934	49.8195	43.5331	41.2463	45.0868	45.3599	51.7154	55.6716	61.8756 (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	20.4115	18.4362	20.4115	19.7531	20.4115	19.7531	20.4115	20.4115	19.7531	20.4115	19.7531	20.4115 (231)
Lighting	24.5129	19.6651	17.7063	12.9724	10.0202	8.1866	9.1408	11.8816	15.4330	20.2489	22.8711	25.1942 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-9.3788	-16.3830	-29.4602	-39.5974	-47.0495	-43.6703	-42.8303	-37.6197	-29.2390	-20.5824	-11.1151	-7.6782 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-1.4538	-3.9383	-10.5372	-20.8826	-32.9454	-36.9697	-35.9147	-27.7928	-17.1290	-6.9159	-2.1905	-1.0712 (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	1095.8951 (211)											
Space heating fuel - main system 2	0.0000 (213)											
Space heating fuel - secondary	0.0000 (215)											
Efficiency of water heater	344.2432											
Water heating fuel used	620.7006 (219)											
Space cooling fuel	0.0000 (221)											
Electricity for pumps and fans:												

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(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9940)	
mechanical ventilation fans (SFP = 0.9940)	240.3289 (230a)
Total electricity for the above, kWh/year	240.3289 (231)
Electricity for lighting (calculated in Appendix L)	197.8329 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-532.3450 (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	1622.4125 (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 (high-rate cost)	1095.8951	0.1624	177.9815 (261)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000 (261)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000 (262)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating - high rate cost	28.0911	0.1481	4.1603 (264)
Water heating - low rate cost	592.6095	0.1243	73.6604 (264)
Space and water heating			255.8022 (265)
Pumps, fans and electric keep-hot	240.3289	0.1432	33.3474 (267)
Energy for lighting	197.8329	0.1490	29.4810 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-334.6038	0.1358	-45.4526
PV Unit electricity exported	-197.7412	0.1191	-23.5497
Total			-69.0024 (269)
Total CO2, kg/year			249.6282 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.4000 (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 (high-rate cost)	1095.8951	1.6056	1759.5364 (275)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000 (275)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000 (276)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating - high rate cost	28.0911	1.5536	43.6418 (278)
Water heating - low rate cost	592.6095	1.4449	856.2527 (278)
Space and water heating			2659.4310 (279)
Pumps, fans and electric keep-hot	240.3289	1.5335	363.6069 (281)
Energy for lighting	197.8329	1.5547	307.5797 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-334.6038	1.5066	-504.1191
PV Unit electricity exported	-197.7412	0.4367	-86.3597
Total			-590.4788 (283)
Total Primary energy kWh/year			2740.1387 (286)
Dwelling Primary energy Rate (DPER)			37.3300 (287)

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

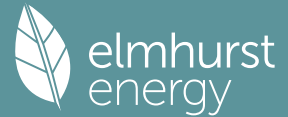
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	73.4000 (1b)	x 2.7000 (2b)	= 198.1800 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.1800 (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) = 0.1514 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4014 (18)

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Number of sides sheltered

2 (19)

Shelter factor

$$(20) = 1 - [0.075 \times (19)] = 0.8500 \quad (20)$$

Infiltration rate adjusted to include shelter factor

$$(21) = (18) \times (20) = 0.3412 \quad (21)$$

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	0.4350	0.4265	0.4179	0.3753	0.3668	0.3241	0.3241	0.3156	0.3412	0.3668	0.3838	0.4009	(22b)
Effective ac	0.5946	0.5909	0.5873	0.5704	0.5673	0.5525	0.5525	0.5498	0.5582	0.5673	0.5737	0.5804	(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)			9.6400	1.1450	11.0382			(27)
Heat Loss Floor 1			73.4000	0.1300	9.5420			(28a)
External Wall 1	28.6200	11.5900	17.0300	0.1800	3.0654			(29a)
Sheltered wall	4.0500		4.0500	0.1800	0.7290			(29a)
Total net area of external elements Aum(A, m2)			106.0700					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	26.3246		(33)
Party Wall 1			69.9300	0.0000	0.0000			(32)

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

56.7518 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element	5.4600	0.0500	0.2730	
E2 Other lintels (including other steel lintels)	4.5300	0.0500	0.2265	
E3 Sill	21.2000	0.0500	1.0600	
E4 Jamb	12.1000	0.1600	1.9360	
E5 Ground floor (normal)	5.4000	0.0600	0.3240	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
E25 Staggered party wall between dwellings	25.9000	0.0800	2.0720	
P1 Party wall - Ground floor	2.7000	0.0900	0.2430	
E16 Corner (normal)	2.7000	-0.0900	-0.2430	
E17 Corner (inverted - internal area greater than external area)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				6.2155 (36)
Point Thermal bridges				0.0000 (36a)
Total fabric heat loss				(33) + (36) + (36a) = 32.5401 (37)

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

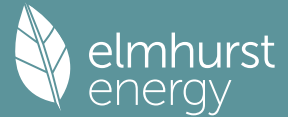
(38)m	Jan 38.8871	Feb 38.6468	Mar 38.4113	Apr 37.3052	May 37.0982	Jun 36.1348	Jul 36.1348	Aug 35.9564	Sep 36.5059	Oct 37.0982	Nov 37.5169	Dec 37.9546	(38)
Heat transfer coeff	71.4272	71.1869	70.9514	69.8452	69.6383	68.6748	68.6748	68.4964	69.0459	69.6383	70.0569	70.4947	(39)
Average = Sum(39)m / 12 =												69.8442	
HLP	Jan 0.9731	Feb 0.9698	Mar 0.9666	Apr 0.9516	May 0.9488	Jun 0.9356	Jul 0.9356	Aug 0.9332	Sep 0.9407	Oct 0.9488	Nov 0.9545	Dec 0.9604	(40)
HLP (average)												0.9516	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.3258 (42)
Hot water usage for mixer showers													
63.2150	62.2650	60.8807	58.2320	56.2774	54.0976	52.8585	54.2324	55.7384	58.0789	60.7844	62.9728	(42a)	
Hot water usage for baths													
27.3078	26.9022	26.3311	25.2781	24.4896	23.6153	23.1430	23.7101	24.3276	25.2631	26.3379	27.2154	(42b)	
Hot water usage for other uses													
38.4481	37.0500	35.6519	34.2538	32.8557	31.4576	31.4576	32.8557	34.2538	35.6519	37.0500	38.4481	(42c)	
Average daily hot water use (litres/day)													118.5536 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
128.9709	126.2172	122.8637	117.7639	113.6226	109.1704	107.4591	110.7982	114.3198	118.9939	124.1723	128.6364	(44)	
Energy content (annual)	204.2584	179.7317	188.8369	161.2128	152.9579	134.2377	129.9625	137.1913	140.9677	161.4736	176.9062	201.4135	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =			1969.1501
30.6388	26.9597	28.3255	24.1819	22.9437	20.1357	19.4944	20.5787	21.1452	24.2210	26.5359	30.2120	(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													
250.8533	221.8174	235.4318	206.3047	199.5528	179.3295	176.5574	183.7862	186.0596	208.0685	221.9980	248.0084	(62)	
WWHRS	-28.8993	-25.5588	-26.7637	-22.1614	-20.6536	-17.6734	-16.5660	-17.6163	-18.2856	-21.5567	-24.4211	-28.3641	(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													
221.9540	196.2586	208.6681	184.1433	178.8992	161.6561	159.9913	166.1699	167.7740	186.5118	197.5769	219.6443	(64)	
12Total per year (kWh/year)													2249.2475 (64)
Electric shower(s)													2249 (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													
105.1918	93.4294	100.0642	89.6767	88.1344	80.7075	80.4884	82.8920	82.9452	90.9659	94.8948	104.2459	(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	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	112.5498	124.6087	112.5498	116.3015	112.5498	116.3015	112.5498	112.5498	116.3015	112.5498	116.3015	112.5498	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	205.0989	207.2272	201.8640	190.4464	176.0336	162.4877	153.4382	151.3099	156.6731	168.0908	182.5035	196.0494	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288	(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)	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	(71)
Water heating gains (Table 5)	141.3869	139.0318	134.4949	124.5510	118.4602	112.0938	108.1834	111.4140	115.2017	122.2660	131.7983	140.1155	(72)
Total internal gains	519.9220	531.7541	509.7951	492.1853	467.9301	448.7694	432.0578	433.1602	446.0627	463.7930	491.4897	509.6011	(73)

6. Solar gains

[Jan]													
					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d			Gains W	
North					2.2400	10.6334	0.6300	0.7000	0.7700			7.2793 (74)	
East					7.4000	19.6403	0.6300	0.7000	0.7700			44.4172 (76)	
Solar gains	51.6965	100.8006	166.7330	246.6642	306.9116	316.5751	300.3841	254.6713	194.8459	119.6610	64.3630	42.5949 (83)	
Total gains	571.6185	632.5547	676.5281	738.8495	774.8417	765.3444	732.4420	687.8315	640.9087	583.4540	555.8527	552.1960 (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	16.1998	16.2545	16.3084	16.5667	16.6159	16.8490	16.8490	16.8929	16.7585	16.6159	16.5166	16.4141	
alpha	2.0800	2.0836	2.0872	2.1044	2.1077	2.1233	2.1233	2.1262	2.1172	2.1077	2.1011	2.0943	
util living area	0.8742	0.8454	0.8033	0.7222	0.6158	0.4828	0.3731	0.4064	0.5746	0.7480	0.8397	0.8808	(86)
MIT	18.1621	18.4928	19.0064	19.7102	20.2930	20.7077	20.8793	20.8514	20.5497	19.8068	18.9040	18.1237	(87)
Th 2	20.1058	20.1085	20.1112	20.1239	20.1263	20.1373	20.1373	20.1394	20.1331	20.1263	20.1215	20.1164	(88)
util rest of house	0.8633	0.8324	0.7863	0.6977	0.5805	0.4331	0.3097	0.3424	0.5263	0.7206	0.8242	0.8705	(89)
MIT 2	16.7880	17.1995	17.8382	18.7052	19.4009	19.8769	20.0515	20.0293	19.7116	18.8402	17.7254	16.7438	(90)
Living area fraction									fLA = Living area / (4) =			0.3760	(91)
MIT	17.3047	17.6858	18.2774	19.0831	19.7364	20.1893	20.3628	20.3384	20.0267	19.2037	18.1686	17.2627	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.3047	17.6858	18.2774	19.0831	19.7364	20.1893	20.3628	20.3384	20.0267	19.2037	18.1686	17.2627	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.8194	0.7881	0.7442	0.6649	0.5634	0.4362	0.3268	0.3578	0.5199	0.6872	0.7815	0.8273	(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	928.8896	910.1814	835.6248	711.2424	559.6390	383.8456	258.4066	269.7651	409.2168	599.1434	775.4293	920.8507	(97)
Space heating kWh	342.6095	276.6417	247.1053	158.3934	91.5564	0.0000	0.0000	0.0000	0.0000	147.4671	245.5469	345.2146	(98a)
Space heating requirement - total per year (kWh/year)												1854.5349	
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	342.6095	276.6417	247.1053	158.3934	91.5564	0.0000	0.0000	0.0000	0.0000	147.4671	245.5469	345.2146	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1854.5349	
Space heating per m2										(98c) / (4) =		25.2661	(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	
Space heating efficiency (main heating system 1)	342.6095	276.6417	247.1053	158.3934	91.5564	0.0000	0.0000	0.0000	0.0000	147.4671	245.5469	345.2146	(98)
Space heating fuel (main heating system)	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 efficiency (main heating system 2)	371.1912	299.7202	267.7197	171.6072	99.1944	0.0000	0.0000	0.0000	0.0000	159.7693	266.0313	374.0137	(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 (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	221.9540	196.2586	208.6681	184.1433	178.8992	161.6561	159.9913	166.1699	167.7740	186.5118	197.5769	219.6443	(64)
Efficiency of water heater	85.0298	84.8295	84.4399	83.7238	82.6352	79.8000	79.8000	79.8000	79.8000	83.5385	84.5484	85.0693	(216)
Fuel for water heating, kWh/month	261.0308	231.3566	247.1203	219.9414	216.4926	202.5766	200.4904	208.2329	210.2430	223.2646	233.6850	258.1946	(219)

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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	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	23.3856	18.7608	16.8920	12.3758	9.5594	7.8102	8.7204	11.3352	14.7233	19.3177	21.8193	24.0356	24.0356	(232)
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-19.6559	-29.1116	-43.9297	-51.9297	-58.2201	-55.1555	-54.4893	-50.3453	-43.4114	-34.4069	-22.1040	-16.8347	-16.8347	(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	-7.2121	-15.4981	-31.4226	-48.1151	-64.5294	-65.1715	-64.3983	-54.0989	-39.1009	-22.4538	-9.7214	-5.6785	-5.6785	(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													2009.2469	(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													2712.6288	(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)													188.7354	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-906.9947	(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													4089.6164	(238)

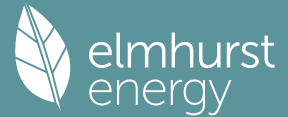
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2009.2469	0.2100	421.9419	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2712.6288	0.2100	569.6520	(264)
Space and water heating			991.5939	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	188.7354	0.1443	27.2404	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-479.5941	0.1336	-64.0569	
PV Unit electricity exported	-427.4006	0.1253	-53.5684	
Total			-117.6253	(269)
Total CO2, kg/year			913.1382	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.4400	(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	2009.2469	1.1300	2270.4490	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2712.6288	1.1300	3065.2705	(278)
Space and water heating			5335.7196	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	188.7354	1.5338	289.4887	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-479.5941	1.4936	-716.3099	
PV Unit electricity exported	-427.4006	0.4600	-196.6214	
Total			-912.9313	(283)
Total Primary energy kWh/year			4842.3778	(286)
Target Primary Energy Rate (TPER)			65.9700	(287)

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Property Reference	P0.11 Latimer			Issued on Date	03/12/2024
Assessment Reference	P0.11 Latimer 3B4P	Prop Type Ref	Grd Mid 3B5P		
Property	0.11, Latimer Road, Wokingham				
SAP Rating	82 B	DER	4.33	TER	13.58
Environmental	96 A	% DER < TER			68.11
CO ₂ Emissions (t/year)	0.28	DFEE	34.92	TFEE	39.58
Compliance Check	See BREL	% DFEE < TFEE			11.76
% DPER < TPER	35.74	DPER	46.21	TPER	71.91
Assessor Details	Mrs. Rebecca Lennon			Assessor ID	P627-0001
Client	RHB, RHB				

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	79.3000	2.7000	214.1100
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.3000		
Dwelling volume			214.1100

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)

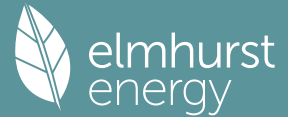
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	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)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.2000 (23c)
Effective ac	0.3207	0.3165	0.3123	0.2910	0.2867	0.2655	0.2655	0.2612	0.2740	0.2867	0.2953	0.3037 (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
Flat ent door			1.9500	1.0000	1.9500		(26a)
Windows (Uw = 1.20)			14.7800	1.1450	16.9237		(27)
Heat Loss Floor 1			79.3000	0.1200	9.5160	0.0000	0.0000 (28a)
External Wall 1	75.0600	16.7300	58.3300	0.1200	6.9996	0.0000	0.0000 (29a)
Sheltered wall	21.6000		21.6000	0.2100	4.5360	0.0000	0.0000 (29a)
Total net area of external elements Aum(A, m ²)			175.9600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.9253		(33)
Party Ceiling 1			79.3000			30.0000	2379.0000 (32b)
Internal Wall 1			152.2800			9.0000	1370.5200 (32c)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			3749.5200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							47.2827 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				7.9800	0.0280	0.2234	

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E3 Sill									7.0500		0.0240		0.1692	
E4 Jamb									24.5000		0.0190		0.4655	
E5 Ground floor (normal)									35.8000		0.0600		2.1480	
E16 Corner (normal)									10.8000		0.0370		0.3996	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)														
Point Thermal bridges													(36a) =	3.4057 (36)
Total fabric heat loss													(33) + (36) + (36a) =	43.3310 (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	22.6630	22.3627	22.0624	20.5610	20.2607	18.7592	18.7592	18.4590	19.3598	20.2607	20.8613	21.4619	(38)	
Average = Sum(39)m / 12 =	65.9940	65.6937	65.3934	63.8920	63.5917	62.0903	62.0903	61.7900	62.6908	63.5917	64.1923	64.7929	(39)	
												63.8169		
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
HLP (average)	0.8322	0.8284	0.8246	0.8057	0.8019	0.7830	0.7830	0.7792	0.7906	0.8019	0.8095	0.8171	(40)	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31		
												0.8048		
												31		

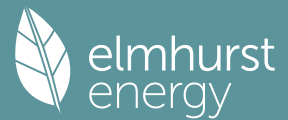
4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.4494 (42)
Hot water usage for mixer showers												
63.6393	62.6650	61.2292	59.0203	57.0412	54.2725	52.0826	54.6427	55.9303	58.6726	61.5285	63.5819	(42a)
Hot water usage for baths												
27.5709	27.1547	26.5626	25.6759	24.8768	23.7768	22.9422	23.9627	24.4983	25.5883	26.7216	27.5491	(42b)
Hot water usage for other uses												
39.7148	38.2706	36.8264	35.3822	33.9381	32.4939	32.4939	33.9381	35.3822	36.8264	38.2706	39.7148	(42c)
Average daily hot water use (litres/day)												120.3396 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	130.9250	128.0903	124.6182	120.0785	115.8561	110.5431	107.5187	112.5435	115.8109	121.0874	126.5207	130.8458 (44)
Energy conte	192.7443	169.4894	178.0769	156.8525	149.2923	127.8395	118.8113	132.4658	134.3349	156.0333	170.9969	192.1566 (45)
Energy content (annual)										Total = Sum(45)m =		1879.0936
Distribution loss (46)m = 0.15 x (45)m												
28.9116	25.4234	26.7115	23.5279	22.3938	19.1759	17.8217	19.8699	20.1502	23.4050	25.6495	28.8235	(46)
Water storage loss:												
Store volume												201.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss												
26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage												
26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month												
219.6957	193.8326	205.0283	182.9345	176.2437	153.9215	145.7627	159.4172	160.4169	182.9847	197.0789	219.1080	(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												
219.6957	193.8326	205.0283	182.9345	176.2437	153.9215	145.7627	159.4172	160.4169	182.9847	197.0789	219.1080	(64)
12Total per year (kWh/year)												2196.4246 (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												
64.0875	56.3552	59.2106	52.1535	49.6397	42.5066	39.5048	44.0449	44.6663	51.8811	56.8565	63.8921	(65)

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
(66)m	122.4723	122.4723	122.4723	122.4723	122.4723	122.4723	122.4723	122.4723	122.4723	122.4723	122.4723	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
111.6965	123.6640	111.6965	115.4197	111.6965	115.4197	111.6965	111.6965	115.4197	111.6965	115.4197	111.6965	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
217.9713	220.2332	214.5334	202.3991	187.0819	172.6858	163.0683	160.8064	166.5062	178.6405	193.9578	208.3539	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
35.2472	35.2472	35.2472	35.2472	35.2472	35.2472	35.2472	35.2472	35.2472	35.2472	35.2472	35.2472	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-97.9778	-97.9778	-97.9778	-97.9778	-97.9778	-97.9778	-97.9778	-97.9778	-97.9778	-97.9778	-97.9778	-97.9778	(71)
Water heating gains (Table 5)												
86.1391	83.8620	79.5841	72.4354	66.7200	59.0370	53.0978	59.2001	62.0366	69.7326	78.9673	85.8764	(72)
Total internal gains												
475.5486	487.5008	465.5556	449.9959	425.2400	406.8841	387.6043	391.4447	403.7042	419.8113	448.0865	465.6685	(73)

6. Solar gains												
[Jan]												
	Area											
	m2											
East	10.6800											
West	4.1000											
Solar gains	67.0554	131.1746	216.0258	315.0608	386.1189	395.2614	376.3049	323.2404	251.2470	155.6497	83.6102	55.1431 (83)
Total gains	542.6040	618.6754	681.5815	765.0567	811.3589	802.1455	763.9092	714.6851	654.9512	575.4610	531.6967	520.8116 (84)

7. Mean internal temperature (heating season)

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Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	15.7822	15.8544	15.9272	16.3015	16.3784	16.7745	16.7745	16.8560	16.6138	16.3784	16.2252	16.0748
alpha	2.0521	2.0570	2.0618	2.0868	2.0919	2.1183	2.1183	2.1237	2.1076	2.0919	2.0817	2.0717
util living area	0.8660	0.8291	0.7762	0.6796	0.5654	0.4318	0.3305	0.3619	0.5313	0.7223	0.8274	0.8736 (86)
MIT	18.1617	18.5487	19.1095	19.8448	20.3934	20.7640	20.9041	20.8813	20.6105	19.8763	18.9410	18.1294 (87)
Th 2	20.2255	20.2288	20.2320	20.2484	20.2517	20.2681	20.2681	20.2714	20.2615	20.2517	20.2451	20.2386 (88)
util rest of house	0.8563	0.8172	0.7606	0.6577	0.5354	0.3922	0.2816	0.3122	0.4912	0.6981	0.8137	0.8645 (89)
MIT 2	16.8736	17.3549	18.0510	18.9570	19.6133	20.0473	20.1936	20.1760	19.8817	19.0144	17.8581	16.8371 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.3300	17.7779	18.4261	19.2716	19.8897	20.3013	20.4454	20.4259	20.1399	19.3198	18.2418	17.2950 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.3300	17.7779	18.4261	19.2716	19.8897	20.3013	20.4454	20.4259	20.1399	19.3198	18.2418	17.2950 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8099	0.7708	0.7175	0.6264	0.5200	0.3940	0.2938	0.3230	0.4842	0.6639	0.7689	0.8191 (94)
Useful gains	439.4805	476.8578	489.0637	479.2191	421.9153	316.0709	224.4060	230.8557	317.1023	382.0740	408.8317	426.5939 (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	859.9047	845.9999	779.8859	662.6607	520.7976	353.9940	238.7612	248.7611	378.6486	554.5066	715.2168	848.4652 (97)
Space heating kWh	312.7956	248.0635	216.3717	132.0779	73.5684	0.0000	0.0000	0.0000	0.0000	128.2899	220.5972	313.8722 (98a)
Space heating requirement - total per year (kWh/year)	1645.6364											
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	312.7956	248.0635	216.3717	132.0779	73.5684	0.0000	0.0000	0.0000	0.0000	128.2899	220.5972	313.8722 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1645.6364											
Space heating per m2	(98c) / (4) = 20.7520 (99)											

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)											
Fraction of space heat from main system(s)	1.0000 (202)											
Fraction of main heating from main system 2	0.0000 (203)											
Fraction of total heating from main system 1	1.0000 (204)											
Fraction of total heating from main system 2	0.0000 (205)											
Efficiency of main space heating system 1 (in %)	100.0000 (206)											
Efficiency of main space heating system 2 (in %)	0.0000 (207)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	312.7956	248.0635	216.3717	132.0779	73.5684	0.0000	0.0000	0.0000	0.0000	128.2899	220.5972	313.8722 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	312.7956	248.0635	216.3717	132.0779	73.5684	0.0000	0.0000	0.0000	0.0000	128.2899	220.5972	313.8722 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Space heating fuel used, main system 2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Water heating												
Water heating requirement	219.6957	193.8326	205.0283	182.9345	176.2437	153.9215	145.7627	159.4172	160.4169	182.9847	197.0789	219.1080 (64)
Efficiency of water heater	343.0324	343.0324	343.0324	343.0324	343.0324	343.0324	343.0324	343.0324	343.0324	343.0324	343.0324	343.0324 (216)
(217)m	343.0324	343.0324	343.0324	343.0324	343.0324	343.0324	343.0324	343.0324	343.0324	343.0324	343.0324	343.0324 (217)
Fuel for water heating, kWh/month	64.0452	56.5056	59.7693	53.3286	51.3782	44.8708	42.4924	46.4729	46.7643	53.3433	57.4520	63.8738 (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	22.0522	19.9181	22.0522	21.3408	22.0522	21.3408	22.0522	22.0522	21.3408	22.0522	21.3408	22.0522 (231)
Lighting	23.9759	19.2343	17.3184	12.6882	9.8007	8.0073	8.9405	11.6213	15.0949	19.8053	22.3700	24.6422 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-9.5149	-16.7265	-30.2748	-40.9630	-48.7386	-44.4371	-43.5708	-38.2000	-29.6067	-21.0885	-11.3126	-7.7821 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-1.3178	-3.5948	-9.7227	-19.5170	-31.2563	-36.2029	-35.1742	-27.2125	-16.7613	-6.4098	-1.9930	-0.9673 (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	1645.6364 (211)											
Space heating fuel - main system 2	0.0000 (213)											
Space heating fuel - secondary	0.0000 (215)											
Efficiency of water heater	343.0324											
Water heating fuel used	640.2965 (219)											
Space cooling fuel	0.0000 (221)											
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9940)												
mechanical ventilation fans (SFP = 0.9940)												
Total electricity for the above, kWh/year	259.6469 (231)											
Electricity for lighting (calculated in Appendix L)	193.4989 (232)											

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

PV generation	-532.3450 (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	2206.7337 (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 (high-rate cost)	1645.6364	0.1621	266.8346 (261)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000 (261)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000 (262)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating - high rate cost	30.5428	0.1481	4.5237 (264)
Water heating - low rate cost	609.7537	0.1243	75.7976 (264)
Space and water heating			347.1560 (265)
Pumps, fans and electric keep-hot	259.6469	0.1432	36.0279 (267)
Energy for lighting	193.4989	0.1490	28.8352 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-342.2155	0.1359	-46.5049
PV Unit electricity exported	-190.1295	0.1185	-22.5209
Total			-69.0258 (269)
Total CO2, kg/year			342.9932 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.3300 (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 (high-rate cost)	1645.6364	1.6046	2640.6533 (275)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000 (275)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000 (276)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating - high rate cost	30.5428	1.5536	47.4522 (278)
Water heating - low rate cost	609.7537	1.4449	881.0490 (278)
Space and water heating			3569.1545 (279)
Pumps, fans and electric keep-hot	259.6469	1.5335	392.8342 (281)
Energy for lighting	193.4989	1.5547	300.8414 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-342.2155	1.5068	-515.6559
PV Unit electricity exported	-190.1295	0.4343	-82.5720
Total			-598.2280 (283)
Total Primary energy kWh/year			3664.6020 (286)
Dwelling Primary energy Rate (DPER)			46.2100 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET EMISSIONS

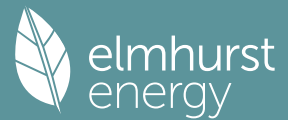
1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	79.3000 (1b)	2.7000 (2b)	214.1100 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	214.1100 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	30.0000 / (5) = 0.1401 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3901 (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) = 0.3316 (21)

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Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4228	0.4145	0.4062	0.3648	0.3565	0.3150	0.3150	0.3067	0.3316	0.3565	0.3730	0.3896 (22b)
	0.5894	0.5859	0.5825	0.5665	0.5635	0.5496	0.5496	0.5470	0.5550	0.5635	0.5696	0.5759 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Semi-glazed door			1.9500	1.0000	1.9500		(26a)
TER Opening Type (Uw = 1.20)			14.7800	1.1450	16.9237		(27)
Heat Loss Floor 1			79.3000	0.1300	10.3090		(28a)
External Wall 1	75.0600	16.7300	58.3300	0.1800	10.4994		(29a)
Sheltered wall	21.6000		21.6000	0.1800	3.8880		(29a)
Total net area of external elements Aum(A, m2)			175.9600				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 43.5701		(33)

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

57.2827 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	7.9800	0.0500	0.3990
E3 Sill	7.0500	0.0500	0.3525
E4 Jamb	24.5000	0.0500	1.2250
E5 Ground floor (normal)	35.8000	0.1600	5.7280
E16 Corner (normal)	10.8000	0.0900	0.9720

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

8.6765 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 52.2466 (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	41.6430	41.3978	41.1574	40.0285	39.8173	38.8340	38.8340	38.6519	39.2127	39.8173	40.2446	40.6913 (38)
Average = Sum(39)m / 12 =	93.8896	93.6444	93.4040	92.2751	92.0638	91.0805	91.0805	90.8985	91.4593	92.0638	92.4911	92.9379 (39)
												92.2740

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1840	1.1809	1.1779	1.1636	1.1610	1.1486	1.1486	1.1463	1.1533	1.1610	1.1663	1.1720 (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												2.4494 (42)
Hot water usage for mixer showers	65.2888	64.3077	62.8779	60.1424	58.1236	55.8723	54.5926	56.0115	57.5669	59.9842	62.7785	65.0387 (42a)
Hot water usage for baths	28.1996	27.7808	27.1910	26.1036	25.2893	24.3865	23.8988	24.4844	25.1221	26.0882	27.1980	28.1042 (42b)
Hot water usage for other uses	39.7148	38.2706	36.8264	35.3822	33.9381	32.4939	32.4939	33.9381	35.3822	36.8264	38.2706	39.7148 (42c)
Average daily hot water use (litres/day)												122.4439 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	133.2032	130.3590	126.8953	121.6282	117.3510	112.7526	110.9853	114.4340	118.0713	122.8988	128.2471	132.8577 (44)
Energy content (annual)	210.9613	185.6295	195.0334	166.5029	157.9770	138.6425	134.2271	141.6932	145.5937	166.7725	182.7115	208.0230 (45)
Distribution loss (46)m = 0.15 x (45)m	31.6442	27.8444	29.2550	24.9754	23.6965	20.7964	20.1341	21.2540	21.8391	25.0159	27.4067	31.2035 (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	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	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

	257.5562	227.7152	241.6283	211.5948	204.5719	183.7344	180.8220	188.2881	190.6855	213.3674	227.8033	254.6179 (62)
WWHRS	-29.8473	-26.3972	-27.6417	-22.8884	-21.3312	-18.2532	-17.1095	-18.1942	-18.8855	-22.2639	-25.2223	-29.2946 (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

227.7088	201.3180	213.9867	188.7064	183.2407	165.4811	163.7125	170.0939	171.8000	191.1035	202.5810	225.3233 (64)
Total per year (kWh/year) = Sum(64)m =											2305.0561 (64)
											2305 (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	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)	

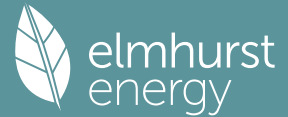
Heat gains from water heating, kWh/month

107.4205	95.3904	102.1245	91.4357	89.8033	82.1721	81.9064	84.3889	84.4834	92.7278	96.8250	106.4436 (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
(66)m	122.4723	122.4723	122.4723	122.4723	122.4723	122.4723	122.4723	122.4723	122.4723	122.4723	122.4723	122.4723 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	111.6965	123.6640	111.6965	115.4197	111.6965	115.4197	111.6965	111.6965	115.4197	111.6965	115.4197	111.6965 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	217.9713	220.2332	214.5334	202.3991	187.0819	172.6858	163.0683	160.8064	166.5062	178.6405	193.9578	208.3539 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2472	35.2472	35.2472	35.2472	35.2472	35.2472	35.2472	35.2472	35.2472	35.2472	35.2472	35.2472 (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)

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Losses e.g. evaporation (negative values) (Table 5)	-97.9778	-97.9778	-97.9778	-97.9778	-97.9778	-97.9778	-97.9778	-97.9778	-97.9778	-97.9778	-97.9778	-97.9778 (71)
Water heating gains (Table 5)	144.3825	141.9500	137.2642	126.9940	120.7033	114.1279	110.0893	113.4260	117.3380	124.6341	134.4792	143.0693 (72)
Total internal gains	536.7920	548.5888	526.2357	507.5545	482.2234	461.9751	444.5958	445.6706	459.0056	477.7128	506.5984	525.8614 (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		
East					10.6800	19.6403	0.6300	0.7000	0.7700	64.1048 (76)		
West					4.1000	19.6403	0.6300	0.7000	0.7700	24.6095 (80)		
Solar gains	88.7143	173.5440	285.8022	416.8255	510.8353	522.9308	497.8514	427.6470	332.3998	205.9245	110.6163	72.9543 (83)
Total gains	625.5062	722.1328	812.0379	924.3800	993.0586	984.9059	942.4472	873.3176	791.4054	683.6373	617.2147	598.8157 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil, m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	13.4393	13.4745	13.5092	13.6745	13.7058	13.8538	13.8538	13.8815	13.7964	13.7058	13.6425	13.5769
alpha	1.8960	1.8983	1.9006	1.9116	1.9137	1.9236	1.9236	1.9254	1.9198	1.9137	1.9095	1.9051
util living area	0.8868	0.8539	0.8041	0.7164	0.6072	0.4795	0.3738	0.4104	0.5811	0.7599	0.8548	0.8942 (86)
MIT	17.5606	17.9707	18.6120	19.4424	20.1306	20.6179	20.8327	20.7935	20.4102	19.4965	18.4044	17.4969 (87)
Th 2	19.9328	19.9353	19.9378	19.9492	19.9514	19.9614	19.9614	19.9632	19.9575	19.9514	19.9470	19.9425 (88)
util rest of house	0.8756	0.8397	0.7849	0.6882	0.5663	0.4214	0.2987	0.3343	0.5249	0.7293	0.8384	0.8836 (89)
MIT 2	15.9966	16.5002	17.2858	18.2904	19.0964	19.6417	19.8537	19.8237	19.4339	18.3812	17.0493	15.9204 (90)
Living area fraction	16.5508	17.0212	17.7557	18.6986	19.4629	19.9876	20.2006	20.1674	19.7798	18.7764	17.5295	16.4790 (92)
MIT	16.5508	17.0212	17.7557	18.6986	19.4629	19.9876	20.2006	20.1674	19.7798	18.7764	17.5295	16.4790 (93)
Temperature adjustment												0.0000
adjusted MIT	16.5508	17.0212	17.7557	18.6986	19.4629	19.9876	20.2006	20.1674	19.7798	18.7764	17.5295	16.4790 (93)

8. Space heating requirement

Utilisation	0.8265	0.7889	0.7357	0.6493	0.5453	0.4230	0.3168	0.3501	0.5143	0.6879	0.7889	0.8356 (94)
Useful gains	517.0073	569.6969	597.4542	600.1710	541.5315	416.5744	298.5328	305.7549	407.0342	470.2841	486.9148	500.3922 (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	1150.2238	1135.0865	1051.3289	904.1687	714.6819	490.7058	327.9418	342.4496	519.4709	752.7528	964.6340	1141.1853 (97)
Space heating kWh	471.1131	379.9418	337.6828	218.8783	128.8238	0.0000	0.0000	0.0000	0.0000	210.1567	343.9578	476.7501 (98a)
Space heating requirement - total per year (kWh/year)												2567.3044
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	471.1131	379.9418	337.6828	218.8783	128.8238	0.0000	0.0000	0.0000	0.0000	210.1567	343.9578	476.7501 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2567.3044
Space heating per m2										(98c) / (4) =		32.3746 (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	471.1131	379.9418	337.6828	218.8783	128.8238	0.0000	0.0000	0.0000	0.0000	210.1567	343.9578	476.7501 (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)	510.4151	411.6379	365.8535	237.1379	139.5708	0.0000	0.0000	0.0000	0.0000	227.6887	372.6520	516.5223 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	227.7088	201.3180	213.9867	188.7064	183.2407	165.4811	163.7125	170.0939	171.8000	191.1035	202.5810	225.3233 (64)
Efficiency of water heater (217)m	85.6523	85.4617	85.0781	84.3933	83.2845	79.8000	79.8000	79.8000	79.8000	84.2734	85.2368	79.8000 (216)
Fuel for water heating, kWh/month	265.8525	235.5652	251.5179	223.6036	220.0177	207.3699	205.1535	213.1503	215.2883	226.7661	237.6686	262.9270 (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	23.2083	18.6186	16.7640	12.2820	9.4870	7.7509	8.6543	11.2492	14.6116	19.1713	21.6539	23.8534 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-21.1461	-31.2744	-47.1313	-55.6405	-62.3154	-59.0065	-58.2799	-53.8654	-46.4890	-36.9127	-23.7593	-18.1150 (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)

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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	-7.8816	-16.9211	-34.2779	-52.4460	-70.3008	-70.9926	-70.1640	-58.9741	-42.6558	-24.5185	-10.6243	-6.2079	(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												2781.4783	(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												2764.8806	(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)												187.3045	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-979.9003	(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												4839.7630	(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	2781.4783	0.2100	584.1104	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2764.8806	0.2100	580.6249	(264)
Space and water heating			1164.7354	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	187.3045	0.1443	27.0338	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-513.9356	0.1336	-68.6590	
PV Unit electricity exported	-465.9647	0.1254	-58.4105	
Total			-127.0695	(269)
Total CO2, kg/year			1076.6289	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.5800	(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	2781.4783	1.1300	3143.0704	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2764.8806	1.1300	3124.3151	(278)
Space and water heating			6267.3855	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	187.3045	1.5338	287.2939	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-513.9356	1.4937	-767.6587	
PV Unit electricity exported	-465.9647	0.4601	-214.3946	
Total			-982.0533	(283)
Total Primary energy kWh/year			5702.7268	(286)
Target Primary Energy Rate (TPER)			71.9100	(287)

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Property Reference	P2.02 Latimer			Issued on Date	03/12/2024
Assessment Reference	P2.02 Latimer 2B4P	Prop Type Ref	2nd Mid 1B2P		
Property	2.02, Latimer Road, Wokingham				
SAP Rating	83 B	DER	4.46	TER	12.58
Environmental	97 A	% DER < TER			64.55
CO ₂ Emissions (t/year)	0.25	DFEE	37.74	TFEE	40.24
Compliance Check	See BREL	% DFEE < TFEE			6.21
% DPER < TPER	27.65	DPER	47.61	TPER	65.81
Assessor Details	Mrs. Rebecca Lennon			Assessor ID	P627-0001
Client	RHB, RHB				

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	71.6000	2.7000	193.3200
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.6000		
Dwelling volume			193.3200

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	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)

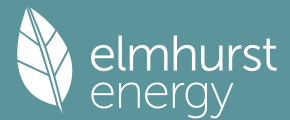
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700 (21)

	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)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.2000 (23c)
Effective ac	0.3207	0.3165	0.3123	0.2910	0.2867	0.2655	0.2655	0.2612	0.2740	0.2867	0.2953	0.3037 (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
Flat ent door			1.9500	1.0000	1.9500		(26)
Windows (Uw = 1.20)			16.5800	1.1450	18.9847		(27)
External Wall 1	60.7500	16.5800	44.1700	0.1200	5.3004	0.0000	0.0000 (29a)
Sheltered wall	4.5900	1.9500	2.6400	0.2100	0.5544	0.0000	0.0000 (29a)
Flat Roof	46.4000		46.4000	0.1100	5.1040	9.0000	417.6000 (30)
Total net area of external elements Aum(A, m ²)			111.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.8935		(33)
Party Wall 1			32.4000	0.0000	0.0000	0.0000	0.0000 (32)
Party Floor 1			71.6000			40.0000	2864.0000 (32d)
Party Ceiling 1			25.2000			30.0000	756.0000 (32b)
Internal Wall 1			123.1200			9.0000	1108.0800 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		5145.6800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							71.8670 (35)
List of Thermal Bridges							

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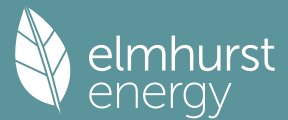
K1 Element	Length	Psi-value	Total
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	5.7000	1.0000	5.7000
E16 Corner (normal)	10.8000	0.0370	0.3996
E17 Corner (inverted - internal area greater than external area)	2.7000	-0.0790	-0.2133
E18 Party wall between dwellings	2.7000	0.0410	0.1107
E25 Staggered party wall between dwellings	2.7000	0.0300	0.0810
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	24.0000	0.0000	0.0000
E2 Other lintels (including other steel lintels)	8.0300	0.0280	0.2248
E3 Sill	7.1000	0.0240	0.1704
E4 Jamb	21.7000	0.0190	0.4123
E7 Party floor between dwellings (in blocks of flats)	24.2000	0.0360	0.8712
E15 Flat roof with parapet	22.4000	0.3000	6.7200
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			14.4767 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss		(33) + (36) + (36a) =	46.3703 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)			
(38)m	Jan	Feb	Mar
Heat transfer coeff	20.4624	20.1913	19.9202
Average = Sum(39)m / 12 =	66.8327	66.5616	66.2904
	Apr	May	Jun
	64.9348	64.6637	63.3080
	Jul	Aug	Sep
	63.3080	63.0369	63.8503
	Oct	Nov	Dec
	64.6637	65.2059	65.7482 (39)
			64.8670
HLP	Jan	Feb	Mar
HLP (average)	0.9334	0.9296	0.9258
Days in mont	31	28	31
	Apr	May	Jun
	0.9069	0.9031	0.8842
	Jul	Aug	Sep
	0.8842	0.8804	0.8918
	Oct	Nov	Dec
	0.9031	0.9107	0.9183 (40)
			0.9060
			31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.2843 (42)
Hot water usage for mixer showers												
Hot water usage for baths	60.9409	60.0079	58.6329	56.5177	54.6225	51.9712	49.8741	52.3257	53.5587	56.1847	58.9195	60.8859 (42a)
Hot water usage for other uses	26.4070	26.0083	25.4412	24.5920	23.8266	22.7730	21.9736	22.9511	23.4641	24.5081	25.5935	26.3860 (42b)
Average daily hot water use (litres/day)	38.0239	36.6412	35.2585	33.8758	32.4931	31.1104	31.1104	32.4931	33.8758	35.2585	36.6412	38.0239 (42c)
												115.2354 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	125.3717	122.6574	119.3326	114.9854	110.9422	105.8546	102.9582	107.7699	110.8986	115.9513	121.1542	125.2958 (44)
Energy content (annual)	184.5688	162.3005	170.5238	150.1997	142.9603	122.4173	113.7719	126.8472	128.6368	149.4150	163.7439	184.0060 (45)
Distribution loss (46)m = 0.15 x (45)m	27.6853	24.3451	25.5786	22.5300	21.4440	18.3626	17.0658	19.0271	19.2955	22.4122	24.5616	27.6009 (46)
Water storage loss:												
Store volume												201.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	211.5202	186.6437	197.4752	176.2817	169.9117	148.4993	140.7233	153.7986	154.7188	176.3664	189.8259	210.9574 (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	211.5202	186.6437	197.4752	176.2817	169.9117	148.4993	140.7233	153.7986	154.7188	176.3664	189.8259	210.9574 (64)
12Total per year (kWh/year)												2116.7222 (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	61.3691	53.9649	56.6992	49.9414	47.5343	40.7038	37.8291	42.1767	42.7718	49.6805	54.4448	61.1820 (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	114.2167	114.2167	114.2167	114.2167	114.2167	114.2167	114.2167	114.2167	114.2167	114.2167	114.2167	114.2167 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	101.3825	112.2449	101.3825	104.7619	101.3825	104.7619	101.3825	101.3825	104.7619	101.3825	104.7619	101.3825 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	201.0022	203.0879	197.8319	186.6423	172.5174	159.2421	150.3734	148.2876	153.5437	164.7332	178.8581	192.1334 (68)
Pumps, fans	34.4217	34.4217	34.4217	34.4217	34.4217	34.4217	34.4217	34.4217	34.4217	34.4217	34.4217	34.4217 (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)	-91.3734	-91.3734	-91.3734	-91.3734	-91.3734	-91.3734	-91.3734	-91.3734	-91.3734	-91.3734	-91.3734	-91.3734 (71)
Total internal gains	82.4854	80.3049	76.2086	69.3631	63.8902	56.5330	50.8456	56.6891	59.4052	66.7748	75.6178	82.2339 (72)
	442.1350	452.9028	432.6879	418.0323	395.0551	377.8020	359.8665	363.6242	374.9758	390.1556	416.5028	433.0148 (73)

6. Solar gains												
[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
Southwest	12.0200	36.7938	0.3000	0.0000	0.7700	102.1625 (79)						
Northwest	4.5600	11.2829	0.3000	0.0000	0.7700	11.8850 (81)						

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Solar gains	114.0475	198.2128	281.6892	366.6025	426.6678	430.6389	412.2452	366.3550	310.9258	221.8946	137.3215	97.1357 (83)
Total gains	556.1825	651.1156	714.3772	784.6348	821.7229	808.4409	772.1117	729.9792	685.9016	612.0502	553.8244	530.1505 (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	21.3871	21.4742	21.5620	22.0122	22.1045	22.5778	22.5778	22.6749	22.3861	22.1045	21.9206	21.7398
alpha	2.4258	2.4316	2.4375	2.4675	2.4736	2.5052	2.5052	2.5117	2.4924	2.4736	2.4614	2.4493
util living area	0.8980	0.8574	0.8052	0.7121	0.5949	0.4526	0.3423	0.3727	0.5455	0.7448	0.8586	0.9064 (86)
MIT	18.6761	19.0618	19.5402	20.1341	20.5699	20.8485	20.9451	20.9309	20.7447	20.1721	19.3592	18.6318 (87)
Th 2	20.1392	20.1424	20.1456	20.1616	20.1648	20.1810	20.1810	20.1842	20.1745	20.1648	20.1584	20.1520 (88)
util rest of house	0.8880	0.8441	0.7872	0.6861	0.5585	0.4043	0.2839	0.3133	0.4967	0.7158	0.8434	0.8972 (89)
MIT 2	17.4086	17.8902	18.4849	19.2173	19.7310	20.0500	20.1437	20.1353	19.9421	19.2803	18.2800	17.3610 (90)
Living area fraction	17.8759	18.3222	18.8740	19.5553	20.0403	20.3444	20.4392	20.4286	20.2381	19.6091	18.6779	17.8295 (92)
MIT	17.8759	18.3222	18.8740	19.5553	20.0403	20.3444	20.4392	20.4286	20.2381	19.6091	18.6779	17.8295 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8759	18.3222	18.8740	19.5553	20.0403	20.3444	20.4392	20.4286	20.2381	19.6091	18.6779	17.8295 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8548	0.8103	0.7563	0.6656	0.5527	0.4142	0.3027	0.3315	0.5007	0.6943	0.8111	0.8650 (94)
Useful gains	475.4096	527.5743	540.2803	522.2766	454.1968	334.8759	233.6831	241.9811	343.4155	424.9657	449.1925	458.5891 (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	907.3144	893.4005	820.2791	691.9015	539.3141	363.6685	243.0496	253.9517	391.9164	582.5628	754.9471	896.1172 (97)
Space heating kWh	321.3372	245.8352	208.3191	122.1299	63.3273	0.0000	0.0000	0.0000	0.0000	117.2523	220.1433	325.5209 (98a)
Space heating requirement - total per year (kWh/year)												1623.8652
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	321.3372	245.8352	208.3191	122.1299	63.3273	0.0000	0.0000	0.0000	0.0000	117.2523	220.1433	325.5209 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1623.8652
Space heating per m2										(98c) / (4) =		22.6797 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Fraction of main heating from main system 2												0.0000 (203)
Fraction of total heating from main system 1												1.0000 (204)
Fraction of total heating from main system 2												0.0000 (205)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	321.3372	245.8352	208.3191	122.1299	63.3273	0.0000	0.0000	0.0000	0.0000	117.2523	220.1433	325.5209 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	321.3372	245.8352	208.3191	122.1299	63.3273	0.0000	0.0000	0.0000	0.0000	117.2523	220.1433	325.5209 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Space heating fuel used, main system 2												0.0000 (213)
Water heating												
Water heating requirement	211.5202	186.6437	197.4752	176.2817	169.9117	148.4993	140.7233	153.7986	154.7188	176.3664	189.8259	210.9574 (64)
Efficiency of water heater (217)m	344.6488	344.6488	344.6488	344.6488	344.6488	344.6488	344.6488	344.6488	344.6488	344.6488	344.6488	344.6488 (216)
Fuel for water heating, kWh/month	61.3727	54.1548	57.2975	51.1482	49.3000	43.0871	40.8309	44.6247	44.8917	51.1728	55.0781	61.2094 (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	19.9109	17.9841	19.9109	19.2687	19.9109	19.2687	19.9109	19.9109	19.2687	19.9109	19.2687	19.9109 (231)
Lighting	20.8977	16.7649	15.0949	11.0592	8.5424	6.9792	7.7927	10.1292	13.1569	17.2625	19.4980	21.4785 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-9.4981	-16.6465	-29.9978	-40.2970	-47.5406	-43.3357	-42.4966	-37.3360	-29.0409	-20.8402	-11.2687	-7.7726 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-1.3346	-3.6748	-9.9996	-20.1830	-32.4542	-37.3043	-36.2483	-28.0765	-17.3271	-6.6581	-2.0369	-0.9769 (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												1623.8652 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												344.6488
Water heating fuel used												614.1679 (219)

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Space cooling fuel	0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9940)	
mechanical ventilation fans (SFP = 0.9940)	234.4353 (230a)
Total electricity for the above, kWh/year	234.4353 (231)
Electricity for lighting (calculated in Appendix L)	168.6562 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-532.3450 (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	-105.9000 (236)
Energy used	29.4000 (237)
Total delivered energy for all uses	2032.2796 (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 (high-rate cost)	1623.8652	0.1626	264.0608	(261)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000	(261)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000	(262)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	27.2927	0.1481	4.0419	(264)
Water heating - low rate cost	586.8752	0.1243	72.9455	(264)
Space and water heating			341.0482	(265)
Pumps, fans and electric keep-hot	234.4353	0.1432	32.5296	(267)
Energy for lighting	168.6562	0.1490	25.1331	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-336.0707	0.1360	-45.7100	
PV Unit electricity exported	-196.2743	0.1184	-23.2460	
Total			-68.9560	(269)
Appendix Q item 'Kelda' - energy saved	-105.9000	0.1360	-14.4024	(270)
Appendix Q item 'Kelda' - energy used	29.4000	0.1360	3.9984	(271)
Total CO2, kg/year			319.3510	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.4600	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	1623.8652	1.6063	2608.4307	(275)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000	(275)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000	(276)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000	(276)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	27.2927	1.5536	42.4010	(278)
Water heating - low rate cost	586.8752	1.4449	847.9590	(278)
Space and water heating			3498.7907	(279)
Pumps, fans and electric keep-hot	234.4353	1.5335	354.6901	(281)
Energy for lighting	168.6562	1.5547	262.2173	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-336.0707	1.5073	-506.5436	
PV Unit electricity exported	-196.2743	0.4343	-85.2326	
Total			-591.7762	(283)
Appendix Q item 'Kelda' - energy saved	-105.9000	1.5010	-158.9559	(284)
Appendix Q item 'Kelda' - energy used	29.4000	1.5010	44.1294	(285)
Total Primary energy kWh/year			3409.0953	(286)
Dwelling Primary energy Rate (DPER)			47.6100	(287)

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

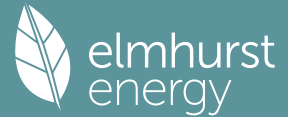
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	71.6000 (1b)	x 2.7000 (2b)	= 193.3200 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.6000			(4)
Dwelling volume		(3a) + (3b) + (3c) + (3d) + (3e) ... (3n) =	193.3200 (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)

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Number of passive vents
Number of flueless gas fires

0 * 10 = 0.0000 (7b)
0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =
Pressure test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Air changes per hour
30.0000 / (5) = 0.1552 (8)
Yes
Blower Door
5.0000 (17)
0.4052 (18)
2 (19)

Shelter factor
Infiltration rate adjusted to include shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
(21) = (18) x (20) = 0.3444 (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 infiltr 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	0.4391	0.4305	0.4219	0.3788	0.3702	0.3272	0.3272	0.3186	0.3444	0.3702	0.3875	0.4047 (22b)
	0.5964	0.5927	0.5890	0.5718	0.5685	0.5535	0.5535	0.5507	0.5593	0.5685	0.5751	0.5819 (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)			15.9500	1.1450	18.2634		(27)
External Wall 1	60.7500	15.9500	44.8000	0.1800	8.0640		(29a)
Sheltered wall	4.5900	1.9500	2.6400	0.1800	0.4752		(29a)
Flat Roof	46.4000		46.4000	0.1100	5.1040		(30)
Total net area of external elements Aum(A, m2)			111.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.8566		(33)
Party Wall 1			32.4000	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 75.3866 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	5.7000	0.0200	0.1140
E16 Corner (normal)	10.8000	0.0900	0.9720
E17 Corner (inverted - internal area greater than external area)	2.7000	-0.0900	-0.2430
E18 Party wall between dwellings	2.7000	0.0600	0.1620
E25 Staggered party wall between dwellings	2.7000	0.0600	0.1620
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	24.0000	0.0000	0.0000
E2 Other lintels (including other steel lintels)	8.0300	0.0500	0.4015
E3 Sill	7.1000	0.0500	0.3550
E4 Jamb	21.7000	0.0500	1.0850
E7 Party floor between dwellings (in blocks of flats)	24.2000	0.0700	1.6940
E15 Flat roof with parapet	22.4000	0.5600	12.5440

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 17.2465 (36)

Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 51.1031 (37)

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

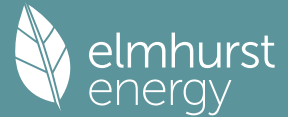
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	38.0485	37.8096	37.5755	36.4759	36.2702	35.3125	35.3125	35.1351	35.6814	36.2702	36.6864	37.1215 (38)
Average = Sum(39)m / 12 =	89.1515	88.9127	88.6786	87.5790	87.3732	86.4155	86.4155	86.2382	86.7844	87.3732	87.7894	88.2245 (39)
												87.5780

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2451	1.2418	1.2385	1.2232	1.2203	1.2069	1.2069	1.2044	1.2121	1.2203	1.2261	1.2322 (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													2.2843 (42)
Hot water usage for mixer showers													
62.5204	61.5809	60.2117	57.5922	55.6590	53.5031	52.2777	53.6365	55.1260	57.4407	60.1165	62.2809	62.2809	(42a)
Hot water usage for baths													
27.0091	26.6079	26.0431	25.0016	24.2217	23.3569	22.8898	23.4508	24.0615	24.9868	26.0498	26.9177	26.9177	(42b)
Hot water usage for other uses													
38.0239	36.6412	35.2585	33.8758	32.4931	31.1104	31.1104	32.4931	33.8758	35.2585	36.6412	38.0239	38.0239	(42c)
Average daily hot water use (litres/day)													117.2505 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	127.5533	124.8300	121.5133	116.4695	112.3738	107.9705	106.2780	109.5804	113.0632	117.6860	122.8075	127.2225	(44)
Energy content (annual)	202.0133	177.7562	186.7614	159.4410	151.2767	132.7623	128.5340	135.6834	139.4183	159.6988	174.9618	199.1997	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1947.5069	
30.3020	26.6634	28.0142	23.9161	22.6915	19.9143	19.2801	20.3525	20.9127	23.9548	26.2443	29.8800	29.8800	(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	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	23.3325	(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	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													
248.6082	219.8419	233.3563	204.5328	197.8716	177.8542	175.1290	182.2783	184.5101	206.2937	220.0536	245.7946	245.7946	(62)
WWHRS	-28.5817	-25.2779	-26.4696	-21.9179	-20.4267	-17.4792	-16.3840	-17.4227	-18.0847	-21.3199	-24.1528	-28.0524	(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													
220.0265	194.5640	206.8867	182.6150	177.4450	160.3749	158.7450	164.8556	166.4254	184.9738	195.9008	217.7421	217.7421	(64)
											</		

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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	104.4453	92.7725	99.3741	89.0876	87.5754	80.2169	80.0135	82.3907	82.4301	90.3758	94.2483	103.5098 (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	114.2167	114.2167	114.2167	114.2167	114.2167	114.2167	114.2167	114.2167	114.2167	114.2167	114.2167	114.2167	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	101.3842	112.2468	101.3842	104.7637	101.3842	104.7637	101.3842	101.3842	104.7637	101.3842	104.7637	101.3842	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	201.0022	203.0879	197.8319	186.6423	172.5174	159.2421	150.3734	148.2876	153.5437	164.7332	178.8581	192.1334	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4217	34.4217	34.4217	34.4217	34.4217	34.4217	34.4217	34.4217	34.4217	34.4217	34.4217	34.4217	(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)	-91.3734	-91.3734	-91.3734	-91.3734	-91.3734	-91.3734	-91.3734	-91.3734	-91.3734	-91.3734	-91.3734	-91.3734	(71)
Water heating gains (Table 5)	140.3835	138.0543	133.5673	123.7328	117.7089	111.4124	107.5450	110.7401	114.4862	121.4728	130.9004	139.1261	(72)
Total internal gains	503.0350	513.6541	493.0484	475.4038	451.8756	432.6833	416.5676	417.6770	430.0586	447.8553	474.7872	492.9088	(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					11.5600	36.7938	0.6300	0.7000	0.7700	129.9884 (79)				
Northwest					4.3900	11.2829	0.6300	0.7000	0.7700	15.1377 (81)				
Solar gains	145.1261	252.2315	358.4698	466.5474	543.0049	548.0659	524.6537	466.2390	395.6819	282.3706	174.7433	123.6052	(83)	
Total gains	648.1610	765.8857	851.5182	941.9512	994.8805	980.7492	941.2213	883.9159	825.7405	730.2259	649.5304	616.5139	(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)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	21.0000 (85)
tau	16.8181	16.8632	16.9078	17.1200	17.1604	17.3505	17.3505	17.3862	17.2768	17.1604	17.0790	16.9948	
alpha	2.1212	2.1242	2.1272	2.1413	2.1440	2.1567	2.1567	2.1591	2.1518	2.1440	2.1386	2.1330	
util living area	0.8954	0.8565	0.8060	0.7208	0.6108	0.4784	0.3678	0.4011	0.5684	0.7528	0.8591	0.9039	(86)
MIT	18.0762	18.5008	19.0653	19.7640	20.3340	20.7260	20.8888	20.8622	20.5779	19.8333	18.8525	18.0081	(87)
Th 2	19.8841	19.8867	19.8893	19.9015	19.9038	19.9145	19.9145	19.9164	19.9104	19.9038	19.8992	19.8943	(88)
util rest of house	0.8833	0.8406	0.7843	0.6893	0.5655	0.4149	0.2876	0.3199	0.5064	0.7177	0.8408	0.8927	(89)
MIT 2	16.5255	17.0508	17.7470	18.5974	19.2628	19.6958	19.8489	19.8308	19.5511	18.7034	17.5051	16.4449	(90)
Living area fraction	17.0972	17.5854	18.2331	19.0275	19.6578	20.0756	20.2323	20.2111	19.9297	19.1200	18.0019	17.0213	(91)
MIT	17.0972	17.5854	18.2331	19.0275	19.6578	20.0756	20.2323	20.2111	19.9297	19.1200	18.0019	17.0213	(92)
Temperature adjustment	17.0972	17.5854	18.2331	19.0275	19.6578	20.0756	20.2323	20.2111	19.9297	19.1200	18.0019	17.0213	(93)
adjusted MIT	17.0972	17.5854	18.2331	19.0275	19.6578	20.0756	20.2323	20.2111	19.9297	19.1200	18.0019	17.0213	(93)

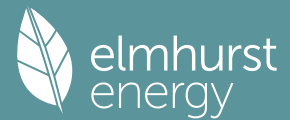
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.8429	0.7990	0.7454	0.6609	0.5544	0.4248	0.3120	0.3430	0.5075	0.6885	0.8007	0.8534	(94)
Useful gains	546.3671	611.9150	634.6929	622.5736	551.5908	416.6681	293.6697	303.1539	419.1031	502.7434	520.0792	526.1556	(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	1140.8926	1127.8934	1040.4751	886.9591	695.2974	473.1811	313.8906	328.6608	505.9303	744.4215	957.0722	1131.1490	(97)
Space heating kWh	442.3270	346.7375	301.9019	190.3576	106.9177	0.0000	0.0000	0.0000	0.0000	179.8085	314.6350	450.1151	(98a)
Space heating requirement - total per year (kWh/year)												2332.8003	
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	442.3270	346.7375	301.9019	190.3576	106.9177	0.0000	0.0000	0.0000	0.0000	179.8085	314.6350	450.1151	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2332.8003	
Space heating per m ²										(98c) / (4) =		32.5810	(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	
	442.3270	346.7375	301.9019	190.3576	106.9177	0.0000	0.0000	0.0000	0.0000	179.8085	314.6350	450.1151	(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)	479.2275	375.6636	327.0877	206.2379	115.8371	0.0000	0.0000	0.0000	0.0000	194.8088	340.8830	487.6654	(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)													

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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)
	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	220.0265	194.5640	206.8867	182.6150	177.4450	160.3749	158.7450	164.8556	166.4254	184.9738	195.9008	217.7421 (64)
Efficiency of water heater	85.5933	85.3405	84.9062	84.1530	82.9614	79.8000	79.8000	79.8000	79.8000	83.9963	85.1165	79.8000 (216)
Fuel for water heating, kWh/month	257.0605	227.9857	243.6651	217.0034	213.8885	200.9711	198.9285	206.5859	208.5532	220.2166	230.1561	85.6506 (217)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	21.0656	16.8996	15.2163	11.1481	8.6111	7.0353	7.8553	10.2107	13.2626	17.4013	19.6547	21.6511 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-33.5713	-47.3724	-68.1672	-76.7461	-82.8597	-77.3924	-76.4403	-72.1089	-64.4846	-54.2125	-36.9241	-29.0197 (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	-18.8469	-39.6590	-78.8416	-118.4365	-156.6188	-157.3601	-155.5039	-131.6568	-96.4931	-56.7201	-25.1658	-14.9026 (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												2527.4109 (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												2679.2362 (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)												170.0118 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1769.5047 (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												3693.1542 (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	2527.4109	0.2100	530.7563 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2679.2362	0.2100	562.6396 (264)
Space and water heating			1093.3959 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	170.0118	0.1443	24.5380 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-719.2994	0.1346	-96.7874
PV Unit electricity exported	-1050.2053	0.1259	-132.2122
Total			-228.9996 (269)
Total CO2, kg/year			900.8635 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.5800 (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	2527.4109	1.1300	2855.9744 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2679.2362	1.1300	3027.5368 (278)
Space and water heating			5883.5112 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	170.0118	1.5338	260.7698 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-719.2994	1.4973	-1077.0081
PV Unit electricity exported	-1050.2053	0.4621	-485.3096
Total			-1562.3176 (283)
Total Primary energy kWh/year			4712.0642 (286)
Target Primary Energy Rate (TPER)			65.8100 (287)

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Property Reference	P2.04 Latimer			Issued on Date	03/12/2024
Assessment Reference	P2.04 Latimer 1B2P	Prop Type Ref	2nd Mid 1B2P		
Property	2.04, Latimer Road, Wokingham				
SAP Rating	85 B	DER	4.32	TER	13.28
Environmental	97 A	% DER < TER			67.47
CO ₂ Emissions (t/year)	0.18	DFEE	37.68	TFEE	37.24
Compliance Check	See BREL	% DFEE < TFEE			-1.19
% DPER < TPER	32.43	DPER	47.07	TPER	69.66
Assessor Details	Mrs. Rebecca Lennon			Assessor ID	P627-0001
Client	RHB, RHB				

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	56.0000 (1b)	2.7000 (2b)	151.2000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.0000		151.2000 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	151.2000 (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)

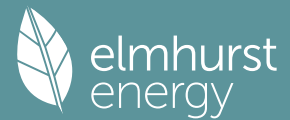
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700 (21)

	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)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.2000 (23c)
Effective ac	0.3207	0.3165	0.3123	0.2910	0.2867	0.2655	0.2655	0.2612	0.2740	0.2867	0.2953	0.3037 (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
Flat ent door			1.9500	1.0000	1.9500		(26)
Windows (Uw = 1.20)			13.4100	1.1450	15.3550		(27)
External Wall 1	25.1100	13.4100	11.7000	0.1200	1.4040	0.0000	0.0000 (29a)
Sheltered wall	27.0000	1.9500	25.0500	0.2100	5.2605	0.0000	0.0000 (29a)
Flat Roof	14.6000		14.6000	0.1100	1.6060	9.0000	131.4000 (30)
Total net area of external elements Aum(A, m ²)			66.7100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.5755		(33)
Party Wall 1			38.0700	0.0000	0.0000	0.0000	0.0000 (32)
Party Floor 1			56.0000			40.0000	2240.0000 (32d)
Party Ceiling 1			41.4000			30.0000	1242.0000 (32b)
Internal Wall 1			93.4200			9.0000	840.7800 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		4454.1800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							79.5389 (35)
List of Thermal Bridges							

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K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	7.1400	0.0280	0.1999
E3 Sill	6.2100	0.0240	0.1490
E4 Jamb	24.8000	0.0190	0.4712
E7 Party floor between dwellings (in blocks of flats)	19.3000	0.0360	0.6948
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	4.5000	1.0000	4.5000
E16 Corner (normal)	5.4000	0.0370	0.1998
E17 Corner (inverted - internal area greater than external area)	5.4000	-0.0790	-0.4266
E18 Party wall between dwellings	5.4000	0.0410	0.2214
E25 Staggered party wall between dwellings	5.4000	0.0300	0.1620
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	14.1000	0.0000	0.0000
E15 Flat roof with parapet	10.6000	0.3000	3.1800
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			9.3516 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	34.9270 (37)

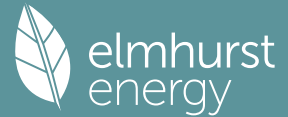
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	16.0041	15.7921	15.5800	14.5197	14.3077	13.2474	13.2474	13.0353	13.6715	14.3077	14.7318	15.1559 (38)
Average = Sum(39)m / 12 =	50.9312	50.7191	50.5070	49.4468	49.2347	48.1744	48.1744	47.9624	48.5985	49.2347	49.6588	50.0829 (39)
												49.3937
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9095	0.9057	0.9019	0.8830	0.8792	0.8603	0.8603	0.8565	0.8678	0.8792	0.8868	0.8943 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												1.8666 (42)
Hot water usage for mixer showers												
	54.1136	53.2851	52.0642	50.1859	48.5031	46.1488	44.2867	46.4636	47.5585	49.8903	52.3187	54.0648 (42a)
Hot water usage for baths												
	23.4620	23.1079	22.6040	21.8495	21.1695	20.2333	19.5231	20.3916	20.8474	21.7749	22.7393	23.4434 (42b)
Hot water usage for other uses												
	33.7458	32.5187	31.2915	30.0644	28.8373	27.6102	27.6102	28.8373	30.0644	31.2915	32.5187	33.7458 (42c)
Average daily hot water use (litres/day)												102.3214 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	111.3214	108.9116	105.9597	102.0998	98.5099	93.9923	91.4200	95.6925	98.4703	102.9568	107.5766	111.2540 (44)
Energy content (annual)	163.8843	144.1121	151.4143	133.3679	126.9399	108.6990	101.0218	112.6318	114.2206	132.6702	145.3934	163.3847 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.5827	21.6168	22.7121	20.0052	19.0410	16.3048	15.1533	16.8948	17.1331	19.9005	21.8090	24.5077 (46)
Water storage loss:												
Store volume												201.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss												
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage												
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	190.8357	168.4553	178.3657	159.4499	153.8913	134.7810	127.9732	139.5832	140.3026	159.6216	171.4754	190.3361 (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	190.8357	168.4553	178.3657	159.4499	153.8913	134.7810	127.9732	139.5832	140.3026	159.6216	171.4754	190.3361 (64)
12Total per year (kWh/year)												1915.0710 (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												
	54.4915	47.9173	50.3452	44.3448	42.2075	36.1424	33.5898	37.4501	37.9783	44.1128	48.3433	54.3254 (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	93.3297	93.3297	93.3297	93.3297	93.3297	93.3297	93.3297	93.3297	93.3297	93.3297	93.3297	93.3297 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	82.0931	90.8888	82.0931	84.8295	82.0931	84.8295	82.0931	82.0931	84.8295	82.0931	84.8295	82.0931 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	162.7587	164.4476	160.1916	151.1310	139.6936	128.9441	121.7627	120.0738	124.3298	133.3904	144.8278	155.5774 (68)
Pumps, fans	32.3330	32.3330	32.3330	32.3330	32.3330	32.3330	32.3330	32.3330	32.3330	32.3330	32.3330	32.3330 (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)	-74.6638	-74.6638	-74.6638	-74.6638	-74.6638	-74.6638	-74.6638	-74.6638	-74.6638	-74.6638	-74.6638	-74.6638 (71)
Total internal gains	73.2413	71.3055	67.6683	61.5900	56.7305	50.1978	45.1475	50.3361	52.7477	59.2915	67.1435	73.0180 (72)
	369.0920	377.6408	360.9519	348.5494	329.5161	314.9703	300.0022	303.5019	312.9060	325.7739	347.7997	361.6873 (73)

6. Solar gains						
[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	3.9900	10.6334	0.3000	0.0000	0.7700	9.8007 (74)
East	9.4200	19.6403	0.3000	0.0000	0.7700	42.7376 (76)

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Solar gains	52.5383	102.3334	169.5098	251.9244	314.9567	325.6407	308.6658	260.6233	198.3971	121.4982	65.3792	43.3157 (83)
Total gains	421.6303	479.9742	530.4617	600.4738	644.4728	640.6110	608.6680	564.1252	511.3031	447.2720	413.1789	405.0030 (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	24.2930	24.3946	24.4970	25.0223	25.1301	25.6832	25.6832	25.7967	25.4590	25.1301	24.9155	24.7045
alpha	2.6195	2.6263	2.6331	2.6682	2.6753	2.7122	2.7122	2.7198	2.6973	2.6753	2.6610	2.6470
util living area	0.9129	0.8805	0.8291	0.7261	0.5952	0.4445	0.3350	0.3720	0.5642	0.7751	0.8791	0.9195 (86)
MIT	18.8633	19.1893	19.6533	20.2464	20.6546	20.8895	20.9622	20.9493	20.7811	20.2310	19.4843	18.8337 (87)
Th 2	20.1594	20.1627	20.1659	20.1820	20.1852	20.2014	20.2014	20.2047	20.1949	20.1852	20.1788	20.1723 (88)
util rest of house	0.9038	0.8685	0.8121	0.7001	0.5585	0.3969	0.2782	0.3132	0.5149	0.7471	0.8650	0.9111 (89)
MIT 2	17.6471	18.0556	18.6331	19.3631	19.8401	20.1075	20.1764	20.1696	19.9973	19.3633	18.4419	17.6180 (90)
Living area fraction	18.1749	18.5475	19.0758	19.7464	20.1936	20.4468	20.5174	20.5079	20.3374	19.7398	18.8942	18.1455 (92)
MIT	18.1749	18.5475	19.0758	19.7464	20.1936	20.4468	20.5174	20.5079	20.3374	19.7398	18.8942	18.1455 (93)
Temperature adjustment												0.0000
adjusted MIT	18.1749	18.5475	19.0758	19.7464	20.1936	20.4468	20.5174	20.5079	20.3374	19.7398	18.8942	18.1455 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8767	0.8405	0.7864	0.6851	0.5589	0.4118	0.3010	0.3360	0.5240	0.7301	0.8386	0.8849 (94)
Useful gains	369.6478	403.4265	417.1599	411.3974	360.1861	263.8298	183.2090	189.5420	267.9037	326.5633	346.4992	358.4008 (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	706.6641	692.1903	635.1661	536.3194	418.1783	281.6685	188.7163	197.0265	303.1284	449.9960	585.6857	698.4325 (97)
Space heating kWh	250.7401	194.0493	162.1966	89.9438	43.1462	0.0000	0.0000	0.0000	0.0000	91.8339	172.2143	252.9835 (98a)
Space heating requirement - total per year (kWh/year)												1257.1078
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	250.7401	194.0493	162.1966	89.9438	43.1462	0.0000	0.0000	0.0000	0.0000	91.8339	172.2143	252.9835 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1257.1078
Space heating per m2										(98c) / (4) =		22.4484 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Fraction of main heating from main system 2												0.0000 (203)
Fraction of total heating from main system 1												1.0000 (204)
Fraction of total heating from main system 2												0.0000 (205)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	250.7401	194.0493	162.1966	89.9438	43.1462	0.0000	0.0000	0.0000	0.0000	91.8339	172.2143	252.9835 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	250.7401	194.0493	162.1966	89.9438	43.1462	0.0000	0.0000	0.0000	0.0000	91.8339	172.2143	252.9835 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Space heating fuel used, main system 2												0.0000 (213)
Water heating												
Water heating requirement	190.8357	168.4553	178.3657	159.4499	153.8913	134.7810	127.9732	139.5832	140.3026	159.6216	171.4754	190.3361 (64)
Efficiency of water heater (217)m	348.7382	348.7382	348.7382	348.7382	348.7382	348.7382	348.7382	348.7382	348.7382	348.7382	348.7382	348.7382 (216)
Fuel for water heating, kWh/month	54.7218	48.3042	51.1460	45.7219	44.1280	38.6482	36.6961	40.0252	40.2315	45.7712	49.1702	54.5785 (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	15.5728	14.0658	15.5728	15.0705	15.5728	15.0705	15.5728	15.5728	15.0705	15.5728	15.0705	15.5728 (231)
Lighting	16.9616	13.6073	12.2518	8.9762	6.9335	5.6647	6.3250	8.2214	10.6788	14.0112	15.8256	17.4331 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-9.3455	-16.2561	-28.9703	-38.2527	-44.4435	-40.5009	-39.7416	-35.1280	-27.5978	-20.1754	-11.0449	-7.6587 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-1.4871	-4.0652	-11.0271	-22.2273	-35.5514	-40.1391	-39.0033	-30.2845	-18.7702	-7.3228	-2.2607	-1.0907 (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												1257.1078 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												348.7382
Water heating fuel used												549.1428 (219)

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Space cooling fuel	0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9940)	
mechanical ventilation fans (SFP = 0.9940)	183.3572 (230a)
Total electricity for the above, kWh/year	183.3572 (231)
Electricity for lighting (calculated in Appendix L)	136.8901 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-532.3450 (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	-93.0000 (236)
Energy used	29.1000 (237)
Total delivered energy for all uses	1530.2531 (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 (high-rate cost)	1257.1078	0.1628	204.6385 (261)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000 (261)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000 (262)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating - high rate cost	19.8701	0.1480	2.9417 (264)
Water heating - low rate cost	529.2727	0.1243	65.7647 (264)
Space and water heating			273.3450 (265)
Pumps, fans and electric keep-hot	183.3572	0.1432	25.4421 (267)
Energy for lighting	136.8901	0.1490	20.3993 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-319.1154	0.1363	-43.4834
PV Unit electricity exported	-213.2295	0.1187	-25.3122
Total			-68.7956 (269)
Appendix Q item 'Kelda' - energy saved	-93.0000	0.1360	-12.6480 (270)
Appendix Q item 'Kelda' - energy used	29.1000	0.1360	3.9576 (271)
Total CO2, kg/year			241.7004 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.3200 (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 (high-rate cost)	1257.1078	1.6069	2020.0791 (275)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000 (275)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000 (276)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating - high rate cost	19.8701	1.5534	30.8662 (278)
Water heating - low rate cost	529.2727	1.4447	764.6459 (278)
Space and water heating			2815.5912 (279)
Pumps, fans and electric keep-hot	183.3572	1.5335	277.4113 (281)
Energy for lighting	136.8901	1.5547	212.8292 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-319.1154	1.5082	-481.2784
PV Unit electricity exported	-213.2295	0.4353	-92.8166
Total			-574.0950 (283)
Appendix Q item 'Kelda' - energy saved	-93.0000	1.5010	-139.5930 (284)
Appendix Q item 'Kelda' - energy used	29.1000	1.5010	43.6791 (285)
Total Primary energy kWh/year			2635.8228 (286)
Dwelling Primary energy Rate (DPER)			47.0700 (287)

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

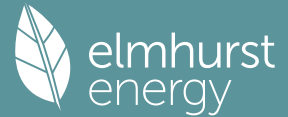
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	56.0000 (1b)	x 2.7000 (2b)	= 151.2000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.0000		(4)
Dwelling volume		(3a) + (3b) + (3c) + (3d) + (3e) ... (3n) =	151.2000 (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)

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Number of passive vents
Number of flueless gas fires

0 * 10 = 0.0000 (7b)
0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =
Pressure test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Air changes per hour
20.0000 / (5) = 0.1323 (8)
Yes
Blower Door
5.0000 (17)
0.3823 (18)
2 (19)

Shelter factor
Infiltration rate adjusted to include shelter factor

(20) = 1 - [0.075 x (19)] = 0.8500 (20)
(21) = (18) x (20) = 0.3249 (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 infiltr 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	0.4143	0.4062	0.3980	0.3574	0.3493	0.3087	0.3087	0.3006	0.3249	0.3493	0.3656	0.3818 (22b)
	0.5858	0.5825	0.5792	0.5639	0.5610	0.5476	0.5476	0.5452	0.5528	0.5610	0.5668	0.5729 (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)			12.0600	1.1450	13.8092		(27)
External Wall 1	25.1100	12.0600	13.0500	0.1800	2.3490		(29a)
Sheltered wall	27.0000	1.9500	25.0500	0.1800	4.5090		(29a)
Flat Roof	14.6000		14.6000	0.1100	1.6060		(30)
Total net area of external elements Aum(A, m2)			66.7100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	24.2232		(33)
Party Wall 1			38.0700	0.0000	0.0000		(32)

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

86.9318 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	7.1400	0.0500	0.3570
E3 Sill	6.2100	0.0500	0.3105
E4 Jamb	24.8000	0.0500	1.2400
E7 Party floor between dwellings (in blocks of flats)	19.3000	0.0700	1.3510
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	4.5000	0.0200	0.0900
E16 Corner (normal)	5.4000	0.0900	0.4860
E17 Corner (inverted - internal area greater than external area)	5.4000	-0.0900	-0.4860
E18 Party wall between dwellings	5.4000	0.0600	0.3240
E25 Staggered party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	14.1000	0.0000	0.0000
E15 Flat roof with parapet	10.6000	0.5600	5.9360

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

9.9325 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 34.1557 (37)

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

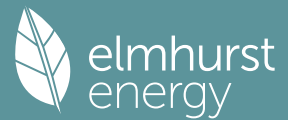
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	29.2300	29.0637	28.9007	28.1352	27.9920	27.3252	27.3252	27.2018	27.5821	27.9920	28.2817	28.5846 (38)
Average = Sum(39)m / 12 =	63.3857	63.2194	63.0564	62.2909	62.1476	61.4809	61.4809	61.3574	61.7377	62.1476	62.4374	62.7403 (39)
												62.2902

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1319	1.1289	1.1260	1.1123	1.1098	1.0979	1.0979	1.0957	1.1025	1.1098	1.1150	1.1204 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.8666 (42)
Hot water usage for mixer showers													
55.5162	54.6819	53.4661	51.1400	49.4234	47.5091	46.4210	47.6275	48.9501	51.0055	53.3816	55.3035	55.3035	(42a)
Hot water usage for baths													
23.9970	23.6406	23.1387	22.2134	21.5205	20.7522	20.3372	20.8355	21.3781	22.2003	23.1447	23.9159	23.9159	(42b)
Hot water usage for other uses													
33.7458	32.5187	31.2915	30.0644	28.8373	27.6102	27.6102	28.8373	30.0644	31.2915	32.5187	33.7458	33.7458	(42c)
Average daily hot water use (litres/day)													104.1111 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
113.2590	110.8412	107.8964	103.4179	99.7812	95.8715	94.3684	97.3004	100.3927	104.4974	109.0450	112.9651	112.9651	(44)
Energy content (annual)	179.3745	157.8363	165.8328	141.5739	134.3247	117.8852	114.1303	120.4782	123.7942	141.8019	155.3545	176.8761	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =	1729.2628		
26.9062	23.6755	24.8749	21.2361	20.1487	17.6828	17.1196	18.0717	18.5691	21.2703	23.3032	26.5314	26.5314	(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	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	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													
225.9694	199.9221	212.4277	186.6657	180.9196	162.9770	160.7252	167.0731	168.8861	188.3968	200.4464	223.4710	223.4710	(62)
WWHRS	-25.3797	-22.4460	-23.5042	-19.4624	-18.1382	-15.5210	-14.5485	-15.4708	-16.0586	-18.9314	-21.4469	-24.9097	(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													
200.5897	177.4761	188.9235	167.2034	162.7814	147.4560	146.1768	151.6022	152.8274	169.4655	178.9994	198.5613	198.5613	(64)
											</		

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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	96.9180	86.1492	92.4153	83.1468	81.9389	75.2703	75.2243	77.3349	77.2351	84.4251	87.7289	96.0872 (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	93.3297	93.3297	93.3297	93.3297	93.3297	93.3297	93.3297	93.3297	93.3297	93.3297	93.3297	93.3297	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	82.1933	90.9998	82.1933	84.9331	82.1933	84.9331	82.1933	82.1933	84.9331	82.1933	84.9331	82.1933	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	162.7587	164.4476	160.1916	151.1310	139.6936	128.9441	121.7627	120.0738	124.3298	133.3904	144.8278	155.5774	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.3330	32.3330	32.3330	32.3330	32.3330	32.3330	32.3330	32.3330	32.3330	32.3330	32.3330	32.3330	(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)	-74.6638	-74.6638	-74.6638	-74.6638	-74.6638	-74.6638	-74.6638	-74.6638	-74.6638	-74.6638	-74.6638	-74.6638	(71)
Water heating gains (Table 5)	130.2661	128.1982	124.2142	115.4816	110.1329	104.5421	101.1079	103.9448	107.2709	113.4745	121.8456	129.1495	(72)
Total internal gains	429.2170	437.6444	420.5980	405.5447	386.0188	369.4182	356.0628	357.2108	367.5328	383.0572	405.6055	420.9191	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access Factor Table 6d	Gains W
North					3.5900	10.6334	0.6300	0.7000			0.7700	11.6664 (74)
East					8.4700	19.6403	0.6300	0.7000			0.7700	50.8396 (76)
Solar gains	62.5061	121.7483	201.6701	299.7238	374.7196	387.4329	367.2360	310.0746	236.0389	144.5490	77.7831	51.5338 (83)
Total gains	491.7231	559.3927	622.2680	705.2684	760.7384	756.8510	723.2989	667.2854	603.5716	527.6062	483.3886	472.4529 (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)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	21.0000 (85)
tau	21.3340	21.3902	21.4454	21.7090	21.7590	21.9950	21.9950	22.0393	21.9035	21.7590	21.6581	21.5535	
alpha	2.4223	2.4260	2.4297	2.4473	2.4506	2.4663	2.4663	2.4693	2.4602	2.4506	2.4439	2.4369	
util living area	0.9099	0.8790	0.8289	0.7331	0.6078	0.4644	0.3526	0.3923	0.5800	0.7782	0.8777	0.9166	(86)
MIT	18.5681	18.9041	19.4106	20.0511	20.5360	20.8308	20.9376	20.9173	20.6945	20.0539	19.2234	18.5182	(87)
Th 2	19.9749	19.9773	19.9797	19.9908	19.9929	20.0026	20.0026	20.0044	19.9988	19.9929	19.9886	19.9842	(88)
util rest of house	0.8990	0.8648	0.8088	0.7025	0.5636	0.4046	0.2794	0.3166	0.5198	0.7452	0.8611	0.9065	(89)
MIT 2	17.1588	17.5778	18.2055	18.9858	19.5469	19.8684	19.9660	19.9532	19.7383	19.0114	17.9921	17.1019	(90)
Living area fraction	17.7703	18.1533	18.7284	19.4481	19.9761	20.2860	20.3876	20.3716	20.1532	19.4638	18.5264	17.7165	(91)
MIT	17.7703	18.1533	18.7284	19.4481	19.9761	20.2860	20.3876	20.3716	20.1532	19.4638	18.5264	17.7165	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.7703	18.1533	18.7284	19.4481	19.9761	20.2860	20.3876	20.3716	20.1532	19.4638	18.5264	17.7165	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.8687	0.8336	0.7799	0.6844	0.5628	0.4222	0.3083	0.3453	0.5296	0.7253	0.8313	0.8771	(94)
Useful gains	427.1669	466.3001	485.2802	482.6669	428.1771	319.5198	223.0238	230.4228	319.6625	382.6981	401.8501	414.3778	(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	853.8265	837.8670	771.0800	657.0478	514.3404	349.5790	232.8646	243.6842	373.7108	550.8639	713.4350	848.0277	(97)
Space heating kWh	317.4348	249.6930	212.6350	125.5543	64.1055	0.0000	0.0000	0.0000	0.0000	125.1153	224.3411	322.6356	(98a)
Space heating requirement - total per year (kWh/year)												1641.5144	
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	317.4348	249.6930	212.6350	125.5543	64.1055	0.0000	0.0000	0.0000	0.0000	125.1153	224.3411	322.6356	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1641.5144	
Space heating per m ²										(98c) / (4) =		29.3128	(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	
	317.4348	249.6930	212.6350	125.5543	64.1055	0.0000	0.0000	0.0000	0.0000	125.1153	224.3411	322.6356	(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)	343.9163	270.5232	230.3738	136.0284	69.4534	0.0000	0.0000	0.0000	0.0000	135.5529	243.0565	349.5510	(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)													

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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)
	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	200.5897	177.4761	188.9235	167.2034	162.7814	147.4560	146.1768	151.6022	152.8274	169.4655	178.9994	198.5613 (64)
Efficiency of water heater	85.0842	84.8253	84.3256	83.4262	82.1525	79.8000	79.8000	79.8000	79.8000	83.3896	84.5673	79.8000 (216)
Fuel for water heating, kWh/month	235.7543	209.2254	224.0406	200.4206	198.1453	184.7819	183.1789	189.9777	191.5131	203.2213	211.6652	85.1417 (217)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	17.0782	13.7007	12.3360	9.0379	6.9811	5.7036	6.3684	8.2779	10.7522	14.1074	15.9343	17.5528 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-26.5624	-37.6406	-54.4013	-61.5455	-66.7291	-62.4613	-61.7271	-58.1105	-51.7582	-43.2459	-29.2845	-22.9453 (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	-14.4351	-30.4287	-60.5776	-91.1113	-120.5726	-121.1440	-119.6817	-101.2593	-74.1461	-43.5170	-19.2774	-11.4073 (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												1778.4555 (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												2465.1371 (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)												137.8305 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1383.9702 (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												3083.4529 (238)

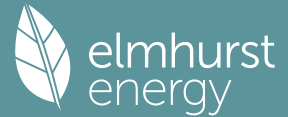
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1778.4555	0.2100	373.4757 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2465.1371	0.2100	517.6788 (264)
Space and water heating			891.1544 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	137.8305	0.1443	19.8932 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-576.4118	0.1344	-77.4983
PV Unit electricity exported	-807.5584	0.1259	-101.6414
Total			-179.1396 (269)
Total CO2, kg/year			743.8373 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.2800 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1778.4555	1.1300	2009.6547 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2465.1371	1.1300	2785.6049 (278)
Space and water heating			4795.2596 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	137.8305	1.5338	211.4090 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-576.4118	1.4969	-862.8276
PV Unit electricity exported	-807.5584	0.4620	-373.0932
Total			-1235.9208 (283)
Total Primary energy kWh/year			3900.8486 (286)
Target Primary Energy Rate (TPER)			69.6600 (287)

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Property Reference	P2.11 Latimer			Issued on Date	03/12/2024
Assessment Reference	P2.11 Latimer 2B3P	Prop Type Ref	2nd Mid 1B2P		
Property	2.11, Latimer Road, Wokingham				
SAP Rating	82 B	DER	4.83	TER	13.61
Environmental	96 A	% DER < TER			64.51
CO ₂ Emissions (t/year)	0.25	DFEE	39.90	TFEE	43.12
Compliance Check	See BREL	% DFEE < TFEE			7.45
% DPER < TPER	27.84	DPER	51.49	TPER	71.36
Assessor Details	Mrs. Rebecca Lennon			Assessor ID	P627-0001
Client	RHB, RHB				

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	66.0000	2.7000	178.2000
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.0000		
Dwelling volume			178.2000

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)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.2000 (23c)
Effective ac	0.3207	0.3165	0.3123	0.2910	0.2867	0.2655	0.2655	0.2612	0.2740	0.2867	0.2953	0.3037 (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
Flat ent door			1.9500	1.0000	1.9500		(26)
Windows (Uw = 1.20)			15.7100	1.1450	17.9885		(27)
External Wall 1	69.3900	15.7100	53.6800	0.1200	6.4416	0.0000	0.0000 (29a)
Sheltered wall	10.8000	1.9500	8.8500	0.2100	1.8585	0.0000	0.0000 (29a)
Flat Roof	32.5000		32.5000	0.1100	3.5750	9.0000	292.5000 (30)
Total net area of external elements Aum(A, m ²)			112.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.8136		(33)
Party Wall 1			14.8500	0.0000	0.0000	0.0000	0.0000 (32)
Party Floor 1			66.0000			40.0000	2640.0000 (32d)
Party Ceiling 1			33.5000			30.0000	1005.0000 (32b)
Internal Wall 1			121.5000			9.0000	1093.5000 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		5031.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							76.2273 (35)
List of Thermal Bridges							

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K1 Element	Length	Psi-value	Total
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	5.0000	1.0000	5.0000
E16 Corner (normal)	13.5000	0.0370	0.4995
E17 Corner (inverted - internal area greater than external area)	5.4000	-0.0790	-0.4266
E25 Staggered party wall between dwellings	5.4000	0.0300	0.1620
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.0000	0.0000	0.0000
E2 Other lintels (including other steel lintels)	7.8300	0.0280	0.2192
E3 Sill	6.9000	0.0240	0.1656
E4 Jamb	21.9000	0.0190	0.4161
E7 Party floor between dwellings (in blocks of flats)	29.7000	0.0360	1.0692
E15 Flat roof with parapet	19.8000	0.3000	5.9400
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			13.0450 (36)
Point Thermal Bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	44.8587 (37)

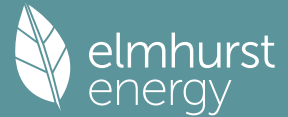
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	18.8620	18.6121	18.3622	17.1125	16.8626	15.6130	15.6130	15.3631	16.1128	16.8626	17.3625	17.8623	(38)
Heat transfer coeff	63.7207	63.4708	63.2209	61.9712	61.7213	60.4717	60.4717	60.2218	60.9715	61.7213	62.2212	62.7210	(39)
Average = Sum(39)m / 12 =												61.9088	
HLP	0.9655	0.9617	0.9579	0.9390	0.9352	0.9162	0.9162	0.9125	0.9238	0.9352	0.9427	0.9503	(40)
HLP (average)												0.9380	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)													
Assumed occupancy													2.1452 (42)
Hot water usage for mixer showers	58.6677	57.7695	56.4458	54.4095	52.5850	50.0326	48.0138	50.3739	51.5609	54.0890	56.7217	58.6148	(42a)
Hot water usage for baths	25.4264	25.0426	24.4966	23.6789	22.9419	21.9274	21.1577	22.0989	22.5928	23.5980	24.6432	25.4063	(42b)
Hot water usage for other uses	36.5995	35.2686	33.9377	32.6068	31.2759	29.9450	29.9450	31.2759	32.6068	33.9377	35.2686	36.5995	(42c)
Average daily hot water use (litres/day)												110.9356	(43)
Daily hot water use	120.6936	118.0807	114.8800	110.6951	106.8028	101.9050	99.1165	103.7487	106.7605	111.6247	116.6335	120.6205	(44)
Energy conte	177.6818	156.2446	164.1612	144.5955	137.6262	117.8497	109.5267	122.1141	123.8369	143.8397	157.6340	177.1401	(45)
Energy content (annual)										Total = Sum(45)m =		1732.2505	
Distribution loss (46)m = 0.15 x (45)m	26.6523	23.4367	24.6242	21.6893	20.6439	17.6775	16.4290	18.3171	18.5755	21.5760	23.6451	26.5710	(46)
Water storage loss:													
Store volume												201.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8694	(55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	204.6332	180.5878	191.1126	170.6775	164.5776	143.9317	136.4781	149.0655	149.9189	170.7911	183.7160	204.0915	(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	204.6332	180.5878	191.1126	170.6775	164.5776	143.9317	136.4781	149.0655	149.9189	170.7911	183.7160	204.0915	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2049.5815	(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	59.0792	51.9513	54.5836	48.0780	45.7607	39.1850	36.4176	40.6029	41.1758	47.8267	52.4133	58.8991	(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	107.2623	107.2623	107.2623	107.2623	107.2623	107.2623	107.2623	107.2623	107.2623	107.2623	107.2623	107.2623	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	94.7172	104.8655	94.7172	97.8745	94.7172	97.8745	94.7172	94.7172	97.8745	94.7172	97.8745	94.7172	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	187.7875	189.7362	184.8256	174.3717	161.1755	148.7729	140.4872	138.5386	143.4491	153.9031	167.0993	179.5018	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.7262	33.7262	33.7262	33.7262	33.7262	33.7262	33.7262	33.7262	33.7262	33.7262	33.7262	33.7262	(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)	-85.8098	-85.8098	-85.8098	-85.8098	-85.8098	-85.8098	-85.8098	-85.8098	-85.8098	-85.8098	-85.8098	-85.8098	(71)
Water heating gains (Table 5)	79.4075	77.3085	73.3651	66.7750	61.5063	54.4237	48.9484	54.5738	57.1886	64.2832	72.7963	79.1654	(72)
Total internal gains	417.0910	427.0889	408.0866	394.1999	372.5778	356.2497	339.3316	343.0084	353.6908	368.0822	392.9487	408.5632	(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
East	5.8500	19.6403	0.3000	0.0000	0.7700	26.5409 (76)
West	9.8600	19.6403	0.3000	0.0000	0.7700	44.7338 (80)

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Solar gains	71.2747	139.4285	229.6188	334.8853	410.4146	420.1323	399.9831	343.5796	267.0562	165.4436	88.8712	58.6129 (83)
Total gains	488.3657	566.5173	637.7054	729.0852	782.9923	776.3821	739.3147	686.5879	620.7470	533.5258	481.8199	467.1760 (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	21.9316	22.0180	22.1050	22.5508	22.6421	23.1100	23.1100	23.2059	22.9205	22.6421	22.4602	22.2812	
alpha	2.4621	2.4679	2.4737	2.5034	2.5095	2.5407	2.5407	2.5471	2.5280	2.5095	2.4973	2.4854	
util living area	0.9147	0.8806	0.8269	0.7245	0.5978	0.4519	0.3422	0.3786	0.5683	0.7777	0.8820	0.9217 (86)	
MIT	18.5946	18.9591	19.4780	20.1265	20.5818	20.8560	20.9481	20.9320	20.7304	20.1038	19.2689	18.5561 (87)	
Th 2	20.1122	20.1154	20.1186	20.1345	20.1377	20.1537	20.1537	20.1569	20.1473	20.1377	20.1313	20.1249 (88)	
util rest of house	0.9057	0.8685	0.8094	0.6979	0.5599	0.4018	0.2816	0.3162	0.5171	0.7493	0.8680	0.9133 (89)	
MIT 2	17.2863	17.7432	18.3891	19.1867	19.7204	20.0316	20.1196	20.1101	19.9044	19.1806	18.1490	17.2456 (90)	
Living area fraction									fLA = Living area / (4) =				0.4455 (91)
MIT	17.8691	18.2848	18.8741	19.6053	20.1041	20.3988	20.4886	20.4762	20.2723	19.5918	18.6479	17.8294 (92)	
Temperature adjustment												0.0000	
adjusted MIT	17.8691	18.2848	18.8741	19.6053	20.1041	20.3988	20.4886	20.4762	20.2723	19.5918	18.6479	17.8294 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8763	0.8376	0.7807	0.6801	0.5584	0.4167	0.3060	0.3404	0.5250	0.7290	0.8387	0.8850 (94)
Useful gains	427.9317	474.5107	497.8333	495.8584	437.2034	323.5134	226.2643	233.6843	325.8900	388.9472	404.1004	413.4441 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	14.0000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	864.6333	849.5456	782.3023	663.4237	518.7137	350.6649	235.1510	245.4761	376.3372	554.9877	718.5210	854.8502 (97)
Space heating kWh	324.9060	252.0234	211.6449	120.6471	60.6437	0.0000	0.0000	0.0000	0.0000	123.5341	226.3828	328.4062 (98a)
Space heating requirement - total per year (kWh/year)												1648.1883
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	324.9060	252.0234	211.6449	120.6471	60.6437	0.0000	0.0000	0.0000	0.0000	123.5341	226.3828	328.4062 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1648.1883
Space heating per m2										(98c) / (4) =		24.9725 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Fraction of main heating from main system 2													0.0000 (203)
Fraction of total heating from main system 1													1.0000 (204)
Fraction of total heating from main system 2													0.0000 (205)
Efficiency of main space heating system 1 (in %)													100.0000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	324.9060	252.0234	211.6449	120.6471	60.6437	0.0000	0.0000	0.0000	0.0000	123.5341	226.3828	328.4062 (98)	
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)	
Space heating fuel (main heating system)	324.9060	252.0234	211.6449	120.6471	60.6437	0.0000	0.0000	0.0000	0.0000	123.5341	226.3828	328.4062 (211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)	
Space heating fuel used, main system 2												0.0000 (213)	
Water heating													
Water heating requirement	204.6332	180.5878	191.1126	170.6775	164.5776	143.9317	136.4781	149.0655	149.9189	170.7911	183.7160	204.0915 (64)	
Efficiency of water heater (217)m	346.0104	346.0104	346.0104	346.0104	346.0104	346.0104	346.0104	346.0104	346.0104	346.0104	346.0104	346.0104 (216)	
Fuel for water heating, kWh/month	59.1408	52.1914	55.2332	49.3273	47.5644	41.5975	39.4433	43.0812	43.3279	49.3601	53.0955	58.9842 (219)	
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)	
Pumps and Fa	18.3537	16.5775	18.3537	17.7616	18.3537	17.7616	18.3537	18.3537	17.7616	18.3537	17.7616	18.3537 (231)	
Lighting	20.8229	16.7049	15.0409	11.0196	8.5119	6.9543	7.7648	10.0930	13.1098	17.2008	19.4283	21.4017 (232)	
Electricity generated by PVs (Appendix M) (negative quantity)	-9.4838	-16.6150	-29.8740	-39.9090	-46.7866	-42.4571	-41.6464	-36.6637	-28.6094	-20.7737	-11.2511	-7.7619 (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)	-1.3488	-3.7063	-10.1235	-20.5710	-33.2083	-38.1829	-37.0986	-28.7488	-17.7586	-6.7246	-2.0545	-0.9875 (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												1648.1883 (211)	
Space heating fuel - main system 2												0.0000 (213)	
Space heating fuel - secondary												0.0000 (215)	
Efficiency of water heater												346.0104	
Water heating fuel used												592.3468 (219)	
Space cooling fuel												0.0000 (221)	

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Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9940)	
mechanical ventilation fans (SFP = 0.9940)	216.0996 (230a)
Total electricity for the above, kWh/year	216.0996 (231)
Electricity for lighting (calculated in Appendix L)	168.0530 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-532.3450 (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	-101.7000 (236)
Energy used	29.3000 (237)
Total delivered energy for all uses	2019.9427 (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 (high-rate cost)	1648.1883	0.1626	268.0309 (261)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000 (261)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000 (262)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating - high rate cost	24.6950	0.1481	3.6568 (264)
Water heating - low rate cost	567.6518	0.1243	70.5491 (264)
Space and water heating			342.2369 (265)
Pumps, fans and electric keep-hot	216.0996	0.1432	29.9854 (267)
Energy for lighting	168.0530	0.1490	25.0432 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-331.8317	0.1361	-45.1709
PV Unit electricity exported	-200.5133	0.1183	-23.7287
Total			-68.8996 (269)
Appendix Q item 'Kelda' - energy saved	-101.7000	0.1360	-13.8312 (270)
Appendix Q item 'Kelda' - energy used	29.3000	0.1360	3.9848 (271)
Total CO2, kg/year			318.5195 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.8300 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1 (high-rate cost)	1648.1883	1.6063	2647.5521 (275)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000 (275)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000 (276)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating - high rate cost	24.6950	1.5535	38.3640 (278)
Water heating - low rate cost	567.6518	1.4448	820.1553 (278)
Space and water heating			3506.0714 (279)
Pumps, fans and electric keep-hot	216.0996	1.5335	326.9490 (281)
Energy for lighting	168.0530	1.5547	261.2794 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-331.8317	1.5077	-500.2918
PV Unit electricity exported	-200.5133	0.4339	-87.0008
Total			-587.2926 (283)
Appendix Q item 'Kelda' - energy saved	-101.7000	1.5010	-152.6517 (284)
Appendix Q item 'Kelda' - energy used	29.3000	1.5010	43.9793 (285)
Total Primary energy kWh/year			3398.3348 (286)
Dwelling Primary energy Rate (DPER)			51.4900 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET EMISSIONS

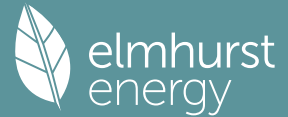
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	66.0000 (1b)	x 2.7000 (2b)	= 178.2000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	178.2000 (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)

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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) =

Air changes per hour
20.0000 / (5) = 0.1122 (8)

Pressure test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Yes
Blower Door
5.0000 (17)
0.3622 (18)
2 (19)

Shelter factor

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

Infiltration rate adjusted to include shelter factor

(21) = (18) x (20) = 0.3079 (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	0.3926	0.3849	0.3772	0.3387	0.3310	0.2925	0.2925	0.2848	0.3079	0.3310	0.3464	0.3618 (22b)
Effective ac	0.5771	0.5741	0.5711	0.5574	0.5548	0.5428	0.5428	0.5406	0.5474	0.5548	0.5600	0.5654 (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)			14.5500	1.1450	16.6603		(27)
External Wall 1	69.3900	14.5500	54.8400	0.1800	9.8712		(29a)
Sheltered wall	10.8000	1.9500	8.8500	0.1800	1.5930		(29a)
Flat Roof	32.5000		32.5000	0.1100	3.5750		(30)
Total net area of external elements Aum(A, m2)			112.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.6495		(33)
Party Wall 1			14.8500	0.0000	0.0000		(32)

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

81.3030 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	5.0000	0.0200	0.1000
E16 Corner (normal)	13.5000	0.0900	1.2150
E17 Corner (inverted - internal area greater than external area)	5.4000	-0.0900	-0.4860
E25 Staggered party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.0000	0.0000	0.0000
E2 Other lintels (including other steel lintels)	7.8300	0.0500	0.3915
E3 Sill	6.9000	0.0500	0.3450
E4 Jamb	21.9000	0.0500	1.0950
E7 Party floor between dwellings (in blocks of flats)	29.7000	0.0700	2.0790
E15 Flat roof with parapet	19.8000	0.5600	11.0880

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

16.1515 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 49.8010 (37)

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

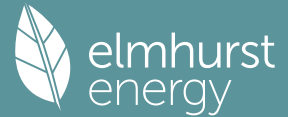
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	33.9343	33.7584	33.5859	32.7758	32.6242	31.9187	31.9187	31.7880	32.1904	32.6242	32.9309	33.2514 (38)
Heat transfer coeff	83.7353	83.5594	83.3869	82.5768	82.4252	81.7197	81.7197	81.5890	81.9915	82.4252	82.7319	83.0524 (39)
Average = Sum(39)m / 12 =												82.5761

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2687	1.2661	1.2634	1.2512	1.2489	1.2382	1.2382	1.2362	1.2423	1.2489	1.2535	1.2584 (40)
HLP (average)												1.2512
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.1452 (42)
Hot water usage for mixer showers	60.1883	59.2838	57.9658	55.4439	53.5828	51.5074	50.3277	51.6358	53.0697	55.2981	57.8741	59.9577 (42a)	
Hot water usage for baths	26.0062	25.6199	25.0761	24.0732	23.3223	22.4897	22.0399	22.5800	23.1681	24.0590	25.0825	25.9183 (42b)	
Hot water usage for other uses	36.5995	35.2686	33.9377	32.6068	31.2759	29.9450	29.9450	31.2759	32.6068	33.9377	35.2686	36.5995 (42c)	
Average daily hot water use (litres/day)												112.8757 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	122.7940	120.1723	116.9795	112.1239	108.1810	103.9421	102.3126	105.4917	108.8445	113.2948	118.2252	122.4754 (44)	
Energy conte	194.4756	171.1238	179.7931	153.4920	145.6325	127.8089	123.7383	130.6207	134.2162	153.7399	168.4334	191.7669 (45)	
Energy content (annual)										Total = Sum(45)m =		1874.8415	
Distribution loss (46)m = 0.15 x (45)m	29.1713	25.6686	26.9690	23.0238	21.8449	19.1713	18.5607	19.5931	20.1324	23.0610	25.2650	28.7650 (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	241.0705	213.2095	226.3880	198.5839	192.2274	172.9007	170.3332	177.2156	179.3080	200.3348	213.5253	238.3618 (62)	
WWHRS	-27.5156	-24.3350	-25.4822	-21.1003	-19.6647	-16.8272	-15.7728	-16.7728	-17.4101	-20.5246	-23.2519	-27.0060 (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	213.5549	188.8745	200.9058	177.4836	172.5627	156.0735	154.5603	160.4428	161.8979	179.8102	190.2734	211.3558 (64)	
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2167.7955 (64)	
Electric shower(s)												2168 (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)	

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Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	101.9391	90.5672	97.0571	87.1096	85.6987	78.5699	78.4189	80.7073	80.7004	88.3945	92.0776	101.0384 (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	107.2623	107.2623	107.2623	107.2623	107.2623	107.2623	107.2623	107.2623	107.2623	107.2623	107.2623	107.2623	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	94.7438	104.8949	94.7438	97.9019	94.7438	97.9019	94.7438	94.7438	97.9019	94.7438	97.9019	94.7438	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	187.7875	189.7362	184.8256	174.3717	161.1755	148.7729	140.4872	138.5386	143.4491	153.9031	167.0993	179.5018	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.7262	33.7262	33.7262	33.7262	33.7262	33.7262	33.7262	33.7262	33.7262	33.7262	33.7262	33.7262	(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)	-85.8098	-85.8098	-85.8098	-85.8098	-85.8098	-85.8098	-85.8098	-85.8098	-85.8098	-85.8098	-85.8098	-85.8098	(71)
Water heating gains (Table 5)	137.0149	134.7727	130.4531	120.9855	115.1865	109.1249	105.4017	108.4776	112.0838	118.8097	127.8855	135.8043	(72)
Total internal gains	477.7249	487.5825	468.2013	451.4379	429.2845	410.9785	395.8115	396.9387	408.6136	425.6353	451.0654	468.2287	(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
East					5.4200	19.6403	0.6300	0.7000			0.7700	32.5326 (76)
West					9.1300	19.6403	0.6300	0.7000			0.7700	54.8012 (80)
Solar gains	87.3338	170.8434	281.3547	410.3390	502.8859	514.7932	490.1041	420.9922	327.2271	202.7200	108.8949	71.8190 (83)
Total gains	565.0587	658.4258	749.5560	861.7769	932.1703	925.7716	885.9156	817.9308	735.8407	628.3553	559.9604	540.0477 (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	17.8008	17.8383	17.8752	18.0505	18.0837	18.2399	18.2399	18.2691	18.1794	18.0837	18.0167	17.9472	
alpha	2.1867	2.1892	2.1917	2.2034	2.2056	2.2160	2.2160	2.2179	2.2120	2.2056	2.2011	2.1965	
util living area	0.9130	0.8810	0.8297	0.7370	0.6186	0.4825	0.3713	0.4108	0.5946	0.7866	0.8831	0.9199	(86)
MIT	18.0639	18.4514	19.0425	19.7808	20.3634	20.7430	20.8969	20.8677	20.5691	19.7833	18.8067	17.9992	(87)
Th 2	19.8654	19.8675	19.8696	19.8793	19.8811	19.8896	19.8896	19.8912	19.8863	19.8811	19.8774	19.8736	(88)
util rest of house	0.9021	0.8665	0.8089	0.7051	0.5717	0.4165	0.2881	0.3256	0.5300	0.7526	0.8664	0.9099	(89)
MIT 2	16.4842	16.9668	17.6985	18.5965	19.2739	19.6884	19.8308	19.8113	19.5226	18.6268	17.4258	16.4069	(90)
Living area fraction									fLA = Living area / (4) =			0.4455	(91)
MIT	17.1879	17.6281	18.2972	19.1240	19.7592	20.1582	20.3057	20.2818	19.9888	19.1420	18.0409	17.1162	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.1879	17.6281	18.2972	19.1240	19.7592	20.1582	20.3057	20.2818	19.9888	19.1420	18.0409	17.1162	(93)

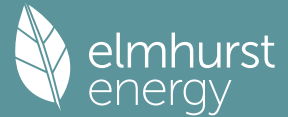
8. Space heating requirement

Utilisation	0.8674	0.8298	0.7739	0.6807	0.5662	0.4332	0.3203	0.3569	0.5364	0.7262	0.8312	0.8762	(94)
Useful gains	490.1224	546.3544	580.0474	586.6468	527.7887	401.0782	283.7549	291.8797	394.6854	456.3125	465.4405	473.2010	(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	1079.1736	1063.5541	983.7333	844.2684	664.2837	454.2129	302.8285	316.7160	482.8306	704.0733	905.1649	1072.7181	(97)
Space heating kWh	438.2541	347.5582	300.3423	185.4876	101.5523	0.0000	0.0000	0.0000	0.0000	184.3340	316.6016	446.0408	(98a)
Space heating requirement - total per year (kWh/year)												2320.1707	
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	438.2541	347.5582	300.3423	185.4876	101.5523	0.0000	0.0000	0.0000	0.0000	184.3340	316.6016	446.0408	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2320.1707	
Space heating per m ²										(98c) / (4) =		35.1541	(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	438.2541	347.5582	300.3423	185.4876	101.5523	0.0000	0.0000	0.0000	0.0000	184.3340	316.6016	446.0408	(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)	474.8148	376.5527	325.3979	200.9616	110.0242	0.0000	0.0000	0.0000	0.0000	199.7118	343.0136	483.2511	(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)													

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	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	213.5549	188.8745	200.9058	177.4836	172.5627	156.0735	154.5603	160.4428	161.8979	179.8102	190.2734	211.3558	(64)
Efficiency of water heater	85.6357	85.4084	84.9595	84.1589	82.9132	79.8000	79.8000	79.8000	79.8000	84.1156	85.1932	85.6928	(216)
(217)m													(217)
Fuel for water heating, kWh/month	249.3762	221.1427	236.4725	210.8912	208.1244	195.5808	193.6846	201.0561	202.8796	213.7657	223.3434	246.6436	(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	19.6859	15.7928	14.2196	10.4179	8.0471	6.5745	7.3408	9.5419	12.3940	16.2615	18.3674	20.2330	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-31.0759	-43.9183	-63.2968	-71.3863	-77.1876	-72.1479	-71.2728	-67.1849	-59.9961	-50.3288	-34.2081	-26.8557	(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	-17.2426	-36.3062	-72.2141	-108.5307	-143.5608	-144.2440	-142.5305	-120.6439	-88.3912	-51.9275	-23.0257	-13.6313	(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												2513.7278	(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												2602.9609	(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)												158.8764	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1631.1077	(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												3730.4575	(238)

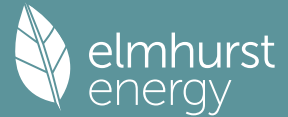
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2513.7278	0.2100	527.8828 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2602.9609	0.2100	546.6218 (264)
Space and water heating			1074.5046 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	158.8764	0.1443	22.9308 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-668.8593	0.1345	-89.9746
PV Unit electricity exported	-962.2484	0.1259	-121.1280
Total			-211.1026 (269)
Total CO2, kg/year			898.2621 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.6100 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2513.7278	1.1300	2840.5124 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2602.9609	1.1300	2941.3459 (278)
Space and water heating			5781.8582 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	158.8764	1.5338	243.6900 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-668.8593	1.4972	-1001.3876
PV Unit electricity exported	-962.2484	0.4621	-444.6227
Total			-1446.0104 (283)
Total Primary energy kWh/year			4709.6387 (286)
Target Primary Energy Rate (TPER)			71.3600 (287)

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Property Reference	P3.02 Latimer			Issued on Date	03/12/2024
Assessment Reference	P3.02 Latimer 1B2P	Prop Type Ref	3rd End 2B3P		
Property	3.02, Latimer Road, Wokingham				
SAP Rating	82 B	DER	5.08	TER	15.67
Environmental	97 A	% DER < TER			67.58
CO ₂ Emissions (t/year)	0.2	DFEE	41.71	TFEE	39.53
Compliance Check	See BREL	% DFEE < TFEE			-5.52
% DPER < TPER	33.38	DPER	55.36	TPER	83.09
Assessor Details	Mrs. Rebecca Lennon			Assessor ID	P627-0001
Client	RHB, RHB				

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	50.0000 (1b)	2.7000 (2b)	135.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000		135.0000 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	135.0000 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	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)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.2000 (23c)
Effective ac	0.3207	0.3165	0.3123	0.2910	0.2867	0.2655	0.2655	0.2612	0.2740	0.2867	0.2953	0.3037 (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
Flat ent door			1.9500	1.0000	1.9500		(26)
Windows (Uw = 1.10)			8.5200	1.0536	8.9770		(27)
External Wall 1	30.2400	8.5200	21.7200	0.1200	2.6064	0.0000	0.0000 (29a)
Sheltered wall	31.5900	1.9500	29.6400	0.2100	6.2244	0.0000	0.0000 (29a)
Flat Roof	50.0000		50.0000	0.1100	5.5000	9.0000	450.0000 (30)
Total net area of external elements Aum(A, m ²)			111.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.2578		(33)
Party Wall 1			28.6200	0.0000	0.0000	0.0000	0.0000 (32)
Party Floor 1			50.0000			40.0000	2000.0000 (32d)
Internal Wall 1			78.3000			9.0000	704.7000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	3154.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							63.0940 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	

elmhurst
energy

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)m \times (5)$												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	14.2894	14.1001	13.9107	12.9641	12.7747	11.8280	11.8280	11.6387	12.2067	12.7747	13.1534	13.5321 (38)
Heat transfer coeff												
	50.7668	50.5774	50.3881	49.4414	49.2521	48.3054	48.3054	48.1160	48.6841	49.2521	49.6307	50.0094 (39)
Average = Sum(39)m / 12 =												49.3941
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1.0153	1.0115	1.0078	0.9888	0.9850	0.9661	0.9661	0.9623	0.9737	0.9850	0.9926	1.0002 (40)
HLP (average)												0.9879
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

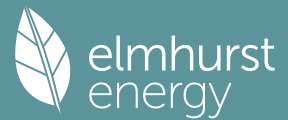
4. Water heating energy requirements (kWh/year)												
Assumed occupancy												1.6901 (42)
Hot water usage for mixer showers	51.2291	50.4448	49.2889	47.5108	45.9176	43.6888	41.9260	43.9869	45.0234	47.2309	49.5299	51.1829 (42a)
Hot water usage for baths	22.2178	21.8825	21.4053	20.6908	20.0468	19.1604	18.4878	19.3102	19.7418	20.6202	21.5334	22.2002 (42b)
Hot water usage for other uses	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383 (42c)
Average daily hot water use (litres/day)												96.8653 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	105.3852	103.1041	100.3098	96.6557	93.2572	88.9805	86.5452	90.5898	93.2194	97.4666	101.8402	105.3214 (44)
Energy content (annual)	155.1453	136.4276	143.3406	126.2565	120.1714	102.9030	95.6350	106.6259	108.1298	125.5956	137.6404	154.6722 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m =											1512.5434
	23.2718	20.4641	21.5011	18.9385	18.0257	15.4355	14.3452	15.9939	16.2195	18.8393	20.6461	23.2008 (46)
Water storage loss:												
Store volume												201.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss												
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	182.0967	160.7708	170.2920	152.3385	147.1228	128.9850	122.5864	133.5773	134.2118	152.5470	163.7224	181.6236 (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	182.0967	160.7708	170.2920	152.3385	147.1228	128.9850	122.5864	133.5773	134.2118	152.5470	163.7224	181.6236 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											1829.8744 (64)
Electric shower(s)												1830 (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	51.5858	45.3622	47.6607	41.9803	39.9570	34.2153	31.7986	35.4531	35.9532	41.7605	45.7654	51.4285 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	76.5595	84.7623	76.5595	79.1115	76.5595	79.1115	76.5595	76.5595	79.1115	76.5595	79.1115	76.5595 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040 (71)
Water heating gains (Table 5)	69.3358	67.5033	64.0601	58.3060	53.7056	47.5212	42.7401	47.6520	49.9349	56.1298	63.5631	69.1244 (72)
Total internal gains	341.4807	349.3789	333.8829	322.4843	304.9856	291.6289	277.7995	281.1836	289.8686	301.7078	322.0395	334.7730 (73)

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	8.5200	19.6403	0.6500	0.7000	0.7700	52.7633 (76)

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Solar gains	52.7633	103.2161	169.9822	247.9090	303.8217	311.0156	296.0995	254.3451	197.6964	122.4746	65.7896	43.3899 (83)
Total gains	394.2440	452.5950	503.8651	570.3933	608.8073	602.6445	573.8990	535.5287	487.5649	424.1824	387.8291	378.1629 (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	17.2614	17.3260	17.3911	17.7241	17.7923	18.1410	18.1410	18.2123	17.9998	17.7923	17.6565	17.5228
alpha	2.1508	2.1551	2.1594	2.1816	2.1862	2.2094	2.2094	2.2142	2.2000	2.1862	2.1771	2.1682
util living area	0.8868	0.8514	0.7986	0.7019	0.5846	0.4482	0.3433	0.3769	0.5534	0.7480	0.8512	0.8941 (86)
MIT	18.2217	18.6036	19.1630	19.8824	20.4220	20.7771	20.9112	20.8885	20.6240	19.8972	18.9719	18.1801 (87)
Th 2	20.0706	20.0737	20.0769	20.0927	20.0958	20.1117	20.1117	20.1149	20.1053	20.0958	20.0895	20.0832 (88)
util rest of house	0.8761	0.8379	0.7803	0.6753	0.5472	0.3980	0.2812	0.3136	0.5029	0.7189	0.8355	0.8841 (89)
MIT 2	16.8235	17.2992	17.9933	18.8763	19.5135	19.9188	20.0513	20.0356	19.7615	18.9169	17.7754	16.7767 (90)
Living area fraction	17.5282	17.9566	18.5829	19.3833	19.9714	20.3514	20.4847	20.4655	20.1962	19.4109	18.3785	17.4840 (91)
Temperature adjustment	17.5282	17.9566	18.5829	19.3833	19.9714	20.3514	20.4847	20.4655	20.1962	19.4109	18.3785	17.4840 (92)
adjusted MIT	17.5282	17.9566	18.5829	19.3833	19.9714	20.3514	20.4847	20.4655	20.1962	19.4109	18.3785	17.4840 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8385	0.7998	0.7454	0.6523	0.5417	0.4120	0.3078	0.3393	0.5083	0.6939	0.7993	0.8474 (94)
Useful gains	330.5788	362.0078	375.5807	372.0693	329.8147	248.3025	176.6629	181.7160	247.8245	294.3494	309.9805	320.4716 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	14.1000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	671.5536	660.3716	608.8318	518.3113	407.3824	277.8231	187.6514	195.6142	296.7870	433.9572	559.7582	664.3274 (97)
Space heating kWh	253.6853	200.5005	173.5388	105.2943	57.7104	0.0000	0.0000	0.0000	0.0000	103.8682	179.8399	255.8287 (98a)
Space heating requirement - total per year (kWh/year)												1330.2661
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	253.6853	200.5005	173.5388	105.2943	57.7104	0.0000	0.0000	0.0000	0.0000	103.8682	179.8399	255.8287 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1330.2661
Space heating per m2										(98c) / (4) =		26.6053 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Fraction of main heating from main system 2												0.0000 (203)
Fraction of total heating from main system 1												1.0000 (204)
Fraction of total heating from main system 2												0.0000 (205)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	253.6853	200.5005	173.5388	105.2943	57.7104	0.0000	0.0000	0.0000	0.0000	103.8682	179.8399	255.8287 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	253.6853	200.5005	173.5388	105.2943	57.7104	0.0000	0.0000	0.0000	0.0000	103.8682	179.8399	255.8287 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Space heating fuel used, main system 2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Water heating												
Water heating requirement	182.0967	160.7708	170.2920	152.3385	147.1228	128.9850	122.5864	133.5773	134.2118	152.5470	163.7224	181.6236 (64)
Efficiency of water heater (217)m	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100 (216)
Fuel for water heating, kWh/month	52.1155	46.0121	48.7370	43.5988	42.1061	36.9151	35.0838	38.2294	38.4110	43.6585	46.8568	51.9801 (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	13.9043	12.5587	13.9043	13.4558	13.9043	13.4558	13.9043	13.9043	13.4558	13.9043	13.4558	13.9043 (231)
Lighting	15.5824	12.5008	11.2556	8.2463	6.3697	5.2041	5.8106	7.5529	9.8105	12.8719	14.5387	16.0155 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-9.3184	-16.1972	-28.8576	-38.1569	-44.2684	-39.1451	-38.4252	-34.0699	-26.9020	-20.1129	-11.0142	-7.6392 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-1.5143	-4.1241	-11.1399	-22.3231	-35.7264	-41.4949	-40.3197	-31.3426	-19.4660	-7.3853	-2.2914	-1.1103 (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												1330.2661 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												349.4100
Water heating fuel used												523.7041 (219)
Space cooling fuel												0.0000 (221)

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Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9940)	
mechanical ventilation fans (SFP = 0.9940)	163.7118 (230a)
Total electricity for the above, kWh/year	163.7118 (231)
Electricity for lighting (calculated in Appendix L)	125.7590 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-532.3450 (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	1611.0960 (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 (high-rate cost)	1330.2661	0.1622	215.7768 (261)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000 (261)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000 (262)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating - high rate cost	17.1232	0.1480	2.5347 (264)
Water heating - low rate cost	506.5808	0.1242	62.9352 (264)
Space and water heating			281.2467 (265)
Pumps, fans and electric keep-hot	163.7118	0.1432	22.7162 (267)
Energy for lighting	125.7590	0.1490	18.7406 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-314.1070	0.1365	-42.8677
PV Unit electricity exported	-218.2379	0.1184	-25.8431
Total			-68.7109 (269)
Total CO2, kg/year			253.9926 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.0800 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1 (high-rate cost)	1330.2661	1.6049	2134.8800 (275)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000 (275)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000 (276)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating - high rate cost	17.1232	1.5533	26.5977 (278)
Water heating - low rate cost	506.5808	1.4446	731.8230 (278)
Space and water heating			2893.3008 (279)
Pumps, fans and electric keep-hot	163.7118	1.5335	247.6886 (281)
Energy for lighting	125.7590	1.5547	195.5231 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-314.1070	1.5089	-473.9714
PV Unit electricity exported	-218.2379	0.4342	-94.7521
Total			-568.7235 (283)
Total Primary energy kWh/year			2767.7891 (286)
Dwelling Primary energy Rate (DPER)			55.3600 (287)

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

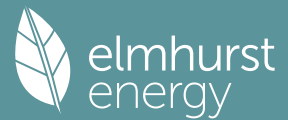
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	50.0000 (1b)	x 2.7000 (2b)	= 135.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 135.0000 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1481 (8)
Pressure test	Yes
Pressure Test Method	Blower Door

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Measured/design AP50 5.0000 (17)
 Infiltration rate 0.3981 (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) = 0.3384 (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	0.4315	0.4230	0.4146	0.3723	0.3638	0.3215	0.3215	0.3130	0.3384	0.3638	0.3807	0.3977 (22b)
	0.5931	0.5895	0.5859	0.5693	0.5662	0.5517	0.5517	0.5490	0.5573	0.5662	0.5725	0.5791 (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)			8.5200	1.1450	9.7557		(27)
External Wall 1	30.2400	8.5200	21.7200	0.1800	3.9096		(29a)
Sheltered wall	31.5900	1.9500	29.6400	0.1800	5.3352		(29a)
Flat Roof	50.0000		50.0000	0.1100	5.5000		(30)
Total net area of external elements Aum(A, m2)			111.8300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	26.4505	(33)
Party Wall 1			28.6200	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 63.0940 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	5.9000	0.0200	0.1180
E16 Corner (normal)	8.1000	0.0900	0.7290
E17 Corner (inverted - internal area greater than external area)	8.1000	-0.0900	-0.7290
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	21.2000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	10.6000	0.1200	1.2720
E2 Other lintels (including other steel lintels)	4.5300	0.0500	0.2265
E3 Sill	3.6000	0.0500	0.1800
E4 Jamb	13.4000	0.0500	0.6700
E7 Party floor between dwellings (in blocks of flats)	22.9000	0.0700	1.6030
E14 Flat roof	22.9000	0.0800	1.8320
E18 Party wall between dwellings	2.7000	0.0600	0.1620
E25 Staggered party wall between dwellings	8.1000	0.0600	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.5495 (36)

Point Thermal Bridges

Total fabric heat loss (33) + (36) + (36a) = 33.0000 (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	26.4223	26.2613	26.1034	25.3620	25.2232	24.5775	24.5775	24.4579	24.8262	25.2232	25.5039	25.7973 (38)
Heat transfer coeff	59.4223	59.2613	59.1034	58.3620	58.2233	57.5775	57.5775	57.4579	57.8262	58.2233	58.5039	58.7973 (39)
Average = Sum(39)m / 12 =												58.3613

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1884	1.1852	1.1821	1.1672	1.1645	1.1515	1.1515	1.1492	1.1565	1.1645	1.1701	1.1759 (40)
HLP (average)												1.1672
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.6901 (42)
Hot water usage for mixer showers	52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556 (42a)
Hot water usage for baths	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476 (42b)
Hot water usage for other uses	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383 (42c)
Average daily hot water use (litres/day)												98.5597 (43)

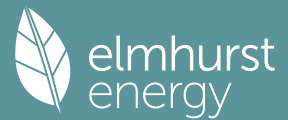
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415 (44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445 (45)
Energy content (annual)										Total = Sum(45)m =		1637.0557
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167 (46)

Water storage loss:

Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	216.4047	191.5060	203.5855	179.1170	173.7575	156.6915	154.6398	160.6490	162.2850	180.8355	192.1624	214.0394 (62)
WWHRS	-24.0268	-21.2495	-22.2513	-18.4249	-17.1714	-14.6937	-13.7730	-14.6462	-15.2026	-17.9222	-20.3037	-23.5819 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	192.3778	170.2565	181.3342	160.6920	156.5861	141.9978	140.8668	146.0028	147.0824	162.9133	171.8587	190.4575 (64)
Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		1962.4258 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)

Heat gains from water heating, kWh/month	93.7377	83.3508	89.4753	80.6368	79.5575	73.1803	73.2008	75.1989	75.0402	81.9109	84.9744	92.9512 (65)
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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
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	76.5595	84.7623	76.5595	79.1115	76.5595	79.1115	76.5595	76.5595	79.1115	76.5595	79.1115	76.5595 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040 (71)
Water heating gains (Table 5)	125.9915	124.0340	120.2625	111.9956	106.9321	101.6394	98.3882	101.0738	104.2225	110.0953	118.0201	124.9344 (72)
Total internal gains	401.1365	408.9096	393.0852	379.1739	361.2120	345.7471	333.4476	334.6054	344.1561	358.6733	379.4965	393.5831 (73)

6. Solar gains

[Jan]	Area m ²		Solar flux Table 6a W/m ²		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W	
East	8.5200		19.6403		0.6300		0.7000		0.7700		51.1398 (76)	
Solar gains	51.1398	100.0402	164.7520	240.2810	294.4734	301.4459	286.9888	246.5191	191.6134	118.7062	63.7653	42.0549 (83)
Total gains	452.2762	508.9498	557.8372	619.4549	655.6854	647.1930	620.4364	581.1245	535.7695	477.3795	443.2618	435.6379 (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	14.7471	14.7872	14.8266	15.0150	15.0508	15.2196	15.2196	15.2513	15.1541	15.0508	14.9786	14.9038
alpha	1.9831	1.9858	1.9884	2.0010	2.0034	2.0146	2.0146	2.0168	2.0103	2.0034	1.9986	1.9936
util living area	0.8733	0.8418	0.7944	0.7094	0.6016	0.4729	0.3657	0.3990	0.5660	0.7425	0.8386	0.8804 (86)
MIT	17.9238	18.2891	18.8626	19.6130	20.2345	20.6729	20.8615	20.8300	20.4997	19.6929	18.7074	17.8706 (87)
Th 2	19.9293	19.9318	19.9344	19.9463	19.9485	19.9590	19.9590	19.9609	19.9549	19.9485	19.9440	19.9393 (88)
util rest of house	0.8605	0.8263	0.7738	0.6800	0.5596	0.4139	0.2906	0.3230	0.5085	0.7097	0.8203	0.8683 (89)
MIT 2	16.4060	16.8558	17.5605	18.4712	19.1992	19.6884	19.8717	19.8485	19.5159	18.5901	17.3875	16.3435 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.1709	17.5782	18.2167	19.0467	19.7210	20.1846	20.3706	20.3432	20.0118	19.1459	18.0527	17.1131 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.1709	17.5782	18.2167	19.0467	19.7210	20.1846	20.3706	20.3432	20.0118	19.1459	18.0527	17.1131 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8178	0.7835	0.7342	0.6517	0.5497	0.4273	0.3213	0.3521	0.5118	0.6808	0.7793	0.8262 (94)
Useful gains	369.8790	398.7459	409.5822	403.6731	360.4618	276.5554	199.3346	204.6019	274.2264	324.9805	345.4498	359.9419 (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	764.8208	751.3274	692.4982	592.1811	467.0086	321.5475	217.1013	226.5661	341.8549	497.5706	640.7769	759.2567 (97)
Space heating kWh	293.8366	236.9348	210.4895	135.7258	79.2708	0.0000	0.0000	0.0000	0.0000	128.4071	212.6355	297.0902 (98a)
Space heating requirement - total per year (kWh/year)	1594.3903											
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	293.8366	236.9348	210.4895	135.7258	79.2708	0.0000	0.0000	0.0000	0.0000	128.4071	212.6355	297.0902 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1594.3903											
Space heating per m ²	(98c) / (4) = 31.8878 (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	293.8366	236.9348	210.4895	135.7258	79.2708	0.0000	0.0000	0.0000	0.0000	128.4071	212.6355	297.0902 (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)	318.3496	256.7007	228.0493	147.0485	85.8838	0.0000	0.0000	0.0000	0.0000	139.1193	230.3744	321.8746 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	192.3778	170.2565	181.3342	160.6920	156.5861	141.9978	140.8668	146.0028	147.0824	162.9133	171.8587	190.4575 (64)

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Efficiency of water heater (217)m	85.0067	84.8010	84.3950	83.6835	82.6142	79.8000	79.8000	79.8000	79.8000	83.5316	84.5384	79.8000 (216)
Fuel for water heating, kWh/month	226.3091	200.7717	214.8636	192.0235	189.5391	177.9421	176.5248	182.9609	184.3137	195.0318	203.2908	85.0528 (217)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	15.9076	12.7616	11.4904	8.4184	6.5026	5.3127	5.9319	7.7105	10.0152	13.1404	14.8421	16.3497 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-17.2238	-25.1803	-37.5284	-43.8221	-48.6971	-46.0143	-45.4847	-42.2433	-36.7404	-29.5446	-19.2638	-14.7904 (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	-7.1795	-15.3371	-30.9114	-47.0451	-62.7920	-63.2746	-62.4968	-52.6197	-38.2026	-22.1000	-9.6421	-5.6576 (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												1727.4001 (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												2367.4996 (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)												128.3831 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-823.7918 (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												3485.4910 (238)

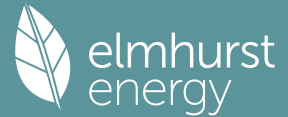
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1727.4001	0.2100	362.7540	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2367.4996	0.2100	497.1749	(264)
Space and water heating			859.9289	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	128.3831	0.1443	18.5296	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-406.5333	0.1338	-54.3946	
PV Unit electricity exported	-417.2585	0.1255	-52.3754	
Total			-106.7700	(269)
Total CO2, kg/year			783.6179	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.6700	(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	1727.4001	1.1300	1951.9621	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2367.4996	1.1300	2675.2746	(278)
Space and water heating			4627.2366	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	128.3831	1.5338	196.9183	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-406.5333	1.4945	-607.5483	
PV Unit electricity exported	-417.2585	0.4607	-192.2468	
Total			-799.7952	(283)
Total Primary energy kWh/year			4154.4606	(286)
Target Primary Energy Rate (TPER)			83.0900	(287)

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Property Reference	P3.05 Latimer				Issued on Date	03/12/2024
Assessment Reference	P3.05 Latimer 2B4P		Prop Type Ref	3rd End 2B3P		
Property	3.05, Latimer Road, Wokingham					
SAP Rating	75 C	DER	6.08	TER	13.49	
Environmental	95 A	% DER < TER				54.93
CO ₂ Emissions (t/year)	0.4	DFEE	46.96	TFEE	41.46	
Compliance Check	See BREL	% DFEE < TFEE				-13.25
% DPER < TPER	10.53	DPER	63.52	TPER	70.99	
Assessor Details	Mrs. Rebecca Lennon				Assessor ID	P627-0001
Client	RHB, RHB					

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	78.0000	2.7000	210.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.0000			(4)
Dwelling volume			210.6000	(5)

2. Ventilation rate

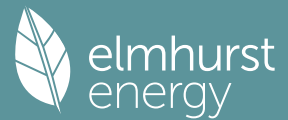
	m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
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)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.2000	(23c)
Effective ac	0.3207	0.3165	0.3123	0.2910	0.2867	0.2655	0.2655	0.2612	0.2740	0.2867	0.2953	0.3037	(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	
Flat ent door			1.9500	1.0000	1.9500			(26)
Windows (Uw = 1.10)			17.0100	1.0536	17.9224			(27)
External Wall 1	52.6500	17.0100	35.6400	0.1200	4.2768	0.0000	0.0000	(29a)
Sheltered wall	49.6800	1.9500	47.7300	0.2100	10.0233	0.0000	0.0000	(29a)
Flat Roof	78.0000		78.0000	0.1100	8.5800	9.0000	702.0000	(30)
Total net area of external elements Aum(A, m ²)			180.3300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.7525			(33)
Party Wall 1			11.3400	0.0000	0.0000	0.0000	0.0000	(32)
Party Floor 1			78.0000			40.0000	3120.0000	(32d)
Internal Wall 1			139.8600			9.0000	1258.7400	(32c)
Heat capacity Cm = Sum(A x k)								
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							5080.7400	(34)
List of Thermal Bridges							65.1377	(35)
K1 Element				Length	Psi-value		Total	

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E23 Balcony within or between dwellings, balcony support penetrates wall insulation	14.9000	1.0000	14.9000
E16 Corner (normal)	13.5000	0.0370	0.4995
E17 Corner (inverted - internal area greater than external area)	2.7000	-0.0790	-0.2133
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	4.2000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	4.2000	0.0330	0.1386
E2 Other lintels (including other steel lintels)	7.2300	0.0280	0.2024
E3 Sill	6.3000	0.0240	0.1512
E4 Jamb	20.4000	0.0190	0.3876
E7 Party floor between dwellings (in blocks of flats)	37.9000	0.0360	1.3644
E14 Flat roof	37.9000	0.1600	6.0640
E25 Staggered party wall between dwellings	8.1000	0.0410	0.3321
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			23.8265 (36)
Point Thermal Bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	66.5791 (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	22.2915	21.9961	21.7008	20.2239	19.9286	18.4517	18.4517	18.1564	19.0425	19.9286	20.5193	21.1100 (38)
Average = Sum(39)m / 12 =	88.8705	88.5752	88.2798	86.8030	86.5076	85.0308	85.0308	84.7354	85.6215	86.5076	87.0983	87.6891 (39)
												86.7291
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1394	1.1356	1.1318	1.1129	1.1091	1.0901	1.0901	1.0864	1.0977	1.1091	1.1166	1.1242 (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												2.4238 (42)
Hot water usage for mixer showers	63.2205	62.2526	60.8262	58.6318	56.6658	53.9153	51.7398	54.2831	55.5622	58.2865	61.1235	63.1635 (42a)
Hot water usage for baths	27.3903	26.9768	26.3886	25.5077	24.7138	23.6210	22.7919	23.8057	24.3378	25.4207	26.5465	27.3685 (42b)
Hot water usage for other uses	39.4523	38.0177	36.5831	35.1484	33.7138	32.2792	32.2792	33.7138	35.1484	36.5831	38.0177	39.4523 (42c)
Average daily hot water use (litres/day)												119.5474 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	130.0630	127.2471	123.7978	119.2879	115.0934	109.8154	106.8108	111.8026	115.0484	120.2902	125.6877	129.9843 (44)
Energy content (annual)	191.4753	168.3736	176.9045	155.8199	148.3095	126.9979	118.0291	131.5937	133.4504	155.0060	169.8711	190.8915 (45)
Distribution loss (46)m = 0.15 x (45)m	28.7213	25.2560	26.5357	23.3730	22.2464	19.0497	17.7044	19.7391	20.0176	23.2509	25.4807	28.6337 (46)
Water storage loss:												
Store volume												201.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	218.4267	192.7168	203.8559	181.9019	175.2609	153.0799	144.9805	158.5451	159.5324	181.9574	195.9531	217.8429 (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	218.4267	192.7168	203.8559	181.9019	175.2609	153.0799	144.9805	158.5451	159.5324	181.9574	195.9531	217.8429 (64)
12Total per year (kWh/year)												2184.0535 (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	63.6655	55.9842	58.8207	51.8101	49.3129	42.2268	39.2447	43.7549	44.3723	51.5395	56.4821	63.4714 (65)

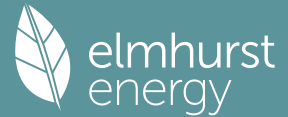
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	121.1909	121.1909	121.1909	121.1909	121.1909	121.1909	121.1909	121.1909	121.1909	121.1909	121.1909	121.1909 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	108.6201	120.2579	108.6201	112.2407	108.6201	112.2407	108.6201	108.6201	112.2407	108.6201	112.2407	108.6201 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.2098	217.4430	211.8154	199.8349	184.7117	170.4980	161.0024	158.7692	164.3968	176.3773	191.5005	205.7142 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1191	35.1191	35.1191	35.1191	35.1191	35.1191	35.1191	35.1191	35.1191	35.1191	35.1191	35.1191 (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)	-96.9527	-96.9527	-96.9527	-96.9527	-96.9527	-96.9527	-96.9527	-96.9527	-96.9527	-96.9527	-96.9527	-96.9527 (71)
Water heating gains (Table 5)	85.5720	83.3098	79.0601	71.9585	66.2808	58.6483	52.7482	58.8103	61.6282	69.2735	78.4474	85.3111 (72)
Total internal gains	468.7591	480.3680	458.8529	443.3914	418.9698	400.7443	381.7279	385.5568	397.6229	413.6281	441.5459	459.0026 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m2	Table 6a	Specific data	Specific data	factor	W
		W/m2	or Table 6b	or Table 6c	Table 6d	
West	17.0100	19.6403	0.6500	0.7000	0.7700	105.3407 (80)
Solar gains	105.3407	206.0688	339.3659	494.9450	606.5737	620.9361
						591.1565
						507.7947
						394.6966
						244.5180
						131.3475
						86.6271 (83)

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Total gains 574.0998 686.4368 798.2188 938.3364 1025.5434 1021.6804 972.8844 893.3515 792.3195 658.1461 572.8934 545.6296 (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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	15.8806	15.9335	15.9869	16.2589	16.3144	16.5977	16.5977	16.6556	16.4832	16.3144	16.2037	16.0946	21.0000 (85)
alpha	2.0587	2.0622	2.0658	2.0839	2.0876	2.1065	2.1065	2.1104	2.0989	2.0876	2.0802	2.0730	
util living area	0.9082	0.8715	0.8145	0.7130	0.5913	0.4557	0.3512	0.3901	0.5742	0.7742	0.8766	0.9157	(86)
MIT	17.8002	18.2440	18.8994	19.7177	20.3328	20.7330	20.8899	20.8595	20.5400	19.6858	18.6215	17.7425	(87)
Th 2	19.9688	19.9719	19.9750	19.9903	19.9934	20.0089	20.0089	20.0120	20.0027	19.9934	19.9873	19.9811	(88)
util rest of house	0.8984	0.8583	0.7955	0.6843	0.5504	0.3999	0.2812	0.3182	0.5183	0.7442	0.8617	0.9067	(89)
MIT 2	16.2571	16.8084	17.6184	18.6156	19.3359	19.7861	19.9384	19.9174	19.5932	18.6061	17.2954	16.1888	(90)
Living area fraction	fLA = Living area / (4) =												0.4372 (91)
MIT	16.9317	17.4360	18.1784	19.0974	19.7717	20.2001	20.3543	20.3293	20.0071	19.0781	17.8751	16.8680	(92)
Temperature adjustment													0.0000
adjusted MIT	16.9317	17.4360	18.1784	19.0974	19.7717	20.2001	20.3543	20.3293	20.0071	19.0781	17.8751	16.8680	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8590	0.8163	0.7552	0.6558	0.5407	0.4111	0.3064	0.3422	0.5186	0.7119	0.8214	0.8687	(94)
Useful gains	493.1627	560.3105	602.8276	615.3909	554.5107	420.0212	298.0615	305.6644	410.8587	468.5647	470.5927	473.9735	(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	1122.5888	1110.3780	1030.9705	885.1634	698.2663	476.1773	319.2348	332.9477	505.7772	733.4234	938.4956	1110.8486	(97)
Space heating kWh	468.2930	369.6454	318.5383	194.2362	106.9542	0.0000	0.0000	0.0000	0.0000	197.0549	336.8901	473.8351	(98a)
Space heating requirement - total per year (kWh/year)													2465.4472
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	468.2930	369.6454	318.5383	194.2362	106.9542	0.0000	0.0000	0.0000	0.0000	197.0549	336.8901	473.8351	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)													2465.4472
Space heating per m2													(98c) / (4) = 31.6083 (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)
Fraction of main heating from main system 2													1.0000 (202)
Fraction of total heating from main system 1													0.0000 (203)
Fraction of total heating from main system 1													1.0000 (204)
Fraction of total heating from main system 2													0.0000 (205)
Efficiency of main space heating system 1 (in %)													100.0000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	468.2930	369.6454	318.5383	194.2362	106.9542	0.0000	0.0000	0.0000	0.0000	197.0549	336.8901	473.8351	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	468.2930	369.6454	318.5383	194.2362	106.9542	0.0000	0.0000	0.0000	0.0000	197.0549	336.8901	473.8351	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Space heating fuel used, main system 2													0.0000 (213)
Water heating													
Water heating requirement	218.4267	192.7168	203.8559	181.9019	175.2609	153.0799	144.9805	158.5451	159.5324	181.9574	195.9531	217.8429	(64)
Efficiency of water heater (217)m	343.2833	343.2833	343.2833	343.2833	343.2833	343.2833	343.2833	343.2833	343.2833	343.2833	343.2833	343.2833	(216)
Fuel for water heating, kWh/month	63.6287	56.1393	59.3842	52.9888	51.0543	44.5929	42.2335	46.1849	46.4725	53.0050	57.0820	63.4586	(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	21.6907	19.5916	21.6907	20.9910	21.6907	20.9910	21.6907	21.6907	20.9910	21.6907	20.9910	21.6907	(231)
Lighting	23.1720	18.5894	16.7377	12.2628	9.4721	7.7388	8.6408	11.2316	14.5888	19.1412	21.6200	23.8160	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-9.6457	-17.0485	-31.0029	-42.0452	-49.7894	-44.2585	-43.3959	-38.0580	-29.5127	-21.5188	-11.4972	-7.8824	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.1869	-3.2728	-8.9946	-18.4348	-30.2055	-36.3815	-35.3490	-27.3545	-16.8553	-5.9794	-1.8084	-0.8670	(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													2465.4472 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													343.2833
Water heating fuel used													636.2247 (219)
Space cooling fuel													0.0000 (221)

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Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9940)	
mechanical ventilation fans (SFP = 0.9940)	255.3904 (230a)
Total electricity for the above, kWh/year	255.3904 (231)
Electricity for lighting (calculated in Appendix L)	187.0112 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-532.3450 (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	3011.7286 (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 (high-rate cost)	2465.4472	0.1622	399.7916 (261)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000 (261)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000 (262)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating - high rate cost	30.0264	0.1481	4.4472 (264)
Water heating - low rate cost	606.1984	0.1243	75.3544 (264)
Space and water heating			479.5931 (265)
Pumps, fans and electric keep-hot	255.3904	0.1432	35.4373 (267)
Energy for lighting	187.0112	0.1490	27.8684 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-345.6553	0.1361	-47.0336
PV Unit electricity exported	-186.6896	0.1176	-21.9537
Total			-68.9874 (269)
Total CO2, kg/year			473.9114 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			6.0800 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1 (high-rate cost)	2465.4472	1.6047	3956.2567 (275)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000 (275)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000 (276)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating - high rate cost	30.0264	1.5536	46.6496 (278)
Water heating - low rate cost	606.1984	1.4449	875.9068 (278)
Space and water heating			4878.8131 (279)
Pumps, fans and electric keep-hot	255.3904	1.5335	386.3943 (281)
Energy for lighting	187.0112	1.5547	290.7547 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-345.6553	1.5075	-521.0659
PV Unit electricity exported	-186.6896	0.4311	-80.4737
Total			-601.5396 (283)
Total Primary energy kWh/year			4954.4225 (286)
Dwelling Primary energy Rate (DPER)			63.5200 (287)

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

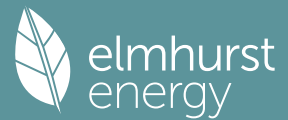
1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	78.0000 (1b)	x 2.7000 (2b)	= 210.6000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.6000 (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) = 0.1425 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)

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Infiltration rate	0.3925	(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) =	0.3336 (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)
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	0.4253	0.4170	0.4086	0.3669	0.3586	0.3169	0.3169	0.3086	0.3336	0.3586	0.3753	0.3920	(22b)
Effective ac	0.5904	0.5869	0.5835	0.5673	0.5643	0.5502	0.5502	0.5476	0.5556	0.5643	0.5704	0.5768	(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)			17.0100	1.1450	19.4771			(27)
External Wall 1	52.6500	17.0100	35.6400	0.1800	6.4152			(29a)
Sheltered wall	49.6800	1.9500	47.7300	0.1800	8.5914			(29a)
Flat Roof	78.0000		78.0000	0.1100	8.5800			(30)
Total net area of external elements Aum(A, m2)			180.3300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.0137			(33)
Party Wall 1			11.3400	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 65.1377 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	14.9000	0.0200	0.2980	
E16 Corner (normal)	13.5000	0.0900	1.2150	
E17 Corner (inverted - internal area greater than external area)	2.7000	-0.0900	-0.2430	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	4.2000	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	4.2000	0.1200	0.5040	
E2 Other lintels (including other steel lintels)	7.2300	0.0500	0.3615	
E3 Sill	6.3000	0.0500	0.3150	
E4 Jamb	20.4000	0.0500	1.0200	
E7 Party floor between dwellings (in blocks of flats)	37.9000	0.0700	2.6530	
E14 Flat roof	37.9000	0.0800	3.0320	
E25 Staggered party wall between dwellings	8.1000	0.0600	0.4860	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.6415 (36)

Point Thermal Bridges

Total fabric heat loss (33) + (36) + (36a) = 54.6552 (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	
	41.0349	40.7908	40.5516	39.4278	39.2175	38.2388	38.2388	38.0575	38.6158	39.2175	39.6429	40.0876	(38)
Heat transfer coeff	95.6901	95.4460	95.2068	94.0830	93.8727	92.8940	92.8940	92.7127	93.2710	93.8727	94.2981	94.7428	(39)
Average = Sum(39)m / 12 =												94.0820	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	1.2268	1.2237	1.2206	1.2062	1.2035	1.1909	1.1909	1.1886	1.1958	1.2035	1.2089	1.2147	(40)
HLP (average)												1.2062	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.4238	(42)
Hot water usage for mixer showers	64.8591	63.8844	62.4641	59.7465	57.7410	55.5045	54.2333	55.6429	57.1881	59.5894	62.3653	64.6106	(42a)	
Hot water usage for baths	28.0148	27.5987	27.0128	25.9325	25.1236	24.2267	23.7422	24.3240	24.9575	25.9172	27.0198	27.9201	(42b)	
Hot water usage for other uses	39.4523	38.0177	36.5831	35.1484	33.7138	32.2792	32.2792	33.7138	35.1484	36.5831	38.0177	39.4523	(42c)	
Average daily hot water use (litres/day)													121.6378	(43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	132.3262	129.5008	126.0600	120.8275	116.5785	112.0104	110.2546	113.6807	117.2939	122.0897	127.4028	131.9830	(44)
Energy conte	209.5724	184.4075	193.7495	165.4068	156.9370	137.7298	133.3434	140.7604	144.6352	165.6745	181.5086	206.6535	(45)
Energy content (annual)										Total = Sum(45)m =		2020.3786	
Distribution loss (46)m = 0.15 x (45)m	31.4359	27.6611	29.0624	24.8110	23.5406	20.6595	20.0015	21.1141	21.6953	24.8512	27.2263	30.9980	(46)

Water storage loss:

Store volume 150.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day):

Temperature factor from Table 2b 1.3938 (48)

Enter (49) or (54) in (55) 0.5400 (49)

Total storage loss 0.7527 (55)

23.3325 21.0745 23.3325 22.5798 23.3325 22.5798 23.3325 23.3325 22.5798 23.3325 22.5798 23.3325 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 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 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 0.0000 (61)

Total heat required for water heating calculated for each month 256.1673 226.4932 240.3444 210.4986 203.5319 182.8217 179.9383 187.3553 189.7270 212.2694 226.6004 253.2484 (62)

WWHRS -29.6509 -26.2235 -27.4597 -22.7377 -21.1908 -18.1331 -16.9969 -18.0745 -18.7612 -22.1174 -25.0563 -29.1018 (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 226.5164 200.2697 212.8846 187.7609 182.3412 164.6886 162.9415 169.2808 170.9658 190.1521 201.5441 224.1466 (64)

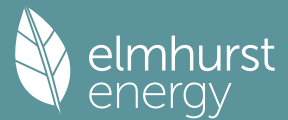
Total per year (kWh/year) = Sum(64)m = 2293.4923 (64)

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 106.9587 94.9841 101.6976 91.0712 89.4575 81.8686 81.6126 84.0788 84.1647 92.3627 96.4251 105.9882 (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	
(66)m	121.1909	121.1909	121.1909	121.1909	121.1909	121.1909	121.1909	121.1909	121.1909	121.1909	121.1909	121.1909	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	108.6201	120.2579	108.6201	112.2407	108.6201	112.2407	108.6201	108.6201	112.2407	108.6201	112.2407	108.6201	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.2098	217.4430	211.8154	199.8349	184.7117	170.4980	161.0024	158.7692	164.3968	176.3773	191.5005	205.7142	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1191	35.1191	35.1191	35.1191	35.1191	35.1191	35.1191	35.1191	35.1191	35.1191	35.1191	35.1191	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-96.9527	-96.9527	-96.9527	-96.9527	-96.9527	-96.9527	-96.9527	-96.9527	-96.9527	-96.9527	-96.9527	-96.9527	(71)
Water heating gains (Table 5)	143.7618	141.3453	136.6904	126.4878	120.2385	113.7064	109.6944	113.0091	116.8954	124.1434	133.9237	142.4573	(72)
Total internal gains	529.9489	541.4035	519.4831	500.9207	475.9275	455.8024	438.6740	439.7555	452.8901	471.4980	500.0222	519.1488	(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
West					17.0100	19.6403	0.6300	0.7000			0.7700	102.0995 (80)
Solar gains	102.0995	199.7282	328.9239	479.7159	587.9099	601.8304	572.9670	492.1702	382.5521	236.9943	127.3060	83.9616 (83)
Total gains	632.0483	741.1317	848.4070	980.6366	1063.8374	1057.6328	1011.6411	931.9258	835.4422	708.4923	627.3282	603.1104 (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	14.7488	14.7865	14.8237	15.0008	15.0344	15.1928	15.1928	15.2225	15.1314	15.0344	14.9665	14.8963	
alpha	1.9833	1.9858	1.9882	2.0001	2.0023	2.0129	2.0129	2.0148	2.0088	2.0023	1.9978	1.9931	
util living area	0.8975	0.8628	0.8090	0.7150	0.5993	0.4684	0.3625	0.4009	0.5778	0.7665	0.8656	0.9050	(86)
MIT	17.7041	18.1270	18.7744	19.5890	20.2392	20.6780	20.8634	20.8280	20.4784	19.6003	18.5257	17.6378	(87)
Th 2	19.8986	19.9011	19.9036	19.9150	19.9172	19.9272	19.9272	19.9272	19.9234	19.9172	19.9128	19.9083	(88)
util rest of house	0.8864	0.8483	0.7888	0.6849	0.5559	0.4078	0.2855	0.3222	0.5183	0.7342	0.8490	0.8947	(89)
MIT 2	16.1176	16.6395	17.4350	18.4211	19.1790	19.6650	19.8434	19.8179	19.4697	18.4633	17.1490	16.0383	(90)
Living area fraction									fLA = Living area /	(4) =			(91)
MIT	16.8112	17.2898	18.0205	18.9317	19.6425	20.1079	20.2894	20.2595	19.9107	18.9604	17.7509	16.7376	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.8112	17.2898	18.0205	18.9317	19.6425	20.1079	20.2894	20.2595	19.9107	18.9604	17.7509	16.7376	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8438	0.8038	0.7463	0.6538	0.5440	0.4185	0.3124	0.3475	0.5175	0.7004	0.8061	0.8532	(94)
Useful gains	533.3079	595.7080	633.1809	641.1757	578.7239	442.6701	316.0472	323.8901	432.3341	496.2239	505.6841	514.5705	(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	1197.1966	1182.5540	1096.8306	943.8137	745.5855	511.6467	342.7188	357.8234	541.9696	784.8108	1004.3584	1187.8429	(97)
Space heating kWh	493.9332	394.3605	344.9554	217.8993	124.1450	0.0000	0.0000	0.0000	0.0000	214.7086	359.0455	500.9147	(98a)
Space heating requirement - total per year (kWh/year)												2649.9623	
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	493.9332	394.3605	344.9554	217.8993	124.1450	0.0000	0.0000	0.0000	0.0000	214.7086	359.0455	500.9147	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2649.9623	
Space heating per m ²										(98c) / (4) =		33.9739	(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	493.9332	394.3605	344.9554	217.8993	124.1450	0.0000	0.0000	0.0000	0.0000	214.7086	359.0455	500.9147	(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)	535.1389	427.2595	373.7328	236.0773	134.5016	0.0000	0.0000	0.0000	0.0000	232.6204	388.9984	542.7029	(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	226.5164	200.2697	212.8846	187.7609	182.3412	164.6886	162.9415	169.2808	170.9658	190.1521	201.5441	224.1466	(64)
Efficiency of water heater	85.7590	85.5504	85.1357	84.3945	83.2163	79.8000	79.8000	79.8000	79.8000	84.3328	85.3397	85.8082	(217)

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Fuel for water heating, kWh/month	264.1313	234.0956	250.0532	222.4800	219.1171	206.3767	204.1873	212.1314	214.2429	225.4781	236.1670	261.2180 (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	22.5691	18.1058	16.3022	11.9437	9.2257	7.5375	8.4160	10.9394	14.2092	18.6432	21.0575	23.1964 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-26.3927	-38.3359	-56.7562	-65.7916	-72.6503	-68.4267	-67.5799	-62.9518	-55.0793	-44.7077	-29.4107	-22.6877 (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	-11.6764	-24.8713	-50.0099	-75.9611	-101.2726	-102.0639	-100.8712	-85.0345	-61.8319	-35.8579	-15.6826	-9.2112 (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												2871.0317 (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												2749.6785 (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)												182.1456 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1285.1151 (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												4603.7407 (238)

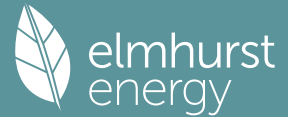
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2871.0317	0.2100	602.9167	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2749.6785	0.2100	577.4325	(264)
Space and water heating			1180.3491	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	182.1456	0.1443	26.2892	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-610.7704	0.1340	-81.8197	
PV Unit electricity exported	-674.3447	0.1256	-84.6741	
Total			-166.4938	(269)
Total CO2, kg/year			1052.0739	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.4900	(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	2871.0317	1.1300	3244.2658	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2749.6785	1.1300	3107.1368	(278)
Space and water heating			6351.4026	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	182.1456	1.5338	279.3810	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-610.7704	1.4951	-913.1406	
PV Unit electricity exported	-674.3447	0.4609	-310.8015	
Total			-1223.9421	(283)
Total Primary energy kWh/year			5536.9422	(286)
Target Primary Energy Rate (TPER)			70.9900	(287)

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Property Reference	P3.07 Latimer				Issued on Date	03/12/2024
Assessment Reference	P3.07 Latimer 2B3P		Prop Type Ref	3rd End 2B3P		
Property	3.07, Latimer Road, Wokingham					
SAP Rating	79 C	DER	5.50	TER	16.25	
Environmental	96 A	% DER < TER				66.15
CO ₂ Emissions (t/year)	0.29	DFEE	43.96	TFEE	49.62	
Compliance Check	See BREL	% DFEE < TFEE				11.41
% DPER < TPER	32.01	DPER	58.42	TPER	85.92	
Assessor Details	Mrs. Rebecca Lennon				Assessor ID	P627-0001
Client	RHB, RHB					

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	64.5000 (1b)	2.7000 (2b)	174.1500 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	174.1500 (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)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.2000 (23c)
Effective ac	0.3207	0.3165	0.3123	0.2910	0.2867	0.2655	0.2655	0.2612	0.2740	0.2867	0.2953	0.3037 (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
Flat ent door			1.9500	1.0000	1.9500		(26)
Windows (Uw = 1.10)			17.0700	1.0536	17.9856		(27)
External Wall 1	56.1600	17.0700	39.0900	0.1200	4.6908	0.0000	0.0000 (29a)
Sheltered wall	30.2400	1.9500	28.2900	0.2100	5.9409	0.0000	0.0000 (29a)
Flat Roof	64.5000		64.5000	0.1100	7.0950	9.0000	580.5000 (30)
Total net area of external elements Aum(A, m ²)			150.9000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	37.6623		(33)
Party Wall 1			15.6600	0.0000	0.0000	0.0000	0.0000 (32)
Party Floor 1			64.5000			40.0000	2580.0000 (32d)
Internal Wall 1			100.4400			9.0000	903.9600 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	4064.4600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							63.0149 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	

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E2 Other lintels (including other steel lintels)	9.0300	0.0280	0.2528
E3 Sill	8.1000	0.0240	0.1944
E4 Jamb	24.8000	0.0190	0.4712
E7 Party floor between dwellings (in blocks of flats)	32.0000	0.0360	1.1520
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	5.2000	1.0000	5.2000
E15 Flat roof with parapet	32.0000	0.3000	9.6000
E16 Corner (normal)	13.5000	0.0370	0.4995
E17 Corner (inverted - internal area greater than external area)	8.1000	-0.0790	-0.6399
E18 Party wall between dwellings	5.4000	0.0410	0.2214
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.8000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	5.8000	0.0330	0.1914
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			17.1428 (36)
Point Thermal Bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	54.8052 (37)

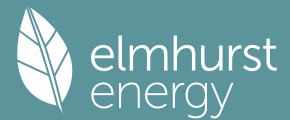
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	18.4333	18.1891	17.9449	16.7236	16.4794	15.2582	15.2582	15.0139	15.7466	16.4794	16.9679	17.4564	(38)
Heat transfer coeff	73.2385	72.9943	72.7500	71.5288	71.2846	70.0633	70.0633	69.8191	70.5518	71.2846	71.7730	72.2615	(39)
Average = Sum(39)m / 12 =												71.4677	
HLP	1.1355	1.1317	1.1279	1.1090	1.1052	1.0863	1.0863	1.0825	1.0938	1.1052	1.1128	1.1203	(40)
HLP (average)												1.1080	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.1056 (42)
Hot water usage for mixer showers	58.0197	57.1314	55.8224	53.8085	52.0042	49.4800	47.4835	49.8175	50.9914	53.4916	56.0953	57.9674 (42a)
Hot water usage for baths	25.1469	24.7673	24.2273	23.4186	22.6897	21.6864	20.9252	21.8560	22.3445	23.3387	24.3723	25.1270 (42b)
Hot water usage for other uses	36.1934	34.8773	33.5612	32.2451	30.9289	29.6128	29.6128	30.9289	32.2451	33.5612	34.8773	36.1934 (42c)
Average daily hot water use (litres/day)												109.7100 (43)
Daily hot water use	119.3601	116.7761	113.6108	109.4722	105.6229	100.7792	98.0214	102.6024	105.5810	110.3914	115.3448	119.2878 (44)
Energy content (annual)	175.7187	154.5184	162.3476	142.9980	136.1058	116.5477	108.3166	120.7649	122.4687	142.2505	155.8924	175.1829 (45)
Distribution loss (46)m = 0.15 x (45)m	26.3578	23.1778	24.3521	21.4497	20.4159	17.4822	16.2475	18.1147	18.3703	21.3376	23.3839	26.2774 (46)
Water storage loss:												
Store volume												201.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	202.6701	178.8616	189.2990	169.0800	163.0572	142.6297	135.2680	147.7163	148.5507	169.2019	181.9744	202.1343 (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	202.6701	178.8616	189.2990	169.0800	163.0572	142.6297	135.2680	147.7163	148.5507	169.2019	181.9744	202.1343 (64)
12Total per year (kWh/year)												2030.4431 (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	58.4265	51.3774	53.9806	47.5468	45.2552	38.7521	36.0153	40.1543	40.7208	47.2983	51.8342	58.2483 (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	105.2799	105.2799	105.2799	105.2799	105.2799	105.2799	105.2799	105.2799	105.2799	105.2799	105.2799	105.2799 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	92.8760	102.8270	92.8760	95.9719	92.8760	95.9719	92.8760	92.8760	95.9719	92.8760	95.9719	92.8760 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	184.1370	186.0478	181.2327	170.9820	158.0423	145.8809	137.7562	135.8455	140.6605	150.9113	163.8509	176.0124 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.5280	33.5280	33.5280	33.5280	33.5280	33.5280	33.5280	33.5280	33.5280	33.5280	33.5280	33.5280 (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)	-84.2239	-84.2239	-84.2239	-84.2239	-84.2239	-84.2239	-84.2239	-84.2239	-84.2239	-84.2239	-84.2239	-84.2239 (71)
Water heating gains (Table 5)	78.5302	76.4544	72.5545	66.0373	60.8268	53.8224	48.4076	53.9709	56.5567	63.5730	71.9920	78.2908 (72)
Total internal gains	410.1272	419.9132	401.2472	387.5751	366.3291	350.2591	333.6238	337.2763	347.7731	361.9442	386.3988	401.7631 (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	
East	11.3700	19.6403	0.6500	0.7000	0.7700	70.4129	(76)
South	5.7000	46.7521	0.6500	0.7000	0.7700	84.0273	(78)

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Solar gains	154.4402	275.3577	402.1396	528.9601	611.9095	613.7395	589.2762	527.9518	446.9457	311.8739	187.3976	130.5115 (83)
Total gains	564.5674	695.2708	803.3868	916.5352	978.2386	963.9986	922.9001	865.2282	794.7188	673.8181	573.7964	532.2746 (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	15.4156	15.4672	15.5191	15.7841	15.8382	16.1142	16.1142	16.1706	16.0027	15.8382	15.7304	15.6240	
alpha	2.0277	2.0311	2.0346	2.0523	2.0559	2.0743	2.0743	2.0780	2.0668	2.0559	2.0487	2.0416	
util living area	0.8758	0.8234	0.7564	0.6529	0.5365	0.4090	0.3103	0.3399	0.5017	0.7043	0.8321	0.8864 (86)	
MIT	18.0184	18.5294	19.1639	19.8939	20.4271	20.7733	20.9085	20.8867	20.6326	19.8931	18.8492	17.9420 (87)	
Th 2	19.9720	19.9750	19.9781	19.9935	19.9966	20.0121	20.0121	20.0152	20.0059	19.9966	19.9904	19.9843 (88)	
util rest of house	0.8635	0.8072	0.7345	0.6229	0.4964	0.3568	0.2472	0.2754	0.4481	0.6708	0.8139	0.8752 (89)	
MIT 2	16.5363	17.1640	17.9388	18.8194	19.4373	19.8242	19.9538	19.9396	19.6841	18.8454	17.5786	16.4461 (90)	
Living area fraction									fLA = Living area / (4) =				0.4450 (91)
MIT	17.1958	17.7715	18.4839	19.2975	19.8777	20.2465	20.3786	20.3610	20.1062	19.3116	18.1440	17.1117 (92)	
Temperature adjustment												0.0000	
adjusted MIT	17.1958	17.7715	18.4839	19.2975	19.8777	20.2465	20.3786	20.3610	20.1062	19.3116	18.1440	17.1117 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8205	0.7644	0.6975	0.6001	0.4913	0.3696	0.2712	0.2987	0.4538	0.6449	0.7727	0.8332 (94)
Useful gains	463.2347	531.4328	560.3299	550.0195	480.6491	356.3005	250.2704	258.4262	360.6539	434.5730	443.3696	443.4811 (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	944.4677	939.5489	871.8302	743.7192	582.9445	395.6139	264.7411	276.5536	423.7461	621.0004	792.6592	933.0189 (97)
Space heating kWh	358.0373	274.2540	231.7562	139.4638	76.1078	0.0000	0.0000	0.0000	0.0000	138.7020	251.4885	364.2162 (98a)
Space heating requirement - total per year (kWh/year)												1834.0258
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	358.0373	274.2540	231.7562	139.4638	76.1078	0.0000	0.0000	0.0000	0.0000	138.7020	251.4885	364.2162 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1834.0258
Space heating per m2										(98c) / (4) =		28.4345 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Fraction of main heating from main system 2												0.0000 (203)
Fraction of total heating from main system 1												1.0000 (204)
Fraction of total heating from main system 2												0.0000 (205)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	358.0373	274.2540	231.7562	139.4638	76.1078	0.0000	0.0000	0.0000	0.0000	138.7020	251.4885	364.2162 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	358.0373	274.2540	231.7562	139.4638	76.1078	0.0000	0.0000	0.0000	0.0000	138.7020	251.4885	364.2162 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Space heating fuel used, main system 2												0.0000 (213)
Water heating												
Water heating requirement	202.6701	178.8616	189.2990	169.0800	163.0572	142.6297	135.2680	147.7163	148.5507	169.2019	181.9744	202.1343 (64)
Efficiency of water heater (217)m	346.3985	346.3985	346.3985	346.3985	346.3985	346.3985	346.3985	346.3985	346.3985	346.3985	346.3985	346.3985 (216)
Fuel for water heating, kWh/month	58.5078	51.6346	54.6477	48.8108	47.0721	41.1750	39.0498	42.6435	42.8843	48.8460	52.5333	58.3531 (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	17.9365	16.2007	17.9365	17.3579	17.9365	17.3579	17.9365	17.9365	17.3579	17.9365	17.3579	17.9365 (231)
Lighting	19.2524	15.4450	13.9065	10.1885	7.8699	6.4298	7.1792	9.3318	12.1210	15.9035	17.9629	19.7875 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-9.5122	-16.6717	-30.0079	-40.2300	-47.2599	-42.1666	-41.3606	-36.4277	-28.4496	-20.8572	-11.2909	-7.7851 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-1.3204	-3.6495	-9.9895	-20.2500	-32.7350	-38.4734	-37.3844	-28.9848	-17.9184	-6.6410	-2.0147	-0.9643 (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												1834.0258 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												346.3985
Water heating fuel used												586.1582 (219)
Space cooling fuel												0.0000 (221)

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Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9940)	
mechanical ventilation fans (SFP = 0.9940)	211.1882 (230a)
Total electricity for the above, kWh/year	211.1882 (231)
Electricity for lighting (calculated in Appendix L)	155.3780 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-532.3450 (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	2254.4052 (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 (high-rate cost)	1834.0258	0.1624	297.8848 (261)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000 (261)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000 (262)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating - high rate cost	23.9778	0.1481	3.5505 (264)
Water heating - low rate cost	562.1804	0.1243	69.8670 (264)
Space and water heating			371.3023 (265)
Pumps, fans and electric keep-hot	211.1882	0.1432	29.3039 (267)
Energy for lighting	155.3780	0.1490	23.1544 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-332.0194	0.1362	-45.2236
PV Unit electricity exported	-200.3256	0.1181	-23.6525
Total			-68.8761 (269)
Total CO2, kg/year			354.8845 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.5000 (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 (high-rate cost)	1834.0258	1.6056	2944.7597 (275)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000 (275)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000 (276)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating - high rate cost	23.9778	1.5535	37.2494 (278)
Water heating - low rate cost	562.1804	1.4448	812.2417 (278)
Space and water heating			3794.2509 (279)
Pumps, fans and electric keep-hot	211.1882	1.5335	319.5183 (281)
Energy for lighting	155.3780	1.5547	241.5730 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-332.0194	1.5080	-500.6755
PV Unit electricity exported	-200.3256	0.4329	-86.7134
Total			-587.3889 (283)
Total Primary energy kWh/year			3767.9533 (286)
Dwelling Primary energy Rate (DPER)			58.4200 (287)

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

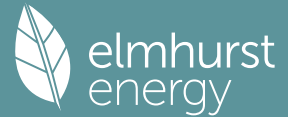
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	64.5000 (1b)	x 2.7000 (2b)	= 174.1500 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 174.1500 (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)
Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1148 (8)
Pressure test	Yes
Pressure Test Method	Blower Door

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Measured/design AP50												5.0000 (17)
Infiltration rate												0.3648 (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) = 0.3101 (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	0.3954	0.3876	0.3799	0.3411	0.3334	0.2946	0.2946	0.2869	0.3101	0.3334	0.3489	0.3644 (22b)
	0.5782	0.5751	0.5722	0.5582	0.5556	0.5434	0.5434	0.5411	0.5481	0.5556	0.5609	0.5664 (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)			14.1700	1.1450	16.2252		(27)
External Wall 1	56.1600	14.1700	41.9900	0.1800	7.5582		(29a)
Sheltered wall	30.2400	1.9500	28.2900	0.1800	5.0922		(29a)
Flat Roof	64.5000		64.5000	0.1100	7.0950		(30)
Total net area of external elements Aum(A, m2)			150.9000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 37.9206		(33)
Party Wall 1			15.6600	0.0000	0.0000		(32)

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

63.0149 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	9.0300	0.0500	0.4515
E3 Sill	8.1000	0.0500	0.4050
E4 Jamb	24.8000	0.0500	1.2400
E7 Party floor between dwellings (in blocks of flats)	32.0000	0.0700	2.2400
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	5.2000	0.0200	0.1040
E15 Flat roof with parapet	32.0000	0.5600	17.9200
E16 Corner (normal)	13.5000	0.0900	1.2150
E17 Corner (inverted - internal area greater than external area)	8.1000	-0.0900	-0.7290
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.8000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	5.8000	0.1200	0.6960

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

23.8665 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 61.7871 (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	33.2272	33.0527	32.8817	32.0786	31.9283	31.2288	31.2288	31.0993	31.4982	31.9283	32.2323	32.5501 (38)
Average = Sum(39)m / 12 =	95.0142	94.8398	94.6688	93.8657	93.7154	93.0159	93.0159	92.8864	93.2853	93.7154	94.0194	94.3372 (39)
												93.8649

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4731	1.4704	1.4677	1.4553	1.4530	1.4421	1.4421	1.4401	1.4463	1.4530	1.4577	1.4626 (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												2.1056 (42)
Hot water usage for mixer showers												
	59.5236	58.6290	57.3255	54.8315	52.9910	50.9385	49.7719	51.0655	52.4835	54.6873	57.2349	59.2955 (42a)
Hot water usage for baths												
	25.7203	25.3383	24.8004	23.8086	23.0659	22.2425	21.7976	22.3318	22.9134	23.7945	24.8068	25.6334 (42b)
Hot water usage for other uses												
	36.1934	34.8773	33.5612	32.2451	30.9289	29.6128	29.6128	30.9289	32.2451	33.5612	34.8773	36.1934 (42c)
Average daily hot water use (litres/day)												111.6286 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	121.4373	118.8447	115.6871	110.8852	106.9859	102.7938	101.1823	104.3262	107.6420	112.0431	116.9190	121.1223 (44)
Energy content (annual)	192.3270	169.2332	177.8068	151.7963	144.0236	126.3969	122.3712	129.1776	132.7333	152.0414	166.5725	189.6482 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1854.1283

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

238.9219 211.3190 224.4017 196.8881 190.6185 171.4888 168.9661 175.7725 177.8252 198.6363 211.6644 236.2432 (62)

WWHRS -27.2117 -24.0662 -25.2008 -20.8672 -19.4475 -16.6414 -15.5986 -16.5876 -17.2178 -20.2979 -22.9951 -26.7078 (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 (64a)

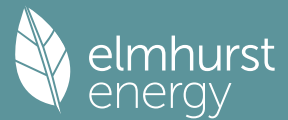
Output from w/h 211.7102 187.2527 199.2010 176.0209 171.1710 154.8474 153.3675 159.1850 160.6074 178.3384 188.6693 209.5354 (64)

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)

Heat gains from water heating, kWh/month 101.2247 89.9386 96.3967 86.5457 85.1638 78.1005 77.9644 80.2275 80.2073 87.8297 91.4588 100.3340 (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
(66)m	105.2799	105.2799	105.2799	105.2799	105.2799	105.2799	105.2799	105.2799	105.2799	105.2799	105.2799	105.2799 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	92.9122	102.8671	92.9122	96.0093	92.9122	96.0093	92.9122	92.9122	96.0093	92.9122	96.0093	92.9122 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	184.1370	186.0478	181.2327	170.9820	158.0423	145.8809	137.7562	135.8455	140.6605	150.9113	163.8509	176.0124 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.5280	33.5280	33.5280	33.5280	33.5280	33.5280	33.5280	33.5280	33.5280	33.5280	33.5280	33.5280 (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)	-84.2239	-84.2239	-84.2239	-84.2239	-84.2239	-84.2239	-84.2239	-84.2239	-84.2239	-84.2239	-84.2239	-84.2239 (71)
Water heating gains (Table 5)	136.0546	133.8372	129.5654	120.2024	114.4674	108.4729	104.7908	107.8326	111.3990	118.0506	127.0262	134.8575 (72)
Total internal gains	470.6879	480.3361	461.2944	444.7777	423.0060	404.9470	390.0433	391.1743	402.6529	419.4581	444.4704	461.3661 (73)

6. Solar gains

[Jan]	Area		Solar flux		Specific data		FF		Access		Gains	
	m2		Table 6a		or Table 6b		or Table 6c		factor		W	
			W/m2						Table 6d			
East	9.4400		19.6403		0.6300		0.7000		0.7700		56.6619 (76)	
South	4.7300		46.7521		0.6300		0.7000		0.7700		67.5824 (78)	
Solar gains	124.2443	221.5253	323.5321	425.5761	492.3228	493.7987	474.1147	424.7688	359.5847	250.9058	150.7589	104.9934 (83)
Total gains	594.9322	701.8614	784.8265	870.3538	915.3288	898.7457	864.1580	815.9431	762.2376	670.3639	595.2293	566.3595 (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	11.8826	11.9045	11.9260	12.0280	12.0473	12.1379	12.1379	12.1548	12.1028	12.0473	12.0083	11.9679
alpha	1.7922	1.7936	1.7951	1.8019	1.8032	1.8092	1.8092	1.8103	1.8069	1.8032	1.8006	1.7979
util living area	0.8848	0.8487	0.8014	0.7248	0.6274	0.5076	0.4001	0.4313	0.5883	0.7553	0.8514	0.8929 (86)
MIT	17.2664	17.7172	18.3752	19.2084	19.9442	20.5036	20.7734	20.7310	20.3046	19.3368	18.1642	17.1831 (87)
Th 2	19.7077	19.7098	19.7118	19.7212	19.7230	19.7312	19.7312	19.7327	19.7280	19.7230	19.7194	19.7157 (88)
util rest of house	0.8714	0.8316	0.7784	0.6916	0.5787	0.4357	0.3043	0.3358	0.5203	0.7183	0.8317	0.8804 (89)
MIT 2	15.5491	16.0947	16.8904	17.8855	18.7363	19.3486	19.6047	19.5738	19.1560	18.0646	16.6559	15.4497 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	16.3132	16.8167	17.5511	18.4741	19.2738	19.8625	20.1247	20.0887	19.6671	18.6306	17.3270	16.2210 (92)
Temperature adjustment	0.0000											
adjusted MIT	16.3132	16.8167	17.5511	18.4741	19.2738	19.8625	20.1247	20.0887	19.6671	18.6306	17.3270	16.2210 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8222	0.7808	0.7300	0.6533	0.5595	0.4437	0.3358	0.3644	0.5167	0.6798	0.7826	0.8323 (94)
Useful gains	489.1827	548.0298	572.8873	568.6446	512.1260	398.7945	290.1425	297.3618	393.8599	455.7293	465.8348	471.3773 (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	1141.4288	1130.1730	1046.1921	898.6830	709.7806	489.4968	327.8572	342.6295	519.3292	752.5941	961.5382	1134.0270 (97)
Space heating kWh	485.2711	391.2002	352.1388	237.6276	147.0550	0.0000	0.0000	0.0000	0.0000	220.8674	356.9064	493.0113 (98a)
Space heating requirement - total per year (kWh/year)	2684.0779											
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	485.2711	391.2002	352.1388	237.6276	147.0550	0.0000	0.0000	0.0000	0.0000	220.8674	356.9064	493.0113 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	2684.0779											
Space heating per m2	(98c) / (4) =											
	41.6136 (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	485.2711	391.2002	352.1388	237.6276	147.0550	0.0000	0.0000	0.0000	0.0000	220.8674	356.9064	493.0113 (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)	525.7542	423.8356	381.5155	257.4514	159.3229	0.0000	0.0000	0.0000	0.0000	239.2930	386.6809	534.1401 (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	211.7102	187.2527	199.2010	176.0209	171.1710	154.8474	153.3675	159.1850	160.6074	178.3384	188.6693	209.5354 (64)

Full SAP Calculation Printout



Efficiency of water heater (217)m	85.8587	85.6722	85.3232	84.7334	83.7211	79.8000	79.8000	79.8000	79.8000	84.5406	85.4666	79.8000 (216)
Fuel for water heating, kWh/month	246.5799	218.5688	233.4663	207.7349	204.4538	194.0444	192.1898	199.4799	201.2624	210.9501	220.7520	85.9102 (217)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa (233a)m	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 (234a)m	19.3053	15.4874	13.9447	10.2165	7.8915	6.4474	7.1989	9.3574	12.1544	15.9472	18.0123	19.8419 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-22.0094	-32.0676	-47.6265	-55.3995	-61.3551	-57.8717	-57.1739	-53.1804	-46.3992	-37.4987	-24.5669	-18.9099 (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	-9.4708	-20.1999	-40.6609	-61.8192	-82.4658	-83.1109	-82.1222	-69.1929	-50.2774	-29.1228	-12.7218	-7.4680 (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												2907.9934 (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												2573.3827 (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)												155.8050 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1062.6914 (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												4660.4898 (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	2907.9934	0.2100	610.6786	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2573.3827	0.2100	540.4104	(264)
Space and water heating			1151.0890	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	155.8050	0.1443	22.4875	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-514.0588	0.1339	-68.8258	
PV Unit electricity exported	-548.6326	0.1255	-68.8769	
Total			-137.7027	(269)
Total CO2, kg/year			1047.8031	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			16.2500	(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	2907.9934	1.1300	3286.0326	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2573.3827	1.1300	2907.9225	(278)
Space and water heating			6193.9551	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	155.8050	1.5338	238.9790	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-514.0588	1.4948	-768.4068	
PV Unit electricity exported	-548.6326	0.4608	-252.8167	
Total			-1021.2234	(283)
Total Primary energy kWh/year			5541.8114	(286)
Target Primary Energy Rate (TPER)			85.9200	(287)

APPENDIX B – Full SAP Calculation for Option 2

Full SAP Calculation Printout



Property Reference	P0.03 Latimer			Issued on Date	03/12/2024
Assessment Reference	P0.03 Kelda	Prop Type Ref	Grd Mid 3B5P		
Property	0.03, Latimer Road, Wokingham				
SAP Rating	78 C	DER	4.62	TER	11.46
Environmental	96 A	% DER < TER			59.69
CO ₂ Emissions (t/year)	0.44	DFEE	37.52	TFEE	38.61
Compliance Check	See BREL	% DFEE < TFEE			2.82
% DPER < TPER	20.40	DPER	48.06	TPER	60.37
Assessor Details	Mrs. Rebecca Lennon			Assessor ID	P627-0001
Client	RHB, RHB				

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	114.9000 (1b)	2.7000 (2b)	310.2300 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.9000		310.2300 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	310.2300 (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)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.2000 (23c)
Effective ac	0.3207	0.3165	0.3123	0.2910	0.2867	0.2655	0.2655	0.2612	0.2740	0.2867	0.2953	0.3037 (25)

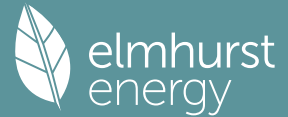
3. Heat losses and heat loss parameter

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
Flat ent door			1.9500	1.0000	1.9500		(26)
Windows (Uw = 1.20)			33.6100	1.1450	38.4847		(27)
Heat Loss Floor 1			114.9000	0.1200	13.7880	0.0000	0.0000 (28a)
External Wall 1	61.5600	33.6100	27.9500	0.1200	3.3540	0.0000	0.0000 (29a)
Sheltered wall	30.2400	1.9500	28.2900	0.2100	5.9409	0.0000	0.0000 (29a)
Total net area of external elements Aum(A, m ²)			206.7000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.5176		(33)
Party Wall 1			36.4500	0.0000	0.0000	0.0000	0.0000 (32)
Party Ceiling 1			114.9000			30.0000	3447.0000 (32b)
Internal Wall 1			109.7800			9.0000	988.0200 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	4435.0200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							38.5990 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	

elmhurst
energy

Solar gains	119.1126	231.2302	384.7477	580.0436	735.8457	766.2394	724.0342	603.7799	452.5034	274.6592	147.9972	98.3976 (83)
Total gains	698.3865	825.9327	952.4151	1129.0246	1254.2901	1262.5202	1196.8128	1080.3860	944.1930	785.6376	693.3857	665.0979 (84)

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7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	12.1771	12.2297	12.2828	12.5551	12.6110	12.8982	12.8982	12.9573	12.7818	12.6110	12.4997	12.3903
alpha	1.8118	1.8153	1.8189	1.8370	1.8407	1.8599	1.8599	1.8638	1.8521	1.8407	1.8333	1.8260
util living area	0.8709	0.8305	0.7706	0.6637	0.5405	0.4101	0.3169	0.3565	0.5322	0.7275	0.8342	0.8790 (86)
MIT	17.4569	17.9252	18.6270	19.5377	20.2282	20.6824	20.8609	20.8225	20.4513	19.5122	18.3644	17.4041 (87)
Th 2	20.1841	20.1873	20.1906	20.2068	20.2100	20.2263	20.2263	20.2296	20.2198	20.2100	20.2035	20.1971 (88)
util rest of house	0.8618	0.8190	0.7552	0.6418	0.5107	0.3710	0.2683	0.3062	0.4919	0.7040	0.8212	0.8706 (89)
MIT 2	16.0629	16.6362	17.4935	18.5954	19.4087	19.9319	20.1186	20.0873	19.6883	18.5900	17.1892	15.9994 (90)
Living area fraction	fLA = Living area / (4) = 0.3168 (91)											
MIT	16.5045	17.0446	17.8526	18.8940	19.6683	20.1697	20.3538	20.3202	19.9301	18.8821	17.5615	16.4444 (92)
Temperature adjustment	0.0000											
adjusted MIT	16.5045	17.0446	17.8526	18.8940	19.6683	20.1697	20.3538	20.3202	19.9301	18.8821	17.5615	16.4444 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8063	0.7620	0.7012	0.6011	0.4888	0.3680	0.2765	0.3124	0.4758	0.6575	0.7656	0.8163 (94)
Useful gains	563.0909	629.4003	667.8281	678.7056	613.0394	464.6004	330.9731	337.4605	449.2776	516.5243	530.8527	542.9222 (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	1234.7214	1223.3724	1138.6522	980.6431	778.4092	531.9785	358.5346	372.7227	561.9203	809.0676	1031.0707	1217.4511 (97)
Space heating kWh	499.6931	399.1492	350.2931	217.3950	123.0352	0.0000	0.0000	0.0000	0.0000	217.6522	360.1570	501.8495 (98a)
Space heating requirement - total per year (kWh/year)	2669.2243											
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	499.6931	399.1492	350.2931	217.3950	123.0352	0.0000	0.0000	0.0000	0.0000	217.6522	360.1570	501.8495 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	2669.2243											
Space heating per m2	(98c) / (4) = 23.2308 (99)											
9a. Energy requirements - Individual heating systems, including micro-CHP												
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Fraction of main heating from main system 2												0.0000 (203)
Fraction of total heating from main system 1												1.0000 (204)
Fraction of total heating from main system 2												0.0000 (205)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	499.6931	399.1492	350.2931	217.3950	123.0352	0.0000	0.0000	0.0000	0.0000	217.6522	360.1570	501.8495 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	499.6931	399.1492	350.2931	217.3950	123.0352	0.0000	0.0000	0.0000	0.0000	217.6522	360.1570	501.8495 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Space heating fuel used, main system 2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Water heating												
Water heating requirement												
Efficiency of water heater (217)m	339.1968	339.1968	339.1968	339.1968	339.1968	339.1968	339.1968	339.1968	339.1968	339.1968	339.1968	339.1968 (216)
Fuel for water heating, kWh/month	70.4889	62.1739	65.7293	58.5859	56.3890	49.1715	46.4985	50.9292	51.2794	58.5766	63.1758	70.2982 (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	31.9521	28.8599	31.9521	30.9213	31.9521	30.9213	31.9521	31.9521	30.9213	31.9521	30.9213	31.9521 (231)
Lighting	32.7388	26.2642	23.6480	17.3256	13.3828	10.9338	12.2082	15.8687	20.6119	27.0439	30.5460	33.6487 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-9.7276	-17.2859	-31.6999	-43.5662	-52.4351	-47.6857	-46.7368	-40.7224	-31.2349	-22.0266	-11.6291	-7.9402 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-1.1050	-3.0354	-8.2976	-16.9138	-27.5598	-32.9543	-32.0082	-24.6900	-15.1331	-5.4716	-1.6765	-0.8093 (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	2669.2243 (211)											
Space heating fuel - main system 2	0.0000 (213)											
Space heating fuel - secondary	0.0000 (215)											
Efficiency of water heater	339.1968											
Water heating fuel used	703.2963 (219)											
Space cooling fuel	0.0000 (221)											
Electricity for pumps and fans:												

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(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9940)	
mechanical ventilation fans (SFP = 0.9940)	376.2097 (230a)
Total electricity for the above, kWh/year	376.2097 (231)
Electricity for lighting (calculated in Appendix L)	264.2205 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-532.3450 (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	-123.7000 (236)
Energy used	29.9000 (237)
Total delivered energy for all uses	3386.8058 (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 (high-rate cost)	2669.2243	0.1620	432.3352 (261)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000 (261)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000 (262)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating - high rate cost	38.9930	0.1481	5.7766 (264)
Water heating - low rate cost	664.3033	0.1243	82.5978 (264)
Space and water heating			520.7097 (265)
Pumps, fans and electric keep-hot	376.2097	0.1432	52.2018 (267)
Energy for lighting	264.2205	0.1490	39.3741 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-362.6903	0.1357	-49.2147
PV Unit electricity exported	-169.6547	0.1178	-19.9850
Total			-69.1997 (269)
Appendix Q item 'kelda' - energy saved	-123.7000	0.1360	-16.8232 (270)
Appendix Q item 'kelda' - energy used	29.9000	0.1360	4.0664 (271)
Total CO2, kg/year			530.3291 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.6200 (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 (high-rate cost)	2669.2243	1.6040	4281.4557 (275)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000 (275)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000 (276)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating - high rate cost	38.9930	1.5538	60.5855 (278)
Water heating - low rate cost	664.3033	1.4450	959.9466 (278)
Space and water heating			5301.9877 (279)
Pumps, fans and electric keep-hot	376.2097	1.5335	569.1885 (281)
Energy for lighting	264.2205	1.5547	410.7954 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-362.6903	1.5061	-546.2431
PV Unit electricity exported	-169.6547	0.4318	-73.2606
Total			-619.5037 (283)
Appendix Q item 'kelda' - energy saved	-123.7000	1.5010	-185.6737 (284)
Appendix Q item 'kelda' - energy used	29.9000	1.5010	44.8799 (285)
Total Primary energy kWh/year			5521.6741 (286)
Dwelling Primary energy Rate (DPER)			48.0600 (287)

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

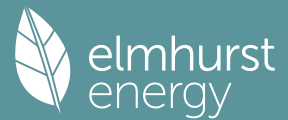
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	114.9000 (1b)	x 2.7000 (2b)	= 310.2300 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 310.2300 (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)

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Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.1289 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.0000 (17)
Infiltration rate 0.3789 (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) = 0.3221 (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	0.4107	0.4026	0.3946	0.3543	0.3463	0.3060	0.3060	0.2979	0.3221	0.3463	0.3624	0.3785 (22b)
	0.5843	0.5811	0.5778	0.5628	0.5599	0.5468	0.5468	0.5444	0.5519	0.5599	0.5657	0.5716 (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)			26.7800	1.1450	30.6641		(27)
Heat Loss Floor 1			114.9000	0.1300	14.9370		(28a)
External Wall 1	61.5600	26.7800	34.7800	0.1800	6.2604		(29a)
Sheltered wall	30.2400	1.9500	28.2900	0.1800	5.0922		(29a)
Total net area of external elements Aum(A, m2)			206.7000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	58.9037		(33)
Party Wall 1			36.4500	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 48.5990 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	15.4300	0.0500	0.7715
E3 Sill	14.5000	0.0500	0.7250
E4 Jamb	44.3000	0.0500	2.2150
E5 Ground floor (normal)	34.0000	0.1600	5.4400
E16 Corner (normal)	5.4000	0.0900	0.4860
E17 Corner (inverted - internal area greater than external area)	2.7000	-0.0900	-0.2430
E18 Party wall between dwellings	5.4000	0.0600	0.3240
E25 Staggered party wall between dwellings	5.4000	0.0600	0.3240
P1 Party wall - Ground floor	13.5000	0.0800	1.0800

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.1225 (36)

Point Thermal bridges

Total fabric heat loss (33) + (36) + (36a) = 70.0262 (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	59.8209	59.4857	59.1571	57.6137	57.3249	55.9807	55.9807	55.7318	56.4985	57.3249	57.9091	58.5198 (38)
Average = Sum(39)m / 12 =	129.8471	129.5119	129.1833	127.6399	127.3512	126.0069	126.0069	125.7580	126.5247	127.3512	127.9353	128.5460 (39)
												127.6385

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1301	1.1272	1.1243	1.1109	1.1084	1.0967	1.0967	1.0945	1.1012	1.1084	1.1134	1.1188 (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												2.8413 (42)
Hot water usage for mixer showers												
	71.8583	70.7784	69.2048	66.1940	63.9721	61.4942	60.0858	61.6475	63.3594	66.0199	69.0954	71.5830 (42a)
Hot water usage for baths												
	31.0247	30.5639	29.9150	28.7187	27.8229	26.8296	26.2930	26.9373	27.6389	28.7017	29.9227	30.9198 (42b)
Hot water usage for other uses												
	43.7273	42.1372	40.5471	38.9570	37.3670	35.7769	35.7769	37.3670	38.9570	40.5471	42.1372	43.7273 (42c)
Average daily hot water use (litres/day)												134.7678 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	146.6103	143.4795	139.6670	133.8697	129.1619	124.1007	122.1557	125.9518	129.9553	135.2688	141.1553	146.2301 (44)
Energy content (annual)	232.1948	204.3129	214.6630	183.2610	173.8768	152.5962	147.7367	155.9546	160.2479	183.5584	201.1017	228.9609 (45)
Distribution loss (46)m = 0.15 x (45)m	34.8292	30.6469	32.1994	27.4891	26.0815	22.8894	22.1605	23.3932	24.0372	27.5338	30.1652	34.3441 (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

278.7897 246.3987 261.2579 228.3528 220.4717 197.6881 194.3316 202.5495 205.3398 230.1533 246.1935 275.5558 (62)

WWHRS -32.8506 -29.0534 -30.4230 -25.1915 -23.4775 -20.0899 -18.8311 -20.0250 -20.7858 -24.5041 -27.7602 -32.2423 (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

245.9391 217.3453 230.8349 203.1614 196.9941 177.5982 175.5006 182.5246 184.5540 205.6492 218.4333 243.3136 (64)

12Total per year (kWh/year) 2481.8482 (64)

Electric shower(s) 2482 (64)

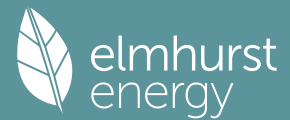
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

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

Heat gains from water heating, kWh/month

114.4807 101.6026 108.6514 97.0077 95.0899 86.8117 86.3984 89.1308 89.3559 98.3091 102.9398 113.4054 (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
(66)m	142.0628	142.0628	142.0628	142.0628	142.0628	142.0628	142.0628	142.0628	142.0628	142.0628	142.0628	142.0628 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	140.4292	155.4752	140.4292	145.1102	140.4292	145.1102	140.4292	140.4292	145.1102	140.4292	145.1102	140.4292 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	278.4166	281.3056	274.0252	258.5261	238.9612	220.5729	208.2885	205.3994	212.6798	228.1789	247.7438	266.1321 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2063	37.2063	37.2063	37.2063	37.2063	37.2063	37.2063	37.2063	37.2063	37.2063	37.2063	37.2063 (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)	-113.6502	-113.6502	-113.6502	-113.6502	-113.6502	-113.6502	-113.6502	-113.6502	-113.6502	-113.6502	-113.6502	-113.6502 (71)
Water heating gains (Table 5)	153.8719	151.1944	146.0368	134.7330	127.8091	120.5718	116.1269	119.7995	124.1054	132.1359	142.9719	152.4267 (72)
Total internal gains	641.3365	656.5940	629.1100	606.9880	575.8183	551.8738	530.4633	531.2469	547.5142	569.3628	604.4447	627.6067 (73)

6. Solar gains

[Jan]	Area m ²		Solar flux Table 6a W/m ²		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W	
North	12.7800		10.6334		0.6300		0.7000		0.7700		41.5312 (74)	
East	14.0000		19.6403		0.6300		0.7000		0.7700		84.0325 (76)	
Solar gains	125.5637	243.7536	405.5853	611.4574	775.6962	807.7353	763.2447	636.4788	477.0104	289.5346	156.0127	103.7267 (83)
Total gains	766.9002	900.3476	1034.6953	1218.4454	1351.5144	1359.6091	1293.7080	1167.7257	1024.5246	858.8975	760.4574	731.3334 (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, n _{l,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	11.9457	11.9766	12.0071	12.1523	12.1798	12.3098	12.3098	12.3341	12.2594	12.1798	12.1242	12.0666
alpha	1.7964	1.7984	1.8005	1.8102	1.8120	1.8207	1.8207	1.8223	1.8173	1.8120	1.8083	1.8044
util living area	0.8943	0.8613	0.8102	0.7175	0.6012	0.4722	0.3709	0.4148	0.5925	0.7723	0.8643	0.9015 (86)
MIT	17.1876	17.6267	18.3305	19.2579	20.0322	20.5691	20.8046	20.7531	20.3049	19.2791	18.0905	17.1178 (87)
Th 2	19.9763	19.9787	19.9810	19.9920	19.9940	20.0036	20.0036	20.0053	19.9999	19.9940	19.9899	19.9855 (88)
util rest of house	0.8845	0.8488	0.7928	0.6914	0.5631	0.4181	0.3004	0.3428	0.5401	0.7447	0.8500	0.8924 (89)
MIT 2	15.6154	16.1522	17.0104	18.1273	19.0323	19.6344	19.8717	19.8307	19.3681	18.1808	16.7345	15.5312 (90)
Living area fraction	f _{LA} = Living area / (4) =											
MIT	16.1135	16.6193	17.4286	18.4855	19.3491	19.9305	20.1672	20.1229	19.6649	18.5288	17.1641	16.0338 (92)
Temperature adjustment	0.0000											
adjusted MIT	16.1135	16.6193	17.4286	18.4855	19.3491	19.9305	20.1672	20.1229	19.6649	18.5288	17.1641	16.0338 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8319	0.7929	0.7373	0.6455	0.5360	0.4138	0.3126	0.3518	0.5206	0.6952	0.7954	0.8411 (94)
Useful gains	637.9587	713.9292	762.9183	786.4779	724.3945	562.6361	404.4090	410.7966	533.3665	597.0794	604.8611	615.1500 (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	1533.9441	1517.7947	1411.7948	1223.4869	974.1193	671.6861	449.4969	468.1858	704.0989	1009.7391	1287.5496	1521.1894 (97)
Space heating kWh	666.6131	540.1976	482.7641	314.6465	185.7953	0.0000	0.0000	0.0000	0.0000	307.0188	491.5357	674.0934 (98a)
Space heating requirement - total per year (kWh/year)	3662.6645											
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	666.6131	540.1976	482.7641	314.6465	185.7953	0.0000	0.0000	0.0000	0.0000	307.0188	491.5357	674.0934 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	3662.6645											
Space heating per m ²	(98c) / (4) = 31.8770 (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	666.6131	540.1976	482.7641	314.6465	185.7953	0.0000	0.0000	0.0000	0.0000	307.0188	491.5357	674.0934 (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)	722.2244	585.2629	523.0380	340.8954	201.2950	0.0000	0.0000	0.0000	0.0000	332.6315	532.5414	730.3287 (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

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Water heating requirement	245.9391	217.3453	230.8349	203.1614	196.9941	177.5982	175.5006	182.5246	184.5540	205.6492	218.4333	243.3136 (64)
Efficiency of water heater												79.8000 (216)
(217)m	86.1805	86.0167	85.6744	85.0371	83.9287	79.8000	79.8000	79.8000	79.8000	84.9565	85.8220	86.2210 (217)
Fuel for water heating, kWh/month	285.3767	252.6781	269.4328	238.9090	234.7160	222.5541	219.9255	228.7276	231.2707	242.0641	254.5189	282.1977 (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	29.1784	23.4080	21.0763	15.4414	11.9274	9.7448	10.8806	14.1430	18.3703	24.1028	27.2241	29.9894 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-29.9091	-43.8484	-65.5017	-76.6112	-85.1544	-80.3649	-79.3363	-73.6157	-63.9979	-51.4036	-33.4583	-25.6623 (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	-12.1499	-25.9834	-52.4544	-79.9984	-106.9970	-107.9944	-106.7698	-89.8807	-65.1665	-37.6058	-16.3610	-9.5798 (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												3968.2172 (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												2962.3713 (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)												235.4865 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1419.8051 (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												5832.2699 (238)

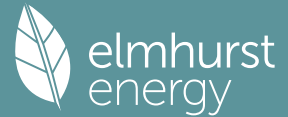
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3968.2172	0.2100	833.3256 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2962.3713	0.2100	622.0980 (264)
Space and water heating			1455.4236 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	235.4865	0.1443	33.9880 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-708.8640	0.1338	-94.8374
PV Unit electricity exported	-710.9411	0.1254	-89.1794
Total			-184.0168 (269)
Total CO2, kg/year			1317.3241 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.4600 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3968.2172	1.1300	4484.0855 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2962.3713	1.1300	3347.4795 (278)
Space and water heating			7831.5650 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	235.4865	1.5338	361.1970 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-708.8640	1.4944	-1059.3349
PV Unit electricity exported	-710.9411	0.4604	-327.3335
Total			-1386.6684 (283)
Total Primary energy kWh/year			6936.1944 (286)
Target Primary Energy Rate (TPER)			60.3700 (287)

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Property Reference	P0.05 Latimer			Issued on Date	03/12/2024
Assessment Reference	P0.05 Kelda	Prop Type Ref	Grd Mid 3B5P		
Property	0.05, Latimer Road, Wokingham				
SAP Rating	88 B	DER	3.26	TER	12.44
Environmental	97 A	% DER < TER			73.79
CO ₂ Emissions (t/year)	0.18	DFEE	28.59	TFEE	31.38
Compliance Check	See BREL	% DFEE < TFEE			8.88
% DPER < TPER	45.82	DPER	35.74	TPER	65.97
Assessor Details	Mrs. Rebecca Lennon			Assessor ID	P627-0001
Client	RHB, RHB				

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	73.4000	2.7000	198.1800
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.4000		
Dwelling volume			

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)

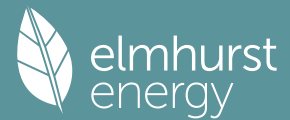
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700 (21)

	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)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.2000 (23c)
Effective ac	0.3207	0.3165	0.3123	0.2910	0.2867	0.2655	0.2655	0.2612	0.2740	0.2867	0.2953	0.3037 (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
Flat ent door			1.9500	1.0000	1.9500		(26)
Windows (Uw = 1.20)			9.6400	1.1450	11.0382		(27)
Heat Loss Floor 1			73.4000	0.1200	8.8080	0.0000	0.0000 (28a)
External Wall 1	28.6200	11.5900	17.0300	0.1600	2.7248	0.0000	0.0000 (29a)
Sheltered wall	4.0500		4.0500	0.1500	0.6075	0.0000	0.0000 (29a)
Total net area of external elements Aum(A, m ²)			106.0700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.1285		(33)
Party Wall 1			69.9300	0.0000	0.0000	0.0000	0.0000 (32)
Party Ceiling 1			73.4000			30.0000	2202.0000 (32b)
Internal Wall 1			136.6200			9.0000	1229.5800 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) =
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							3431.5800 (34)
List of Thermal Bridges							46.7518 (35)
K1 Element				Length	Psi-value		Total

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7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.3476	19.4574	19.5684	20.1431	20.2621	20.8789	20.8789	21.0068	20.6277	20.2621	20.0255	19.7943
alpha	2.2898	2.2972	2.3046	2.3429	2.3508	2.3919	2.3919	2.4005	2.3752	2.3508	2.3350	2.3196
util living area	0.8453	0.8113	0.7652	0.6718	0.5590	0.4194	0.3170	0.3438	0.5085	0.6964	0.8015	0.8519 (86)
MIT	18.8274	19.1304	19.5540	20.1452	20.5693	20.8507	20.9445	20.9316	20.7485	20.2079	19.4872	18.8228 (87)
Th 2	20.3663	20.3697	20.3731	20.3899	20.3933	20.4102	20.4102	20.4136	20.4035	20.3933	20.3865	20.3798 (88)
util rest of house	0.8359	0.8002	0.7512	0.6529	0.5336	0.3869	0.2781	0.3044	0.4751	0.6749	0.7884	0.8430 (89)
MIT 2	17.7631	18.1436	18.6748	19.4142	19.9271	20.2646	20.3640	20.3551	20.1495	19.5035	18.6067	17.7653 (90)
Living area fraction	fLA = Living area / (4) = 0.3760 (91)											
MIT	18.1633	18.5147	19.0054	19.6891	20.1686	20.4850	20.5823	20.5719	20.3748	19.7683	18.9378	18.1630 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.1633	18.5147	19.0054	19.6891	20.1686	20.4850	20.5823	20.5719	20.3748	19.7683	18.9378	18.1630 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.7967	0.7623	0.7170	0.6296	0.5238	0.3911	0.2896	0.3152	0.4735	0.6508	0.7528	0.8045 (94)
Useful gains	396.7553	417.0553	412.5618	391.1432	336.8390	247.6212	174.4523	180.1695	254.8225	323.1355	362.7082	387.6358 (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	683.0171	666.9829	609.1626	510.5640	398.3989	268.6760	181.8108	189.3050	289.9599	431.3183	563.4811	672.4018 (97)
Space heating kWh	212.9788	167.9513	146.2710	85.9830	45.8005	0.0000	0.0000	0.0000	0.0000	80.4881	144.5565	211.8659 (98a)
Space heating requirement - total per year (kWh/year)	1095.8951											
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	212.9788	167.9513	146.2710	85.9830	45.8005	0.0000	0.0000	0.0000	0.0000	80.4881	144.5565	211.8659 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1095.8951											
Space heating per m2	(98c) / (4) = 14.9305 (99)											
9a. Energy requirements - Individual heating systems, including micro-CHP												
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Fraction of main heating from main system 2												0.0000 (203)
Fraction of total heating from main system 1												1.0000 (204)
Fraction of total heating from main system 2												0.0000 (205)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	212.9788	167.9513	146.2710	85.9830	45.8005	0.0000	0.0000	0.0000	0.0000	80.4881	144.5565	211.8659 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	212.9788	167.9513	146.2710	85.9830	45.8005	0.0000	0.0000	0.0000	0.0000	80.4881	144.5565	211.8659 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Space heating fuel used, main system 2	0.0000 (213)											
Water heating												
Water heating requirement												
Efficiency of water heater (217)m	344.2432	344.2432	344.2432	344.2432	344.2432	344.2432	344.2432	344.2432	344.2432	344.2432	344.2432	344.2432 (216)
Fuel for water heating, kWh/month	62.0408	54.7425	57.9155	51.6934	49.8195	43.5331	41.2463	45.0868	45.3599	51.7154	55.6716	61.8756 (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	20.4115	18.4362	20.4115	19.7531	20.4115	19.7531	20.4115	20.4115	19.7531	20.4115	19.7531	20.4115 (231)
Lighting	24.5129	19.6651	17.7063	12.9724	10.0202	8.1866	9.1408	11.8816	15.4330	20.2489	22.8711	25.1942 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-9.3788	-16.3830	-29.4602	-39.5974	-47.0495	-43.6703	-42.8303	-37.6197	-29.2390	-20.5824	-11.1151	-7.6782 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-1.4538	-3.9383	-10.5372	-20.8826	-32.9454	-36.9697	-35.9147	-27.7928	-17.1290	-6.9159	-2.1905	-1.0712 (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	1095.8951 (211)											
Space heating fuel - main system 2	0.0000 (213)											
Space heating fuel - secondary	0.0000 (215)											
Efficiency of water heater	344.2432											
Water heating fuel used	620.7006 (219)											
Space cooling fuel	0.0000 (221)											
Electricity for pumps and fans:												

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(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9940)	
mechanical ventilation fans (SFP = 0.9940)	240.3289 (230a)
Total electricity for the above, kWh/year	240.3289 (231)
Electricity for lighting (calculated in Appendix L)	197.8329 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-532.3450 (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	-107.2000 (236)
Energy used	29.5000 (237)
Total delivered energy for all uses	1544.7125 (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 (high-rate cost)	1095.8951	0.1624	177.9815 (261)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000 (261)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000 (262)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating - high rate cost	28.0911	0.1481	4.1603 (264)
Water heating - low rate cost	592.6095	0.1243	73.6604 (264)
Space and water heating			255.8022 (265)
Pumps, fans and electric keep-hot	240.3289	0.1432	33.3474 (267)
Energy for lighting	197.8329	0.1490	29.4810 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-334.6038	0.1358	-45.4526
PV Unit electricity exported	-197.7412	0.1191	-23.5497
Total			-69.0024 (269)
Appendix Q item 'kelda' - energy saved	-107.2000	0.1360	-14.5792 (270)
Appendix Q item 'kelda' - energy used	29.5000	0.1360	4.0120 (271)
Total CO2, kg/year			239.0610 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.2600 (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 (high-rate cost)	1095.8951	1.6056	1759.5364 (275)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000 (275)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000 (276)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating - high rate cost	28.0911	1.5536	43.6418 (278)
Water heating - low rate cost	592.6095	1.4449	856.2527 (278)
Space and water heating			2659.4310 (279)
Pumps, fans and electric keep-hot	240.3289	1.5335	363.6069 (281)
Energy for lighting	197.8329	1.5547	307.5797 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-334.6038	1.5066	-504.1191
PV Unit electricity exported	-197.7412	0.4367	-86.3597
Total			-590.4788 (283)
Appendix Q item 'kelda' - energy saved	-107.2000	1.5010	-160.9072 (284)
Appendix Q item 'kelda' - energy used	29.5000	1.5010	44.2795 (285)
Total Primary energy kWh/year			2623.5110 (286)
Dwelling Primary energy Rate (DPER)			35.7400 (287)

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

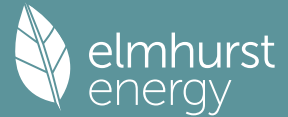
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	73.4000 (1b)	x 2.7000 (2b)	= 198.1800 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	198.1800 (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)

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Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 30.0000 / (5) = 0.1514 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.0000 (17)
Infiltration rate 0.4014 (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) = 0.3412 (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	0.4350	0.4265	0.4179	0.3753	0.3668	0.3241	0.3241	0.3156	0.3412	0.3668	0.3838	0.4009 (22b)
	0.5946	0.5909	0.5873	0.5704	0.5673	0.5525	0.5525	0.5498	0.5582	0.5673	0.5737	0.5804 (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)			9.6400	1.1450	11.0382		(27)
Heat Loss Floor 1			73.4000	0.1300	9.5420		(28a)
External Wall 1	28.6200	11.5900	17.0300	0.1800	3.0654		(29a)
Sheltered wall	4.0500		4.0500	0.1800	0.7290		(29a)
Total net area of external elements Aum(A, m2)			106.0700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.3246		(33)
Party Wall 1			69.9300	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 56.7518 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	5.4600	0.0500	0.2730
E3 Sill	4.5300	0.0500	0.2265
E4 Jamb	21.2000	0.0500	1.0600
E5 Ground floor (normal)	12.1000	0.1600	1.9360
E18 Party wall between dwellings	5.4000	0.0600	0.3240
E25 Staggered party wall between dwellings	5.4000	0.0600	0.3240
P1 Party wall - Ground floor	25.9000	0.0800	2.0720
E16 Corner (normal)	2.7000	0.0900	0.2430
E17 Corner (inverted - internal area greater than external area)	2.7000	-0.0900	-0.2430

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.2155 (36)

Point Thermal bridges

Total fabric heat loss (33) + (36) + (36a) = 32.5401 (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	38.8871	38.6468	38.4113	37.3052	37.0982	36.1348	36.1348	35.9564	36.5059	37.0982	37.5169	37.9546 (38)
Average = Sum(39)m / 12 =	71.4272	71.1869	70.9514	69.8452	69.6383	68.6748	68.6748	68.4964	69.0459	69.6383	70.0569	70.4947 (39)
												69.8442

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9731	0.9698	0.9666	0.9516	0.9488	0.9356	0.9356	0.9332	0.9407	0.9488	0.9545	0.9604 (40)
HLP (average)												0.9516
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3258 (42)

Hot water usage for mixer showers 63.2150 62.2650 60.8807 58.2320 56.2774 54.0976 52.8585 54.2324 55.7384 58.0789 60.7844 62.9728 (42a)

Hot water usage for baths 27.3078 26.9022 26.3311 25.2781 24.4896 23.6153 23.1430 23.7101 24.3276 25.2631 26.3379 27.2154 (42b)

Hot water usage for other uses 38.4481 37.0500 35.6519 34.2538 32.8557 31.4576 31.4576 32.8557 34.2538 35.6519 37.0500 38.4481 (42c)

Average daily hot water use (litres/day) 118.5536 (43)

Daily hot water use 128.9709 126.2172 122.8637 117.7639 113.6226 109.1704 107.4591 110.7982 114.3198 118.9939 124.1723 128.6364 (44)

Energy conte 204.2584 179.7317 188.8369 161.2128 152.9579 134.2377 129.9625 137.1913 140.9677 161.4736 176.9062 201.4135 (45)

Energy content (annual) 1969.1501

Distribution loss (46)m = 0.15 x (45)m 30.6388 26.9597 28.3255 24.1819 22.9437 20.1357 19.4944 20.5787 21.1452 24.2210 26.5359 30.2120 (46)

Water storage loss: 150.0000 (47)

Store volume 1.3938 (48)

a) If manufacturer declared loss factor is known (kWh/day): 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 250.8533 221.8174 235.4318 206.3047 199.5528 179.3295 176.5574 183.7862 186.0596 208.0685 221.9980 248.0084 (62)

WWHRS -28.8993 -25.5588 -26.7637 -22.1614 -20.6536 -17.6734 -16.5660 -17.6163 -18.2856 -21.5567 -24.4211 -28.3641 (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 221.9540 196.2586 208.6681 184.1433 178.8992 161.6561 159.9913 166.1699 167.7740 186.5118 197.5769 219.6443 (64)

12Total per year (kWh/year) 2249.2475 (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 105.1918 93.4294 100.0642 89.6767 88.1344 80.7075 80.4884 82.8920 82.9452 90.9659 94.8948 104.2459 (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
(66)m	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	112.5498	124.6087	112.5498	116.3015	112.5498	116.3015	112.5498	112.5498	116.3015	112.5498	116.3015	112.5498 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	205.0989	207.2272	201.8640	190.4464	176.0336	162.4877	153.4382	151.3099	156.6731	168.0908	182.5035	196.0494 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288 (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)	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304 (71)
Water heating gains (Table 5)	141.3869	139.0318	134.4949	124.5510	118.4602	112.0938	108.1834	111.4140	115.2017	122.2660	131.7983	140.1155 (72)
Total internal gains	519.9220	531.7541	509.7951	492.1853	467.9301	448.7694	432.0578	433.1602	446.0627	463.7930	491.4897	509.6011 (73)

6. Solar gains

[Jan]	Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W	
North	2.2400		10.6334		0.6300		0.7000		0.7700		7.2793 (74)	
East	7.4000		19.6403		0.6300		0.7000		0.7700		44.4172 (76)	
Solar gains	51.6965	100.8006	166.7330	246.6642	306.9116	316.5751	300.3841	254.6713	194.8459	119.6610	64.3630	42.5949 (83)
Total gains	571.6185	632.5547	676.5281	738.8495	774.8417	765.3444	732.4420	687.8315	640.9087	583.4540	555.8527	552.1960 (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	16.1998	16.2545	16.3084	16.5667	16.6159	16.8490	16.8490	16.8929	16.7585	16.6159	16.5166	16.4141
alpha	2.0800	2.0836	2.0872	2.1044	2.1077	2.1233	2.1233	2.1262	2.1172	2.1077	2.1011	2.0943
util living area	0.8742	0.8454	0.8033	0.7222	0.6158	0.4828	0.3731	0.4064	0.5746	0.7480	0.8397	0.8808 (86)
MIT	18.1621	18.4928	19.0064	19.7102	20.2930	20.7077	20.8793	20.8514	20.5497	19.8068	18.9040	18.1237 (87)
Th 2	20.1058	20.1085	20.1112	20.1239	20.1263	20.1373	20.1373	20.1394	20.1331	20.1263	20.1215	20.1164 (88)
util rest of house	0.8633	0.8324	0.7863	0.6977	0.5805	0.4331	0.3097	0.3424	0.5263	0.7206	0.8242	0.8705 (89)
MIT 2	16.7880	17.1995	17.8382	18.7052	19.4009	19.8769	20.0515	20.0293	19.7116	18.8402	17.7254	16.7438 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.3047	17.6858	18.2774	19.0831	19.7364	20.1893	20.3628	20.3384	20.0267	19.2037	18.1686	17.2627 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.3047	17.6858	18.2774	19.0831	19.7364	20.1893	20.3628	20.3384	20.0267	19.2037	18.1686	17.2627 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8194	0.7881	0.7442	0.6649	0.5634	0.4362	0.3268	0.3578	0.5199	0.6872	0.7815	0.8273 (94)
Useful gains	468.3929	498.5122	503.4940	491.2515	436.5792	333.8502	239.3638	246.0848	333.2325	400.9350	434.3920	456.8526 (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	928.8896	910.1814	835.6248	711.2424	559.6390	383.8456	258.4066	269.7651	409.2168	599.1434	775.4293	920.8507 (97)
Space heating kWh	342.6095	276.6417	247.1053	158.3934	91.5564	0.0000	0.0000	0.0000	0.0000	147.4671	245.5469	345.2146 (98a)
Space heating requirement - total per year (kWh/year)												1854.5349
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	342.6095	276.6417	247.1053	158.3934	91.5564	0.0000	0.0000	0.0000	0.0000	147.4671	245.5469	345.2146 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1854.5349
Space heating per m2												(98c) / (4) = 25.2661 (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	342.6095	276.6417	247.1053	158.3934	91.5564	0.0000	0.0000	0.0000	0.0000	147.4671	245.5469	345.2146 (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)	371.1912	299.7202	267.7197	171.6072	99.1944	0.0000	0.0000	0.0000	0.0000	159.7693	266.0313	374.0137 (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

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Water heating requirement	221.9540	196.2586	208.6681	184.1433	178.8992	161.6561	159.9913	166.1699	167.7740	186.5118	197.5769	219.6443 (64)
Efficiency of water heater												79.8000 (216)
(217)m	85.0298	84.8295	84.4399	83.7238	82.6352	79.8000	79.8000	79.8000	79.8000	83.5385	84.5484	85.0693 (217)
Fuel for water heating, kWh/month	261.0308	231.3566	247.1203	219.9414	216.4926	202.5766	200.4904	208.2329	210.2430	223.2646	233.6850	258.1946 (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	23.3856	18.7608	16.8920	12.3758	9.5594	7.8102	8.7204	11.3352	14.7233	19.3177	21.8193	24.0356 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-19.6559	-29.1116	-43.9297	-51.9297	-58.2201	-55.1555	-54.4893	-50.3453	-43.4114	-34.4069	-22.1040	-16.8347 (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	-7.2121	-15.4981	-31.4226	-48.1151	-64.5294	-65.1715	-64.3983	-54.0989	-39.1009	-22.4538	-9.7214	-5.6785 (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												2009.2469 (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												2712.6288 (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)												188.7354 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-906.9947 (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												4089.6164 (238)

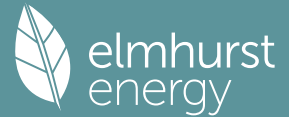
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2009.2469	0.2100	421.9419 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2712.6288	0.2100	569.6520 (264)
Space and water heating			991.5939 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	188.7354	0.1443	27.2404 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-479.5941	0.1336	-64.0569
PV Unit electricity exported	-427.4006	0.1253	-53.5684
Total			-117.6253 (269)
Total CO2, kg/year			913.1382 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.4400 (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	2009.2469	1.1300	2270.4490 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2712.6288	1.1300	3065.2705 (278)
Space and water heating			5335.7196 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	188.7354	1.5338	289.4887 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-479.5941	1.4936	-716.3099
PV Unit electricity exported	-427.4006	0.4600	-196.6214
Total			-912.9313 (283)
Total Primary energy kWh/year			4842.3778 (286)
Target Primary Energy Rate (TPER)			65.9700 (287)

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Property Reference	P0.11 Latimer			Issued on Date	03/12/2024
Assessment Reference	P0.11 Kelda	Prop Type Ref	Grd Mid 3B5P		
Property	0.11, Latimer Road, Wokingham				
SAP Rating	83 B	DER	4.19	TER	13.58
Environmental	97 A	% DER < TER			69.15
CO ₂ Emissions (t/year)	0.27	DFEE	34.92	TFEE	39.58
Compliance Check	See BREL	% DFEE < TFEE			11.76
% DPER < TPER	37.88	DPER	44.67	TPER	71.91
Assessor Details	Mrs. Rebecca Lennon			Assessor ID	P627-0001
Client	RHB, RHB				

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	79.3000	2.7000	214.1100
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.3000		
Dwelling volume			

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)

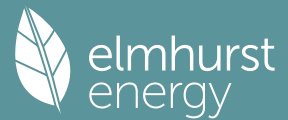
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700 (21)

	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)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.2000 (23c)
Effective ac	0.3207	0.3165	0.3123	0.2910	0.2867	0.2655	0.2655	0.2612	0.2740	0.2867	0.2953	0.3037 (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
Flat ent door			1.9500	1.0000	1.9500		(26a)
Windows (Uw = 1.20)			14.7800	1.1450	16.9237		(27)
Heat Loss Floor 1			79.3000	0.1200	9.5160	0.0000	0.0000 (28a)
External Wall 1	75.0600	16.7300	58.3300	0.1200	6.9996	0.0000	0.0000 (29a)
Sheltered wall	21.6000		21.6000	0.2100	4.5360	0.0000	0.0000 (29a)
Total net area of external elements Aum(A, m ²)			175.9600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.9253		(33)
Party Ceiling 1			79.3000			30.0000	2379.0000 (32b)
Internal Wall 1			152.2800			9.0000	1370.5200 (32c)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			3749.5200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							47.2827 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				7.9800	0.0280	0.2234	

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E3 Sill					7.0500		0.0240		0.1692			
E4 Jamb					24.5000		0.0190		0.4655			
E5 Ground floor (normal)					35.8000		0.0600		2.1480			
E16 Corner (normal)					10.8000		0.0370		0.3996			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												3.4057 (36)
Point Thermal bridges												0.0000
Total fabric heat loss												(33) + (36) + (36a) = 43.3310 (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	22.6630	22.3627	22.0624	20.5610	20.2607	18.7592	18.7592	18.4590	19.3598	20.2607	20.8613	21.4619 (38)
Average = Sum(39)m / 12 =	65.9940	65.6937	65.3934	63.8920	63.5917	62.0903	62.0903	61.7900	62.6908	63.5917	64.1923	64.7929 (39)
												63.8169
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8322	0.8284	0.8246	0.8057	0.8019	0.7830	0.7830	0.7792	0.7906	0.8019	0.8095	0.8171 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

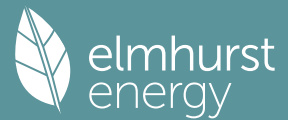
4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.4494 (42)
Hot water usage for mixer showers												63.5819 (42a)
Hot water usage for baths												27.5491 (42b)
Hot water usage for other uses												39.7148 (42c)
Average daily hot water use (litres/day)												120.3396 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	130.9250	128.0903	124.6182	120.0785	115.8561	110.5431	107.5187	112.5435	115.8109	121.0874	126.5207	130.8458 (44)
Energy conte	192.7443	169.4894	178.0769	156.8525	149.2923	127.8395	118.8113	132.4658	134.3349	156.0333	170.9969	192.1566 (45)
Energy content (annual)										Total = Sum(45)m =		1879.0936
Distribution loss (46)m = 0.15 x (45)m	28.9116	25.4234	26.7115	23.5279	22.3938	19.1759	17.8217	19.8699	20.1502	23.4050	25.6495	28.8235 (46)
Water storage loss:												
Store volume												201.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss												
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage												
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	219.6957	193.8326	205.0283	182.9345	176.2437	153.9215	145.7627	159.4172	160.4169	182.9847	197.0789	219.1080 (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	219.6957	193.8326	205.0283	182.9345	176.2437	153.9215	145.7627	159.4172	160.4169	182.9847	197.0789	219.1080 (64)
Total per year (kWh/year)												2196.4246 (64)
Electric shower(s)												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												
	64.0875	56.3552	59.2106	52.1535	49.6397	42.5066	39.5048	44.0449	44.6663	51.8811	56.8565	63.8921 (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	122.4723	122.4723	122.4723	122.4723	122.4723	122.4723	122.4723	122.4723	122.4723	122.4723	122.4723	122.4723 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	111.6965	123.6640	111.6965	115.4197	111.6965	115.4197	111.6965	111.6965	115.4197	111.6965	115.4197	111.6965 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	217.9713	220.2332	214.5334	202.3991	187.0819	172.6858	163.0683	160.8064	166.5062	178.6405	193.9578	208.3539 (68)
Pumps, fans	35.2472	35.2472	35.2472	35.2472	35.2472	35.2472	35.2472	35.2472	35.2472	35.2472	35.2472	35.2472 (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)	-97.9778	-97.9778	-97.9778	-97.9778	-97.9778	-97.9778	-97.9778	-97.9778	-97.9778	-97.9778	-97.9778	-97.9778 (71)
Total internal gains	86.1391	83.8620	79.5841	72.4354	66.7200	59.0370	53.0978	59.2001	62.0366	69.7326	78.9673	85.8764 (72)
	475.5486	487.5008	465.5556	449.9959	425.2400	406.8841	387.6043	391.4447	403.7042	419.8113	448.0865	465.6685 (73)

6. Solar gains												
[Jan]												
	Area											
	m2											
	Solar flux											
	Table 6a											
	W/m2											
	Specific data											
	or Table 6b											
	Specific data											
	or Table 6c											
	Access											
	factor											
	Table 6d											
	Gains											
	W											
East	10.6800											48.4541 (76)
West	4.1000											18.6013 (80)
Solar gains	67.0554	131.1746	216.0258	315.0608	386.1189	395.2614	376.3049	323.2404	251.2470	155.6497	83.6102	55.1431 (83)
Total gains	542.6040	618.6754	681.5815	765.0567	811.3589	802.1455	763.9092	714.6851	654.9512	575.4610	531.6967	520.8116 (84)

7. Mean internal temperature (heating season)

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Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	15.7822	15.8544	15.9272	16.3015	16.3784	16.7745	16.7745	16.8560	16.6138	16.3784	16.2252	16.0748
alpha	2.0521	2.0570	2.0618	2.0868	2.0919	2.1183	2.1183	2.1237	2.1076	2.0919	2.0817	2.0717
util living area	0.8660	0.8291	0.7762	0.6796	0.5654	0.4318	0.3305	0.3619	0.5313	0.7223	0.8274	0.8736 (86)
MIT	18.1617	18.5487	19.1095	19.8448	20.3934	20.7640	20.9041	20.8813	20.6105	19.8763	18.9410	18.1294 (87)
Th 2	20.2255	20.2288	20.2320	20.2484	20.2517	20.2681	20.2681	20.2714	20.2615	20.2517	20.2451	20.2386 (88)
util rest of house	0.8563	0.8172	0.7606	0.6577	0.5354	0.3922	0.2816	0.3122	0.4912	0.6981	0.8137	0.8645 (89)
MIT 2	16.8736	17.3549	18.0510	18.9570	19.6133	20.0473	20.1936	20.1760	19.8817	19.0144	17.8581	16.8371 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.3300	17.7779	18.4261	19.2716	19.8897	20.3013	20.4454	20.4259	20.1399	19.3198	18.2418	17.2950 (92)
Temperature adjustment												
adjusted MIT	17.3300	17.7779	18.4261	19.2716	19.8897	20.3013	20.4454	20.4259	20.1399	19.3198	18.2418	17.2950 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8099	0.7708	0.7175	0.6264	0.5200	0.3940	0.2938	0.3230	0.4842	0.6639	0.7689	0.8191 (94)
Useful gains	439.4805	476.8578	489.0637	479.2191	421.9153	316.0709	224.4060	230.8557	317.1023	382.0740	408.8317	426.5939 (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	859.9047	845.9999	779.8859	662.6607	520.7976	353.9940	238.7612	248.7611	378.6486	554.5066	715.2168	848.4652 (97)
Space heating kWh	312.7956	248.0635	216.3717	132.0779	73.5684	0.0000	0.0000	0.0000	0.0000	128.2899	220.5972	313.8722 (98a)
Space heating requirement - total per year (kWh/year)	1645.6364											
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	312.7956	248.0635	216.3717	132.0779	73.5684	0.0000	0.0000	0.0000	0.0000	128.2899	220.5972	313.8722 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1645.6364											
Space heating per m2	(98c) / (4) = 20.7520 (99)											

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Fraction of main heating from main system 2													0.0000 (203)
Fraction of total heating from main system 1													1.0000 (204)
Fraction of total heating from main system 2													0.0000 (205)
Efficiency of main space heating system 1 (in %)													100.0000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	312.7956	248.0635	216.3717	132.0779	73.5684	0.0000	0.0000	0.0000	0.0000	128.2899	220.5972	313.8722 (98)	
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)	
Space heating fuel (main heating system)	312.7956	248.0635	216.3717	132.0779	73.5684	0.0000	0.0000	0.0000	0.0000	128.2899	220.5972	313.8722 (211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)	
Space heating fuel used, main system 2												0.0000 (213)	
Water heating													
Water heating requirement	219.6957	193.8326	205.0283	182.9345	176.2437	153.9215	145.7627	159.4172	160.4169	182.9847	197.0789	219.1080 (64)	
Efficiency of water heater	343.0324	343.0324	343.0324	343.0324	343.0324	343.0324	343.0324	343.0324	343.0324	343.0324	343.0324	343.0324 (216)	
(217)m	343.0324	343.0324	343.0324	343.0324	343.0324	343.0324	343.0324	343.0324	343.0324	343.0324	343.0324	343.0324 (217)	
Fuel for water heating, kWh/month	64.0452	56.5056	59.7693	53.3286	51.3782	44.8708	42.4924	46.4729	46.7643	53.3433	57.4520	63.8738 (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	22.0522	19.9181	22.0522	21.3408	22.0522	21.3408	22.0522	22.0522	21.3408	22.0522	21.3408	22.0522 (231)	
Lighting	23.9759	19.2343	17.3184	12.6882	9.8007	8.0073	8.9405	11.6213	15.0949	19.8053	22.3700	24.6422 (232)	
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-9.5149	-16.7265	-30.2748	-40.9630	-48.7386	-44.4371	-43.5708	-38.2000	-29.6067	-21.0885	-11.3126	-7.7821 (233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)	
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.3178	-3.5948	-9.7227	-19.5170	-31.2563	-36.2029	-35.1742	-27.2125	-16.7613	-6.4098	-1.9930	-0.9673 (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													1645.6364 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													343.0324
Water heating fuel used													640.2965 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9940)													
mechanical ventilation fans (SFP = 0.9940)													259.6469 (230a)
Total electricity for the above, kWh/year													259.6469 (231)
Electricity for lighting (calculated in Appendix L)													193.4989 (232)

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

PV generation	-532.3450 (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	-111.1000 (236)
Energy used	29.6000 (237)
Total delivered energy for all uses	2125.2337 (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 (high-rate cost)	1645.6364	0.1621	266.8346 (261)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000 (261)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000 (262)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating - high rate cost	30.5428	0.1481	4.5237 (264)
Water heating - low rate cost	609.7537	0.1243	75.7976 (264)
Space and water heating			347.1560 (265)
Pumps, fans and electric keep-hot	259.6469	0.1432	36.0279 (267)
Energy for lighting	193.4989	0.1490	28.8352 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-342.2155	0.1359	-46.5049
PV Unit electricity exported	-190.1295	0.1185	-22.5209
Total			-69.0258 (269)
Appendix Q item 'Kelda' - energy saved	-111.1000	0.1360	-15.1096 (270)
Appendix Q item 'Kelda' - energy used	29.6000	0.1360	4.0256 (271)
Total CO2, kg/year			331.9092 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.1900 (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 (high-rate cost)	1645.6364	1.6046	2640.6533 (275)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000 (275)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000 (276)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating - high rate cost	30.5428	1.5536	47.4522 (278)
Water heating - low rate cost	609.7537	1.4449	881.0490 (278)
Space and water heating			3569.1545 (279)
Pumps, fans and electric keep-hot	259.6469	1.5335	392.8342 (281)
Energy for lighting	193.4989	1.5547	300.8414 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-342.2155	1.5068	-515.6559
PV Unit electricity exported	-190.1295	0.4343	-82.5720
Total			-598.2280 (283)
Appendix Q item 'Kelda' - energy saved	-111.1000	1.5010	-166.7611 (284)
Appendix Q item 'Kelda' - energy used	29.6000	1.5010	44.4296 (285)
Total Primary energy kWh/year			3542.2705 (286)
Dwelling Primary energy Rate (DPER)			44.6700 (287)

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

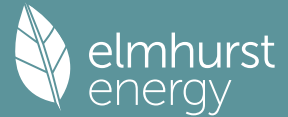
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	79.3000 (1b)	x 2.7000 (2b)	= 214.1100 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 214.1100 (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) = 0.1401 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)

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Infiltration rate	0.3901 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = $1 - [0.075 \times (19)] = 0.8500$ (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3316 (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 infiltr rate	0.4228	0.4145	0.4062	0.3648	0.3565	0.3150	0.3150	0.3067	0.3316	0.3565	0.3730	0.3896	(22b)
Effective ac	0.5894	0.5859	0.5825	0.5665	0.5635	0.5496	0.5496	0.5470	0.5550	0.5635	0.5696	0.5759	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			1.9500	1.0000	1.9500			(26a)
TER Opening Type (Uw = 1.20)			14.7800	1.1450	16.9237			(27)
Heat Loss Floor 1			79.3000	0.1300	10.3090			(28a)
External Wall 1	75.0600	16.7300	58.3300	0.1800	10.4994			(29a)
Sheltered wall	21.6000		21.6000	0.1800	3.8880			(29a)
Total net area of external elements Aum(A, m2)			175.9600					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 43.5701			(33)

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

57.2827 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element	7.9800	0.0500	0.3990	
E2 Other lintels (including other steel lintels)	7.0500	0.0500	0.3525	
E3 Sill	24.5000	0.0500	1.2250	
E4 Jamb	35.8000	0.1600	5.7280	
E5 Ground floor (normal)	10.8000	0.0900	0.9720	
E16 Corner (normal)				

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

8.6765 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 52.2466 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	41.6430	41.3978	41.1574	40.0285	39.8173	38.8340	38.8340	38.6519	39.2127	39.8173	40.2446	40.6913	(38)
Heat transfer coeff	93.8896	93.6444	93.4040	92.2751	92.0638	91.0805	91.0805	90.8985	91.4593	92.0638	92.4911	92.9379	(39)
Average = Sum(39)m / 12 =												92.2740	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1840	1.1809	1.1779	1.1636	1.1610	1.1486	1.1486	1.1463	1.1533	1.1610	1.1663	1.1720	(40)
HLP (average)												1.1636	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4494 (42)
Hot water usage for mixer showers												
65.2888	64.3077	62.8779	60.1424	58.1236	55.8723	54.5926	56.0115	57.5669	59.9842	62.7785	65.0387 (42a)	
Hot water usage for baths												
28.1996	27.7808	27.1910	26.1036	25.2893	24.3865	23.8988	24.4844	25.1221	26.0882	27.1980	28.1042 (42b)	
Hot water usage for other uses												
39.7148	38.2706	36.8264	35.3822	33.9381	32.4939	32.4939	33.9381	35.3822	36.8264	38.2706	39.7148 (42c)	
Average daily hot water use (litres/day)											122.4439 (43)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	133.2032	130.3590	126.8953	121.6282	117.3510	112.7526	110.9853	114.4340	118.0713	122.8988	128.2471	132.8577	(44)
Energy conte	210.9613	185.6295	195.0334	166.5029	157.9770	138.6425	134.2271	141.6932	145.5937	166.7725	182.7115	208.0230	(45)
Energy content (annual)										Total = Sum(45)m =		2033.7677	
Distribution loss (46)m = 0.15 x (45)m	31.6442	27.8444	29.2550	24.9754	23.6965	20.7964	20.1341	21.2540	21.8391	25.0159	27.4067	31.2035	(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												0.7327 (55)
	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												
	257.5562	227.7152	241.6283	211.5948	204.5719	183.7344	180.8220	188.2881	190.6855	213.3674	227.8033	254.6179 (62)
WWHRS	-29.8473	-26.3972	-27.6417	-22.8884	-21.3312	-18.2532	-17.1095	-18.1942	-18.8855	-22.2639	-25.2223	-29.2946 (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												

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	107.4205	95.3904	102.1245	91.4357	89.8033	82.1721	81.9064	84.3889	84.4834	92.7278	96.8250	106.4436	(65)
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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	122.4723	122.4723	122.4723	122.4723	122.4723	122.4723	122.4723	122.4723	122.4723	122.4723	122.4723	122.4723	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													

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111.6965	123.6640	111.6965	115.4197	111.6965	115.4197	111.6965	111.6965	115.4197	111.6965	115.4197	111.6965 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5											
217.9713	220.2332	214.5334	202.3991	187.0819	172.6858	163.0683	160.8064	166.5062	178.6405	193.9578	208.3539 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5											
35.2472	35.2472	35.2472	35.2472	35.2472	35.2472	35.2472	35.2472	35.2472	35.2472	35.2472	35.2472 (69)
Pumps, fans	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)											
-97.9778	-97.9778	-97.9778	-97.9778	-97.9778	-97.9778	-97.9778	-97.9778	-97.9778	-97.9778	-97.9778	-97.9778 (71)
Water heating gains (Table 5)											
144.3825	141.9500	137.2642	126.9940	120.7033	114.1279	110.0893	113.4260	117.3380	124.6341	134.4792	143.0693 (72)
Total internal gains	536.7920	548.5888	526.2357	507.5545	482.2234	461.9751	444.5958	445.6706	459.0056	477.7128	506.5984 (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
East					10.6800	19.6403	0.6300	0.7000	0.7700			64.1048 (76)
West					4.1000	19.6403	0.6300	0.7000	0.7700			24.6095 (80)
Solar gains	88.7143	173.5440	285.8022	416.8255	510.8353	522.9308	497.8514	427.6470	332.3998	205.9245	110.6163	72.9543 (83)
Total gains	625.5062	722.1328	812.0379	924.3800	993.0586	984.9059	942.4472	873.3176	791.4054	683.6373	617.2147	598.8157 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	13.4393	13.4745	13.5092	13.6745	13.7058	13.8538	13.8538	13.8815	13.7964	13.7058	13.6425	13.5769
alpha	1.8960	1.8983	1.9006	1.9116	1.9137	1.9236	1.9236	1.9254	1.9198	1.9137	1.9095	1.9051
util living area	0.8868	0.8539	0.8041	0.7164	0.6072	0.4795	0.3738	0.4104	0.5811	0.7599	0.8548	0.8942 (86)
MIT	17.5606	17.9707	18.6120	19.4424	20.1306	20.6179	20.8327	20.7935	20.4102	19.4965	18.4044	17.4969 (87)
Th 2	19.9328	19.9353	19.9378	19.9492	19.9514	19.9614	19.9614	19.9632	19.9575	19.9514	19.9470	19.9425 (88)
util rest of house	0.8756	0.8397	0.7849	0.6882	0.5663	0.4214	0.2987	0.3343	0.5249	0.7293	0.8384	0.8836 (89)
MIT 2	15.9966	16.5002	17.2858	18.2904	19.0964	19.6417	19.8537	19.8237	19.4339	18.3812	17.0493	15.9204 (90)
Living area fraction	FLA = Living area / (4) =											
MIT	16.5508	17.0212	17.7557	18.6986	19.4629	19.9876	20.2006	20.1674	19.7798	18.7764	17.5295	16.4790 (92)
Temperature adjustment	0.0000											
adjusted MIT	16.5508	17.0212	17.7557	18.6986	19.4629	19.9876	20.2006	20.1674	19.7798	18.7764	17.5295	16.4790 (93)

8. Space heating requirement

Utilisation	0.8265	0.7889	0.7357	0.6493	0.5453	0.4230	0.3168	0.3501	0.5143	0.6879	0.7889	0.8356 (94)
Useful gains	517.0073	569.6969	597.4542	600.1710	541.5315	416.5744	298.5328	305.7549	407.0342	470.2841	486.9148	500.3922 (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	1150.2238	1135.0865	1051.3289	904.1687	714.6819	490.7058	327.9418	342.4496	519.4709	752.7528	964.6340	1141.1853 (97)
Space heating kWh	471.1131	379.9418	337.6828	218.8783	128.8238	0.0000	0.0000	0.0000	0.0000	210.1567	343.9578	476.7501 (98a)
Space heating requirement - total per year (kWh/year)	2567.3044											
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	471.1131	379.9418	337.6828	218.8783	128.8238	0.0000	0.0000	0.0000	0.0000	210.1567	343.9578	476.7501 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	2567.3044											
Space heating per m2	(98c) / (4) = 32.3746 (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	471.1131	379.9418	337.6828	218.8783	128.8238	0.0000	0.0000	0.0000	0.0000	210.1567	343.9578	476.7501 (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)	510.4151	411.6379	365.8535	237.1379	139.5708	0.0000	0.0000	0.0000	0.0000	227.6887	372.6520	516.5223 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	227.7088	201.3180	213.9867	188.7064	183.2407	165.4811	163.7125	170.0939	171.8000	191.1035	202.5810	225.3233 (64)
Efficiency of water heater (217)m	85.6523	85.4617	85.0781	84.3933	83.2845	79.8000	79.8000	79.8000	79.8000	84.2734	85.2368	79.8000 (216)
Fuel for water heating, kWh/month	265.8525	235.5652	251.5179	223.6036	220.0177	207.3699	205.1535	213.1503	215.2883	226.7661	237.6686	262.9270 (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	23.2083	18.6186	16.7640	12.2820	9.4870	7.7509	8.6543	11.2492	14.6116	19.1713	21.6539	23.8534 (232)

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Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-21.1461	-31.2744	-47.1313	-55.6405	-62.3154	-59.0065	-58.2799	-53.8654	-46.4890	-36.9127	-23.7593	-18.1150	(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	-7.8816	-16.9211	-34.2779	-52.4460	-70.3008	-70.9926	-70.1640	-58.9741	-42.6558	-24.5185	-10.6243	-6.2079	(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												2781.4783	(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												2764.8806	(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)												187.3045	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-979.9003	(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												4839.7630	(238)

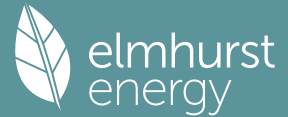
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2781.4783	0.2100	584.1104	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2764.8806	0.2100	580.6249	(264)
Space and water heating			1164.7354	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	187.3045	0.1443	27.0338	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-513.9356	0.1336	-68.6590	
PV Unit electricity exported	-465.9647	0.1254	-58.4105	
Total			-127.0695	(269)
Total CO2, kg/year			1076.6289	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.5800	(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	2781.4783	1.1300	3143.0704	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2764.8806	1.1300	3124.3151	(278)
Space and water heating			6267.3855	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	187.3045	1.5338	287.2939	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-513.9356	1.4937	-767.6587	
PV Unit electricity exported	-465.9647	0.4601	-214.3946	
Total			-982.0533	(283)
Total Primary energy kWh/year			5702.7268	(286)
Target Primary Energy Rate (TPER)			71.9100	(287)

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Property Reference	P2.02 Latimer			Issued on Date	03/12/2024
Assessment Reference	P2.02 Kelda	Prop Type Ref	2nd Mid 1B2P		
Property	2.02, Latimer Road, Wokingham				
SAP Rating	83 B	DER	4.46	TER	12.58
Environmental	97 A	% DER < TER			64.55
CO ₂ Emissions (t/year)	0.25	DFEE	37.74	TFEE	40.24
Compliance Check	See BREL	% DFEE < TFEE			6.21
% DPER < TPER	27.65	DPER	47.61	TPER	65.81
Assessor Details	Mrs. Rebecca Lennon			Assessor ID	P627-0001
Client	RHB, RHB				

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	71.6000	2.7000	193.3200
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.6000		
Dwelling volume			

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)

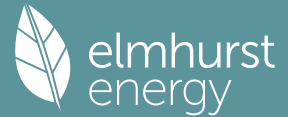
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.2000 (23c)
Effective ac	0.3207	0.3165	0.3123	0.2910	0.2867	0.2655	0.2655	0.2612	0.2740	0.2867	0.2953	0.3037 (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
Flat ent door			1.9500	1.0000	1.9500		(26)
Windows (Uw = 1.20)			16.5800	1.1450	18.9847		(27)
External Wall 1	60.7500	16.5800	44.1700	0.1200	5.3004	0.0000	0.0000 (29a)
Sheltered wall	4.5900	1.9500	2.6400	0.2100	0.5544	0.0000	0.0000 (29a)
Flat Roof	46.4000		46.4000	0.1100	5.1040	9.0000	417.6000 (30)
Total net area of external elements Aum(A, m ²)			111.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.8935		(33)
Party Wall 1			32.4000	0.0000	0.0000	0.0000	0.0000 (32)
Party Floor 1			71.6000			40.0000	2864.0000 (32d)
Party Ceiling 1			25.2000			30.0000	756.0000 (32b)
Internal Wall 1			123.1200			9.0000	1108.0800 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		5145.6800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							71.8670 (35)
List of Thermal Bridges							

6. Solar gains						
[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Southwest	12.0200	36.7938	0.3000	0.0000	0.7700	102.1625 (79)
Northwest	4.5600	11.2829	0.3000	0.0000	0.7700	11.8850 (81)

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Solar gains	114.0475	198.2128	281.6892	366.6025	426.6678	430.6389	412.2452	366.3550	310.9258	221.8946	137.3215	97.1357 (83)
Total gains	556.1825	651.1156	714.3772	784.6348	821.7229	808.4409	772.1117	729.9792	685.9016	612.0502	553.8244	530.1505 (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	21.3871	21.4742	21.5620	22.0122	22.1045	22.5778	22.5778	22.6749	22.3861	22.1045	21.9206	21.7398
alpha	2.4258	2.4316	2.4375	2.4675	2.4736	2.5052	2.5052	2.5117	2.4924	2.4736	2.4614	2.4493
util living area	0.8980	0.8574	0.8052	0.7121	0.5949	0.4526	0.3423	0.3727	0.5455	0.7448	0.8586	0.9064 (86)
MIT	18.6761	19.0618	19.5402	20.1341	20.5699	20.8485	20.9451	20.9309	20.7447	20.1721	19.3592	18.6318 (87)
Th 2	20.1392	20.1424	20.1456	20.1616	20.1648	20.1810	20.1810	20.1842	20.1745	20.1648	20.1584	20.1520 (88)
util rest of house	0.8880	0.8441	0.7872	0.6861	0.5585	0.4043	0.2839	0.3133	0.4967	0.7158	0.8434	0.8972 (89)
MIT 2	17.4086	17.8902	18.4849	19.2173	19.7310	20.0500	20.1437	20.1353	19.9421	19.2803	18.2800	17.3610 (90)
Living area fraction	17.8759	18.3222	18.8740	19.5553	20.0403	20.3444	20.4392	20.4286	20.2381	19.6091	18.6779	17.8295 (92)
MIT	17.8759	18.3222	18.8740	19.5553	20.0403	20.3444	20.4392	20.4286	20.2381	19.6091	18.6779	17.8295 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8759	18.3222	18.8740	19.5553	20.0403	20.3444	20.4392	20.4286	20.2381	19.6091	18.6779	17.8295 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8548	0.8103	0.7563	0.6656	0.5527	0.4142	0.3027	0.3315	0.5007	0.6943	0.8111	0.8650 (94)
Useful gains	475.4096	527.5743	540.2803	522.2766	454.1968	334.8759	233.6831	241.9811	343.4155	424.9657	449.1925	458.5891 (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	907.3144	893.4005	820.2791	691.9015	539.3141	363.6685	243.0496	253.9517	391.9164	582.5628	754.9471	896.1172 (97)
Space heating kWh	321.3372	245.8352	208.3191	122.1299	63.3273	0.0000	0.0000	0.0000	0.0000	117.2523	220.1433	325.5209 (98a)
Space heating requirement - total per year (kWh/year)												1623.8652
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	321.3372	245.8352	208.3191	122.1299	63.3273	0.0000	0.0000	0.0000	0.0000	117.2523	220.1433	325.5209 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1623.8652
Space heating per m2										(98c) / (4) =		22.6797 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Fraction of main heating from main system 2												0.0000 (203)
Fraction of total heating from main system 1												1.0000 (204)
Fraction of total heating from main system 2												0.0000 (205)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	321.3372	245.8352	208.3191	122.1299	63.3273	0.0000	0.0000	0.0000	0.0000	117.2523	220.1433	325.5209 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	321.3372	245.8352	208.3191	122.1299	63.3273	0.0000	0.0000	0.0000	0.0000	117.2523	220.1433	325.5209 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Space heating fuel used, main system 2												0.0000 (213)
Water heating												
Water heating requirement	211.5202	186.6437	197.4752	176.2817	169.9117	148.4993	140.7233	153.7986	154.7188	176.3664	189.8259	210.9574 (64)
Efficiency of water heater (217)m	344.6488	344.6488	344.6488	344.6488	344.6488	344.6488	344.6488	344.6488	344.6488	344.6488	344.6488	344.6488 (216)
Fuel for water heating, kWh/month	61.3727	54.1548	57.2975	51.1482	49.3000	43.0871	40.8309	44.6247	44.8917	51.1728	55.0781	61.2094 (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	19.9109	17.9841	19.9109	19.2687	19.9109	19.2687	19.9109	19.9109	19.2687	19.9109	19.2687	19.9109 (231)
Lighting	20.8977	16.7649	15.0949	11.0592	8.5424	6.9792	7.7927	10.1292	13.1569	17.2625	19.4980	21.4785 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-9.4981	-16.6465	-29.9978	-40.2970	-47.5406	-43.3357	-42.4966	-37.3360	-29.0409	-20.8402	-11.2687	-7.7726 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-1.3346	-3.6748	-9.9996	-20.1830	-32.4542	-37.3043	-36.2483	-28.0765	-17.3271	-6.6581	-2.0369	-0.9769 (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												1623.8652 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												344.6488
Water heating fuel used												614.1679 (219)

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Space cooling fuel	0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9940)	
mechanical ventilation fans (SFP = 0.9940)	234.4353 (230a)
Total electricity for the above, kWh/year	234.4353 (231)
Electricity for lighting (calculated in Appendix L)	168.6562 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-532.3450 (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	-105.9000 (236)
Energy used	29.4000 (237)
Total delivered energy for all uses	2032.2796 (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 (high-rate cost)	1623.8652	0.1626	264.0608	(261)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000	(261)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000	(262)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	27.2927	0.1481	4.0419	(264)
Water heating - low rate cost	586.8752	0.1243	72.9455	(264)
Space and water heating			341.0482	(265)
Pumps, fans and electric keep-hot	234.4353	0.1432	32.5296	(267)
Energy for lighting	168.6562	0.1490	25.1331	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-336.0707	0.1360	-45.7100	
PV Unit electricity exported	-196.2743	0.1184	-23.2460	
Total			-68.9560	(269)
Appendix Q item 'Kelda' - energy saved	-105.9000	0.1360	-14.4024	(270)
Appendix Q item 'Kelda' - energy used	29.4000	0.1360	3.9984	(271)
Total CO2, kg/year			319.3510	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.4600	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	1623.8652	1.6063	2608.4307	(275)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000	(275)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000	(276)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000	(276)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	27.2927	1.5536	42.4010	(278)
Water heating - low rate cost	586.8752	1.4449	847.9590	(278)
Space and water heating			3498.7907	(279)
Pumps, fans and electric keep-hot	234.4353	1.5335	354.6901	(281)
Energy for lighting	168.6562	1.5547	262.2173	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-336.0707	1.5073	-506.5436	
PV Unit electricity exported	-196.2743	0.4343	-85.2326	
Total			-591.7762	(283)
Appendix Q item 'Kelda' - energy saved	-105.9000	1.5010	-158.9559	(284)
Appendix Q item 'Kelda' - energy used	29.4000	1.5010	44.1294	(285)
Total Primary energy kWh/year			3409.0953	(286)
Dwelling Primary energy Rate (DPER)			47.6100	(287)

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

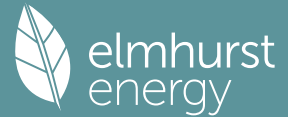
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	71.6000 (1b)	x 2.7000 (2b)	= 193.3200 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	193.3200 (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)

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Number of passive vents
Number of flueless gas fires

0 * 10 = 0.0000 (7b)
0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =
Pressure Test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Air changes per hour
30.0000 / (5) = 0.1552 (8)
Yes
Blower Door
5.0000 (17)
0.4052 (18)
2 (19)

Shelter factor
Infiltration rate adjusted to include shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
(21) = (18) x (20) = 0.3444 (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 infiltr 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	0.4391	0.4305	0.4219	0.3788	0.3702	0.3272	0.3272	0.3186	0.3444	0.3702	0.3875	0.4047 (22b)
	0.5964	0.5927	0.5890	0.5718	0.5685	0.5535	0.5535	0.5507	0.5593	0.5685	0.5751	0.5819 (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)			15.9500	1.1450	18.2634		(27)
External Wall 1	60.7500	15.9500	44.8000	0.1800	8.0640		(29a)
Sheltered wall	4.5900	1.9500	2.6400	0.1800	0.4752		(29a)
Flat Roof	46.4000		46.4000	0.1100	5.1040		(30)
Total net area of external elements Aum(A, m2)			111.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.8566		(33)
Party Wall 1			32.4000	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 75.3866 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	5.7000	0.0200	0.1140
E16 Corner (normal)	10.8000	0.0900	0.9720
E17 Corner (inverted - internal area greater than external area)	2.7000	-0.0900	-0.2430
E18 Party wall between dwellings	2.7000	0.0600	0.1620
E25 Staggered party wall between dwellings	2.7000	0.0600	0.1620
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	24.0000	0.0000	0.0000
E2 Other lintels (including other steel lintels)	8.0300	0.0500	0.4015
E3 Sill	7.1000	0.0500	0.3550
E4 Jamb	21.7000	0.0500	1.0850
E7 Party floor between dwellings (in blocks of flats)	24.2000	0.0700	1.6940
E15 Flat roof with parapet	22.4000	0.5600	12.5440

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 17.2465 (36)

Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 51.1031 (37)

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

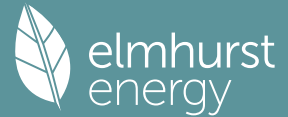
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	38.0485	37.8096	37.5755	36.4759	36.2702	35.3125	35.3125	35.1351	35.6814	36.2702	36.6864	37.1215 (38)
Average = Sum(39)m / 12 =	89.1515	88.9127	88.6786	87.5790	87.3732	86.4155	86.4155	86.2382	86.7844	87.3732	87.7894	88.2245 (39)
												87.5780

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2451	1.2418	1.2385	1.2232	1.2203	1.2069	1.2069	1.2044	1.2121	1.2203	1.2261	1.2322 (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													2.2843 (42)
Hot water usage for mixer showers													62.2809 (42a)
Hot water usage for baths													26.9177 (42b)
Hot water usage for other uses													38.0239 (42c)
Average daily hot water use (litres/day)													117.2505 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	127.5533	124.8300	121.5133	116.4695	112.3738	107.9705	106.2780	109.5804	113.0632	117.6860	122.8075	127.2225	(44)
Energy content (annual)	202.0133	177.7562	186.7614	159.4410	151.2767	132.7623	128.5340	135.6834	139.4183	159.6988	174.9618	199.1997	(45)
Distribution loss (46)m = 0.15 x (45)m										Total =	Sum(45)m =	1947.5069	
Water storage loss:	30.3020	26.6634	28.0142	23.9161	22.6915	19.9143	19.2801	20.3525	20.9127	23.9548	26.2443	29.8800	(46)
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	248.6082	219.8419	233.3563	204.5328	197.8716	177.8542	175.1290	182.2783	184.5101	206.2937	220.0536	245.7946	(62)
WWHRS	-28.5817	-25.2779	-26.4696	-21.9179	-20.4267	-17.4792	-16.3840	-17.4227	-18.0847	-21.3199	-24.1528	-28.0524	(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	220.0265	194.5640	206.8867	182.6150	177.4450	160.3749	158.7450	164.8556	166.4254	184.9738	195.9008	217.7421	(64)
12Total per year (kWh/year)								Total per year (kWh/year) =	Sum(64)m =			2230.5549	(64)
												2231	(64)

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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	104.4453	92.7725	99.3741	89.0876	87.5754	80.2169	80.0135	82.3907	82.4301	90.3758	94.2483	103.5098 (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	114.2167	114.2167	114.2167	114.2167	114.2167	114.2167	114.2167	114.2167	114.2167	114.2167	114.2167	114.2167	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	101.3842	112.2468	101.3842	104.7637	101.3842	104.7637	101.3842	101.3842	104.7637	101.3842	104.7637	101.3842	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	201.0022	203.0879	197.8319	186.6423	172.5174	159.2421	150.3734	148.2876	153.5437	164.7332	178.8581	192.1334	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4217	34.4217	34.4217	34.4217	34.4217	34.4217	34.4217	34.4217	34.4217	34.4217	34.4217	34.4217	(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)	-91.3734	-91.3734	-91.3734	-91.3734	-91.3734	-91.3734	-91.3734	-91.3734	-91.3734	-91.3734	-91.3734	-91.3734	(71)
Water heating gains (Table 5)	140.3835	138.0543	133.5673	123.7328	117.7089	111.4124	107.5450	110.7401	114.4862	121.4728	130.9004	139.1261	(72)
Total internal gains	503.0350	513.6541	493.0484	475.4038	451.8756	432.6833	416.5676	417.6770	430.0586	447.8553	474.7872	492.9088	(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					11.5600	36.7938	0.6300	0.7000	0.7700	129.9884	(79)	
Northwest					4.3900	11.2829	0.6300	0.7000	0.7700	15.1377	(81)	
Solar gains	145.1261	252.2315	358.4698	466.5474	543.0049	548.0659	524.6537	466.2390	395.6819	282.3706	174.7433	123.6052 (83)
Total gains	648.1610	765.8857	851.5182	941.9512	994.8805	980.7492	941.2213	883.9159	825.7405	730.2259	649.5304	616.5139 (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)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	21.0000 (85)
tau	16.8181	16.8632	16.9078	17.1200	17.1604	17.3505	17.3505	17.3862	17.2768	17.1604	17.0790	16.9948	
alpha	2.1212	2.1242	2.1272	2.1413	2.1440	2.1567	2.1567	2.1591	2.1518	2.1440	2.1386	2.1330	
util living area	0.8954	0.8565	0.8060	0.7208	0.6108	0.4784	0.3678	0.4011	0.5684	0.7528	0.8591	0.9039	(86)
MIT	18.0762	18.5008	19.0653	19.7640	20.3340	20.7260	20.8888	20.8622	20.5779	19.8333	18.8525	18.0081	(87)
Th 2	19.8841	19.8867	19.8893	19.9015	19.9038	19.9145	19.9145	19.9164	19.9104	19.9038	19.8992	19.8943	(88)
util rest of house	0.8833	0.8406	0.7843	0.6893	0.5655	0.4149	0.2876	0.3199	0.5064	0.7177	0.8408	0.8927	(89)
MIT 2	16.5255	17.0508	17.7470	18.5974	19.2628	19.6958	19.8489	19.8308	19.5511	18.7034	17.5051	16.4449	(90)
Living area fraction	17.0972	17.5854	18.2331	19.0275	19.6578	20.0756	20.2323	20.2111	19.9297	19.1200	18.0019	17.0213	(91)
MIT	17.0972	17.5854	18.2331	19.0275	19.6578	20.0756	20.2323	20.2111	19.9297	19.1200	18.0019	17.0213	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.0972	17.5854	18.2331	19.0275	19.6578	20.0756	20.2323	20.2111	19.9297	19.1200	18.0019	17.0213	(93)

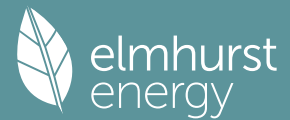
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.8429	0.7990	0.7454	0.6609	0.5544	0.4248	0.3120	0.3430	0.5075	0.6885	0.8007	0.8534	(94)
Useful gains	546.3671	611.9150	634.6929	622.5736	551.5908	416.6681	293.6697	303.1539	419.1031	502.7434	520.0792	526.1556	(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	1140.8926	1127.8934	1040.4751	886.9591	695.2974	473.1811	313.8906	328.6608	505.9303	744.4215	957.0722	1131.1490	(97)
Space heating kWh	442.3270	346.7375	301.9019	190.3576	106.9177	0.0000	0.0000	0.0000	0.0000	179.8085	314.6350	450.1151	(98a)
Space heating requirement - total per year (kWh/year)												2332.8003	
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	442.3270	346.7375	301.9019	190.3576	106.9177	0.0000	0.0000	0.0000	0.0000	179.8085	314.6350	450.1151	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2332.8003	
Space heating per m ²										(98c) / (4) =		32.5810	(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	
	442.3270	346.7375	301.9019	190.3576	106.9177	0.0000	0.0000	0.0000	0.0000	179.8085	314.6350	450.1151	(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)	479.2275	375.6636	327.0877	206.2379	115.8371	0.0000	0.0000	0.0000	0.0000	194.8088	340.8830	487.6654	(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)													

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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)
	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	220.0265	194.5640	206.8867	182.6150	177.4450	160.3749	158.7450	164.8556	166.4254	184.9738	195.9008	217.7421 (64)
Efficiency of water heater	85.5933	85.3405	84.9062	84.1530	82.9614	79.8000	79.8000	79.8000	79.8000	83.9963	85.1165	79.8000 (216)
Fuel for water heating, kWh/month	257.0605	227.9857	243.6651	217.0034	213.8885	200.9711	198.9285	206.5859	208.5532	220.2166	230.1561	85.6506 (217)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	21.0656	16.8996	15.2163	11.1481	8.6111	7.0353	7.8553	10.2107	13.2626	17.4013	19.6547	21.6511 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-33.5713	-47.3724	-68.1672	-76.7461	-82.8597	-77.3924	-76.4403	-72.1089	-64.4846	-54.2125	-36.9241	-29.0197 (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	-18.8469	-39.6590	-78.8416	-118.4365	-156.6188	-157.3601	-155.5039	-131.6568	-96.4931	-56.7201	-25.1658	-14.9026 (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												2527.4109 (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												2679.2362 (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)												170.0118 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1769.5047 (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												3693.1542 (238)

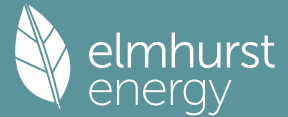
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2527.4109	0.2100	530.7563 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2679.2362	0.2100	562.6396 (264)
Space and water heating			1093.3959 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	170.0118	0.1443	24.5380 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-719.2994	0.1346	-96.7874
PV Unit electricity exported	-1050.2053	0.1259	-132.2122
Total			-228.9996 (269)
Total CO2, kg/year			900.8635 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.5800 (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	2527.4109	1.1300	2855.9744 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2679.2362	1.1300	3027.5368 (278)
Space and water heating			5883.5112 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	170.0118	1.5338	260.7698 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-719.2994	1.4973	-1077.0081
PV Unit electricity exported	-1050.2053	0.4621	-485.3096
Total			-1562.3176 (283)
Total Primary energy kWh/year			4712.0642 (286)
Target Primary Energy Rate (TPER)			65.8100 (287)

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Property Reference	P2.04 Latimer			Issued on Date	03/12/2024
Assessment Reference	P2.04 Kelda	Prop Type Ref	2nd Mid 1B2P		
Property	2.04, Latimer Road, Wokingham				
SAP Rating	85 B	DER	4.32	TER	13.28
Environmental	97 A	% DER < TER			67.47
CO ₂ Emissions (t/year)	0.18	DFEE	37.68	TFEE	37.24
Compliance Check	See BREL	% DFEE < TFEE			-1.19
% DPER < TPER	32.43	DPER	47.07	TPER	69.66
Assessor Details	Mrs. Rebecca Lennon			Assessor ID	P627-0001
Client	RHB, RHB				

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	56.0000 (1b)	2.7000 (2b)	151.2000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.0000		151.2000 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	151.2000 (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)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.2000 (23c)
Effective ac	0.3207	0.3165	0.3123	0.2910	0.2867	0.2655	0.2655	0.2612	0.2740	0.2867	0.2953	0.3037 (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
Flat ent door			1.9500	1.0000	1.9500		(26)
Windows (Uw = 1.20)			13.4100	1.1450	15.3550		(27)
External Wall 1	25.1100	13.4100	11.7000	0.1200	1.4040	0.0000	0.0000 (29a)
Sheltered wall	27.0000	1.9500	25.0500	0.2100	5.2605	0.0000	0.0000 (29a)
Flat Roof	14.6000		14.6000	0.1100	1.6060	9.0000	131.4000 (30)
Total net area of external elements Aum(A, m ²)			66.7100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.5755		(33)
Party Wall 1			38.0700	0.0000	0.0000	0.0000	0.0000 (32)
Party Floor 1			56.0000			40.0000	2240.0000 (32d)
Party Ceiling 1			41.4000			30.0000	1242.0000 (32b)
Internal Wall 1			93.4200			9.0000	840.7800 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		4454.1800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							79.5389 (35)
List of Thermal Bridges							

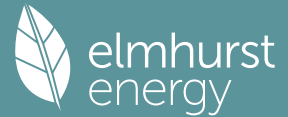
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	16.0041	15.7921	15.5800	14.5197	14.3077	13.2474	13.2474	13.0353	13.6715	14.3077	14.7318	15.1559 (38)
Heat transfer coeff	50.9312	50.7191	50.5070	49.4468	49.2347	48.1744	48.1744	47.9624	48.5985	49.2347	49.6588	50.0829 (39)
Average = Sum(39)m / 12 =												49.3937
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9095	0.9057	0.9019	0.8830	0.8792	0.8603	0.8603	0.8565	0.8678	0.8792	0.8868	0.8943 (40)
HLP (average)												0.8820
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

Assumed occupancy												1.8666 (42)
Hot water usage for mixer showers	54.1136	53.2851	52.0642	50.1859	48.5031	46.1488	44.2867	46.4636	47.5585	49.8903	52.3187	54.0648 (42a)
Hot water usage for baths	23.4620	23.1079	22.6040	21.8495	21.1695	20.2333	19.5231	20.3916	20.8474	21.7749	22.7393	23.4434 (42b)
Hot water usage for other uses	33.7458	32.5187	31.2915	30.0644	28.8373	27.6102	27.6102	28.8373	30.0644	31.2915	32.5187	33.7458 (42c)
Average daily hot water use (litres/day)												102.3214 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.3214	108.9116	105.9597	102.0998	98.5099	93.9923	91.4200	95.6925	98.4703	102.9568	107.5766	111.2540 (44)
Energy content (annual)	163.8843	144.1121	151.4143	133.3679	126.9399	108.6990	101.0218	112.6318	114.2206	132.6702	145.3934	163.3847 (45)
Distribution loss (46)m = 0.15 x (45)m	24.5827	21.6168	22.7121	20.0052	19.0410	16.3048	15.1533	16.8948	17.1331	19.9005	21.8090	24.5077 (46)
Water storage loss:												
Store volume												201.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	190.8357	168.4553	178.3657	159.4499	153.8913	134.7810	127.9732	139.5832	140.3026	159.6216	171.4754	190.3361 (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	190.8357	168.4553	178.3657	159.4499	153.8913	134.7810	127.9732	139.5832	140.3026	159.6216	171.4754	190.3361 (64)
12Total per year (kWh/year)												1915.0710 (64a)
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	54.4915	47.9173	50.3452	44.3448	42.2075	36.1424	33.5898	37.4501	37.9783	44.1128	48.3433	54.3254 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	93.3297	93.3297	93.3297	93.3297	93.3297	93.3297	93.3297	93.3297	93.3297	93.3297	93.3297	93.3297 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	82.0931	90.8888	82.0931	84.8295	82.0931	84.8295	82.0931	82.0931	84.8295	82.0931	84.8295	82.0931 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	162.7587	164.4476	160.1916	151.1310	139.6936	128.9441	121.7627	120.0738	124.3298	133.3904	144.8278	155.5774 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.3330	32.3330	32.3330	32.3330	32.3330	32.3330	32.3330	32.3330	32.3330	32.3330	32.3330	32.3330 (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)	-74.6638	-74.6638	-74.6638	-74.6638	-74.6638	-74.6638	-74.6638	-74.6638	-74.6638	-74.6638	-74.6638	-74.6638 (71)
Water heating gains (Table 5)	73.2413	71.3055	67.6683	61.5900	56.7305	50.1978	45.1475	50.3361	52.7477	59.2915	67.1435	73.0180 (72)
Total internal gains	369.0920	377.6408	360.9519	348.5494	329.5161	314.9703	300.0022	303.5019	312.9060	325.7739	347.7997	361.6873 (73)

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	3.9900	10.6334	0.3000	0.0000	0.7700	9.8007 (74)
East	9.4200	19.6403	0.3000	0.0000	0.7700	42.7376 (76)

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Solar gains	52.5383	102.3334	169.5098	251.9244	314.9567	325.6407	308.6658	260.6233	198.3971	121.4982	65.3792	43.3157 (83)
Total gains	421.6303	479.9742	530.4617	600.4738	644.4728	640.6110	608.6680	564.1252	511.3031	447.2720	413.1789	405.0030 (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	24.2930	24.3946	24.4970	25.0223	25.1301	25.6832	25.6832	25.7967	25.4590	25.1301	24.9155	24.7045
alpha	2.6195	2.6263	2.6331	2.6682	2.6753	2.7122	2.7122	2.7198	2.6973	2.6753	2.6610	2.6470
util living area	0.9129	0.8805	0.8291	0.7261	0.5952	0.4445	0.3350	0.3720	0.5642	0.7751	0.8791	0.9195 (86)
MIT	18.8633	19.1893	19.6533	20.2464	20.6546	20.8895	20.9622	20.9493	20.7811	20.2310	19.4843	18.8337 (87)
Th 2	20.1594	20.1627	20.1659	20.1820	20.1852	20.2014	20.2014	20.2047	20.1949	20.1852	20.1788	20.1723 (88)
util rest of house	0.9038	0.8685	0.8121	0.7001	0.5585	0.3969	0.2782	0.3132	0.5149	0.7471	0.8650	0.9111 (89)
MIT 2	17.6471	18.0556	18.6331	19.3631	19.8401	20.1075	20.1764	20.1696	19.9973	19.3633	18.4419	17.6180 (90)
Living area fraction	18.1749	18.5475	19.0758	19.7464	20.1936	20.4468	20.5174	20.5079	20.3374	19.7398	18.8942	18.1455 (92)
MIT	18.1749	18.5475	19.0758	19.7464	20.1936	20.4468	20.5174	20.5079	20.3374	19.7398	18.8942	18.1455 (93)
Temperature adjustment												0.0000
adjusted MIT	18.1749	18.5475	19.0758	19.7464	20.1936	20.4468	20.5174	20.5079	20.3374	19.7398	18.8942	18.1455 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8767	0.8405	0.7864	0.6851	0.5589	0.4118	0.3010	0.3360	0.5240	0.7301	0.8386	0.8849 (94)
Useful gains	369.6478	403.4265	417.1599	411.3974	360.1861	263.8298	183.2090	189.5420	267.9037	326.5633	346.4992	358.4008 (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	706.6641	692.1903	635.1661	536.3194	418.1783	281.6685	188.7163	197.0265	303.1284	449.9960	585.6857	698.4325 (97)
Space heating kWh	250.7401	194.0493	162.1966	89.9438	43.1462	0.0000	0.0000	0.0000	0.0000	91.8339	172.2143	252.9835 (98a)
Space heating requirement - total per year (kWh/year)												1257.1078
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	250.7401	194.0493	162.1966	89.9438	43.1462	0.0000	0.0000	0.0000	0.0000	91.8339	172.2143	252.9835 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1257.1078
Space heating per m2										(98c) / (4) =		22.4484 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Fraction of main heating from main system 2												0.0000 (203)
Fraction of total heating from main system 1												1.0000 (204)
Fraction of total heating from main system 2												0.0000 (205)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	250.7401	194.0493	162.1966	89.9438	43.1462	0.0000	0.0000	0.0000	0.0000	91.8339	172.2143	252.9835 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	250.7401	194.0493	162.1966	89.9438	43.1462	0.0000	0.0000	0.0000	0.0000	91.8339	172.2143	252.9835 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Space heating fuel used, main system 2												0.0000 (213)
Water heating												
Water heating requirement	190.8357	168.4553	178.3657	159.4499	153.8913	134.7810	127.9732	139.5832	140.3026	159.6216	171.4754	190.3361 (64)
Efficiency of water heater (217)m	348.7382	348.7382	348.7382	348.7382	348.7382	348.7382	348.7382	348.7382	348.7382	348.7382	348.7382	348.7382 (216)
Fuel for water heating, kWh/month	54.7218	48.3042	51.1460	45.7219	44.1280	38.6482	36.6961	40.0252	40.2315	45.7712	49.1702	54.5785 (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	15.5728	14.0658	15.5728	15.0705	15.5728	15.0705	15.5728	15.5728	15.0705	15.5728	15.0705	15.5728 (231)
Lighting	16.9616	13.6073	12.2518	8.9762	6.9335	5.6647	6.3250	8.2214	10.6788	14.0112	15.8256	17.4331 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-9.3455	-16.2561	-28.9703	-38.2527	-44.4435	-40.5009	-39.7416	-35.1280	-27.5978	-20.1754	-11.0449	-7.6587 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-1.4871	-4.0652	-11.0271	-22.2273	-35.5514	-40.1391	-39.0033	-30.2845	-18.7702	-7.3228	-2.2607	-1.0907 (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												1257.1078 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												348.7382
Water heating fuel used												549.1428 (219)

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Space cooling fuel	0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9940)	
mechanical ventilation fans (SFP = 0.9940)	183.3572 (230a)
Total electricity for the above, kWh/year	183.3572 (231)
Electricity for lighting (calculated in Appendix L)	136.8901 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-532.3450 (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	-93.0000 (236)
Energy used	29.1000 (237)
Total delivered energy for all uses	1530.2531 (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 (high-rate cost)	1257.1078	0.1628	204.6385 (261)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000 (261)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000 (262)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating - high rate cost	19.8701	0.1480	2.9417 (264)
Water heating - low rate cost	529.2727	0.1243	65.7647 (264)
Space and water heating			273.3450 (265)
Pumps, fans and electric keep-hot	183.3572	0.1432	25.4421 (267)
Energy for lighting	136.8901	0.1490	20.3993 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-319.1154	0.1363	-43.4834
PV Unit electricity exported	-213.2295	0.1187	-25.3122
Total			-68.7956 (269)
Appendix Q item 'Kelda' - energy saved	-93.0000	0.1360	-12.6480 (270)
Appendix Q item 'Kelda' - energy used	29.1000	0.1360	3.9576 (271)
Total CO2, kg/year			241.7004 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.3200 (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 (high-rate cost)	1257.1078	1.6069	2020.0791 (275)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000 (275)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000 (276)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating - high rate cost	19.8701	1.5534	30.8662 (278)
Water heating - low rate cost	529.2727	1.4447	764.6459 (278)
Space and water heating			2815.5912 (279)
Pumps, fans and electric keep-hot	183.3572	1.5335	277.4113 (281)
Energy for lighting	136.8901	1.5547	212.8292 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-319.1154	1.5082	-481.2784
PV Unit electricity exported	-213.2295	0.4353	-92.8166
Total			-574.0950 (283)
Appendix Q item 'Kelda' - energy saved	-93.0000	1.5010	-139.5930 (284)
Appendix Q item 'Kelda' - energy used	29.1000	1.5010	43.6791 (285)
Total Primary energy kWh/year			2635.8228 (286)
Dwelling Primary energy Rate (DPER)			47.0700 (287)

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

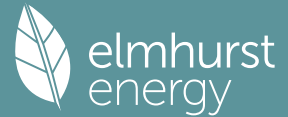
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	56.0000 (1b)	x 2.7000 (2b)	= 151.2000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.0000		(4)
Dwelling volume		(3a) + (3b) + (3c) + (3d) + (3e) ... (3n) =	151.2000 (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)

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Number of passive vents
Number of flueless gas fires

0 * 10 = 0.0000 (7b)
0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =
Pressure test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Air changes per hour
20.0000 / (5) = 0.1323 (8)
Yes
Blower Door
5.0000 (17)
0.3823 (18)
2 (19)

Shelter factor
Infiltration rate adjusted to include shelter factor

(20) = 1 - [0.075 x (19)] = 0.8500 (20)
(21) = (18) x (20) = 0.3249 (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 infiltr 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	0.4143	0.4062	0.3980	0.3574	0.3493	0.3087	0.3087	0.3006	0.3249	0.3493	0.3656	0.3818 (22b)
	0.5858	0.5825	0.5792	0.5639	0.5610	0.5476	0.5476	0.5452	0.5528	0.5610	0.5668	0.5729 (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)			12.0600	1.1450	13.8092		(27)
External Wall 1	25.1100	12.0600	13.0500	0.1800	2.3490		(29a)
Sheltered wall	27.0000	1.9500	25.0500	0.1800	4.5090		(29a)
Flat Roof	14.6000		14.6000	0.1100	1.6060		(30)
Total net area of external elements Aum(A, m2)			66.7100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	24.2232		(33)
Party Wall 1			38.0700	0.0000	0.0000		(32)

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

86.9318 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	7.1400	0.0500	0.3570
E3 Sill	6.2100	0.0500	0.3105
E4 Jamb	24.8000	0.0500	1.2400
E7 Party floor between dwellings (in blocks of flats)	19.3000	0.0700	1.3510
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	4.5000	0.0200	0.0900
E16 Corner (normal)	5.4000	0.0900	0.4860
E17 Corner (inverted - internal area greater than external area)	5.4000	-0.0900	-0.4860
E18 Party wall between dwellings	5.4000	0.0600	0.3240
E25 Staggered party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	14.1000	0.0000	0.0000
E15 Flat roof with parapet	10.6000	0.5600	5.9360

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

9.9325 (36)

Point Thermal Bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 34.1557 (37)

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

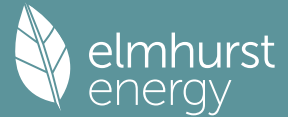
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	29.2300	29.0637	28.9007	28.1352	27.9920	27.3252	27.3252	27.2018	27.5821	27.9920	28.2817	28.5846 (38)
Average = Sum(39)m / 12 =	63.3857	63.2194	63.0564	62.2909	62.1476	61.4809	61.4809	61.3574	61.7377	62.1476	62.4374	62.7403 (39)
												62.2902

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1319	1.1289	1.1260	1.1123	1.1098	1.0979	1.0979	1.0957	1.1025	1.1098	1.1150	1.1204 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.8666 (42)
Hot water usage for mixer showers													
55.5162	54.6819	53.4661	51.1400	49.4234	47.5091	46.4210	47.6275	48.9501	51.0055	53.3816	55.3035	55.3035	(42a)
Hot water usage for baths													
23.9970	23.6406	23.1387	22.2134	21.5205	20.7522	20.3372	20.8355	21.3781	22.2003	23.1447	23.9159	23.9159	(42b)
Hot water usage for other uses													
33.7458	32.5187	31.2915	30.0644	28.8373	27.6102	27.6102	28.8373	30.0644	31.2915	32.5187	33.7458	33.7458	(42c)
Average daily hot water use (litres/day)													104.1111 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
113.2590	110.8412	107.8964	103.4179	99.7812	95.8715	94.3684	97.3004	100.3927	104.4974	109.0450	112.9651	112.9651	(44)
Energy content	179.3745	157.8363	165.8328	141.5739	134.3247	117.8852	114.1303	120.4782	123.7942	141.8019	155.3545	176.8761	(45)
Energy content (annual)										Total = Sum(45)m =		1729.2628	
Distribution loss (46)m = 0.15 x (45)m													
26.9062	23.6755	24.8749	21.2361	20.1487	17.6828	17.1196	18.0717	18.5691	21.2703	23.3032	26.5314	26.5314	(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	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	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													
225.9694	199.9221	212.4277	186.6657	180.9196	162.9770	160.7252	167.0731	168.8861	188.3968	200.4464	223.4710	223.4710	(62)
WWHRS	-25.3797	-22.4460	-23.5042	-19.4624	-18.1382	-15.5210	-14.5485	-15.4708	-16.0586	-18.9314	-21.4469	-24.9097	(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													
200.5897	177.4761	188.9235	167.2034	162.7814	147.4560	146.1768	151.6022	152.8274	169.4655	178.9994	198.5613	198.5613	(64)
Total per year (kWh/year)													2042.0628 (64)
12Total per year (kWh/year)													2042 (64)

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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	96.9180	86.1492	92.4153	83.1468	81.9389	75.2703	75.2243	77.3349	77.2351	84.4251	87.7289	96.0872 (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	93.3297	93.3297	93.3297	93.3297	93.3297	93.3297	93.3297	93.3297	93.3297	93.3297	93.3297	93.3297	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	82.1933	90.9998	82.1933	84.9331	82.1933	84.9331	82.1933	82.1933	84.9331	82.1933	84.9331	82.1933	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	162.7587	164.4476	160.1916	151.1310	139.6936	128.9441	121.7627	120.0738	124.3298	133.3904	144.8278	155.5774	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.3330	32.3330	32.3330	32.3330	32.3330	32.3330	32.3330	32.3330	32.3330	32.3330	32.3330	32.3330	(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)	-74.6638	-74.6638	-74.6638	-74.6638	-74.6638	-74.6638	-74.6638	-74.6638	-74.6638	-74.6638	-74.6638	-74.6638	(71)
Water heating gains (Table 5)	130.2661	128.1982	124.2142	115.4816	110.1329	104.5421	101.1079	103.9448	107.2709	113.4745	121.8456	129.1495	(72)
Total internal gains	429.2170	437.6444	420.5980	405.5447	386.0188	369.4182	356.0628	357.2108	367.5328	383.0572	405.6055	420.9191	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
North					3.5900	10.6334	0.6300	0.7000	0.7700	11.6664 (74)				
East					8.4700	19.6403	0.6300	0.7000	0.7700	50.8396 (76)				
Solar gains	62.5061	121.7483	201.6701	299.7238	374.7196	387.4329	367.2360	310.0746	236.0389	144.5490	77.7831	51.5338	(83)	
Total gains	491.7231	559.3927	622.2680	705.2684	760.7384	756.8510	723.2989	667.2854	603.5716	527.6062	483.3886	472.4529	(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	21.3340	21.3902	21.4454	21.7090	21.7590	21.9950	21.9950	22.0393	21.9035	21.7590	21.6581	21.5535	
alpha	2.4223	2.4260	2.4297	2.4473	2.4506	2.4663	2.4663	2.4693	2.4602	2.4506	2.4439	2.4369	
util living area	0.9099	0.8790	0.8289	0.7331	0.6078	0.4644	0.3526	0.3923	0.5800	0.7782	0.8777	0.9166	(86)
MIT	18.5681	18.9041	19.4106	20.0511	20.5360	20.8308	20.9376	20.9173	20.6945	20.0539	19.2234	18.5182	(87)
Th 2	19.9749	19.9773	19.9797	19.9908	19.9929	20.0026	20.0026	20.0044	19.9988	19.9929	19.9886	19.9842	(88)
util rest of house	0.8990	0.8648	0.8088	0.7025	0.5636	0.4046	0.2794	0.3166	0.5198	0.7452	0.8611	0.9065	(89)
MIT 2	17.1588	17.5778	18.2055	18.9858	19.5469	19.8684	19.9660	19.9532	19.7383	19.0114	17.9921	17.1019	(90)
Living area fraction	17.7703	18.1533	18.7284	19.4481	19.9761	20.2860	20.3876	20.3716	20.1532	19.4638	18.5264	17.7165	(91)
MIT	17.7703	18.1533	18.7284	19.4481	19.9761	20.2860	20.3876	20.3716	20.1532	19.4638	18.5264	17.7165	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.7703	18.1533	18.7284	19.4481	19.9761	20.2860	20.3876	20.3716	20.1532	19.4638	18.5264	17.7165	(93)

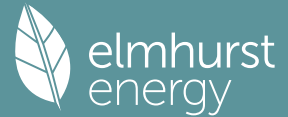
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.8687	0.8336	0.7799	0.6844	0.5628	0.4222	0.3083	0.3453	0.5296	0.7253	0.8313	0.8771	(94)
Useful gains	427.1669	466.3001	485.2802	482.6669	428.1771	319.5198	223.0238	230.4228	319.6625	382.6981	401.8501	414.3778	(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	853.8265	837.8670	771.0800	657.0478	514.3404	349.5790	232.8646	243.6842	373.7108	550.8639	713.4350	848.0277	(97)
Space heating kWh	317.4348	249.6930	212.6350	125.5543	64.1055	0.0000	0.0000	0.0000	0.0000	125.1153	224.3411	322.6356	(98a)
Space heating requirement - total per year (kWh/year)												1641.5144	
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	317.4348	249.6930	212.6350	125.5543	64.1055	0.0000	0.0000	0.0000	0.0000	125.1153	224.3411	322.6356	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1641.5144	
Space heating per m ²										(98c) / (4) =		29.3128	(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	317.4348	249.6930	212.6350	125.5543	64.1055	0.0000	0.0000	0.0000	0.0000	125.1153	224.3411	322.6356	(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)	343.9163	270.5232	230.3738	136.0284	69.4534	0.0000	0.0000	0.0000	0.0000	135.5529	243.0565	349.5510	(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)													

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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)
	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	200.5897	177.4761	188.9235	167.2034	162.7814	147.4560	146.1768	151.6022	152.8274	169.4655	178.9994	198.5613 (64)
Efficiency of water heater	85.0842	84.8253	84.3256	83.4262	82.1525	79.8000	79.8000	79.8000	79.8000	83.3896	84.5673	79.8000 (216)
Fuel for water heating, kWh/month	235.7543	209.2254	224.0406	200.4206	198.1453	184.7819	183.1789	189.9777	191.5131	203.2213	211.6652	85.1417 (217)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	17.0782	13.7007	12.3360	9.0379	6.9811	5.7036	6.3684	8.2779	10.7522	14.1074	15.9343	17.5528 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-26.5624	-37.6406	-54.4013	-61.5455	-66.7291	-62.4613	-61.7271	-58.1105	-51.7582	-43.2459	-29.2845	-22.9453 (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	-14.4351	-30.4287	-60.5776	-91.1113	-120.5726	-121.1440	-119.6817	-101.2593	-74.1461	-43.5170	-19.2774	-11.4073 (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												1778.4555 (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												2465.1371 (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)												137.8305 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1383.9702 (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												3083.4529 (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	1778.4555	0.2100	373.4757 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2465.1371	0.2100	517.6788 (264)
Space and water heating			891.1544 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	137.8305	0.1443	19.8932 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-576.4118	0.1344	-77.4983
PV Unit electricity exported	-807.5584	0.1259	-101.6414
Total			-179.1396 (269)
Total CO2, kg/year			743.8373 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.2800 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1778.4555	1.1300	2009.6547 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2465.1371	1.1300	2785.6049 (278)
Space and water heating			4795.2596 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	137.8305	1.5338	211.4090 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-576.4118	1.4969	-862.8276
PV Unit electricity exported	-807.5584	0.4620	-373.0932
Total			-1235.9208 (283)
Total Primary energy kWh/year			3900.8486 (286)
Target Primary Energy Rate (TPER)			69.6600 (287)

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Property Reference	P2.11 Latimer			Issued on Date	03/12/2024
Assessment Reference	P2.11 Kelda	Prop Type Ref	2nd Mid 1B2P		
Property	2.11, Latimer Road, Wokingham				
SAP Rating	82 B	DER	4.83	TER	13.61
Environmental	96 A	% DER < TER			64.51
CO ₂ Emissions (t/year)	0.25	DFEE	39.90	TFEE	43.12
Compliance Check	See BREL	% DFEE < TFEE			7.45
% DPER < TPER	27.84	DPER	51.49	TPER	71.36
Assessor Details	Mrs. Rebecca Lennon			Assessor ID	P627-0001
Client	RHB, RHB				

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	66.0000	2.7000	178.2000
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.0000		
Dwelling volume			178.2000

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)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.2000 (23c)
Effective ac	0.3207	0.3165	0.3123	0.2910	0.2867	0.2655	0.2655	0.2612	0.2740	0.2867	0.2953	0.3037 (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
Flat ent door			1.9500	1.0000	1.9500		(26)
Windows (Uw = 1.20)			15.7100	1.1450	17.9885		(27)
External Wall 1	69.3900	15.7100	53.6800	0.1200	6.4416	0.0000	0.0000 (29a)
Sheltered wall	10.8000	1.9500	8.8500	0.2100	1.8585	0.0000	0.0000 (29a)
Flat Roof	32.5000		32.5000	0.1100	3.5750	9.0000	292.5000 (30)
Total net area of external elements Aum(A, m ²)			112.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.8136		(33)
Party Wall 1			14.8500	0.0000	0.0000	0.0000	0.0000 (32)
Party Floor 1			66.0000			40.0000	2640.0000 (32d)
Party Ceiling 1			33.5000			30.0000	1005.0000 (32b)
Internal Wall 1			121.5000			9.0000	1093.5000 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		5031.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							76.2273 (35)
List of Thermal Bridges							

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K1 Element	Length	Psi-value	Total
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	5.0000	1.0000	5.0000
E16 Corner (normal)	13.5000	0.0370	0.4995
E17 Corner (inverted - internal area greater than external area)	5.4000	-0.0790	-0.4266
E25 Staggered party wall between dwellings	5.4000	0.0300	0.1620
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.0000	0.0000	0.0000
E2 Other lintels (including other steel lintels)	7.8300	0.0280	0.2192
E3 Sill	6.9000	0.0240	0.1656
E4 Jamb	21.9000	0.0190	0.4161
E7 Party floor between dwellings (in blocks of flats)	29.7000	0.0360	1.0692
E15 Flat roof with parapet	19.8000	0.3000	5.9400
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			13.0450 (36)
Point Thermal Bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	44.8587 (37)

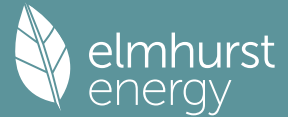
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	18.8620	18.6121	18.3622	17.1125	16.8626	15.6130	15.6130	15.3631	16.1128	16.8626	17.3625	17.8623	(38)
Heat transfer coeff	63.7207	63.4708	63.2209	61.9712	61.7213	60.4717	60.4717	60.2218	60.9715	61.7213	62.2212	62.7210	(39)
Average = Sum(39)m / 12 =												61.9088	
HLP	0.9655	0.9617	0.9579	0.9390	0.9352	0.9162	0.9162	0.9125	0.9238	0.9352	0.9427	0.9503	(40)
HLP (average)												0.9380	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)													
Assumed occupancy													2.1452 (42)
Hot water usage for mixer showers	58.6677	57.7695	56.4458	54.4095	52.5850	50.0326	48.0138	50.3739	51.5609	54.0890	56.7217	58.6148	(42a)
Hot water usage for baths	25.4264	25.0426	24.4966	23.6789	22.9419	21.9274	21.1577	22.0989	22.5928	23.5980	24.6432	25.4063	(42b)
Hot water usage for other uses	36.5995	35.2686	33.9377	32.6068	31.2759	29.9450	29.9450	31.2759	32.6068	33.9377	35.2686	36.5995	(42c)
Average daily hot water use (litres/day)												110.9356	(43)
Daily hot water use	120.6936	118.0807	114.8800	110.6951	106.8028	101.9050	99.1165	103.7487	106.7605	111.6247	116.6335	120.6205	(44)
Energy conte	177.6818	156.2446	164.1612	144.5955	137.6262	117.8497	109.5267	122.1141	123.8369	143.8397	157.6340	177.1401	(45)
Energy content (annual)										Total = Sum(45)m =		1732.2505	
Distribution loss (46)m = 0.15 x (45)m	26.6523	23.4367	24.6242	21.6893	20.6439	17.6775	16.4290	18.3171	18.5755	21.5760	23.6451	26.5710	(46)
Water storage loss:													
Store volume												201.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8694	(55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	204.6332	180.5878	191.1126	170.6775	164.5776	143.9317	136.4781	149.0655	149.9189	170.7911	183.7160	204.0915	(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	204.6332	180.5878	191.1126	170.6775	164.5776	143.9317	136.4781	149.0655	149.9189	170.7911	183.7160	204.0915	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2049.5815	(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	59.0792	51.9513	54.5836	48.0780	45.7607	39.1850	36.4176	40.6029	41.1758	47.8267	52.4133	58.8991	(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	107.2623	107.2623	107.2623	107.2623	107.2623	107.2623	107.2623	107.2623	107.2623	107.2623	107.2623	107.2623	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	94.7172	104.8655	94.7172	97.8745	94.7172	97.8745	94.7172	94.7172	97.8745	94.7172	97.8745	94.7172	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	187.7875	189.7362	184.8256	174.3717	161.1755	148.7729	140.4872	138.5386	143.4491	153.9031	167.0993	179.5018	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.7262	33.7262	33.7262	33.7262	33.7262	33.7262	33.7262	33.7262	33.7262	33.7262	33.7262	33.7262	(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)	-85.8098	-85.8098	-85.8098	-85.8098	-85.8098	-85.8098	-85.8098	-85.8098	-85.8098	-85.8098	-85.8098	-85.8098	(71)
Water heating gains (Table 5)	79.4075	77.3085	73.3651	66.7750	61.5063	54.4237	48.9484	54.5738	57.1886	64.2832	72.7963	79.1654	(72)
Total internal gains	417.0910	427.0889	408.0866	394.1999	372.5778	356.2497	339.3316	343.0084	353.6908	368.0822	392.9487	408.5632	(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
East	5.8500	19.6403	0.3000	0.0000	0.7700	26.5409 (76)
West	9.8600	19.6403	0.3000	0.0000	0.7700	44.7338 (80)

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Solar gains	71.2747	139.4285	229.6188	334.8853	410.4146	420.1323	399.9831	343.5796	267.0562	165.4436	88.8712	58.6129 (83)
Total gains	488.3657	566.5173	637.7054	729.0852	782.9923	776.3821	739.3147	686.5879	620.7470	533.5258	481.8199	467.1760 (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	21.9316	22.0180	22.1050	22.5508	22.6421	23.1100	23.1100	23.2059	22.9205	22.6421	22.4602	22.2812	
alpha	2.4621	2.4679	2.4737	2.5034	2.5095	2.5407	2.5407	2.5471	2.5280	2.5095	2.4973	2.4854	
util living area	0.9147	0.8806	0.8269	0.7245	0.5978	0.4519	0.3422	0.3786	0.5683	0.7777	0.8820	0.9217 (86)	
MIT	18.5946	18.9591	19.4780	20.1265	20.5818	20.8560	20.9481	20.9320	20.7304	20.1038	19.2689	18.5561 (87)	
Th 2	20.1122	20.1154	20.1186	20.1345	20.1377	20.1537	20.1537	20.1569	20.1473	20.1377	20.1313	20.1249 (88)	
util rest of house	0.9057	0.8685	0.8094	0.6979	0.5599	0.4018	0.2816	0.3162	0.5171	0.7493	0.8680	0.9133 (89)	
MIT 2	17.2863	17.7432	18.3891	19.1867	19.7204	20.0316	20.1196	20.1101	19.9044	19.1806	18.1490	17.2456 (90)	
Living area fraction									fLA = Living area / (4) =				0.4455 (91)
MIT	17.8691	18.2848	18.8741	19.6053	20.1041	20.3988	20.4886	20.4762	20.2723	19.5918	18.6479	17.8294 (92)	
Temperature adjustment												0.0000	
adjusted MIT	17.8691	18.2848	18.8741	19.6053	20.1041	20.3988	20.4886	20.4762	20.2723	19.5918	18.6479	17.8294 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8763	0.8376	0.7807	0.6801	0.5584	0.4167	0.3060	0.3404	0.5250	0.7290	0.8387	0.8850 (94)
Useful gains	427.9317	474.5107	497.8333	495.8584	437.2034	323.5134	226.2643	233.6843	325.8900	388.9472	404.1004	413.4441 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	14.0000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	864.6333	849.5456	782.3023	663.4237	518.7137	350.6649	235.1510	245.4761	376.3372	554.9877	718.5210	854.8502 (97)
Space heating kWh	324.9060	252.0234	211.6449	120.6471	60.6437	0.0000	0.0000	0.0000	0.0000	123.5341	226.3828	328.4062 (98a)
Space heating requirement - total per year (kWh/year)												1648.1883
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	324.9060	252.0234	211.6449	120.6471	60.6437	0.0000	0.0000	0.0000	0.0000	123.5341	226.3828	328.4062 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1648.1883
Space heating per m2										(98c) / (4) =		24.9725 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Fraction of main heating from main system 2													0.0000 (203)
Fraction of total heating from main system 1													1.0000 (204)
Fraction of total heating from main system 2													0.0000 (205)
Efficiency of main space heating system 1 (in %)													100.0000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	324.9060	252.0234	211.6449	120.6471	60.6437	0.0000	0.0000	0.0000	0.0000	123.5341	226.3828	328.4062 (98)	
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)	
Space heating fuel (main heating system)	324.9060	252.0234	211.6449	120.6471	60.6437	0.0000	0.0000	0.0000	0.0000	123.5341	226.3828	328.4062 (211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)	
Space heating fuel used, main system 2												0.0000 (213)	
Water heating requirement	204.6332	180.5878	191.1126	170.6775	164.5776	143.9317	136.4781	149.0655	149.9189	170.7911	183.7160	204.0915 (64)	
Efficiency of water heater (217)m	346.0104	346.0104	346.0104	346.0104	346.0104	346.0104	346.0104	346.0104	346.0104	346.0104	346.0104	346.0104 (216)	
Fuel for water heating, kWh/month	59.1408	52.1914	55.2332	49.3273	47.5644	41.5975	39.4433	43.0812	43.3279	49.3601	53.0955	58.9842 (219)	
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)	
Pumps and Fa	18.3537	16.5775	18.3537	17.7616	18.3537	17.7616	18.3537	18.3537	17.7616	18.3537	17.7616	18.3537 (231)	
Lighting	20.8229	16.7049	15.0409	11.0196	8.5119	6.9543	7.7648	10.0930	13.1098	17.2008	19.4283	21.4017 (232)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-9.4838	-16.6150	-29.8740	-39.9090	-46.7866	-42.4571	-41.6464	-36.6637	-28.6094	-20.7737	-11.2511	-7.7619 (233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)	
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-1.3488	-3.7063	-10.1235	-20.5710	-33.2083	-38.1829	-37.0986	-28.7488	-17.7586	-6.7246	-2.0545	-0.9875 (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												1648.1883 (211)	
Space heating fuel - main system 2												0.0000 (213)	
Space heating fuel - secondary												0.0000 (215)	
Efficiency of water heater												346.0104	
Water heating fuel used												592.3468 (219)	
Space cooling fuel												0.0000 (221)	

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Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9940)	
mechanical ventilation fans (SFP = 0.9940)	216.0996 (230a)
Total electricity for the above, kWh/year	216.0996 (231)
Electricity for lighting (calculated in Appendix L)	168.0530 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-532.3450 (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	-101.7000 (236)
Energy used	29.3000 (237)
Total delivered energy for all uses	2019.9427 (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 (high-rate cost)	1648.1883	0.1626	268.0309	(261)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000	(261)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000	(262)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	24.6950	0.1481	3.6568	(264)
Water heating - low rate cost	567.6518	0.1243	70.5491	(264)
Space and water heating			342.2369	(265)
Pumps, fans and electric keep-hot	216.0996	0.1432	29.9854	(267)
Energy for lighting	168.0530	0.1490	25.0432	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-331.8317	0.1361	-45.1709	
PV Unit electricity exported	-200.5133	0.1183	-23.7287	
Total			-68.8996	(269)
Appendix Q item 'Kelda' - energy saved	-101.7000	0.1360	-13.8312	(270)
Appendix Q item 'Kelda' - energy used	29.3000	0.1360	3.9848	(271)
Total CO2, kg/year			318.5195	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.8300	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	1648.1883	1.6063	2647.5521	(275)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000	(275)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000	(276)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000	(276)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	24.6950	1.5535	38.3640	(278)
Water heating - low rate cost	567.6518	1.4448	820.1553	(278)
Space and water heating			3506.0714	(279)
Pumps, fans and electric keep-hot	216.0996	1.5335	326.9490	(281)
Energy for lighting	168.0530	1.5547	261.2794	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-331.8317	1.5077	-500.2918	
PV Unit electricity exported	-200.5133	0.4339	-87.0008	
Total			-587.2926	(283)
Appendix Q item 'Kelda' - energy saved	-101.7000	1.5010	-152.6517	(284)
Appendix Q item 'Kelda' - energy used	29.3000	1.5010	43.9793	(285)
Total Primary energy kWh/year			3398.3348	(286)
Dwelling Primary energy Rate (DPER)			51.4900	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET EMISSIONS

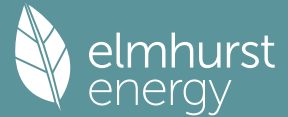
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	66.0000 (1b)	x 2.7000 (2b)	= 178.2000 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.0000		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)... (3n) =	178.2000 (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)

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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) =
Pressure test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Air changes per hour
20.0000 / (5) = 0.1122 (8)
Yes
Blower Door
5.0000 (17)
0.3622 (18)
2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3079 (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	0.3926	0.3849	0.3772	0.3387	0.3310	0.2925	0.2925	0.2848	0.3079	0.3310	0.3464	0.3618 (22b)
Effective ac	0.5771	0.5741	0.5711	0.5574	0.5548	0.5428	0.5428	0.5406	0.5474	0.5548	0.5600	0.5654 (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)			14.5500	1.1450	16.6603		(27)
External Wall 1	69.3900	14.5500	54.8400	0.1800	9.8712		(29a)
Sheltered wall	10.8000	1.9500	8.8500	0.1800	1.5930		(29a)
Flat Roof	32.5000		32.5000	0.1100	3.5750		(30)
Total net area of external elements Aum(A, m2)			112.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.6495		(33)
Party Wall 1			14.8500	0.0000	0.0000		(32)

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

81.3030 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	5.0000	0.0200	0.1000
E16 Corner (normal)	13.5000	0.0900	1.2150
E17 Corner (inverted - internal area greater than external area)	5.4000	-0.0900	-0.4860
E25 Staggered party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.0000	0.0000	0.0000
E2 Other lintels (including other steel lintels)	7.8300	0.0500	0.3915
E3 Sill	6.9000	0.0500	0.3450
E4 Jamb	21.9000	0.0500	1.0950
E7 Party floor between dwellings (in blocks of flats)	29.7000	0.0700	2.0790
E15 Flat roof with parapet	19.8000	0.5600	11.0880

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

Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 49.8010 (37)

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

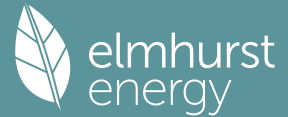
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	33.9343	33.7584	33.5859	32.7758	32.6242	31.9187	31.9187	31.7880	32.1904	32.6242	32.9309	33.2514 (38)
Heat transfer coeff	83.7353	83.5594	83.3869	82.5768	82.4252	81.7197	81.7197	81.5890	81.9915	82.4252	82.7319	83.0524 (39)
Average = Sum(39)m / 12 =												82.5761

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2687	1.2661	1.2634	1.2512	1.2489	1.2382	1.2382	1.2362	1.2423	1.2489	1.2535	1.2584 (40)
HLP (average)												1.2512
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.1452 (42)
Hot water usage for mixer showers	60.1883	59.2838	57.9658	55.4439	53.5828	51.5074	50.3277	51.6358	53.0697	55.2981	57.8741	59.9577 (42a)	
Hot water usage for baths	26.0062	25.6199	25.0761	24.0732	23.3223	22.4897	22.0399	22.5800	23.1681	24.0590	25.0825	25.9183 (42b)	
Hot water usage for other uses	36.5995	35.2686	33.9377	32.6068	31.2759	29.9450	29.9450	31.2759	32.6068	33.9377	35.2686	36.5995 (42c)	
Average daily hot water use (litres/day)												112.8757 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	122.7940	120.1723	116.9795	112.1239	108.1810	103.9421	102.3126	105.4917	108.8445	113.2948	118.2252	122.4754 (44)	
Energy conte	194.4756	171.1238	179.7931	153.4920	145.6325	127.8089	123.7383	130.6207	134.2162	153.7399	168.4334	191.7669 (45)	
Energy content (annual)										Total = Sum(45)m =		1874.8415	
Distribution loss (46)m = 0.15 x (45)m	29.1713	25.6686	26.9690	23.0238	21.8449	19.1713	18.5607	19.5931	20.1324	23.0610	25.2650	28.7650 (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	241.0705	213.2095	226.3880	198.5839	192.2274	172.9007	170.3332	177.2156	179.3080	200.3348	213.5253	238.3618 (62)	
WWHRS	-27.5156	-24.3350	-25.4822	-21.1003	-19.6647	-16.8272	-15.7728	-16.7728	-17.4101	-20.5246	-23.2519	-27.0060 (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	213.5549	188.8745	200.9058	177.4836	172.5627	156.0735	154.5603	160.4428	161.8979	179.8102	190.2734	211.3558 (64)	
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2167.7955 (64)	
Electric shower(s)												2168 (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)	

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Heat gains from water heating, kWh/month
101.9391 90.5672 97.0571 87.1096 85.6987 78.5699 78.4189 80.7073 80.7004 88.3945 92.0776 101.0384 (65)

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

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	107.2623	107.2623	107.2623	107.2623	107.2623	107.2623	107.2623	107.2623	107.2623	107.2623	107.2623	107.2623	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	94.7438	104.8949	94.7438	97.9019	94.7438	97.9019	94.7438	94.7438	97.9019	94.7438	97.9019	94.7438	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	187.7875	189.7362	184.8256	174.3717	161.1755	148.7729	140.4872	138.5386	143.4491	153.9031	167.0993	179.5018	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.7262	33.7262	33.7262	33.7262	33.7262	33.7262	33.7262	33.7262	33.7262	33.7262	33.7262	33.7262	(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)	-85.8098	-85.8098	-85.8098	-85.8098	-85.8098	-85.8098	-85.8098	-85.8098	-85.8098	-85.8098	-85.8098	-85.8098	(71)
Water heating gains (Table 5)	137.0149	134.7727	130.4531	120.9855	115.1865	109.1249	105.4017	108.4776	112.0838	118.8097	127.8855	135.8043	(72)
Total internal gains	477.7249	487.5825	468.2013	451.4379	429.2845	410.9785	395.8115	396.9387	408.6136	425.6353	451.0654	468.2287	(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
East					5.4200	19.6403	0.6300	0.7000			0.7700	32.5326 (76)
West					9.1300	19.6403	0.6300	0.7000			0.7700	54.8012 (80)
Solar gains	87.3338	170.8434	281.3547	410.3390	502.8859	514.7932	490.1041	420.9922	327.2271	202.7200	108.8949	71.8190 (83)
Total gains	565.0587	658.4258	749.5560	861.7769	932.1703	925.7716	885.9156	817.9308	735.8407	628.3553	559.9604	540.0477 (84)

7. Mean internal temperature (heating season)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)													21.0000 (85)
tau	17.8008	17.8383	17.8752	18.0505	18.0837	18.2399	18.2399	18.2691	18.1794	18.0837	18.0167	17.9472	
alpha	2.1867	2.1892	2.1917	2.2034	2.2056	2.2160	2.2160	2.2179	2.2120	2.2056	2.2011	2.1965	
util living area	0.9130	0.8810	0.8297	0.7370	0.6186	0.4825	0.3713	0.4108	0.5946	0.7866	0.8831	0.9199	(86)
MIT	18.0639	18.4514	19.0425	19.7808	20.3634	20.7430	20.8969	20.8677	20.5691	19.7833	18.8067	17.9992	(87)
Th 2	19.8654	19.8675	19.8696	19.8793	19.8811	19.8896	19.8896	19.8912	19.8863	19.8811	19.8774	19.8736	(88)
util rest of house	0.9021	0.8665	0.8089	0.7051	0.5717	0.4165	0.2881	0.3256	0.5300	0.7526	0.8664	0.9099	(89)
MIT 2	16.4842	16.9668	17.6985	18.5965	19.2739	19.6884	19.8308	19.8113	19.5226	18.6268	17.4258	16.4069	(90)
Living area fraction									fLA = Living area / (4) =			0.4455	(91)
MIT	17.1879	17.6281	18.2972	19.1240	19.7592	20.1582	20.3057	20.2818	19.9888	19.1420	18.0409	17.1162	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.1879	17.6281	18.2972	19.1240	19.7592	20.1582	20.3057	20.2818	19.9888	19.1420	18.0409	17.1162	(93)

8. Space heating requirement

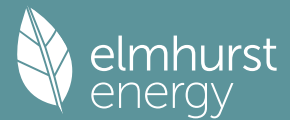
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8674	0.8298	0.7739	0.6807	0.5662	0.4332	0.3203	0.3569	0.5364	0.7262	0.8312	0.8762	(94)
Useful gains	490.1224	546.3544	580.0474	586.6468	527.7887	401.0782	283.7549	291.8797	394.6854	456.3125	465.4405	473.2010	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1079.1736	1063.5541	983.7333	844.2684	664.2837	454.2129	302.8285	316.7160	482.8306	704.0733	905.1649	1072.7181	(97)
Space heating kWh	438.2541	347.5582	300.3423	185.4876	101.5523	0.0000	0.0000	0.0000	0.0000	184.3340	316.6016	446.0408	(98a)
Space heating requirement - total per year (kWh/year)												2320.1707	
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	438.2541	347.5582	300.3423	185.4876	101.5523	0.0000	0.0000	0.0000	0.0000	184.3340	316.6016	446.0408	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2320.1707	
Space heating per m ²										(98c) / (4) =		35.1541	(99)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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)
Space heating requirement	438.2541	347.5582	300.3423	185.4876	101.5523	0.0000	0.0000	0.0000	0.0000	184.3340	316.6016	446.0408	(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)	474.8148	376.5527	325.3979	200.9616	110.0242	0.0000	0.0000	0.0000	0.0000	199.7118	343.0136	483.2511	(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)													

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	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	213.5549	188.8745	200.9058	177.4836	172.5627	156.0735	154.5603	160.4428	161.8979	179.8102	190.2734	211.3558	(64)
Efficiency of water heater	85.6357	85.4084	84.9595	84.1589	82.9132	79.8000	79.8000	79.8000	79.8000	84.1156	85.1932	85.6928	(216)
(217)m													(217)
Fuel for water heating, kWh/month	249.3762	221.1427	236.4725	210.8912	208.1244	195.5808	193.6846	201.0561	202.8796	213.7657	223.3434	246.6436	(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	19.6859	15.7928	14.2196	10.4179	8.0471	6.5745	7.3408	9.5419	12.3940	16.2615	18.3674	20.2330	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-31.0759	-43.9183	-63.2968	-71.3863	-77.1876	-72.1479	-71.2728	-67.1849	-59.9961	-50.3288	-34.2081	-26.8557	(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	-17.2426	-36.3062	-72.2141	-108.5307	-143.5608	-144.2440	-142.5305	-120.6439	-88.3912	-51.9275	-23.0257	-13.6313	(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												2513.7278	(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												2602.9609	(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)												158.8764	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1631.1077	(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												3730.4575	(238)

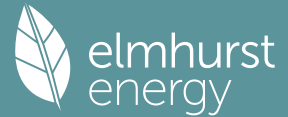
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2513.7278	0.2100	527.8828 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2602.9609	0.2100	546.6218 (264)
Space and water heating			1074.5046 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	158.8764	0.1443	22.9308 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-668.8593	0.1345	-89.9746
PV Unit electricity exported	-962.2484	0.1259	-121.1280
Total			-211.1026 (269)
Total CO2, kg/year			898.2621 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.6100 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2513.7278	1.1300	2840.5124 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2602.9609	1.1300	2941.3459 (278)
Space and water heating			5781.8582 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	158.8764	1.5338	243.6900 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-668.8593	1.4972	-1001.3876
PV Unit electricity exported	-962.2484	0.4621	-444.6227
Total			-1446.0104 (283)
Total Primary energy kWh/year			4709.6387 (286)
Target Primary Energy Rate (TPER)			71.3600 (287)

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Property Reference	P3.02 Latimer			Issued on Date	03/12/2024
Assessment Reference	P3.02 Kelda	Prop Type Ref	3rd End 2B3P		
Property	3.02, Latimer Road, Wokingham				
SAP Rating	83 B	DER	4.92	TER	15.67
Environmental	97 A	% DER < TER			68.60
CO ₂ Emissions (t/year)	0.2	DFEE	41.71	TFEE	39.53
Compliance Check	See BREL	% DFEE < TFEE			-5.52
% DPER < TPER	35.51	DPER	53.59	TPER	83.09
Assessor Details	Mrs. Rebecca Lennon			Assessor ID	P627-0001
Client	RHB, RHB				

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	50.0000 (1b)	2.7000 (2b)	135.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000		4
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	135.0000 (5)

2. Ventilation rate

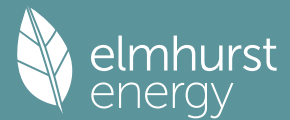
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	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)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.2000 (23c)
Effective ac	0.3207	0.3165	0.3123	0.2910	0.2867	0.2655	0.2655	0.2612	0.2740	0.2867	0.2953	0.3037 (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
Flat ent door			1.9500	1.0000	1.9500		(26)
Windows (Uw = 1.10)			8.5200	1.0536	8.9770		(27)
External Wall 1	30.2400	8.5200	21.7200	0.1200	2.6064	0.0000	0.0000 (29a)
Sheltered wall	31.5900	1.9500	29.6400	0.2100	6.2244	0.0000	0.0000 (29a)
Flat Roof	50.0000		50.0000	0.1100	5.5000	9.0000	450.0000 (30)
Total net area of external elements Aum(A, m ²)			111.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.2578		(33)
Party Wall 1			28.6200	0.0000	0.0000	0.0000	0.0000 (32)
Party Floor 1			50.0000			40.0000	2000.0000 (32d)
Internal Wall 1			78.3000			9.0000	704.7000 (32c)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			3154.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							63.0940 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value		Total

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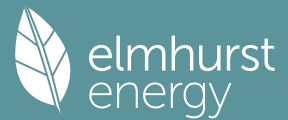


E23 Balcony within or between dwellings, balcony support penetrates wall insulation	5.9000	1.0000	5.9000										
E16 Corner (normal)	8.1000	0.0370	0.2997										
E17 Corner (inverted - internal area greater than external area)	8.1000	-0.0790	-0.6399										
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	21.2000	0.0000	0.0000										
P4 Party wall - Roof (insulation at ceiling level)	10.6000	0.0330	0.3498										
E2 Other lintels (including other steel lintels)	4.5300	0.0280	0.1268										
E3 Sill	3.6000	0.0240	0.0864										
E4 Jamb	13.4000	0.0190	0.2546										
E7 Party floor between dwellings (in blocks of flats)	22.9000	0.0360	0.8244										
E14 Flat roof	22.9000	0.1600	3.6640										
E18 Party wall between dwellings	2.7000	0.0410	0.1107										
E25 Staggered party wall between dwellings	8.1000	0.0300	0.2430										
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												11.2195	(36)
Point Thermal bridges												0.0000	
Total fabric heat loss												36.4774	(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	14.2894	14.1001	13.9107	12.9641	12.7747	11.8280	11.8280	11.6387	12.2067	12.7747	13.1534	13.5321	(38)
Average = Sum(39)m / 12 =	50.7668	50.5774	50.3881	49.4414	49.2521	48.3054	48.3054	48.1160	48.6841	49.2521	49.6307	50.0094	(39)
												49.3941	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0153	1.0115	1.0078	0.9888	0.9850	0.9661	0.9661	0.9623	0.9737	0.9850	0.9926	1.0002	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
4. Water heating energy requirements (kWh/year)													
Assumed occupancy													1.6901 (42)
Hot water usage for mixer showers													
	51.2291	50.4448	49.2889	47.5108	45.9176	43.6888	41.9260	43.9869	45.0234	47.2309	49.5299	51.1829	(42a)
Hot water usage for baths													
	22.2178	21.8825	21.4053	20.6908	20.0468	19.1604	18.4878	19.3102	19.7418	20.6202	21.5334	22.2002	(42b)
Hot water usage for other uses													
	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)
Average daily hot water use (litres/day)													96.8653 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	105.3852	103.1041	100.3098	96.6557	93.2572	88.9805	86.5452	90.5898	93.2194	97.4666	101.8402	105.3214	(44)
Energy content (annual)	155.1453	136.4276	143.3406	126.2565	120.1714	102.9030	95.6350	106.6259	108.1298	125.5956	137.6404	154.6722	(45)
Distribution loss (46)m = 0.15 x (45)m													
	23.2718	20.4641	21.5011	18.9385	18.0257	15.4355	14.3452	15.9939	16.2195	18.8393	20.6461	23.2008	(46)
Water storage loss:													
Store volume													201.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6100 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8694 (55)
Total storage loss													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	182.0967	160.7708	170.2920	152.3385	147.1228	128.9850	122.5864	133.5773	134.2118	152.5470	163.7224	181.6236	(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													
	182.0967	160.7708	170.2920	152.3385	147.1228	128.9850	122.5864	133.5773	134.2118	152.5470	163.7224	181.6236	(64)
12Total per year (kWh/year)													
Electric shower(s)													1830 (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)
Heat gains from water heating, kWh/month													
	51.5858	45.3622	47.6607	41.9803	39.9570	34.2153	31.7986	35.4531	35.9532	41.7605	45.7654	51.4285	(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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	76.5595	84.7623	76.5595	79.1115	76.5595	79.1115	76.5595	76.5595	79.1115	76.5595	79.1115	76.5595	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Pumps, fans	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(69)
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)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Total internal gains	69.3358	67.5033	64.0601	58.3060	53.7056	47.5212	42.7401	47.6520	49.9349	56.1298	63.5631	69.1244	(72)
	341.4807	349.3789	333.8829	322.4843	304.9856	291.6289	277.7995	281.1836	289.8686	301.7078	322.0395	334.7730	(73)

6. Solar gains													
[Jan]													
	Area	Solar flux	g	FF	Access	Gains							
	m2	Table 6a	Specific data	Specific data	factor	W							
		W/m2	or Table 6b	or Table 6c	Table 6d								
East	8.5200	19.6403	0.6500	0.7000	0.7700	52.7633	(76)						

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Solar gains	52.7633	103.2161	169.9822	247.9090	303.8217	311.0156	296.0995	254.3451	197.6964	122.4746	65.7896	43.3899 (83)
Total gains	394.2440	452.5950	503.8651	570.3933	608.8073	602.6445	573.8990	535.5287	487.5649	424.1824	387.8291	378.1629 (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	17.2614	17.3260	17.3911	17.7241	17.7923	18.1410	18.1410	18.2123	17.9998	17.7923	17.6565	17.5228
alpha	2.1508	2.1551	2.1594	2.1816	2.1862	2.2094	2.2094	2.2142	2.2000	2.1862	2.1771	2.1682
util living area	0.8868	0.8514	0.7986	0.7019	0.5846	0.4482	0.3433	0.3769	0.5534	0.7480	0.8512	0.8941 (86)
MIT	18.2217	18.6036	19.1630	19.8824	20.4220	20.7771	20.9112	20.8885	20.6240	19.8972	18.9719	18.1801 (87)
Th 2	20.0706	20.0737	20.0769	20.0927	20.0958	20.1117	20.1117	20.1149	20.1053	20.0958	20.0895	20.0832 (88)
util rest of house	0.8761	0.8379	0.7803	0.6753	0.5472	0.3980	0.2812	0.3136	0.5029	0.7189	0.8355	0.8841 (89)
MIT 2	16.8235	17.2992	17.9933	18.8763	19.5135	19.9188	20.0513	20.0356	19.7615	18.9169	17.7754	16.7767 (90)
Living area fraction	fLA = Living area / (4) =											0.5040 (91)
MIT	17.5282	17.9566	18.5829	19.3833	19.9714	20.3514	20.4847	20.4655	20.1962	19.4109	18.3785	17.4840 (92)
Temperature adjustment												0.0000
adjusted MIT	17.5282	17.9566	18.5829	19.3833	19.9714	20.3514	20.4847	20.4655	20.1962	19.4109	18.3785	17.4840 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8385	0.7998	0.7454	0.6523	0.5417	0.4120	0.3078	0.3393	0.5083	0.6939	0.7993	0.8474 (94)
Useful gains	330.5788	362.0078	375.5807	372.0693	329.8147	248.3025	176.6629	181.7160	247.8245	294.3494	309.9805	320.4716 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	14.1000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	671.5536	660.3716	608.8318	518.3113	407.3824	277.8231	187.6514	195.6142	296.7870	433.9572	559.7582	664.3274 (97)
Space heating kWh	253.6853	200.5005	173.5388	105.2943	57.7104	0.0000	0.0000	0.0000	0.0000	103.8682	179.8399	255.8287 (98a)
Space heating requirement - total per year (kWh/year)	1330.2661											
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	253.6853	200.5005	173.5388	105.2943	57.7104	0.0000	0.0000	0.0000	0.0000	103.8682	179.8399	255.8287 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1330.2661											
Space heating per m2	(98c) / (4) = 26.6053 (99)											

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Fraction of main heating from main system 2												0.0000 (203)
Fraction of total heating from main system 1												1.0000 (204)
Fraction of total heating from main system 2												0.0000 (205)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	253.6853	200.5005	173.5388	105.2943	57.7104	0.0000	0.0000	0.0000	0.0000	103.8682	179.8399	255.8287 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	253.6853	200.5005	173.5388	105.2943	57.7104	0.0000	0.0000	0.0000	0.0000	103.8682	179.8399	255.8287 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Space heating fuel used, main system 2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Water heating												
Water heating requirement	182.0967	160.7708	170.2920	152.3385	147.1228	128.9850	122.5864	133.5773	134.2118	152.5470	163.7224	181.6236 (64)
Efficiency of water heater (217)m	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100 (216)
Fuel for water heating, kWh/month	52.1155	46.0121	48.7370	43.5988	42.1061	36.9151	35.0838	38.2294	38.4110	43.6585	46.8568	51.9801 (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	13.9043	12.5587	13.9043	13.4558	13.9043	13.4558	13.9043	13.9043	13.4558	13.9043	13.4558	13.9043 (231)
Lighting	15.5824	12.5008	11.2556	8.2463	6.3697	5.2041	5.8106	7.5529	9.8105	12.8719	14.5387	16.0155 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-9.3184	-16.1972	-28.8576	-38.1569	-44.2684	-39.1451	-38.4252	-34.0699	-26.9020	-20.1129	-11.0142	-7.6392 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-1.5143	-4.1241	-11.1399	-22.3231	-35.7264	-41.4949	-40.3197	-31.3426	-19.4660	-7.3853	-2.2914	-1.1103 (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	1330.2661 (211)											
Space heating fuel - main system 2	0.0000 (213)											
Space heating fuel - secondary	0.0000 (215)											
Efficiency of water heater	349.4100											
Water heating fuel used	523.7041 (219)											
Space cooling fuel	0.0000 (221)											

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Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9940)	
mechanical ventilation fans (SFP = 0.9940)	163.7118 (230a)
Total electricity for the above, kWh/year	163.7118 (231)
Electricity for lighting (calculated in Appendix L)	125.7590 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-532.3450 (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	-87.8000 (236)
Energy used	28.9000 (237)
Total delivered energy for all uses	1552.1960 (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 (high-rate cost)	1330.2661	0.1622	215.7768 (261)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000 (261)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000 (262)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating - high rate cost	17.1232	0.1480	2.5347 (264)
Water heating - low rate cost	506.5808	0.1242	62.9352 (264)
Space and water heating			281.2467 (265)
Pumps, fans and electric keep-hot	163.7118	0.1432	22.7162 (267)
Energy for lighting	125.7590	0.1490	18.7406 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-314.1070	0.1365	-42.8677
PV Unit electricity exported	-218.2379	0.1184	-25.8431
Total			-68.7109 (269)
Appendix Q item 'Kelda' - energy saved	-87.8000	0.1360	-11.9408 (270)
Appendix Q item 'Kelda' - energy used	28.9000	0.1360	3.9304 (271)
Total CO2, kg/year			245.9822 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.9200 (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 (high-rate cost)	1330.2661	1.6049	2134.8800 (275)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000 (275)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000 (276)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating - high rate cost	17.1232	1.5533	26.5977 (278)
Water heating - low rate cost	506.5808	1.4446	731.8230 (278)
Space and water heating			2893.3008 (279)
Pumps, fans and electric keep-hot	163.7118	1.5335	247.6886 (281)
Energy for lighting	125.7590	1.5547	195.5231 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-314.1070	1.5089	-473.9714
PV Unit electricity exported	-218.2379	0.4342	-94.7521
Total			-568.7235 (283)
Appendix Q item 'Kelda' - energy saved	-87.8000	1.5010	-131.7878 (284)
Appendix Q item 'Kelda' - energy used	28.9000	1.5010	43.3789 (285)
Total Primary energy kWh/year			2679.3802 (286)
Dwelling Primary energy Rate (DPER)			53.5900 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET EMISSIONS

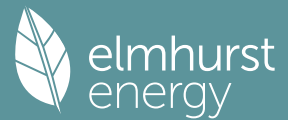
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	50.0000 (1b)	x 2.7000 (2b)	= 135.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	135.0000 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)

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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) =

Air changes per hour
20.0000 / (5) = 0.1481 (8)

Pressure test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Yes
Blower Door
5.0000 (17)
0.3981 (18)
2 (19)

Shelter factor

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

Infiltration rate adjusted to include shelter factor

(21) = (18) x (20) = 0.3384 (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	0.4315	0.4230	0.4146	0.3723	0.3638	0.3215	0.3215	0.3130	0.3384	0.3638	0.3807	0.3977 (22b)
	0.5931	0.5895	0.5859	0.5693	0.5662	0.5517	0.5517	0.5490	0.5573	0.5662	0.5725	0.5791 (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)			8.5200	1.1450	9.7557		(27)
External Wall 1	30.2400	8.5200	21.7200	0.1800	3.9096		(29a)
Sheltered wall	31.5900	1.9500	29.6400	0.1800	5.3352		(29a)
Flat Roof	50.0000		50.0000	0.1100	5.5000		(30)
Total net area of external elements Aum(A, m2)			111.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.4505		(33)
Party Wall 1			28.6200	0.0000	0.0000		(32)

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

63.0940 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	5.9000	0.0200	0.1180
E16 Corner (normal)	8.1000	0.0900	0.7290
E17 Corner (inverted - internal area greater than external area)	8.1000	-0.0900	-0.7290
P3 Party wall - intermediate floor between dwellings (in blocks of flats)	21.2000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	10.6000	0.1200	1.2720
E2 Other lintels (including other steel lintels)	4.5300	0.0500	0.2265
E3 Sill	3.6000	0.0500	0.1800
E4 Jamb	13.4000	0.0500	0.6700
E7 Party floor between dwellings (in blocks of flats)	22.9000	0.0700	1.6030
E14 Flat roof	22.9000	0.0800	1.8320
E18 Party wall between dwellings	2.7000	0.0600	0.1620
E25 Staggered party wall between dwellings	8.1000	0.0600	0.4860

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

6.5495 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 33.0000 (37)

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

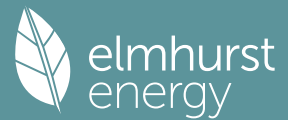
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	26.4223	26.2613	26.1034	25.3620	25.2232	24.5775	24.5775	24.4579	24.8262	25.2232	25.5039	25.7973 (38)
Heat transfer coeff	59.4223	59.2613	59.1034	58.3620	58.2233	57.5775	57.5775	57.4579	57.8262	58.2233	58.5039	58.7973 (39)
Average = Sum(39)m / 12 =												58.3613

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1884	1.1852	1.1821	1.1672	1.1645	1.1515	1.1515	1.1492	1.1565	1.1645	1.1701	1.1759 (40)
HLP (average)												1.1672
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.6901 (42)
Hot water usage for mixer showers												
52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556 (42a)	
Hot water usage for baths												
22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476 (42b)	
Hot water usage for other uses												
31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383 (42c)	
Average daily hot water use (litres/day)												98.5597 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415 (44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445 (45)
Energy content (annual)										Total = Sum(45)m =		1637.0557
Distribution loss (46)m = 0.15 x (45)m												
25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167 (46)	
Water storage loss:												
Store volume												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	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	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
216.4047	191.5060	203.5855	179.1170	173.7575	156.6915	154.6398	160.6490	162.2850	180.8355	192.1624	214.0394 (62)	
WWHRS	-24.0268	-21.2495	-22.2513	-18.4249	-17.1714	-14.6937	-13.7730	-14.6462	-15.2026	-17.9222	-20.3037	-23.5819 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
192.3778	170.2565	181.3342	160.6920	156.5861	141.9978	140.8668	146.0028	147.0824	162.9133	171.8587	190.4575 (64)	
Total per year (kWh/year) = Sum(64)m =												1962.4258 (64)
12Total per year (kWh/year)												1962 (64)

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Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	93.7377	83.3508	89.4753	80.6368	79.5575	73.1803	73.2008	75.1989	75.0402	81.9109	84.9744	92.9512 (65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	76.5595	84.7623	76.5595	79.1115	76.5595	79.1115	76.5595	76.5595	79.1115	76.5595	79.1115	76.5595	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	125.9915	124.0340	120.2625	111.9956	106.9321	101.6394	98.3882	101.0738	104.2225	110.0953	118.0201	124.9344	(72)
Total internal gains	401.1365	408.9096	393.0852	379.1739	361.2120	345.7471	333.4476	334.6054	344.1561	358.6733	379.4965	393.5831	(73)

6. Solar gains

[Jan]												Gains W		
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d			
East	8.5200				19.6403		0.6300		0.7000		0.7700		51.1398 (76)	
Solar gains	51.1398	100.0402	164.7520	240.2810	294.4734	301.4459	286.9888	246.5191	191.6134	118.7062	63.7653	42.0549	(83)	
Total gains	452.2762	508.9498	557.8372	619.4549	655.6854	647.1930	620.4364	581.1245	535.7695	477.3795	443.2618	435.6379	(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	14.7471	14.7872	14.8266	15.0150	15.0508	15.2196	15.2196	15.2513	15.1541	15.0508	14.9786	14.9038
alpha	1.9831	1.9858	1.9884	2.0010	2.0034	2.0146	2.0146	2.0168	2.0103	2.0034	1.9986	1.9936
util living area	0.8733	0.8418	0.7944	0.7094	0.6016	0.4729	0.3657	0.3990	0.5660	0.7425	0.8386	0.8804 (86)
MIT	17.9238	18.2891	18.8626	19.6130	20.2345	20.6729	20.8615	20.8300	20.4997	19.6929	18.7074	17.8706 (87)
Th 2	19.9293	19.9318	19.9344	19.9463	19.9485	19.9590	19.9590	19.9609	19.9549	19.9485	19.9440	19.9393 (88)
util rest of house	0.8605	0.8263	0.7738	0.6800	0.5596	0.4139	0.2906	0.3230	0.5085	0.7097	0.8203	0.8683 (89)
MIT 2	16.4060	16.8558	17.5605	18.4712	19.1992	19.6884	19.8717	19.8485	19.5159	18.5901	17.3875	16.3435 (90)
Living area fraction	17.1709	17.5782	18.2167	19.0467	19.7210	20.1846	20.3706	20.3432	20.0118	19.1459	18.0527	17.1131 (91)
MIT	17.1709	17.5782	18.2167	19.0467	19.7210	20.1846	20.3706	20.3432	20.0118	19.1459	18.0527	17.1131 (92)
Temperature adjustment												0.0000
adjusted MIT	17.1709	17.5782	18.2167	19.0467	19.7210	20.1846	20.3706	20.3432	20.0118	19.1459	18.0527	17.1131 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8178	0.7835	0.7342	0.6517	0.5497	0.4273	0.3213	0.3521	0.5118	0.6808	0.7793	0.8262	(94)
Useful gains	369.8790	398.7459	409.5822	403.6731	360.4618	276.5554	199.3346	204.6019	274.2264	324.9805	345.4498	359.9419	(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	764.8208	751.3274	692.4982	592.1811	467.0086	321.5475	217.1013	226.5661	341.8549	497.5706	640.7769	759.2567	(97)
Space heating kWh	293.8366	236.9348	210.4895	135.7258	79.2708	0.0000	0.0000	0.0000	0.0000	128.4071	212.6355	297.0902	(98a)
Space heating requirement - total per year (kWh/year)												1594.3903	
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	293.8366	236.9348	210.4895	135.7258	79.2708	0.0000	0.0000	0.0000	0.0000	128.4071	212.6355	297.0902	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1594.3903	
Space heating per m ²										(98c) / (4) =		31.8878	(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	293.8366	236.9348	210.4895	135.7258	79.2708	0.0000	0.0000	0.0000	0.0000	128.4071	212.6355	297.0902	(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)	318.3496	256.7007	228.0493	147.0485	85.8838	0.0000	0.0000	0.0000	0.0000	139.1193	230.3744	321.8746	(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)

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Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	192.3778	170.2565	181.3342	160.6920	156.5861	141.9978	140.8668	146.0028	147.0824	162.9133	171.8587	190.4575	(64)
Efficiency of water heater	85.0067	84.8010	84.3950	83.6835	82.6142	79.8000	79.8000	79.8000	79.8000	83.5316	84.5384	85.0528	(217)
Fuel for water heating, kWh/month	226.3091	200.7717	214.8636	192.0235	189.5391	177.9421	176.5248	182.9609	184.3137	195.0318	203.2908	223.9286	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	15.9076	12.7616	11.4904	8.4184	6.5026	5.3127	5.9319	7.7105	10.0152	13.1404	14.8421	16.3497	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-17.2238	-25.1803	-37.5284	-43.8221	-48.6971	-46.0143	-45.4847	-42.2433	-36.7404	-29.5446	-19.2638	-14.7904	(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	-7.1795	-15.3371	-30.9114	-47.0451	-62.7920	-63.2746	-62.4968	-52.6197	-38.2026	-22.1000	-9.6421	-5.6576	(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												1727.4001	(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												2367.4996	(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)												128.3831	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-823.7918	(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												3485.4910	(238)

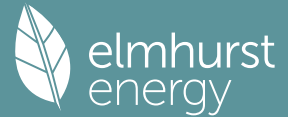
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1727.4001	0.2100	362.7540	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2367.4996	0.2100	497.1749	(264)
Space and water heating			859.9289	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	128.3831	0.1443	18.5296	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-406.5333	0.1338	-54.3946	
PV Unit electricity exported	-417.2585	0.1255	-52.3754	
Total			-106.7700	(269)
Total CO2, kg/year			783.6179	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.6700	(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	1727.4001	1.1300	1951.9621	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2367.4996	1.1300	2675.2746	(278)
Space and water heating			4627.2366	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	128.3831	1.5338	196.9183	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-406.5333	1.4945	-607.5483	
PV Unit electricity exported	-417.2585	0.4607	-192.2468	
Total			-799.7952	(283)
Total Primary energy kWh/year			4154.4606	(286)
Target Primary Energy Rate (TPER)			83.0900	(287)

Full SAP Calculation Printout



Property Reference	P3.05 Latimer			Issued on Date	03/12/2024
Assessment Reference	P3.05 Kelda	Prop Type Ref	3rd End 2B3P		
Property	3.05, Latimer Road, Wokingham				
SAP Rating	75 C	DER	5.94	TER	13.49
Environmental	95 A	% DER < TER			55.97
CO ₂ Emissions (t/year)	0.38	DFEE	46.96	TFEE	41.46
Compliance Check	See BREL	% DFEE < TFEE			-13.25
% DPER < TPER	12.71	DPER	61.97	TPER	70.99
Assessor Details	Mrs. Rebecca Lennon			Assessor ID	P627-0001
Client	RHB, RHB				

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	78.0000	2.7000	210.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.0000			(4)
Dwelling volume			210.6000	(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)

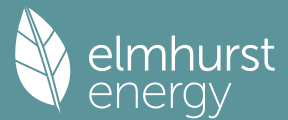
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	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)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.2000	(23c)
Effective ac	0.3207	0.3165	0.3123	0.2910	0.2867	0.2655	0.2655	0.2612	0.2740	0.2867	0.2953	0.3037	(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	
Flat ent door			1.9500	1.0000	1.9500			(26)
Windows (Uw = 1.10)			17.0100	1.0536	17.9224			(27)
External Wall 1	52.6500	17.0100	35.6400	0.1200	4.2768	0.0000	0.0000	(29a)
Sheltered wall	49.6800	1.9500	47.7300	0.2100	10.0233	0.0000	0.0000	(29a)
Flat Roof	78.0000		78.0000	0.1100	8.5800	9.0000	702.0000	(30)
Total net area of external elements Aum(A, m ²)			180.3300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.7525			(33)
Party Wall 1			11.3400	0.0000	0.0000	0.0000	0.0000	(32)
Party Floor 1			78.0000			40.0000	3120.0000	(32d)
Internal Wall 1			139.8600			9.0000	1258.7400	(32c)
Heat capacity Cm = Sum(A x k)								
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							5080.7400	(34)
List of Thermal Bridges							65.1377	(35)
K1 Element				Length	Psi-value		Total	

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E23 Balcony within or between dwellings, balcony support penetrates wall insulation	14.9000	1.0000	14.9000
E16 Corner (normal)	13.5000	0.0370	0.4995
E17 Corner (inverted - internal area greater than external area)	2.7000	-0.0790	-0.2133
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	4.2000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	4.2000	0.0330	0.1386
E2 Other lintels (including other steel lintels)	7.2300	0.0280	0.2024
E3 Sill	6.3000	0.0240	0.1512
E4 Jamb	20.4000	0.0190	0.3876
E7 Party floor between dwellings (in blocks of flats)	37.9000	0.0360	1.3644
E14 Flat roof	37.9000	0.1600	6.0640
E25 Staggered party wall between dwellings	8.1000	0.0410	0.3321
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			23.8265 (36)
Point Thermal Bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	66.5791 (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	22.2915	21.9961	21.7008	20.2239	19.9286	18.4517	18.4517	18.1564	19.0425	19.9286	20.5193	21.1100 (38)
Average = Sum(39)m / 12 =	88.8705	88.5752	88.2798	86.8030	86.5076	85.0308	85.0308	84.7354	85.6215	86.5076	87.0983	87.6891 (39)
												86.7291
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1394	1.1356	1.1318	1.1129	1.1091	1.0901	1.0901	1.0864	1.0977	1.1091	1.1166	1.1242 (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												2.4238 (42)
Hot water usage for mixer showers	63.2205	62.2526	60.8262	58.6318	56.6658	53.9153	51.7398	54.2831	55.5622	58.2865	61.1235	63.1635 (42a)
Hot water usage for baths	27.3903	26.9768	26.3886	25.5077	24.7138	23.6210	22.7919	23.8057	24.3378	25.4207	26.5465	27.3685 (42b)
Hot water usage for other uses	39.4523	38.0177	36.5831	35.1484	33.7138	32.2792	32.2792	33.7138	35.1484	36.5831	38.0177	39.4523 (42c)
Average daily hot water use (litres/day)												119.5474 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	130.0630	127.2471	123.7978	119.2879	115.0934	109.8154	106.8108	111.8026	115.0484	120.2902	125.6877	129.9843 (44)
Energy content (annual)	191.4753	168.3736	176.9045	155.8199	148.3095	126.9979	118.0291	131.5937	133.4504	155.0060	169.8711	190.8915 (45)
Distribution loss (46)m = 0.15 x (45)m	28.7213	25.2560	26.5357	23.3730	22.2464	19.0497	17.7044	19.7391	20.0176	23.2509	25.4807	28.6337 (46)
Water storage loss:												
Store volume												201.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	218.4267	192.7168	203.8559	181.9019	175.2609	153.0799	144.9805	158.5451	159.5324	181.9574	195.9531	217.8429 (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	218.4267	192.7168	203.8559	181.9019	175.2609	153.0799	144.9805	158.5451	159.5324	181.9574	195.9531	217.8429 (64)
12Total per year (kWh/year)												2184.0535 (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	63.6655	55.9842	58.8207	51.8101	49.3129	42.2268	39.2447	43.7549	44.3723	51.5395	56.4821	63.4714 (65)

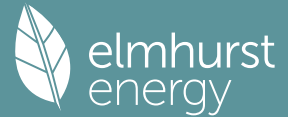
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	121.1909	121.1909	121.1909	121.1909	121.1909	121.1909	121.1909	121.1909	121.1909	121.1909	121.1909	121.1909 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	108.6201	120.2579	108.6201	112.2407	108.6201	112.2407	108.6201	108.6201	112.2407	108.6201	112.2407	108.6201 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.2098	217.4430	211.8154	199.8349	184.7117	170.4980	161.0024	158.7692	164.3968	176.3773	191.5005	205.7142 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1191	35.1191	35.1191	35.1191	35.1191	35.1191	35.1191	35.1191	35.1191	35.1191	35.1191	35.1191 (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)	-96.9527	-96.9527	-96.9527	-96.9527	-96.9527	-96.9527	-96.9527	-96.9527	-96.9527	-96.9527	-96.9527	-96.9527 (71)
Water heating gains (Table 5)	85.5720	83.3098	79.0601	71.9585	66.2808	58.6483	52.7482	58.8103	61.6282	69.2735	78.4474	85.3111 (72)
Total internal gains	468.7591	480.3680	458.8529	443.3914	418.9698	400.7443	381.7279	385.5568	397.6229	413.6281	441.5459	459.0026 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m2	Table 6a	Specific data	Specific data	factor	W
		W/m2	or Table 6b	or Table 6c	Table 6d	
West	17.0100	19.6403	0.6500	0.7000	0.7700	105.3407 (80)
Solar gains	105.3407	206.0688	339.3659	494.9450	606.5737	620.9361
						591.1565
						507.7947
						394.6966
						244.5180
						131.3475
						86.6271 (83)

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Total gains 574.0998 686.4368 798.2188 938.3364 1025.5434 1021.6804 972.8844 893.3515 792.3195 658.1461 572.8934 545.6296 (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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	15.8806	15.9335	15.9869	16.2589	16.3144	16.5977	16.5977	16.6556	16.4832	16.3144	16.2037	16.0946	21.0000 (85)
alpha	2.0587	2.0622	2.0658	2.0839	2.0876	2.1065	2.1065	2.1104	2.0989	2.0876	2.0802	2.0730	
util living area	0.9082	0.8715	0.8145	0.7130	0.5913	0.4557	0.3512	0.3901	0.5742	0.7742	0.8766	0.9157	(86)
MIT	17.8002	18.2440	18.8994	19.7177	20.3328	20.7330	20.8899	20.8595	20.5400	19.6858	18.6215	17.7425	(87)
Th 2	19.9688	19.9719	19.9750	19.9903	19.9934	20.0089	20.0089	20.0120	20.0027	19.9934	19.9873	19.9811	(88)
util rest of house	0.8984	0.8583	0.7955	0.6843	0.5504	0.3999	0.2812	0.3182	0.5183	0.7442	0.8617	0.9067	(89)
MIT 2	16.2571	16.8084	17.6184	18.6156	19.3359	19.7861	19.9384	19.9174	19.5932	18.6061	17.2954	16.1888	(90)
Living area fraction	fLA = Living area / (4) =												0.4372 (91)
MIT	16.9317	17.4360	18.1784	19.0974	19.7717	20.2001	20.3543	20.3293	20.0071	19.0781	17.8751	16.8680	(92)
Temperature adjustment													0.0000
adjusted MIT	16.9317	17.4360	18.1784	19.0974	19.7717	20.2001	20.3543	20.3293	20.0071	19.0781	17.8751	16.8680	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8590	0.8163	0.7552	0.6558	0.5407	0.4111	0.3064	0.3422	0.5186	0.7119	0.8214	0.8687	(94)
Useful gains	493.1627	560.3105	602.8276	615.3909	554.5107	420.0212	298.0615	305.6644	410.8587	468.5647	470.5927	473.9735	(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	1122.5888	1110.3780	1030.9705	885.1634	698.2663	476.1773	319.2348	332.9477	505.7772	733.4234	938.4956	1110.8486	(97)
Space heating kWh	468.2930	369.6454	318.5383	194.2362	106.9542	0.0000	0.0000	0.0000	0.0000	197.0549	336.8901	473.8351	(98a)
Space heating requirement - total per year (kWh/year)													2465.4472
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	468.2930	369.6454	318.5383	194.2362	106.9542	0.0000	0.0000	0.0000	0.0000	197.0549	336.8901	473.8351	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)													2465.4472
Space heating per m2													(98c) / (4) = 31.6083 (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)
Fraction of main heating from main system 2													1.0000 (202)
Fraction of total heating from main system 1													0.0000 (203)
Fraction of total heating from main system 1													1.0000 (204)
Fraction of total heating from main system 2													0.0000 (205)
Efficiency of main space heating system 1 (in %)													100.0000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	468.2930	369.6454	318.5383	194.2362	106.9542	0.0000	0.0000	0.0000	0.0000	197.0549	336.8901	473.8351	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	468.2930	369.6454	318.5383	194.2362	106.9542	0.0000	0.0000	0.0000	0.0000	197.0549	336.8901	473.8351	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Space heating fuel used, main system 2													0.0000 (213)
Water heating													
Water heating requirement	218.4267	192.7168	203.8559	181.9019	175.2609	153.0799	144.9805	158.5451	159.5324	181.9574	195.9531	217.8429	(64)
Efficiency of water heater (217)m	343.2833	343.2833	343.2833	343.2833	343.2833	343.2833	343.2833	343.2833	343.2833	343.2833	343.2833	343.2833	(216)
Fuel for water heating, kWh/month	63.6287	56.1393	59.3842	52.9888	51.0543	44.5929	42.2335	46.1849	46.4725	53.0050	57.0820	63.4586	(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	21.6907	19.5916	21.6907	20.9910	21.6907	20.9910	21.6907	21.6907	20.9910	21.6907	20.9910	21.6907	(231)
Lighting	23.1720	18.5894	16.7377	12.2628	9.4721	7.7388	8.6408	11.2316	14.5888	19.1412	21.6200	23.8160	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-9.6457	-17.0485	-31.0029	-42.0452	-49.7894	-44.2585	-43.3959	-38.0580	-29.5127	-21.5188	-11.4972	-7.8824	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-1.1869	-3.2728	-8.9946	-18.4348	-30.2055	-36.3815	-35.3490	-27.3545	-16.8553	-5.9794	-1.8084	-0.8670	(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													2465.4472 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													343.2833
Water heating fuel used													636.2247 (219)
Space cooling fuel													0.0000 (221)

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Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9940)	
mechanical ventilation fans (SFP = 0.9940)	255.3904 (230a)
Total electricity for the above, kWh/year	255.3904 (231)
Electricity for lighting (calculated in Appendix L)	187.0112 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-532.3450 (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	-110.2000 (236)
Energy used	29.6000 (237)
Total delivered energy for all uses	2931.1286 (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 (high-rate cost)	2465.4472	0.1622	399.7916 (261)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000 (261)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000 (262)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating - high rate cost	30.0264	0.1481	4.4472 (264)
Water heating - low rate cost	606.1984	0.1243	75.3544 (264)
Space and water heating			479.5931 (265)
Pumps, fans and electric keep-hot	255.3904	0.1432	35.4373 (267)
Energy for lighting	187.0112	0.1490	27.8684 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-345.6553	0.1361	-47.0336
PV Unit electricity exported	-186.6896	0.1176	-21.9537
Total			-68.9874 (269)
Appendix Q item 'Kelda' - energy saved	-110.2000	0.1360	-14.9872 (270)
Appendix Q item 'Kelda' - energy used	29.6000	0.1360	4.0256 (271)
Total CO2, kg/year			462.9498 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.9400 (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 (high-rate cost)	2465.4472	1.6047	3956.2567 (275)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000 (275)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000 (276)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating - high rate cost	30.0264	1.5536	46.6496 (278)
Water heating - low rate cost	606.1984	1.4449	875.9068 (278)
Space and water heating			4878.8131 (279)
Pumps, fans and electric keep-hot	255.3904	1.5335	386.3943 (281)
Energy for lighting	187.0112	1.5547	290.7547 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-345.6553	1.5075	-521.0659
PV Unit electricity exported	-186.6896	0.4311	-80.4737
Total			-601.5396 (283)
Appendix Q item 'Kelda' - energy saved	-110.2000	1.5010	-165.4102 (284)
Appendix Q item 'Kelda' - energy used	29.6000	1.5010	44.4296 (285)
Total Primary energy kWh/year			4833.4419 (286)
Dwelling Primary energy Rate (DPER)			61.9700 (287)

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

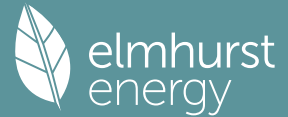
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	78.0000 (1b)	x 2.7000 (2b)	= 210.6000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.6000 (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)

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Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											
Pressure test	30.0000 / (5) =											
Pressure Test Method	Yes											
Measured/design AP50	Blower Door											
Infiltration rate	5.0000 (17)											
Number of sides sheltered	0.3925 (18)											
	2 (19)											
Shelter factor	(20) = 1 - [0.075 x (19)] =											
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =											
	0.8500 (20)											
	0.3336 (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	0.4253	0.4170	0.4086	0.3669	0.3586	0.3169	0.3169	0.3086	0.3336	0.3586	0.3753	0.3920 (22b)
	0.5904	0.5869	0.5835	0.5673	0.5643	0.5502	0.5502	0.5476	0.5556	0.5643	0.5704	0.5768 (25)

3. Heat losses and heat loss parameter

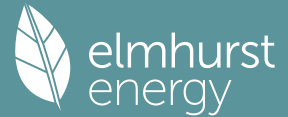
Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.20)			17.0100	1.1450	19.4771		(27)
External Wall 1	52.6500	17.0100	35.6400	0.1800	6.4152		(29a)
Sheltered wall	49.6800	1.9500	47.7300	0.1800	8.5914		(29a)
Flat Roof	78.0000		78.0000	0.1100	8.5800		(30)
Total net area of external elements Aum(A, m2)			180.3300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.0137		(33)
Party Wall 1			11.3400	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							65.1377 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E23 Balcony within or between dwellings, balcony support penetrates wall insulation				14.9000	0.0200	0.2980	
E16 Corner (normal)				13.5000	0.0900	1.2150	
E17 Corner (inverted - internal area greater than external area)				2.7000	-0.0900	-0.2430	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)				4.2000	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)				4.2000	0.1200	0.5040	
E2 Other lintels (including other steel lintels)				7.2300	0.0500	0.3615	
E3 Sill				6.3000	0.0500	0.3150	
E4 Jamb				20.4000	0.0500	1.0200	
E7 Party floor between dwellings (in blocks of flats)				37.9000	0.0700	2.6530	
E14 Flat roof				37.9000	0.0800	3.0320	
E25 Staggered party wall between dwellings				8.1000	0.0600	0.4860	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.6415 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	54.6552 (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	41.0349	40.7908	40.5516	39.4278	39.2175	38.2388	38.2388	38.0575	38.6158	39.2175	39.6429	40.0876 (38)
Average = Sum(39)m / 12 =	95.6901	95.4460	95.2068	94.0830	93.8727	92.8940	92.8940	92.7127	93.2710	93.8727	94.2981	94.7428 (39)
												94.0820
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2268	1.2237	1.2206	1.2062	1.2035	1.1909	1.1909	1.1886	1.1958	1.2035	1.2089	1.2147 (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	2.4238 (42)											
Hot water usage for mixer showers	64.8591	63.8844	62.4641	59.7465	57.7410	55.5045	54.2333	55.6429	57.1881	59.5894	62.3653	64.6106 (42a)
Hot water usage for baths	28.0148	27.5987	27.0128	25.9325	25.1236	24.2267	23.7422	24.3240	24.9575	25.9172	27.0198	27.9201 (42b)
Hot water usage for other uses	39.4523	38.0177	36.5831	35.1484	33.7138	32.2792	32.2792	33.7138	35.1484	36.5831	38.0177	39.4523 (42c)
Average daily hot water use (litres/day)												121.6378 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	132.3262	129.5008	126.0600	120.8275	116.5785	112.0104	110.2546	113.6807	117.2939	122.0897	127.4028	131.9830 (44)
Energy content (annual)	209.5724	184.4075	193.7495	165.4068	156.9370	137.7298	133.3434	140.7604	144.6352	165.6745	181.5086	206.6535 (45)
Distribution loss (46)m = 0.15 x (45)m												
	31.4359	27.6611	29.0624	24.8110	23.5406	20.6595	20.0015	21.1141	21.6953	24.8512	27.2263	30.9980 (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												
WWHRS	256.1673	226.4932	240.3444	210.4986	203.5319	182.8217	179.9383	187.3553	189.7270	212.2694	226.6004	253.2484 (62)
PV diverter	-29.6509	-26.2235	-27.4597	-22.7377	-21.1908	-18.1331	-16.9969	-18.0745	-18.7612	-22.1174	-25.0563	-29.1018 (63a)
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
	226.5164	200.2697	212.8846	187.7609	182.3412	164.6886	162.9415	169.2808	170.9658	190.1521	201.5441	224.1466 (64)
Total per year (kWh/year)												2293.4923 (64)
Electric shower(s)												2293 (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)

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Heat gains from water heating, kWh/month
 106.9587 94.9841 101.6976 91.0712 89.4575 81.8686 81.6126 84.0788 84.1647 92.3627 96.4251 105.9882 (65)

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

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	121.1909	121.1909	121.1909	121.1909	121.1909	121.1909	121.1909	121.1909	121.1909	121.1909	121.1909	121.1909 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	108.6201	120.2579	108.6201	112.2407	108.6201	112.2407	108.6201	108.6201	112.2407	108.6201	112.2407	108.6201 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.2098	217.4430	211.8154	199.8349	184.7117	170.4980	161.0024	158.7692	164.3968	176.3773	191.5005	205.7142 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1191	35.1191	35.1191	35.1191	35.1191	35.1191	35.1191	35.1191	35.1191	35.1191	35.1191	35.1191 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-96.9527	-96.9527	-96.9527	-96.9527	-96.9527	-96.9527	-96.9527	-96.9527	-96.9527	-96.9527	-96.9527	-96.9527 (71)
Water heating gains (Table 5)	143.7618	141.3453	136.6904	126.4878	120.2385	113.7064	109.6944	113.0091	116.8954	124.1434	133.9237	142.4573 (72)
Total internal gains	529.9489	541.4035	519.4831	500.9207	475.9275	455.8024	438.6740	439.7555	452.8901	471.4980	500.0222	519.1488 (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	
West				17.0100	19.6403		0.6300	0.7000		0.7700	102.0995 (80)	
Solar gains	102.0995	199.7282	328.9239	479.7159	587.9099	601.8304	572.9670	492.1702	382.5521	236.9943	127.3060	83.9616 (83)
Total gains	632.0483	741.1317	848.4070	980.6366	1063.8374	1057.6328	1011.6411	931.9258	835.4422	708.4923	627.3282	603.1104 (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	14.7488	14.7865	14.8237	15.0008	15.0344	15.1928	15.1928	15.2225	15.1314	15.0344	14.9665	14.8963
alpha	1.9833	1.9858	1.9882	2.0001	2.0023	2.0129	2.0129	2.0148	2.0088	2.0023	1.9978	1.9931
util living area	0.8975	0.8628	0.8090	0.7150	0.5993	0.4684	0.3625	0.4009	0.5778	0.7665	0.8656	0.9050 (86)
MIT	17.7041	18.1270	18.7744	19.5890	20.2392	20.6780	20.8634	20.8280	20.4784	19.6003	18.5257	17.6378 (87)
Th 2	19.8986	19.9011	19.9036	19.9150	19.9172	19.9272	19.9272	19.9272	19.9234	19.9172	19.9128	19.9083 (88)
util rest of house	0.8864	0.8483	0.7888	0.6849	0.5559	0.4078	0.2855	0.3222	0.5183	0.7342	0.8490	0.8947 (89)
MIT 2	16.1176	16.6395	17.4350	18.4211	19.1790	19.6650	19.8434	19.8179	19.4697	18.4633	17.1490	16.0383 (90)
Living area fraction	16.8112	17.2898	18.0205	18.9317	19.6425	20.1079	20.2894	20.2595	19.9107	18.9604	17.7509	16.7376 (92)
MIT	16.8112	17.2898	18.0205	18.9317	19.6425	20.1079	20.2894	20.2595	19.9107	18.9604	17.7509	16.7376 (93)
Temperature adjustment												0.0000
adjusted MIT	16.8112	17.2898	18.0205	18.9317	19.6425	20.1079	20.2894	20.2595	19.9107	18.9604	17.7509	16.7376 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	533.3079	595.7080	633.1809	641.1757	578.7239	442.6701	316.0472	323.8901	432.3341	496.2239	505.6841	514.5705 (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	1197.1966	1182.5540	1096.8306	943.8137	745.5855	511.6467	342.7188	357.8234	541.9696	784.8108	1004.3584	1187.8429 (97)
Space heating kWh	493.9332	394.3605	344.9554	217.8993	124.1450	0.0000	0.0000	0.0000	0.0000	214.7086	359.0455	500.9147 (98a)
Space heating requirement - total per year (kWh/year)												2649.9623
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	493.9332	394.3605	344.9554	217.8993	124.1450	0.0000	0.0000	0.0000	0.0000	214.7086	359.0455	500.9147 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2649.9623
Space heating per m ²												33.9739 (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	493.9332	394.3605	344.9554	217.8993	124.1450	0.0000	0.0000	0.0000	0.0000	214.7086	359.0455	500.9147 (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)	535.1389	427.2595	373.7328	236.0773	134.5016	0.0000	0.0000	0.0000	0.0000	232.6204	388.9984	542.7029 (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	226.5164	200.2697	212.8846	187.7609	182.3412	164.6886	162.9415	169.2808	170.9658	190.1521	201.5441	224.1466	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.7590	85.5504	85.1357	84.3945	83.2163	79.8000	79.8000	79.8000	79.8000	84.3328	85.3397	85.8082	(217)
Fuel for water heating, kWh/month													
	264.1313	234.0956	250.0532	222.4800	219.1171	206.3767	204.1873	212.1314	214.2429	225.4781	236.1670	261.2180	(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	22.5691	18.1058	16.3022	11.9437	9.2257	7.5375	8.4160	10.9394	14.2092	18.6432	21.0575	23.1964	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-26.3927	-38.3359	-56.7562	-65.7916	-72.6503	-68.4267	-67.5799	-62.9518	-55.0793	-44.7077	-29.4107	-22.6877	(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	-11.6764	-24.8713	-50.0099	-75.9611	-101.2726	-102.0639	-100.8712	-85.0345	-61.8319	-35.8579	-15.6826	-9.2112	(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												2871.0317	(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												2749.6785	(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)												182.1456	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1285.1151	(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												4603.7407	(238)

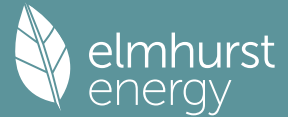
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2871.0317	0.2100	602.9167	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2749.6785	0.2100	577.4325	(264)
Space and water heating			1180.3491	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	182.1456	0.1443	26.2892	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-610.7704	0.1340	-81.8197	
PV Unit electricity exported	-674.3447	0.1256	-84.6741	
Total			-166.4938	(269)
Total CO2, kg/year			1052.0739	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.4900	(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	2871.0317	1.1300	3244.2658	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2749.6785	1.1300	3107.1368	(278)
Space and water heating			6351.4026	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	182.1456	1.5338	279.3810	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-610.7704	1.4951	-913.1406	
PV Unit electricity exported	-674.3447	0.4609	-310.8015	
Total			-1223.9421	(283)
Total Primary energy kWh/year			5536.9422	(286)
Target Primary Energy Rate (TPER)			70.9900	(287)

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Property Reference	P3.07 Latimer			Issued on Date	03/12/2024
Assessment Reference	P3.07 Kelda	Prop Type Ref	3rd End 2B3P		
Property	3.07, Latimer Road, Wokingham				
SAP Rating	79 C	DER	5.35	TER	16.25
Environmental	96 A	% DER < TER			67.08
CO ₂ Emissions (t/year)	0.28	DFEE	43.96	TFEE	49.62
Compliance Check	See BREL	% DFEE < TFEE			11.41
% DPER < TPER	33.94	DPER	56.76	TPER	85.92
Assessor Details	Mrs. Rebecca Lennon			Assessor ID	P627-0001
Client	RHB, RHB				

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	64.5000 (1b)	2.7000 (2b)	174.1500 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.5000		174.1500 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 174.1500 (5)

2. Ventilation rate

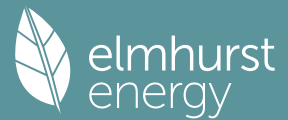
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
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)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.2000 (23c)
Effective ac	0.3207	0.3165	0.3123	0.2910	0.2867	0.2655	0.2655	0.2612	0.2740	0.2867	0.2953	0.3037 (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
Flat ent door			1.9500	1.0000	1.9500		(26)
Windows (Uw = 1.10)			17.0700	1.0536	17.9856		(27)
External Wall 1	56.1600	17.0700	39.0900	0.1200	4.6908	0.0000	0.0000 (29a)
Sheltered wall	30.2400	1.9500	28.2900	0.2100	5.9409	0.0000	0.0000 (29a)
Flat Roof	64.5000		64.5000	0.1100	7.0950	9.0000	580.5000 (30)
Total net area of external elements Aum(A, m ²)			150.9000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	37.6623		(33)
Party Wall 1			15.6600	0.0000	0.0000	0.0000	0.0000 (32)
Party Floor 1			64.5000			40.0000	2580.0000 (32d)
Internal Wall 1			100.4400			9.0000	903.9600 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	4064.4600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							63.0149 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	

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E2 Other lintels (including other steel lintels)	9.0300	0.0280	0.2528
E3 Sill	8.1000	0.0240	0.1944
E4 Jamb	24.8000	0.0190	0.4712
E7 Party floor between dwellings (in blocks of flats)	32.0000	0.0360	1.1520
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	5.2000	1.0000	5.2000
E15 Flat roof with parapet	32.0000	0.3000	9.6000
E16 Corner (normal)	13.5000	0.0370	0.4995
E17 Corner (inverted - internal area greater than external area)	8.1000	-0.0790	-0.6399
E18 Party wall between dwellings	5.4000	0.0410	0.2214
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.8000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	5.8000	0.0330	0.1914
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			17.1428 (36)
Point Thermal Bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	54.8052 (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	18.4333	18.1891	17.9449	16.7236	16.4794	15.2582	15.2582	15.0139	15.7466	16.4794	16.9679	17.4564	(38)
Heat transfer coeff	73.2385	72.9943	72.7500	71.5288	71.2846	70.0633	70.0633	69.8191	70.5518	71.2846	71.7730	72.2615	(39)
Average = Sum(39)m / 12 =												71.4677	
HLP	1.1355	1.1317	1.1279	1.1090	1.1052	1.0863	1.0863	1.0825	1.0938	1.1052	1.1128	1.1203	(40)
HLP (average)												1.1080	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.1056 (42)
Hot water usage for mixer showers	58.0197	57.1314	55.8224	53.8085	52.0042	49.4800	47.4835	49.8175	50.9914	53.4916	56.0953	57.9674	(42a)
Hot water usage for baths	25.1469	24.7673	24.2273	23.4186	22.6897	21.6864	20.9252	21.8560	22.3445	23.3387	24.3723	25.1270	(42b)
Hot water usage for other uses	36.1934	34.8773	33.5612	32.2451	30.9289	29.6128	29.6128	30.9289	32.2451	33.5612	34.8773	36.1934	(42c)
Average daily hot water use (litres/day)												109.7100	(43)
Daily hot water use	119.3601	116.7761	113.6108	109.4722	105.6229	100.7792	98.0214	102.6024	105.5810	110.3914	115.3448	119.2878	(44)
Energy content (annual)	175.7187	154.5184	162.3476	142.9980	136.1058	116.5477	108.3166	120.7649	122.4687	142.2505	155.8924	175.1829	(45)
Distribution loss (46)m = 0.15 x (45)m	26.3578	23.1778	24.3521	21.4497	20.4159	17.4822	16.2475	18.1147	18.3703	21.3376	23.3839	26.2774	(46)
Water storage loss:													
Store volume												201.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8694	(55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	202.6701	178.8616	189.2990	169.0800	163.0572	142.6297	135.2680	147.7163	148.5507	169.2019	181.9744	202.1343	(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	202.6701	178.8616	189.2990	169.0800	163.0572	142.6297	135.2680	147.7163	148.5507	169.2019	181.9744	202.1343	(64)
12Total per year (kWh/year)												2030.4431	(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	58.4265	51.3774	53.9806	47.5468	45.2552	38.7521	36.0153	40.1543	40.7208	47.2983	51.8342	58.2483	(65)

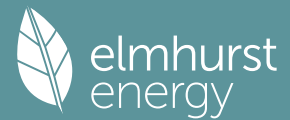
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	105.2799	105.2799	105.2799	105.2799	105.2799	105.2799	105.2799	105.2799	105.2799	105.2799	105.2799	105.2799	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	92.8760	102.8270	92.8760	95.9719	92.8760	95.9719	92.8760	92.8760	95.9719	92.8760	95.9719	92.8760	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	184.1370	186.0478	181.2327	170.9820	158.0423	145.8809	137.7562	135.8455	140.6605	150.9113	163.8509	176.0124	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.5280	33.5280	33.5280	33.5280	33.5280	33.5280	33.5280	33.5280	33.5280	33.5280	33.5280	33.5280	(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)	-84.2239	-84.2239	-84.2239	-84.2239	-84.2239	-84.2239	-84.2239	-84.2239	-84.2239	-84.2239	-84.2239	-84.2239	(71)
Water heating gains (Table 5)	78.5302	76.4544	72.5545	66.0373	60.8268	53.8224	48.4076	53.9709	56.5567	63.5730	71.9920	78.2908	(72)
Total internal gains	410.1272	419.9132	401.2472	387.5751	366.3291	350.2591	333.6238	337.2763	347.7731	361.9442	386.3988	401.7631	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	11.3700	19.6403	0.6500	0.7000	0.7700	70.4129 (76)
South	5.7000	46.7521	0.6500	0.7000	0.7700	84.0273 (78)

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Solar gains	154.4402	275.3577	402.1396	528.9601	611.9095	613.7395	589.2762	527.9518	446.9457	311.8739	187.3976	130.5115 (83)
Total gains	564.5674	695.2708	803.3868	916.5352	978.2386	963.9986	922.9001	865.2282	794.7188	673.8181	573.7964	532.2746 (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	15.4156	15.4672	15.5191	15.7841	15.8382	16.1142	16.1142	16.1706	16.0027	15.8382	15.7304	15.6240	
alpha	2.0277	2.0311	2.0346	2.0523	2.0559	2.0743	2.0743	2.0780	2.0668	2.0559	2.0487	2.0416	
util living area	0.8758	0.8234	0.7564	0.6529	0.5365	0.4090	0.3103	0.3399	0.5017	0.7043	0.8321	0.8864 (86)	
MIT	18.0184	18.5294	19.1639	19.8939	20.4271	20.7733	20.9085	20.8867	20.6326	19.8931	18.8492	17.9420 (87)	
Th 2	19.9720	19.9750	19.9781	19.9935	19.9966	20.0121	20.0121	20.0152	20.0059	19.9966	19.9904	19.9843 (88)	
util rest of house	0.8635	0.8072	0.7345	0.6229	0.4964	0.3568	0.2472	0.2754	0.4481	0.6708	0.8139	0.8752 (89)	
MIT 2	16.5363	17.1640	17.9388	18.8194	19.4373	19.8242	19.9538	19.9396	19.6841	18.8454	17.5786	16.4461 (90)	
Living area fraction									fLA = Living area / (4) =				0.4450 (91)
MIT	17.1958	17.7715	18.4839	19.2975	19.8777	20.2465	20.3786	20.3610	20.1062	19.3116	18.1440	17.1117 (92)	
Temperature adjustment												0.0000	
adjusted MIT	17.1958	17.7715	18.4839	19.2975	19.8777	20.2465	20.3786	20.3610	20.1062	19.3116	18.1440	17.1117 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8205	0.7644	0.6975	0.6001	0.4913	0.3696	0.2712	0.2987	0.4538	0.6449	0.7727	0.8332 (94)
Useful gains	463.2347	531.4328	560.3299	550.0195	480.6491	356.3005	250.2704	258.4262	360.6539	434.5730	443.3696	443.4811 (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	944.4677	939.5489	871.8302	743.7192	582.9445	395.6139	264.7411	276.5536	423.7461	621.0004	792.6592	933.0189 (97)
Space heating kWh	358.0373	274.2540	231.7562	139.4638	76.1078	0.0000	0.0000	0.0000	0.0000	138.7020	251.4885	364.2162 (98a)
Space heating requirement - total per year (kWh/year)												1834.0258
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	358.0373	274.2540	231.7562	139.4638	76.1078	0.0000	0.0000	0.0000	0.0000	138.7020	251.4885	364.2162 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1834.0258
Space heating per m2										(98c) / (4) =		28.4345 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Fraction of main heating from main system 2												0.0000 (203)
Fraction of total heating from main system 1												1.0000 (204)
Fraction of total heating from main system 2												0.0000 (205)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	358.0373	274.2540	231.7562	139.4638	76.1078	0.0000	0.0000	0.0000	0.0000	138.7020	251.4885	364.2162 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	358.0373	274.2540	231.7562	139.4638	76.1078	0.0000	0.0000	0.0000	0.0000	138.7020	251.4885	364.2162 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Space heating fuel used, main system 2												0.0000 (213)
Water heating												
Water heating requirement	202.6701	178.8616	189.2990	169.0800	163.0572	142.6297	135.2680	147.7163	148.5507	169.2019	181.9744	202.1343 (64)
Efficiency of water heater (217)m	346.3985	346.3985	346.3985	346.3985	346.3985	346.3985	346.3985	346.3985	346.3985	346.3985	346.3985	346.3985 (216)
Fuel for water heating, kWh/month	58.5078	51.6346	54.6477	48.8108	47.0721	41.1750	39.0498	42.6435	42.8843	48.8460	52.5333	58.3531 (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	17.9365	16.2007	17.9365	17.3579	17.9365	17.3579	17.9365	17.9365	17.3579	17.9365	17.3579	17.9365 (231)
Lighting	19.2524	15.4450	13.9065	10.1885	7.8699	6.4298	7.1792	9.3318	12.1210	15.9035	17.9629	19.7875 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-9.5122	-16.6717	-30.0079	-40.2300	-47.2599	-42.1666	-41.3606	-36.4277	-28.4496	-20.8572	-11.2909	-7.7851 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-1.3204	-3.6495	-9.9895	-20.2500	-32.7350	-38.4734	-37.3844	-28.9848	-17.9184	-6.6410	-2.0147	-0.9643 (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												1834.0258 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												346.3985
Water heating fuel used												586.1582 (219)
Space cooling fuel												0.0000 (221)

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Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9940)	
mechanical ventilation fans (SFP = 0.9940)	211.1882 (230a)
Total electricity for the above, kWh/year	211.1882 (231)
Electricity for lighting (calculated in Appendix L)	155.3780 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-532.3450 (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	-100.5000 (236)
Energy used	29.3000 (237)
Total delivered energy for all uses	2183.2052 (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 (high-rate cost)	1834.0258	0.1624	297.8848 (261)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000 (261)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000 (262)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating - high rate cost	23.9778	0.1481	3.5505 (264)
Water heating - low rate cost	562.1804	0.1243	69.8670 (264)
Space and water heating			371.3023 (265)
Pumps, fans and electric keep-hot	211.1882	0.1432	29.3039 (267)
Energy for lighting	155.3780	0.1490	23.1544 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-332.0194	0.1362	-45.2236
PV Unit electricity exported	-200.3256	0.1181	-23.6525
Total			-68.8761 (269)
Appendix Q item 'Kelda' - energy saved	-100.5000	0.1360	-13.6680 (270)
Appendix Q item 'Kelda' - energy used	29.3000	0.1360	3.9848 (271)
Total CO2, kg/year			345.2013 (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 (high-rate cost)	1834.0258	1.6056	2944.7597 (275)
Space heating - main system 1 (low-rate cost)	0.0000	0.0000	0.0000 (275)
Space heating - main system 2 (high-rate cost)	0.0000	0.0000	0.0000 (276)
Space heating - main system 2 (low-rate cost)	0.0000	0.0000	0.0000 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating - high rate cost	23.9778	1.5535	37.2494 (278)
Water heating - low rate cost	562.1804	1.4448	812.2417 (278)
Space and water heating			3794.2509 (279)
Pumps, fans and electric keep-hot	211.1882	1.5335	319.5183 (281)
Energy for lighting	155.3780	1.5547	241.5730 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-332.0194	1.5080	-500.6755
PV Unit electricity exported	-200.3256	0.4329	-86.7134
Total			-587.3889 (283)
Appendix Q item 'Kelda' - energy saved	-100.5000	1.5010	-150.8505 (284)
Appendix Q item 'Kelda' - energy used	29.3000	1.5010	43.9793 (285)
Total Primary energy kWh/year			3661.0821 (286)
Dwelling Primary energy Rate (DPER)			56.7600 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET EMISSIONS

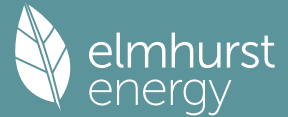
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	64.5000 (1b)	x 2.7000 (2b)	= 174.1500 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	174.1500 (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)

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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) =

Air changes per hour
20.0000 / (5) = 0.1148 (8)

Pressure test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Yes
Blower Door
5.0000 (17)
0.3648 (18)
2 (19)

Shelter factor
Infiltration rate adjusted to include shelter factor

(20) = 1 - [0.075 x (19)] = 0.8500 (20)
(21) = (18) x (20) = 0.3101 (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	0.3954	0.3876	0.3799	0.3411	0.3334	0.2946	0.2946	0.2869	0.3101	0.3334	0.3489	0.3644 (22b)
	0.5782	0.5751	0.5722	0.5582	0.5556	0.5434	0.5434	0.5411	0.5481	0.5556	0.5609	0.5664 (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)			14.1700	1.1450	16.2252		(27)
External Wall 1	56.1600	14.1700	41.9900	0.1800	7.5582		(29a)
Sheltered wall	30.2400	1.9500	28.2900	0.1800	5.0922		(29a)
Flat Roof	64.5000		64.5000	0.1100	7.0950		(30)
Total net area of external elements Aum(A, m2)			150.9000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	37.9206		(33)
Party Wall 1			15.6600	0.0000	0.0000		(32)

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

63.0149 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	9.0300	0.0500	0.4515
E3 Sill	8.1000	0.0500	0.4050
E4 Jamb	24.8000	0.0500	1.2400
E7 Party floor between dwellings (in blocks of flats)	32.0000	0.0700	2.2400
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	5.2000	0.0200	0.1040
E15 Flat roof with parapet	32.0000	0.5600	17.9200
E16 Corner (normal)	13.5000	0.0900	1.2150
E17 Corner (inverted - internal area greater than external area)	8.1000	-0.0900	-0.7290
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.8000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	5.8000	0.1200	0.6960
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			23.8665 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	61.7871 (37)

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

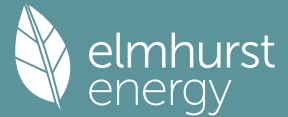
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	33.2272	33.0527	32.8817	32.0786	31.9283	31.2288	31.2288	31.0993	31.4982	31.9283	32.2323	32.5501 (38)
Average = Sum(39)m / 12 =	95.0142	94.8398	94.6688	93.8657	93.7154	93.0159	93.0159	92.8864	93.2853	93.7154	94.0194	94.3372 (39)
												93.8649

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4731	1.4704	1.4677	1.4553	1.4530	1.4421	1.4421	1.4401	1.4463	1.4530	1.4577	1.4626 (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													2.1056 (42)
Hot water usage for mixer showers	59.5236	58.6290	57.3255	54.8315	52.9910	50.9385	49.7719	51.0655	52.4835	54.6873	57.2349	59.2955 (42a)	
Hot water usage for baths	25.7203	25.3383	24.8004	23.8086	23.0659	22.2425	21.7976	22.3318	22.9134	23.7945	24.8068	25.6334 (42b)	
Hot water usage for other uses	36.1934	34.8773	33.5612	32.2451	30.9289	29.6128	29.6128	30.9289	32.2451	33.5612	34.8773	36.1934 (42c)	
Average daily hot water use (litres/day)												111.6286 (43)	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy content (annual)	121.4373	118.8447	115.6871	110.8852	106.9859	102.7938	101.1823	104.3262	107.6420	112.0431	116.9190	121.1223 (44)	
Distribution loss (46)m = 0.15 x (45)m	192.3270	169.2332	177.8068	151.7963	144.0236	126.3969	122.3712	129.1776	132.7333	152.0414	166.5725	189.6482 (45)	
	28.8491	25.3850	26.6710	22.7694	21.6035	18.9595	18.3557	19.3766	19.9100	22.8062	24.9859	28.4472 (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	238.9219	211.3190	224.4017	196.8881	190.6185	171.4888	168.9661	175.7725	177.8252	198.6363	211.6644	236.2432 (62)	
WWHRS	-27.2117	-24.0662	-25.2008	-20.8672	-19.4475	-16.6414	-15.5986	-16.5876	-17.2178	-20.2979	-22.9951	-26.7078 (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	211.7102	187.2527	199.2010	176.0209	171.1710	154.8474	153.3675	159.1850	160.6074	178.3384	188.6693	209.5354 (64)	
12Total per year (kWh/year)												2149.9061 (64)	
Electric shower(s)												2150 (64)	

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	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 =												
Heat gains from water heating, kWh/month	101.2247	89.9386	96.3967	86.5457	85.1638	78.1005	77.9644	80.2275	80.2073	87.8297	91.4588	100.3340 (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	105.2799	105.2799	105.2799	105.2799	105.2799	105.2799	105.2799	105.2799	105.2799	105.2799	105.2799	105.2799 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	92.9122	102.8671	92.9122	96.0093	92.9122	96.0093	92.9122	92.9122	96.0093	92.9122	96.0093	92.9122 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	184.1370	186.0478	181.2327	170.9820	158.0423	145.8809	137.7562	135.8455	140.6605	150.9113	163.8509	176.0124 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.5280	33.5280	33.5280	33.5280	33.5280	33.5280	33.5280	33.5280	33.5280	33.5280	33.5280	33.5280 (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)	-84.2239	-84.2239	-84.2239	-84.2239	-84.2239	-84.2239	-84.2239	-84.2239	-84.2239	-84.2239	-84.2239	-84.2239 (71)
Water heating gains (Table 5)	136.0546	133.8372	129.5654	120.2024	114.4674	108.4729	104.7908	107.8326	111.3990	118.0506	127.0262	134.8575 (72)
Total internal gains	470.6879	480.3361	461.2944	444.7777	423.0060	404.9470	390.0433	391.1743	402.6529	419.4581	444.4704	461.3661 (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	
East				9.4400	19.6403	0.6300	0.7000	0.7700			56.6619 (76)	
South				4.7300	46.7521	0.6300	0.7000	0.7700			67.5824 (78)	
Solar gains	124.2443	221.5253	323.5321	425.5761	492.3228	493.7987	474.1147	424.7688	359.5847	250.9058	150.7589	104.9934 (83)
Total gains	594.9322	701.8614	784.8265	870.3538	915.3288	898.7457	864.1580	815.9431	762.2376	670.3639	595.2293	566.3595 (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	11.8826	11.9045	11.9260	12.0280	12.0473	12.1379	12.1379	12.1548	12.1028	12.0473	12.0083	11.9679
alpha	1.7922	1.7936	1.7951	1.8019	1.8032	1.8092	1.8092	1.8103	1.8069	1.8032	1.8006	1.7979
util living area	0.8848	0.8487	0.8014	0.7248	0.6274	0.5076	0.4001	0.4313	0.5883	0.7553	0.8514	0.8929 (86)
MIT	17.2664	17.7172	18.3752	19.2084	19.9442	20.5036	20.7734	20.7310	20.3046	19.3368	18.1642	17.1831 (87)
Th 2	19.7077	19.7098	19.7118	19.7212	19.7230	19.7312	19.7312	19.7327	19.7280	19.7230	19.7194	19.7157 (88)
util rest of house	0.8714	0.8316	0.7784	0.6916	0.5787	0.4357	0.3043	0.3358	0.5203	0.7183	0.8317	0.8804 (89)
MIT 2	15.5491	16.0947	16.8904	17.8855	18.7363	19.3486	19.6047	19.5738	19.1560	18.0646	16.6559	15.4497 (90)
Living area fraction	16.3132	16.8167	17.5511	18.4741	19.2738	19.8625	20.1247	20.0887	19.6671	18.6306	17.3270	16.2210 (92)
MIT	16.3132	16.8167	17.5511	18.4741	19.2738	19.8625	20.1247	20.0887	19.6671	18.6306	17.3270	16.2210 (93)
Temperature adjustment												0.0000
adjusted MIT	16.3132	16.8167	17.5511	18.4741	19.2738	19.8625	20.1247	20.0887	19.6671	18.6306	17.3270	16.2210 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8222	0.7808	0.7300	0.6533	0.5595	0.4437	0.3358	0.3644	0.5167	0.6798	0.7826	0.8323 (94)
Useful gains	489.1827	548.0298	572.8873	568.6446	512.1260	398.7945	290.1425	297.3618	393.8599	455.7293	465.8348	471.3773 (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	1141.4288	1130.1730	1046.1921	898.6830	709.7806	489.4968	327.8572	342.6295	519.3292	752.5941	961.5382	1134.0270 (97)
Space heating kWh	485.2711	391.2002	352.1388	237.6276	147.0550	0.0000	0.0000	0.0000	0.0000	220.8674	356.9064	493.0113 (98a)
Space heating requirement - total per year (kWh/year)												2684.0779
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	485.2711	391.2002	352.1388	237.6276	147.0550	0.0000	0.0000	0.0000	0.0000	220.8674	356.9064	493.0113 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2684.0779
Space heating per m2										(98c) / (4) =		41.6136 (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	485.2711	391.2002	352.1388	237.6276	147.0550	0.0000	0.0000	0.0000	0.0000	220.8674	356.9064	493.0113 (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)	525.7542	423.8356	381.5155	257.4514	159.3229	0.0000	0.0000	0.0000	0.0000	239.2930	386.6809	534.1401 (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)

Full SAP Calculation Printout



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	211.7102	187.2527	199.2010	176.0209	171.1710	154.8474	153.3675	159.1850	160.6074	178.3384	188.6693	209.5354	(64)
Efficiency of water heater	85.8587	85.6722	85.3232	84.7334	83.7211	79.8000	79.8000	79.8000	79.8000	84.5406	85.4666	79.8000	(216)
Fuel for water heating, kWh/month	246.5799	218.5688	233.4663	207.7349	204.4538	194.0444	192.1898	199.4799	201.2624	210.9501	220.7520	243.9004	(217)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	19.3053	15.4874	13.9447	10.2165	7.8915	6.4474	7.1989	9.3574	12.1544	15.9472	18.0123	19.8419	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-22.0094	-32.0676	-47.6265	-55.3995	-61.3551	-57.8717	-57.1739	-53.1804	-46.3992	-37.4987	-24.5669	-18.9099	(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	-9.4708	-20.1999	-40.6609	-61.8192	-82.4658	-83.1109	-82.1222	-69.1929	-50.2774	-29.1228	-12.7218	-7.4680	(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												2907.9934	(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												2573.3827	(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)												155.8050	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1062.6914	(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												4660.4898	(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	2907.9934	0.2100	610.6786 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2573.3827	0.2100	540.4104 (264)
Space and water heating			1151.0890 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	155.8050	0.1443	22.4875 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-514.0588	0.1339	-68.8258
PV Unit electricity exported	-548.6326	0.1255	-68.8769
Total			-137.7027 (269)
Total CO2, kg/year			1047.8031 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			16.2500 (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	2907.9934	1.1300	3286.0326 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2573.3827	1.1300	2907.9225 (278)
Space and water heating			6193.9551 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	155.8050	1.5338	238.9790 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-514.0588	1.4948	-768.4068
PV Unit electricity exported	-548.6326	0.4608	-252.8167
Total			-1021.2234 (283)
Total Primary energy kWh/year			5541.8114 (286)
Target Primary Energy Rate (TPER)			85.9200 (287)

APPENDIX C – Part G Water Efficiency Calculator



PART G - WATER EFFICIENCY CALCULATOR

Project Ref:	2321
Project Name:	RBH - Latimer Road
Date:	03/12/2024
Assessor:	Saeed Khan
Notes:	

Table A1: The water efficiency calculator						
		(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)	
WCs (multiple fittings)	Average effective flushing volume (litres)	3.06	4.42	0.00	13.53	
Taps (excluding kitchen/utility room taps)	Flow rate (litres/minute)	5.00	1.58	1.58	9.48	
Bath (where shower also present)	Capacity to overflow (litres)	170.00	0.11	0.00	18.70	
Shower (where bath also present)	Flow rate (litres/minute)	4.50	4.37	0.00	19.67	
Bath only	Capacity to overflow (litres)	0.00	0.50	0.00	0.00	
Shower only	Flow rate (litres/minute)	0.00	5.60	0.00	0.00	
Kitchen/utility room sink taps	Flow rate (litres/minute)	6.00	0.44	10.36	13.00	
Washing machine	Litres/kg dry load	Washing machine installed?	8.17	2.10	0.00	
		Yes				
Dishwasher	Litres/place setting	Dishwasher installed?	1.25	3.60	0.00	
		Yes				
Waste disposal unit	Litres/use (If present = 1, If absent = 0)	Waste disposal installed?	0.00	3.08	0.00	
		No				
Water softener	Litres/person/day	Water softener installed?	0.00	1.00	0.00	
		No				
	(5)	Total calculated use = (Sum column 4)				96.03604
	(6)	Greywater Harvesting installed?	Contribution from greywater (litres/person/day) from Table 4.6			0.00
		No				
	(7)	Rainwater Hervesting installed?	Contribution from rainwater (litres/person/day) from Table 5.5			0.00
		No				
	(8)	Normalisation factor				0.91
	(9)	Total Internal Water Consumption = [(5) – (6) – (7)] = (8) (CSH)				87.4
	(10)	External water use				5
	(11)	Total water consumption (including external use) = (9) + (10) (litres/person/day) (Part G)				92.4

This calculation sheet has been developed in accordance with the methodology stated within Building Regulations Approved Document G 2015 (2016 Amendments) Appendix A. Please refer to this document for specific guidance of how flow rates are to be derived.

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