

Welling FC

Energy and Sustainability Strategy

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MWL (Mendick Waring Ltd)
Lymehouse Studios,
30-31 Lyme Street,
London, NW1 0EE
T: 020 8446 9696
www.mwl-group.com

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Author Michael Woodbridge
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Directors
 Suresh Patel BEng (Hons) AMIMechE
 Jon Harris HND
 Dheran Bhudia BA (Hons) MSc
 Michalis Theofilou MEng, MSc
 Luca Marras Meng

Registered Office: Edelman House, 1238 High Road, N20 0LH. Registered
 in England No. 4700822

MWL
 Lymehouse Studios,
 30-31 Lyme Street,
 London, NW1 0EE

Telephone: 020 8446 9696
 E-mail: enquiries@mwlgroup.com
 Website: www.mwlgroup.com

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1.0 Executive Summary

The project proposals consist of the redevelopment of the stadium to provide new commercial space and 104 residential units.

This document addresses the measures of Sustainability and demonstrates the design intention in relation to policies at National, Regional and Local level as appropriate, proving that the required level of CO2 reduction is achieved.

Requirements, Energy Efficient Features and Approach

In accordance with Building Regulations Part L 2021 the residential units of the development are required to achieve a Dwelling CO2 Emission Rate (DER) below the notional Target CO2 Emission Rate (TER), a Dwelling Fabric Energy Efficiency (DFEE) rate below the notional Target Fabric Energy Efficiency (TFEE) rate and a Dwelling Primary Energy Rating (DPER) rate below the notional Target Primary Energy Rating (TPER) rate.

In addition, a Building Emission Rate (BER) below the notional Target Emission Rate (TER) must be satisfied for the commercial units in accordance with Part L 2021 and a Building Primary Energy Rating (BPER) rate below the notional Target Primary Energy Rating (TPER) rate.

New developments should be assessed for their potential to contribute to the local community, and to ensure that they provide a sufficient and balanced contribution across each of the social, economic and environmental sectors to underpin the necessary integration required to ensure the sustained success of the development, and quality of life for the people it is designed to support.

The proposed strategy follows a best practice approach, based on the Mayor of London's Energy Hierarchy:

- Use less energy 'Be Lean'
- Supply energy efficiently 'Be Clean'
- Use Renewable Energy 'Be Green'

The development is subject to target a minimum 35% CO2 reduction over Part L 2021 for all building uses.

A fabric first approach will be followed, incorporating passive design measures such as low u-values, low air leakage and low thermal bridging.

Active design measures have then incorporated via energy efficient building services, such as 100% low energy lighting, and mechanical ventilation with heat recovery (MVHR).

The residential units will benefit from a communal ASHP systems to provide heating and hot water, supplied to the dwellings via HIUs. Roof mounted photovoltaic panels will be used to generate a portion of the electricity demand.

Heating and cooling will be provided to the commercial spaces via individual split VRV systems.

The SAP/SBEM methodology has been used to calculate the energy consumption and resultant CO2 emissions for the proposed development.

Summary of the Results

The sitewide carbon emissions results are presented in the table below:

	Regulated Emissions (tonnes CO ₂ p.a.)	Regulated CO ₂ Savings (tonnes CO ₂ p.a.)	Regulated CO ₂ Savings (%)
Baseline	132.9		
Be Lean	127.4	5.5	4.0%
Be Clean	127.4	0.0	0.0%
Be Green	50.6	76.9	58%
	Cumulative Savings:	82.4	62%

By incorporating a combination of all the feasible passive measures and high efficiency services, along with the use of PV Panels, the CO2 emissions of the residential units have been reduced by 71%.

By incorporating a combination of all the feasible passive measures along with the use of efficient individual split VRV, the shell & core commercial spaces have achieved a CO2 reduction of 37% over Part L of Building Regulations.

By incorporating a combination of all the feasible passive measures along with the use of the above efficient heating & hot water systems and PV Panels, the sitewide CO2 emissions of the development have been reduced more than 35%.

2.0 Site Location and Development Proposal

The site is located within the London Borough of Bexley. The development is bordered by residential areas to the north and west, with a cricket club to the east and a large park to the south. The development can be described as follows:

- Ground + 7 storey residential development
- 104 New homes
- New football facility for Welling United FC & Welling United Academy supporting 40+ football teams
- The refurbishment of the Erith & Belvedere Stand and recreation hall (reverting to Welling United use)
- A multi-purpose FIFA Approved 3G Pitch
- Approximately 4000 spectator ground capacity - combination of covered seating and standing
- New hospitality areas (for hire) which double as classrooms for teaching and community use
- New club shop/ticket, cafe/bar, and food outlet units
- New changing rooms for players and match officials
- New physio, medical, and first aid facilities
- 8 Blue Badge parking spaces
- Introduction of a Car Club with two spaces
- Provision of secure cycle parking for all users; residents, commercial employees, club supporters, youth teams, club staff, and visitors
- Grade level commercial space. Circa 204m² (excluding plant, refuse and cycle stores)

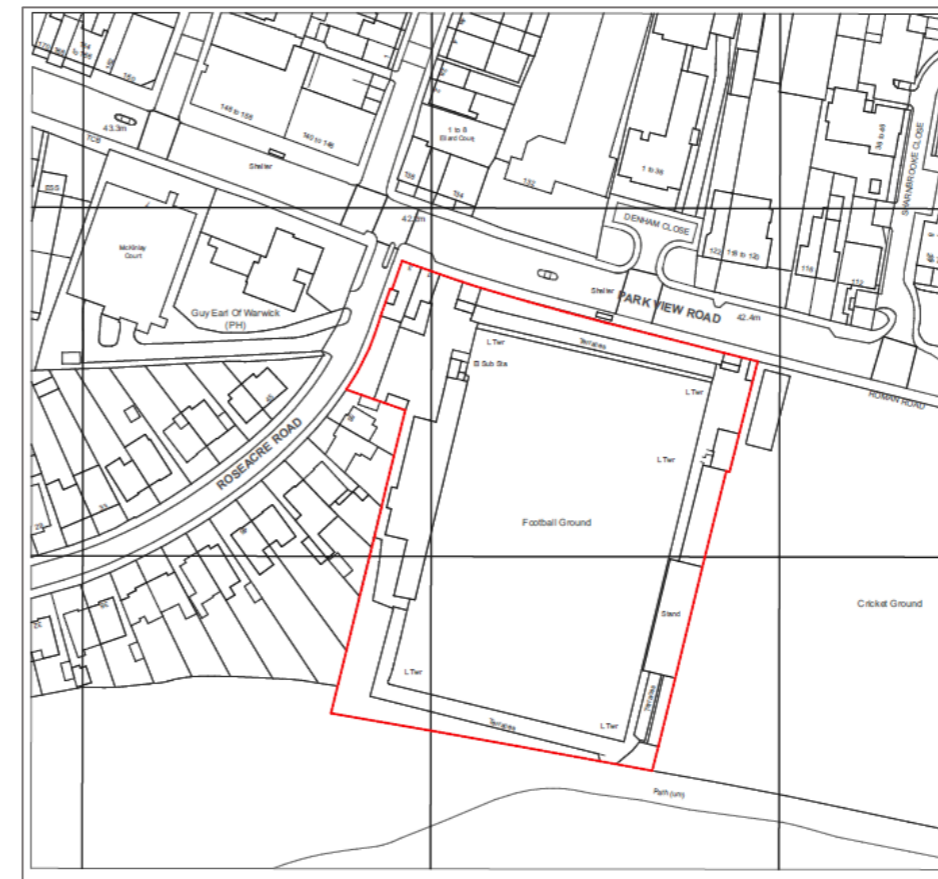


Figure 1: Site Location Plan

3.0 Policy Context

We have reviewed the National, Regional and Local planning policies & requirements, related to the energy strategy, which are presented below..

National Planning Policy Framework (2023)

Policy 14. Meeting the challenge of climate change, flooding and coastal change:

155. To help increase the use and supply of renewable and low carbon energy and heat, plans should:

- a) provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts);
- b) consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and
- c) identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.

156. Local planning authorities should support community-led initiatives for renewable and low carbon energy, including developments outside areas identified in local plans or other strategic policies that are being taken forward through neighbourhood planning.

157. In determining planning applications, local planning authorities should expect new development to:

- a) comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and
- b) take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

London Plan (March 2021)

After a rigorous process of consultation and Examination in Public, the current London Plan was published in March 2021.

Policy SI 2: Minimising greenhouse gas emissions

Development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:

1. Be lean: use less energy.
2. Be clean: supply energy efficiently and cleanly, exploit local energy resource.
3. Be green: maximise use of renewable energy.

Adopted Bexley Local Plan April 2023:

Policy DP 30

Energy reduction in new buildings

1. Major development proposals must meet London Plan requirements and calculate whole life-cycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions.
2. Minor development proposals should aim to achieve net zero carbon; reducing greenhouse gas emissions in operation and minimising annual and peak energy demand in accordance with the London Plan energy hierarchy.

Sustainable design standards for all development

3. The Council expects that, where possible:

- a. new homes be designed to achieve: i. BREEAM Home Quality Mark (HQM), or ii. BREEAM Communities standards (for major housing-led mixed-use development), or iii. Passivhaus, or iv. other appropriate sustainability measures.
- b. residential conversions, refurbishment, extensions and changes of use should be designed to achieve BREEAM Domestic Refurbishment Excellent or other appropriate sustainability measure.
- c. new non-residential development, refurbishment of existing buildings, and conversions, over 500m² floor space (gross) must meet or exceed BREEAM 'excellent' rating; and
- d. minor non-residential development achieves a BREEAM 'Very Good' rating.

Water efficiency

4. Development must be designed to be water efficient and reduce water consumption. Residential

development must not exceed a maximum water use of 105 litres per head per day (excluding the allowance of up to 5 litres for external water consumption). Refurbishments and other non-domestic development will be expected to meet BREEAM water-efficiency credits

Approved Documents Part L, Volume 1, 2021 edition incorporating 2023 Amendments

Approved document Part L Volume 1 sets the standard for energy performance for the new residential buildings.

The proposed new buildings must comply with the criteria set out in the Approved Document, as follows:

- For domestic units, the calculated Dwelling CO₂ Emission Rate (DER) must not be greater than the Target CO₂ Emission Rate (TER)
- For domestic units, the calculated Dwelling Fabric Energy Efficiency (DFEE) rate must not be greater than the Target Fabric Energy Efficiency (TFEE) rate.
- For domestic units, Dwelling Primary Energy Rating (DPER) rate must not be greater than the notional Target Primary Energy Rating (TPER) rate.

Approved document Part L Volume 2 sets the standard for energy performance for the new non-residential buildings, as follows:

- For domestic units, the calculated Building CO₂ Emission Rate (BER) must not be greater than the Target CO₂ Emission Rate (TER)
- For domestic units, Building Primary Energy Rating (BPER) rate must not be greater than the notional Target Primary Energy Rating (TPER) rate.

Therefore, based on all the above policies and regulations the Welling FC development needs to achieve the following:

- **Net-zero with minimum 35% on-site reduction; with any residual carbon be offset via a carbon offset payment**

4.0 Energy Efficient Design

Carbon reduction and energy performance have been maximised through measures developed in line with the energy hierarchy. This includes:

Passive Design: Facades developed to find balance between daylight and reducing heat losses. Elevations therefore have a reasonable window to wall area ratio. Low U-values will reduce the heat loss through the building envelope.

Energy Efficient Fabric: Opaque elements will target excellent U-values, whilst envelope air permeability will be reduced to a target rate of $\leq 3.00 \text{ m}^3/\text{hm}^2$ at 50 Pa through an airtight layer on the warm side of the insulation, and efficient windows are currently proposed for all the dwellings' facades.

Energy Efficient Lighting: All lighting will be energy efficient: the dwellings will be equipped with 100% energy efficient lighting.

Efficient Ventilation Strategy: The dwellings will benefit from MVHR.

Mechanical Cooling: Inline MVHR cooling, where required due to window opening limitations, will be provided to the residential units; the retail units will benefit from efficient individual split VRV ASHP systems.

Low and Zero Carbon / Renewable Technologies: The dwellings will be served via a communal ASHP system for heating and hot water. A system of PV panels is to be integrated within the building design to provide carbon emissions reductions across the site.

Heating and cooling will be provided to the commercial spaces via individual split VRV systems.

Methodology:

The GLA energy hierarchy (Figure 2) was used as it focuses on a "fabric first" approach and aims at reducing the energy consumption through the cleanest possible ways.

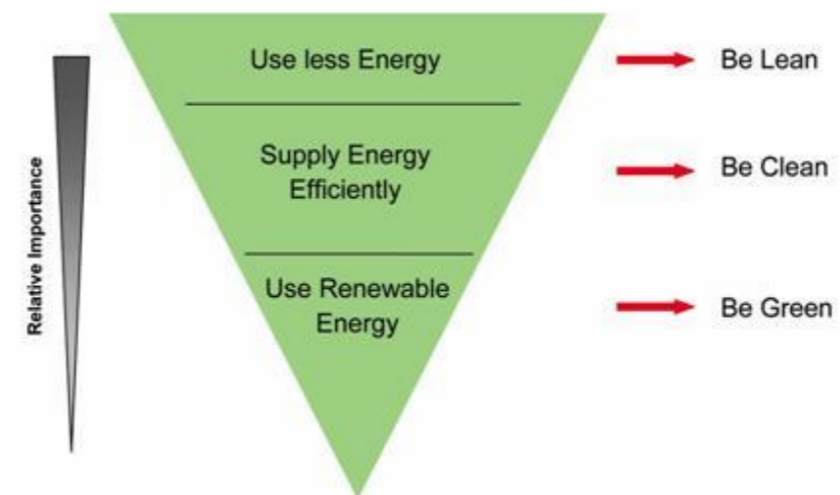


Figure 2: GLA Energy Hierarchy

Government Approved Software **Elmhurst Design SAP 10 for the residential and IES VE Compliance for the commercial areas** have been used to calculate energy consumption and resultant CO₂ emissions.



From this, the Target Emissions Rate (TER) and the potential improvement through energy efficiency, the Dwellings Emissions Rate (DER) & Building Emissions Rate (BER), are established.



5.0 Design Specifications

MWL has carried out the SAP & SBEM calculations with the below listed fabric and system specifications.

Passive Design

Residential Units

Building Element	Limiting Fabric Parameters Part L1A 2013	Proposed Fabric Parameters
External Walls	0.30 W/m ² K	0.16 W/m ² K
Sheltered Walls	0.30 W/m ² K	0.16 W/m ² K
Party Walls	0.20 W/m ² K	0 W/m ² K (Fully Filled Cavity)
Roofs	0.20 W/m ² K	0.10 W/m ² K
Floors	0.25 W/m ² K	0.10 W/m ² K
Windows: U-value/G-value	2.00 W/m ² K	1.20 W/m ² K / 45%
Doors	2.00 W/m ² K	1.20 W/m ² K
Air permeability	10.00 m ³ /m ² .h @ 50pa	3.00 m ³ /m ² .h @ 50pa
Ψ values (Thermal Bridging)	Equivalent psi values to SAP 10 Appendix R targeted	

Non-residential Units:

Building Element	Limiting Fabric Parameters Part L2A 2013	Proposed Fabric Parameters
External Walls	0.35 W/m ² K	0.16 W/m ² K
Roofs	0.25 W/m ² K	0.10 W/m ² K
Floors	0.25 W/m ² K	0.10 W/m ² K
Windows: U-value/G-value	2.20 W/m ² K	1.20 W/m ² K / 30%
Doors	2.20 W/m ² K	1.50 W/m ² K
Air permeability	10.00 m ³ /m ² .h @ 50 Pa	3.00 m ³ /m ² .h @ 50 Pa
Ψ values (Thermal Bridging)	SBEM Default, Accredited Construction Details Not Used	

Active Design

Residential Units

Services	Proposals
Space Heating and Hot Water	Communal ASHP System Overall COP of 2.20
Mechanical Cooling	Inline MVHR cooling where required due to window opening limitations
Renewables	75.6kWp
Ventilation	MVHR: SFP 0.62 / HR 88%
Lighting	100% have luminous efficacy ≥ 75 lm/W

Commercial Units:

Services	Proposals
Space Heating & Cooling Hot Water	VRV - SEER/COP = 7.6/4.3 Hot Water - Instantaneous point of use
Ventilation	Retail - MVHR: SFP = 1.0 W/l/s
Lighting	≥ 120 lumens per Circuit Watt (all areas) - LED Occupancy Sensors Photoelectric dimmable sensor to Retail Photoelectric Parasitic Power 0.10 W/m ²

Football Club Facilities:

Services	Proposals
North Building Space Heating & Cooling Hot Water Ventilation	VRV - SEER/COP = 7.6/4.3 Hot Water – Instantaneous point of use MVHR SFP = 1.0W/l/s
East Building Space Heating Hot Water Ventilation	Heating via Electric Panels Hot Water – Instantaneous point of use Extract SFP = 0.3W/l/s
West Building Space Heating Hot Water Ventilation	Public WC/ Circulation – UHF via ASHP – COP=3.0 Other Spaces – VRV/VRF COP/EER = 4.3/7.6 ASHP – COP=3.0 Storage Cylinder 750L Public WC – Extract SFP = 0.3W/l/s Other Spaces – MVHR SFP = 1.0W/l/s Storage – Natural Ventilation Kitchen – Extract SFP = 0.5Wl/l/s
Renewables (for the whole non-residential)	129.6kWP

6.0 District Energy Network Connection

As detailed under the London Plan policies, consideration should be made to provision of a Decentralised Energy Network, including specifically:

- Require developers to prioritise connection to existing or planned decentralised energy networks where feasible.

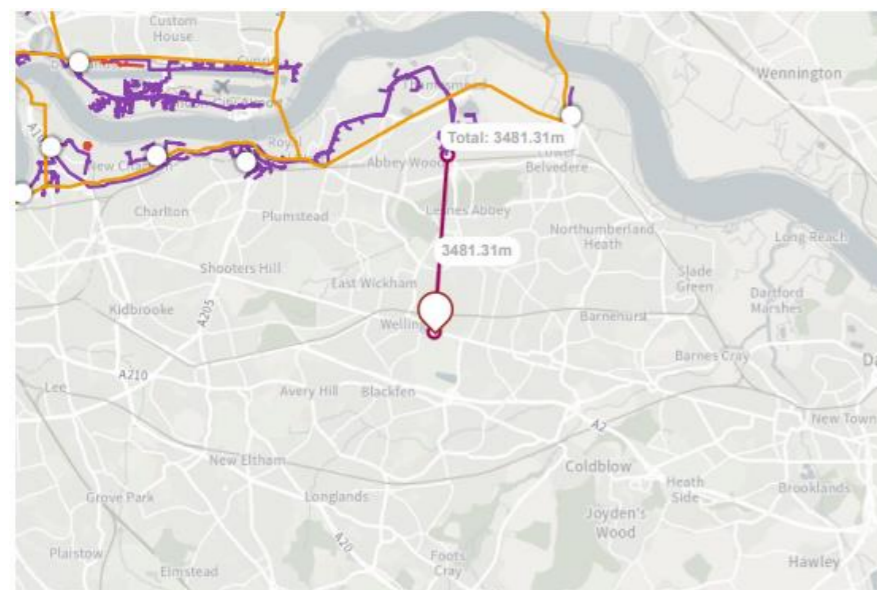
A review of documentation at the time of writing has been undertaken based on the following:

- London Heat Map: <https://maps.london.gov.uk/heatmap>

The London Heat Map is an online tool which exists to assist and promote this aim by enabling information relating to large heat loads and energy supplies within the Greater London area to be collated and searched and hence identify any opportunities that may exist for connecting a proposed development to an existing network or identify centres of significant energy demand which could help the viability of a proposed new heat network.

Investigations have established that there are no current heat networks in the immediate vicinity of the area, nor is the site within a heat network priority area. The nearest proposed network is almost 3.5km away and separate by a high density residential area.

As such, the connection to any existing or potential district heating network **is not feasible**.



Layers shown on map

Proposed Heat Network Transmission Routes, Proposed Heat Networks, Existing Heat Networks.

Figure 3: London Heat map showing the location of the proposed development and its distance from existing & future district heating networks

7.0 Low and Zero Carbon Technologies

This section of the report defines all LZC technologies and identifies the one which is considered feasible.

Wind Energy

Although wind turbines can generate up to 3MW of electricity, smaller units are available generating between 0.5 kW to 6.0 kW. The area would need to be accessed to establish the practicality of installing a wind turbine. Electricity is generated in DC and requires an inverter to convert to AC to operate domestic appliances. Where electricity is generated but not required, it can be sold to the local electricity company.



Given the location and the wind speed available provides minimal feasible electrical generation and as such has been discounted. It should also be noted there are a number of considerations with regards to daylight impact on the surrounding buildings, further providing rational for discounting wind technology.

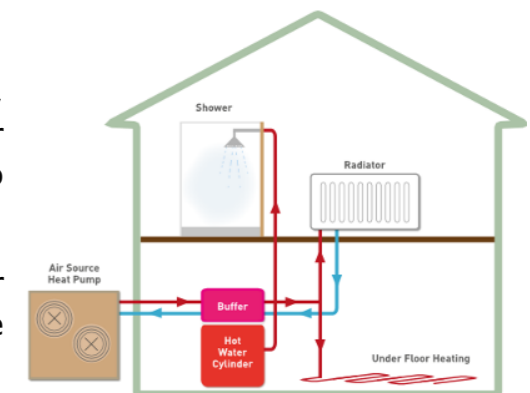
This technology is not considered feasible for the development.

Air Source Heat Pump

Air Source Heat Pumps (ASHP) provide an efficient method of providing space heating and cooling requirements. Heat is absorbed from the air into liquid via a heat exchanger where 'useful' heat is extracted and absorbed. Low grade heat is then extracted by a refrigeration system, compressed and concentrated to temperatures suitable for space heating and hot water requirements.

While ASHP utilise electricity to generate this process, the heat gained is taken directly from the available air and produces fewer greenhouse gases when compared to a conventional gas system.

ASHP have been classified as a renewable system under the European Directive on 'Promotion of Renewable Energy Sources' and Policy SI 3 of the London Plan 2021.

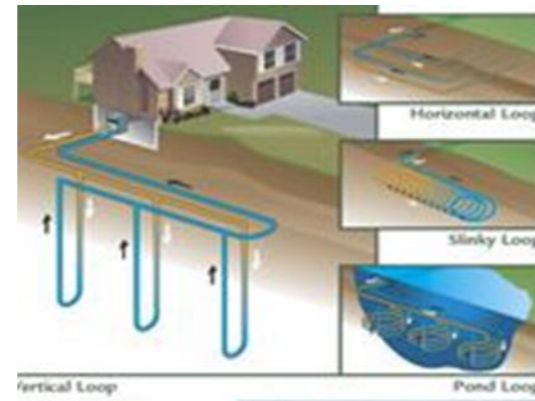


ASHP and associated plant require annual maintenance and adequate space for condensing units. Expected lifetimes range from 7-10 years.

Air Source Heat Pumps have been considered as a viable option to provide various services on site.

Ground Source Heat Pump

A Ground Source Heat Pump (GSHP) transfers energy from the ground to the building to provide space heating or pre-heating of domestic hot water. Unlike wind and solar heating, it requires an electrical input, however, the heat recovered is three to four times the required electrical input. Heat is transferred from the ground using a ground loop, which can either be within a vertical borehole arrangement or laid as coils in a horizontal trench. The heat pump works in the same way as a domestic refrigerator in reverse, by extracting heat from the borehole/trench to evaporate the refrigerant on the heat pump circuit. Heat is then input to the building as the refrigerant condenses.

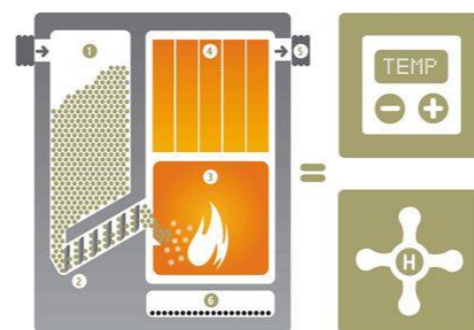


Any proposed GSHP would require the use of a large number of vertical boreholes across the site. This requires intensive investigation and is particularly difficult to suitably excavate in London.

This technology is not feasible for the development.

Biomass

Biomass boilers burn renewable fuel to generate hot water for direct use, or for heating purposes. The fuel they burn is renewable because it is in a constant carbon cycle. There are three main forms of biomass boilers available, namely those using wood chips as fuel, those using wood pellets as fuel and those using wood logs.



The operation and installation of Biomass requires additional plant space for the storage of solid fuel and design of access routes for delivery of fuel. Given the somewhat dense residential location of the development, this has been discounted owing to practical constraints associated with Biomass.

This technology is considered not feasible for this scheme.

Combined Heat & Power (CHP)

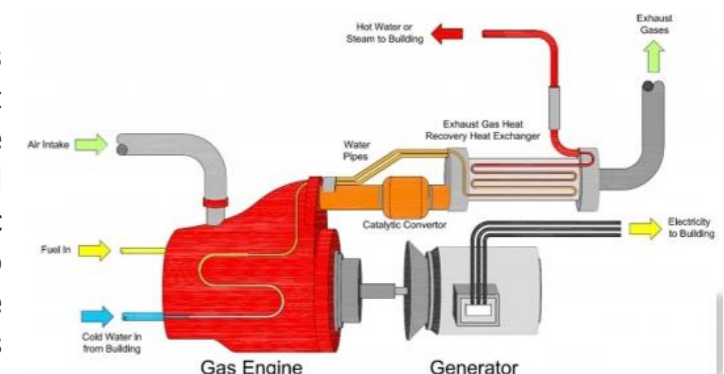
CHP effectively uses waste heat from the electricity generation process to provide useful heat for space and water heating; the advantage of this system is that it leads to higher system efficiencies when compared to a typical supply arrangement of grid-imported electricity and conventional boilers. A further advantage is that because electricity is generated close to the point of use, the losses incurred in High Voltage (HV) transmission are avoided. CHP is considered as a low carbon technology when fired by gas or fuel oil to generate electricity and provide heating and hot water. At this scale, a gas-fired reciprocating engine CHP is the preferred technology due to efficiency, maintenance and plant space considerations, and is well-proven with many successful installations in UK. CHP systems offer optimum carbon and cost savings when matched to the site electricity and heat load profiles such that the units see a high utilisation and make a significant contribution to the site's annual energy demands.

CHP units should be replaced every 15-17 years, with replacement timeframes subject to alteration pending regular maintenance and part failure.

Once an understanding of the site's heat and electricity demand profile has been established the designer is then faced with the task of deciding on the size of the CHP. There is no straightforward way to size a CHP. Some guidance recommends sizing only to meet the lowest demand that occurs — the base-load that will result in the longest running hours and the shortest payback period. However, this is not necessarily the most economically advantageous approach and certainly would limit the amount of CO₂ savings that could be achieved on a given site.

The most accurate models are hourly models simulated over a whole year with occupancy, heat, DHW and electricity demand profiles representing an average year. This is the recommended approach for new buildings where dynamic simulation modelling can be carried out.

Whereas in most engineering calculations it is possible to make simplifications that result in a conservative or a worst-case scenario, simplifying a CHP model generally will result in a more optimistic result (best case scenario) with respect to the CHP operating hours and hence the economic payback and efficiency, which is usually not the case.



The recent change in the electricity carbon factor, makes weak the case for using gas-fired combined heat and power (CHP) and has resulted in an instant step-change towards electrical forms of heating. Therefore, a CHP unit is not considered feasible.

Photovoltaics (PV Panels)

Photovoltaic (PV) panels create electricity from solar radiation with efficiency ranging between 5 and 19%. PV modules generally require minimal maintenance, usually consisting of a visual inspection and associated electrical testing. They have no moving parts and an expected lifetime of over 30-40 years. Manufacturers typically offer a warranty on power output of 20-25 years. PV modules have no operating emissions and produce no noise, making them the most benign zero-carbon technology.



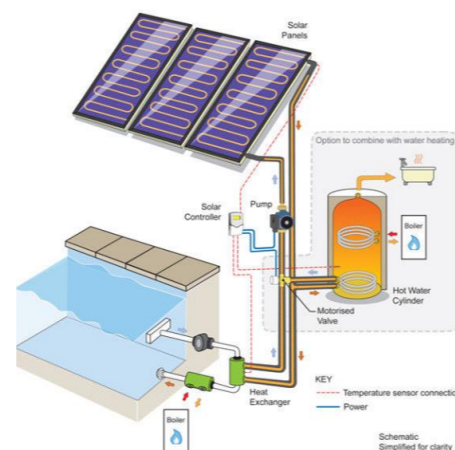
PV on roof space to be maximised subject to specialist design. Please refer to the Roof layout included in Appendix A for current assumption of panel locations.

Solar Thermal Collectors

Solar thermal collectors utilise solar radiation to heat water for use in water heating of a building. The radiation is converted using a solar collector, of which there are two main types available: Flat Plate and Evacuated Tube collectors. Evacuated tube systems occupy a smaller area and are more efficient, but also generally more expensive. Flat plate systems are cheaper to install but generally less efficient.

The solar coverage indicates what percentage of the annual domestic hot water energy requirement can be covered by a solar water heating system. The higher the solar coverage, the more conventional energy usage can be offset, but can cause excess heat generation in the peak summer months and generally lower the average collector efficiency. Therefore, solar coverage of 40-70% are recommended for most domestic applications and up to 40% in non-domestic buildings.

Solar thermal systems in the UK normally operate with a back-up fuel source, such as gas or electricity. The solar system pre-heats the water up to a maximum hot water temperature. If there is not enough solar power available to fully meet the required hot water load, then the back-up fuel system fires up to meet this short fall. The optimum orientation for a solar collector in the UK is a south facing surface, tilted at an angle of 30° from the horizontal. However, orientation is not critical, with azimuths of +/-30° from South and angles of +/-20° from 30° still achieve reasonable outputs.



For the solar water heating system to run safely and efficiently, a series of temperature sensors are connected to a digital solar controller to switch the system on or off according

to the solar energy available. The roof area required depends on the efficiency of the modules specified and will vary depending on the product selected. This will be determined by the relevant contractor.

Roof space has already been allocated to other renewables (PV Panels) and plant equipment. Therefore, this is not a viable option for the development.

Summary of LZC feasibility study

The table, below, presents the result of the feasibility study carried out for the scheme.

Technology	End Use	Result
Wind Turbine	Electricity	NOT Feasible
Ground Source Heat Pumps (GSHP)	Thermal Energy	NOT Feasible
Air Source Heat Pumps (ASHP)	Thermal Energy	FEASIBLE
Biomass	Thermal Energy	NOT Feasible
Combined Heat & Power (CHP)	Electricity and Thermal Energy	NOT Feasible
Solar Hot Water	Thermal Energy	NOT Feasible
Photovoltaics	Electricity	FEASIBLE

Table 1: Summary of LZC Technologies

8.0 Water Usage

Infrequent rainfall events combined with a population density increase could result in reservoir depletion and drought. To mitigate against this, all dwellings shall be designed with water saving fittings to not exceed a maximum water use, set by the local policies, and water efficient irrigation methods shall be used for landscaping.

Based on the Local Policies and new London Plan Policies (as analysed in Chapter 3) the water consumption (internal) for the new-build residential units must be equal or less than 105 litres/person/day.

Implementing measures such as those recommended below, would reduce the internal potable water consumption to less than 105 litres per person per day, as required. Final figures subject to detailed design.

Sanitaryware Element	Targeted Water Consumption
WC Cistern	6 / 3 litres dual flush
Basin Taps	3 litres per min at 3 bar (possible use of flow restrictors)
Shower	9 litres per min at 3 bar (possible use of flow restrictors)
Bath	150 litres capacity to overflow
Kitchen Sink Taps	8 litres per min at 3 bar (possible use flow restrictors)
Washing Machine	8.17 litres per kg
Dishwasher	1.25 litres per place setting

9.0 SAP & SBEM Results Analysis

As mentioned in the above chapters, the energy strategy for the proposed Welling FC development is based on the Energy Hierarchy as follows:

- Use less energy (be lean)
- Supply energy efficiently (be clean) and
- Use renewable energy (be green)

This section of the report shows how the proposed scheme will meet the energy hierarchy, the Building Regulations and the CO2 reduction target.

Domestic Results

The residential units achieve a final reduction of 71% when using the described approach.

The carbon offset payment has been calculated at £95 per tonne as per London Plan guidance.

	Regulated Emissions (tonnes CO ₂ p.a.)	Regulated CO ₂ Savings (tonnes CO ₂ p.a.)	Regulated CO ₂ Savings (%)
Baseline	99.1		
Be Lean	93.1	5.9	6%
Be Clean	93.1	0	0%
Be Green	29.2	64.0	65%
	Cumulative Savings:	69.9	71%
	Offset payment required to Zero Carbon	£83,113	

Table 1: Reduction of Regulated CO₂ Emissions for the residential units

Non-Domestic Results

The non domestic units achieve a final reduction of 9%.

	Regulated Emissions (tonnes CO ₂ p.a.)	Regulated CO ₂ Savings (tonnes CO ₂ p.a.)	Regulated CO ₂ Savings (%)
Baseline	33.9		
Be Lean	34.3	0	0%
Be Clean	34.3	0	0.0%
Be Green	21.4	12.5	37%
	Cumulative Savings:	12.5	37%
	Offset payment required to Zero Carbon	£60,980	

Table 2: Reduction of Regulated CO₂ Emissions for the non-domestic units

Site Wide Residential CO₂ Emissions

The following tables demonstrates the sitewide carbon reductions.

	Regulated Emissions (tonnes CO ₂ p.a.)	Regulated CO ₂ Savings (tonnes CO ₂ p.a.)	Regulated CO ₂ Savings (%)
Baseline	132.9		
Be Lean	127.4	5.5	4.0%
Be Clean	127.4	0.0	0.0%
Be Green	50.6	76.9	58%
	Cumulative Savings:	82.4	62%

Table 3: Sitewide CO₂ Emissions

10.0 Conclusion

The Energy & Sustainability strategy seeks to address the measures of Sustainability (where applicable) and demonstrate the design intention in relation to policies at National, Regional and Local level as appropriate.

The proposed strategy follows a best practice approach to reduction of carbon emissions, based on the London Plan Energy hierarchy of:

- Use less energy 'Be Lean'.
- Supply energy efficiently 'Be Clean'.
- Use Renewable Energy 'Be Green'.

The SAP methodology is used to calculate the energy consumption and resultant CO2 emissions for the proposed dwellings and the IES thermal modelling for the non residential aspect.

A fabric first approach has been followed, incorporating passive design measures such as low u-values, low air leakage and low thermal bridging.

Active design measures have been incorporated such as 100% low energy lighting, and mechanical ventilation with heat recovery (MVHR).

The residential units will benefit from a communal ASHP system for heating and hot water.

Heating, cooling and hot water will be provided to the commercial spaces via individual split VRF Air Source Heat Pump (ASHP) systems.

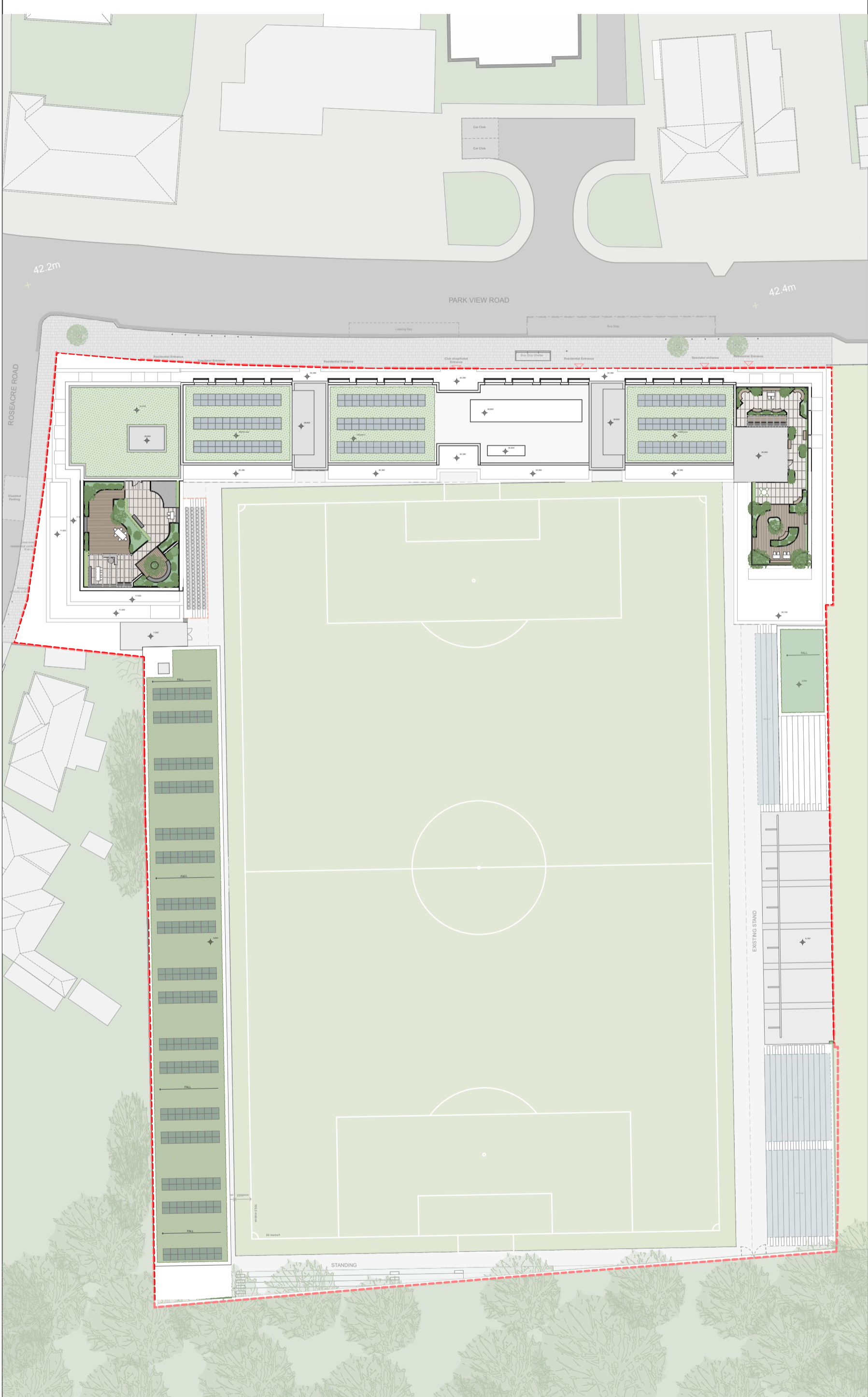
Photovoltaic panels will offset electricity demands and further reducing the carbon emissions of the development. The number of PVs has been maximised based on the available roof space.


By implementing the above approach, the development has achieved a reduction in regulated carbon dioxide emissions of 35% with the remaining carbon offset via offset payments, therefore achieving the required Zero Carbon target.

SAP and SBEM datasheets are presented in the Appendix for the Be Lean and Be Green stages.

By incorporating a combination of all the feasible passive measures along with the use of the above efficient heating & hot water systems and PV Panels, the sitewide CO2 emissions of the development have been reduced by more than 35% in line with relevant policy.

Appendix A – Roof and PV Layout





Rev	Description	Drawn	Checked	Date

CREATE

DESIGN + ARCHITECTURE

Wigglesworth House 69 Southwark Bridge Road London SE1 9HH
+44 207 021 0267 info@createdesign.org www.createdesign.org

WELLING UNITED FC

DA16 1SY

Client
LITA HOMES & WELLING UNITED FC

CONCEPT

PROPOSED PLANS

ROOF PLAN

CDA Ref	Scale(s)	Original Paper Size
694	1:500	A3

Drawing Number	Project	Originator	Volume	Level	Type	Role	Class	Number
694	CDA	ZZ	08	DR	A	05	0105	

Revision	Revision Description

Level 08 Roof Plan
1:500

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Appendix B – Be Lean and Be Green SAP worksheets

Full SAP Calculation Printout



Property Reference	1B2P First Floor		Issued on Date	24/11/2023	
Assessment Reference	Be Green	Prop Type Ref			
Property					
SAP Rating	82 B	DER	4.77	TER	15.39
Environmental	97 A	% DER < TER		69.01	
CO ₂ Emissions (t/year)	0.22	DFEE	33.35	TTEE	33.05
Compliance Check	See BREL	% DFEE < TTEE		-0.92	
% DPER < TPER	39.59	DPER	50.20	TPER	83.10
Assessor Details	Mr. Michael Woodbridge			Assessor ID	M818-0001
Client					

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

1. Overall dwelling characteristics

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

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)

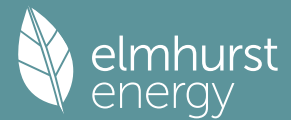
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

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)
Balanced mechanical ventilation with heat recovery	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366 (22b)
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) =												81.0000 (23c)
Effective ac	0.2432	0.2403	0.2374	0.2229	0.2200	0.2054	0.2054	0.2025	0.2112	0.2200	0.2258	0.2316 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening			1.9800	1.2000	2.2560		(26)
Glazing (Uw = 1.20)			12.2400	1.1450	14.0153		(27)
External Wall	35.1000	12.2400	22.8600	0.1600	3.6576	70.0000	1600.2000 (29a)
Sheltered Wall	19.9800	1.8800	18.1000	0.1200	2.1720	70.0000	1267.0000 (29a)
Total net area of external elements Aum(A, m ²)			55.0800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	22.1009	(33)
Party Wall			35.8200	0.0000	0.0000	0.0000	0.0000 (32)
Party Floor 1			50.0000	0.0000	0.0000	0.0000	0.0000 (32a)
Party Ceiling 1			50.0000	0.0000	0.0000	0.0000	0.0000 (32b)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =	2867.2000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							57.3440 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate				6.0000	0.0500	0.3000	

Full SAP Calculation Printout



E4 Jamb	18.6000	0.0500	0.9300	
E7 Party floor between dwellings (in blocks of flats)	37.3500	0.1000	3.7350	
E18 Party wall between dwellings	10.8000	0.0600	0.6480	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	26.5400	0.0000	0.0000	
E8 Balcony within a dwelling, wall insulation continuous	3.4500	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			5.6130	(36)
Point Thermal bridges			0.0000	(36a) =
Total fabric heat loss			27.7139	(33) + (36) + (36a) = (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	10.8354	10.7059	10.5764	9.9291	9.7996	9.1522	9.1522	9.0228	9.4112	9.7996	10.0586	10.3175
Average = Sum(39)m / 12 =	38.5493	38.4198	38.2903	37.6429	37.5135	36.8661	36.8661	36.7366	37.1251	37.5135	37.7724	38.0314
HLP	0.7710	0.7684	0.7658	0.7529	0.7503	0.7373	0.7373	0.7347	0.7425	0.7503	0.7554	0.7606
HLP (average)												0.7522
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													
Hot water usage for baths													
Hot water usage for other uses													
Average daily hot water use (litres/day)													96.8653
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													
Water storage loss:													
Store volume													110.0000
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0152
Volume factor from Table 2a													1.0294
Temperature factor from Table 2b													0.6000
Enter (49) or (54) in (55)													1.0327
Total storage loss													
If cylinder contains dedicated solar storage													
Primary loss													
Combi loss													
Total heat required for water heating calculated for each month													
WWHRS													
PV diverter													
Solar input													
FGHRS													
Output from w/h													
Total per year (kWh/year)													
Electric shower(s)													
Heat gains from water heating, kWh/month													

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

Metabolic gains (Table 5), Watts													
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
Pumps, fans													
Losses e.g. evaporation (negative values) (Table 5)													
Water heating gains (Table 5)													
Total internal gains													

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g Specific data or Table 6c	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	12.2400	19.6403	0.4500		0.8000	0.7700	59.9742
Solar gains	59.9742	117.3223	193.2131	281.7897	345.3439	353.5209	336.5663
Total gains	458.5955	523.5955	584.2364	661.3380	707.4700	702.2138	671.5063

Full SAP Calculation Printout



Total delivered energy for all uses

3560.7144 (338)

 12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			220.0000 (367)
Space and Water heating from Heat pump	1640.2983	0.1556	63.9565 (367)
Electrical energy for heat distribution (space & water)	9.0443	0.0000	5.2123 (372)
Overall CO2 factor for heat network			0.0671 (386)
Total CO2 associated with community systems			242.1342 (373)
Space and water heating			242.1342 (376)
Pumps, fans and electric keep-hot	131.7600	0.1387	18.2767 (378)
Energy for lighting	124.5314	0.1443	17.9737 (379)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-304.2334	0.1316	-40.0285
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-40.0285 (380)
Total CO2, kg/year			238.3561 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.7700 (384)

 13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			220.0000 (467a)
Space and Water heating from Heat pump	1640.2983	1.5759	647.8771 (467)
Electrical energy for heat distribution (space & water)	9.0443	0.0000	55.3657 (472)
Overall CO2 factor for heat network			0.7127 (486)
Total CO2 associated with community systems			2571.9886 (473)
Space and water heating			2571.9886 (476)
Pumps, fans and electric keep-hot	131.7600	1.5128	199.3265 (478)
Energy for lighting	124.5314	1.5338	191.0104 (479)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-304.2334	1.4861	-452.1206
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-452.1206 (480)
Total Primary energy kWh/year			2510.2049 (483)
Dwelling Primary energy Rate (DPER)			50.2000 (484)

 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)	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
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3981 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3086 (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	0.3934 0.3857 0.3780 0.3394 0.3317 0.2931 0.2931 0.2854 0.3086 0.3317 0.3471 0.3626 (22b)	
Effective ac	0.5774 0.5744 0.5714 0.5576 0.5550 0.5430 0.5430 0.5407 0.5476 0.5550 0.5603 0.5657 (25)	

Full SAP Calculation Printout



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
TER Opaque door			1.9800	1.0000	1.8800		(26)
TER Opening Type (Uw = 1.20)			10.6200	1.1450	12.1603		(27)
External Wall	35.1000	10.6200	24.4800	0.1800	4.4064		(29a)
Sheltered Wall	19.9800	1.8800	18.1000	0.1800	3.2580		(29a)
Total net area of external elements Aum(A, m ²)			55.0800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	21.7047	(33)
Party Wall			35.8200	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 57.3440 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	6.0000	0.0500	0.3000
E4 Jamb	18.6000	0.0500	0.9300
E7 Party floor between dwellings (in blocks of flats)	37.3500	0.0700	2.6145
E18 Party wall between dwellings	10.8000	0.0600	0.6480
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	26.5400	0.0000	0.0000
E8 Balcony within a dwelling, wall insulation continuous	3.4500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.4925 (36)

Point Thermal bridges

Total fabric heat loss (36a) = 0.0000

(33) + (36) + (36a) = 26.1972 (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	25.7227	25.5888	25.4576	24.8412	24.7259	24.1891	24.1891	24.0897	24.3959	24.7259	24.9592	25.2031
Average = Sum(39)m / 12 =	51.9199	51.7860	51.6548	51.0384	50.9231	50.3863	50.3863	50.2869	50.5931	50.9231	51.1564	51.4003

Days in mont 31 28 31 30 31 30 31 31 30 31 30 31 31

HLP (average) 1.0384 1.0357 1.0331 1.0208 1.0185 1.0077 1.0077 1.0057 1.0119 1.0185 1.0231 1.0280 1.0208

Days in mont 31 28 31 30 31 30 31 31 30 31 30 31 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)

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) 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)

12Total per year (kWh/year) 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)

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

Metabolic gains (Table 5), Watts (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 74.4107 82.3832 74.4107 76.8910 74.4107 76.8910 74.4107 74.4107 76.8910 74.4107 76.8910 74.4107 (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)

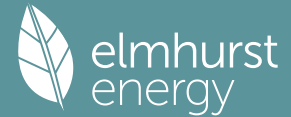
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 0.0000 0.0000 0.0000 0.0000 3.0000 3.0000 3.0000 (70)

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 398.9876 406.5305 390.9364 376.9535 359.0632 343.5266 331.2988 332.4565 341.9357 356.5245 377.2760 391.4342 (73)

Full SAP Calculation Printout



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				10.6200	19.6403	0.6300	0.7000	0.7700	63.7446 (76)			
Solar gains	63.7446	124.6980	205.3599	299.5052	367.0548	375.7459	357.7254	307.2809	238.8421	147.9647	79.4821	52.4205 (83)
Total gains	462.7322	531.2285	596.2963	676.4586	726.1180	719.2726	689.0242	639.7374	580.7777	504.4892	456.7581	443.8547 (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	15.3399	15.3795	15.4186	15.6048	15.6401	15.8068	15.8068	15.8380	15.7422	15.6401	15.5688	15.4949
alpha	2.0227	2.0253	2.0279	2.0403	2.0427	2.0538	2.0538	2.0559	2.0495	2.0427	2.0379	2.0330
util living area	0.8460	0.8043	0.7425	0.6401	0.5220	0.3962	0.2998	0.3317	0.4939	0.6875	0.8037	0.8551 (86)
MIT	18.2483	18.6451	19.2233	19.9226	20.4474	20.7798	20.9112	20.8877	20.6350	19.9319	18.9946	18.1852 (87)
Th 2	20.0515	20.0537	20.0558	20.0661	20.0680	20.0769	20.0769	20.0786	20.0735	20.0680	20.0641	20.0601 (88)
util rest of house	0.8329	0.7884	0.7218	0.6122	0.4851	0.3487	0.2427	0.2727	0.4446	0.6560	0.7853	0.8428 (89)
MIT 2	16.8711	17.3583	18.0656	18.9088	19.5186	19.8889	20.0173	19.9999	19.7450	18.9435	17.8050	16.7965 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.5597	18.0017	18.6445	19.4157	19.9830	20.3343	20.4642	20.4438	20.1900	19.4377	18.3998	17.4908 (91)
Temperature adjustment	0.0000											
adjusted MIT	17.5597	18.0017	18.6445	19.4157	19.9830	20.3343	20.4642	20.4438	20.1900	19.4377	18.3998	17.4908 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.7900	0.7472	0.6866	0.5911	0.4816	0.3623	0.2671	0.2967	0.4511	0.6323	0.7459	0.8002 (94)
Useful gains	365.5664	396.9139	409.3978	399.8273	349.7053	260.6254	184.0584	189.7966	261.9812	319.0061	340.7029	355.1723 (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	688.4414	678.4844	627.3194	536.7043	421.7971	288.9314	194.7037	203.3510	308.1115	450.0443	578.0577	683.1533 (97)
Space heating kWh	240.2190	189.2153	162.1336	98.5515	53.6363	0.0000	0.0000	0.0000	0.0000	97.4924	170.8955	244.0178 (98a)
Space heating requirement - total per year (kWh/year)												1256.1614
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	240.2190	189.2153	162.1336	98.5515	53.6363	0.0000	0.0000	0.0000	0.0000	97.4924	170.8955	244.0178 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1256.1614
Space heating per m2												(98c) / (4) = 25.1232 (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	240.2190	189.2153	162.1336	98.5515	53.6363	0.0000	0.0000	0.0000	0.0000	97.4924	170.8955	244.0178 (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)	260.2589	205.0004	175.6594	106.7730	58.1109	0.0000	0.0000	0.0000	0.0000	105.6256	185.1522	264.3747 (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)
Efficiency of water heater (217)m	84.5590	84.2971	83.8097	82.9978	81.9183	79.8000	79.8000	79.8000	79.8000	82.9474	84.0472	79.8000 (216)
Fuel for water heating, kWh/month	227.5073	201.9719	216.3642	193.6100	191.1491	177.9421	176.5248	182.9609	184.3137	196.4055	204.4788	84.6166 (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	15.4611	12.4034	11.1679	8.1821	6.3201	5.1636	5.7654	7.4941	9.7341	12.7716	14.4255	15.8908 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-8.3410	-12.7511	-19.8583	-24.2592	-27.9135	-26.7188	-26.4061	-24.0482	-20.2197	-15.4015	-9.5184	-7.1012 (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	-2.1176	-4.6136	-9.4730	-14.6839	-19.8675	-20.1193	-19.8717	-16.6074	-11.8988	-6.7319	-2.8698	-1.6623 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

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Annual totals kWh/year		
Space heating fuel - main system 1	1360.9549	(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	2378.3112	(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)	124.7797	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-353.0536	(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	3596.9922	(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	1360.9549	0.2100	285.8005 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2378.3112	0.2100	499.4454 (264)
Space and water heating			785.2459 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	124.7797	0.1443	18.0096 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-222.5368	0.1329	-29.5786
PV Unit electricity exported	-130.5168	0.1250	-16.3146
Total			-45.8932 (269)
Total CO2, kg/year			769.2915 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.3900 (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	1360.9549	1.1300	1537.8791 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2378.3112	1.1300	2687.4917 (278)
Space and water heating			4225.3707 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	124.7797	1.5338	191.3912 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-222.5368	1.4911	-331.8329
PV Unit electricity exported	-130.5168	0.4588	-59.8803
Total			-391.7133 (283)
Total Primary energy kWh/year			4155.1495 (286)
Target Primary Energy Rate (TPER)			83.1000 (287)

Full SAP Calculation Printout



Property Reference	1B2P First Floor		Issued on Date	24/11/2023	
Assessment Reference	Be Lean	Prop Type Ref			
Property					
SAP Rating	82 B	DER	17.25	TER	15.39
Environmental	88 B	% DER < TER	-12.09		
CO ₂ Emissions (t/year)	0.82	DFEE	33.35	TFEE	33.05
Compliance Check	See BREL	% DFEE < TFEE	-0.92		
% DPER < TPER	-17.06	DPER	97.27	TPER	83.10
Assessor Details	Mr. Michael Woodbridge			Assessor ID	M818-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												81.0000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2432	0.2403	0.2374	0.2229	0.2200	0.2054	0.2054	0.2025	0.2112	0.2200	0.2258	0.2316 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening			1.9800	1.2000	2.2560		(26)
Glazing (Uw = 1.20)			12.2400	1.1450	14.0153		(27)
External Wall	35.1000	12.2400	22.8600	0.1600	3.6576	70.0000	1600.2000 (29a)
Sheltered Wall	19.9800	1.8800	18.1000	0.1200	2.1720	70.0000	1267.0000 (29a)
Total net area of external elements Aum(A, m ²)			55.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	22.1009		(33)
Party Wall			35.8200	0.0000	0.0000	0.0000	0.0000 (32)
Party Floor 1			50.0000	0.0000	0.0000	0.0000	0.0000 (32a)
Party Ceiling 1			50.0000	0.0000	0.0000	0.0000	0.0000 (32b)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		2867.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							57.3440 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate				6.0000	0.0500	0.3000	

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Total delivered energy for all uses

3864.9478 (338)

 12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			92.3000 (367)
Space and Water heating from Boilers	3909.7035	0.2100	205.7744 (367)
Electrical energy for heat distribution (space & water)	9.0443	0.0000	5.2123 (372)
Overall CO2 factor for heat network			0.2290 (386)
Total CO2 associated with community systems			826.2500 (373)
Space and water heating			826.2500 (376)
Pumps, fans and electric keep-hot	131.7600	0.1387	18.2767 (378)
Energy for lighting	124.5314	0.1443	17.9737 (379)
Total CO2, kg/year			862.5005 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			17.2500 (384)

 13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Boilers			92.3000 (467a)
Space and Water heating from Boilers	3909.7035	1.1300	1107.2622 (467)
Electrical energy for heat distribution (space & water)	9.0443	0.0000	55.3657 (472)
Overall CO2 factor for heat network			1.2396 (486)
Total CO2 associated with community systems			4473.3307 (473)
Space and water heating			4473.3307 (476)
Pumps, fans and electric keep-hot	131.7600	1.5128	199.3265 (478)
Energy for lighting	124.5314	1.5338	191.0104 (479)
Total Primary energy kWh/year			4863.6676 (483)
Dwelling Primary energy Rate (DPER)			97.2700 (484)

 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)
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	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3981	(18)
Number of sides sheltered	3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3086 (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	0.3934	0.3857	0.3780	0.3394	0.3317	0.2931	0.2931	0.2854	0.3086	0.3317	0.3471	0.3626 (22b)
Effective ac	0.5774	0.5744	0.5714	0.5576	0.5550	0.5430	0.5430	0.5407	0.5476	0.5550	0.5603	0.5657 (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			1.8800	1.0000	1.8800		(26)
TER Opening Type (Uw = 1.20)			10.6200	1.1450	12.1603		(27)
External Wall	35.1000	10.6200	24.4800	0.1800	4.4064		(29a)
Sheltered Wall	19.9800	1.8800	18.1000	0.1800	3.2580		(29a)

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Solar gains	63.7446	124.6980	205.3599	299.5052	367.0548	375.7459	357.7254	307.2809	238.8421	147.9647	79.4821	52.4205 (83)
Total gains	462.7322	531.2285	596.2963	676.4586	726.1180	719.2726	689.0242	639.7374	580.7777	504.4892	456.7581	443.8547 (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	15.3399	15.3795	15.4186	15.6048	15.6401	15.8068	15.8068	15.8380	15.7422	15.6401	15.5688	15.4949
alpha	2.0227	2.0253	2.0279	2.0403	2.0427	2.0538	2.0538	2.0559	2.0495	2.0427	2.0379	2.0330
util living area	0.8460	0.8043	0.7425	0.6401	0.5220	0.3962	0.2998	0.3317	0.4939	0.6875	0.8037	0.8551 (86)
MIT	18.2483	18.6451	19.2233	19.9226	20.4474	20.7798	20.9112	20.8877	20.6350	19.9319	18.9946	18.1852 (87)
Th 2	20.0515	20.0537	20.0558	20.0661	20.0680	20.0769	20.0769	20.0786	20.0735	20.0680	20.0641	20.0601 (88)
util rest of house	0.8329	0.7884	0.7218	0.6122	0.4851	0.3487	0.2427	0.2727	0.4446	0.6560	0.7853	0.8428 (89)
MIT 2	16.8711	17.3583	18.0656	18.9088	19.5186	19.8889	20.0173	19.9999	19.7450	18.9435	17.8050	16.7965 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.5597	18.0017	18.6445	19.4157	19.9830	20.3343	20.4642	20.4438	20.1900	19.4377	18.3998	17.4908 (91)
Temperature adjustment	0.0000											
adjusted MIT	17.5597	18.0017	18.6445	19.4157	19.9830	20.3343	20.4642	20.4438	20.1900	19.4377	18.3998	17.4908 (92)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.7900	0.7472	0.6866	0.5911	0.4816	0.3623	0.2671	0.2967	0.4511	0.6323	0.7459	0.8002 (94)
Useful gains	365.5664	396.9139	409.3978	399.8273	349.7053	260.6254	184.0584	189.7966	261.9812	319.0061	340.7029	355.1723 (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	688.4414	678.4844	627.3194	536.7043	421.7971	288.9314	194.7037	203.3510	308.1115	450.0443	578.0577	683.1533 (97)
Space heating kWh	240.2190	189.2153	162.1336	98.5515	53.6363	0.0000	0.0000	0.0000	0.0000	97.4924	170.8955	244.0178 (98a)
Space heating requirement - total per year (kWh/year)												1256.1614
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	240.2190	189.2153	162.1336	98.5515	53.6363	0.0000	0.0000	0.0000	0.0000	97.4924	170.8955	244.0178 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1256.1614
Space heating per m2												(98c) / (4) = 25.1232 (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	240.2190	189.2153	162.1336	98.5515	53.6363	0.0000	0.0000	0.0000	0.0000	97.4924	170.8955	244.0178 (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)	260.2589	205.0004	175.6594	106.7730	58.1109	0.0000	0.0000	0.0000	0.0000	105.6256	185.1522	264.3747 (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)
Efficiency of water heater												79.8000 (216)
(217)m	84.5590	84.2971	83.8097	82.9978	81.9183	79.8000	79.8000	79.8000	79.8000	82.9474	84.0472	84.6166 (217)
Fuel for water heating, kWh/month	227.5073	201.9719	216.3642	193.6100	191.1491	177.9421	176.5248	182.9609	184.3137	196.4055	204.4788	225.0829 (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	15.4611	12.4034	11.1679	8.1821	6.3201	5.1636	5.7654	7.4941	9.7341	12.7716	14.4255	15.8908 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-8.3410	-12.7511	-19.8583	-24.2592	-27.9135	-26.7188	-26.4061	-24.0482	-20.2197	-15.4015	-9.5184	-7.1012 (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	-2.1176	-4.6136	-9.4730	-14.6839	-19.8675	-20.1193	-19.8717	-16.6074	-11.8988	-6.7319	-2.8698	-1.6623 (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												1360.9549 (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												2378.3112 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												86.0000 (231)

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Electricity for lighting (calculated in Appendix L)	124.7797 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-353.0536 (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	3596.9922 (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	1360.9549	0.2100	285.8005 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2378.3112	0.2100	499.4454 (264)
Space and water heating			785.2459 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	124.7797	0.1443	18.0096 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-222.5368	0.1329	-29.5786
PV Unit electricity exported	-130.5168	0.1250	-16.3146
Total			-45.8932 (269)
Total CO2, kg/year			769.2915 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.3900 (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	1360.9549	1.1300	1537.8791 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2378.3112	1.1300	2687.4917 (278)
Space and water heating			4225.3707 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	124.7797	1.5338	191.3912 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-222.5368	1.4911	-331.8329
PV Unit electricity exported	-130.5168	0.4588	-59.8803
Total			-391.7133 (283)
Total Primary energy kWh/year			4155.1495 (286)
Target Primary Energy Rate (TPER)			83.1000 (287)

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Property Reference	1B2P Mid Floor		Issued on Date	24/11/2023	
Assessment Reference	Be Green	Prop Type Ref			
Property					
SAP Rating	82 B	DER	4.82	TER	15.39
Environmental	97 A	% DER < TER		68.68	
CO ₂ Emissions (t/year)	0.22	DFEE	33.95	TFEE	33.05
Compliance Check	See BREL	% DFEE < TFEE		-2.73	
% DPER < TPER	38.94	DPER	50.74	TPER	83.10
Assessor Details	Mr. Michael Woodbridge			Assessor ID	M818-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)

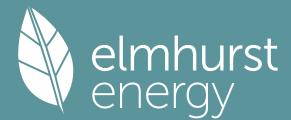
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												81.0000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2432	0.2403	0.2374	0.2229	0.2200	0.2054	0.2054	0.2025	0.2112	0.2200	0.2258	0.2316 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening			1.9800	1.2000	2.2560		(26)
Glazing (Uw = 1.20)			12.2400	1.1450	14.0153		(27)
External Wall	35.1000	12.2400	22.8600	0.1600	3.6576	70.0000	1600.2000 (29a)
Sheltered Wall	19.9800	1.8800	18.1000	0.1600	2.8960	70.0000	1267.0000 (29a)
Total net area of external elements Aum(A, m ²)			55.0800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	22.8249	(33)
Party Wall			35.8200	0.0000	0.0000	0.0000	0.0000 (32)
Party Floor 1			50.0000	0.0000	0.0000	0.0000	0.0000 (32a)
Party Ceiling 1			50.0000	0.0000	0.0000	0.0000	0.0000 (32b)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =	2867.2000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							57.3440 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate				6.0000	0.0500	0.3000	

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E4 Jamb																			18.6000	0.0500	0.9300
E7 Party floor between dwellings (in blocks of flats)																			37.3500	0.1000	3.7350
E18 Party wall between dwellings																			10.8000	0.0600	0.6480
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)																			26.5400	0.0000	0.0000
E8 Balcony within a dwelling, wall insulation continuous																			3.4500	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)																					5.6130 (36)
Point Thermal bridges																					(36a) = 0.0000
Total fabric heat loss																					(33) + (36) + (36a) = 28.4379 (37)

4. Water heating energy requirements (kWh/year)

Assumed occupancy

Hot water usage for mixer showers

Hot water usage for baths

Hot water usage for other uses

Average daily hot water use (litres/day)

Daily hot water use

Energy content (annual)

Distribution loss (46)m = 0.15 x (45)m

Water storage loss:

Store volume

b) If manufacturer declared loss factor is not known :

Hot water storage loss factor from Table 2 (kWh/litre/day)

Volume factor from Table 2a

Temperature factor from Table 2b

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

Total storage loss

If cylinder contains dedicated solar storage

Primary loss

Combi loss

Total heat required for water heating calculated for each month

WWHRs

PV diverter

Solar input

FGHRs

Output from w/h

Total per year (kWh/year)

Electric shower(s)

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

Heat gains from water heating, kWh/month

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

Metabolic gains (Table 5), Watts

(66)m

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

Pumps, fans

Losses e.g. evaporation (negative values) (Table 5)

Water heating gains (Table 5)

Total internal gains

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	12.2400	19.6403	0.4500	0.8000	0.7700	59.9742 (76)
Solar gains	59.9742	117.3223	193.2131	281.7897	345.3439	353.5209
Total gains	458.5955	523.5955	584.2364	661.3380	707.4700	702.2138

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Total delivered energy for all uses

3597.4149 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			220.0000 (367)
Space and Water heating from Heat pump	1656.9804	0.1555	66.5211 (367)
Electrical energy for heat distribution (space & water)	9.4113	0.0000	5.2687 (372)
Overall CO2 factor for heat network			0.0671 (386)
Total CO2 associated with community systems			244.7552 (373)
Space and water heating			244.7552 (376)
Pumps, fans and electric keep-hot	131.7600	0.1387	18.2767 (378)
Energy for lighting	124.5314	0.1443	17.9737 (379)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-304.2334	0.1316	-40.0285
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-40.0285 (380)
Total CO2, kg/year			240.9772 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.8200 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			220.0000 (467a)
Space and Water heating from Heat pump	1656.9804	1.5757	674.0542 (467)
Electrical energy for heat distribution (space & water)	9.4113	0.0000	55.9416 (472)
Overall CO2 factor for heat network			0.7129 (486)
Total CO2 associated with community systems			2598.7416 (473)
Space and water heating			2598.7416 (476)
Pumps, fans and electric keep-hot	131.7600	1.5128	199.3265 (478)
Energy for lighting	124.5314	1.5338	191.0104 (479)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-304.2334	1.4861	-452.1206
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-452.1206 (480)
Total Primary energy kWh/year			2536.9579 (483)
Dwelling Primary energy Rate (DPER)			50.7400 (484)

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

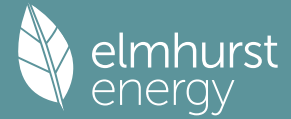
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	50.0000 (1b)	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
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3981 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3086 (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	0.3934 0.3857 0.3780 0.3394 0.3317 0.2931 0.2931 0.2854 0.3086 0.3317 0.3471 0.3626 (22b)	
Effective ac	0.5774 0.5744 0.5714 0.5576 0.5550 0.5430 0.5430 0.5407 0.5476 0.5550 0.5603 0.5657 (25)	

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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				10.6200	19.6403	0.6300	0.7000	0.7700	63.7446 (76)			
Solar gains	63.7446	124.6980	205.3599	299.5052	367.0548	375.7459	357.7254	307.2809	238.8421	147.9647	79.4821	52.4205 (83)
Total gains	462.7322	531.2285	596.2963	676.4586	726.1180	719.2726	689.0242	639.7374	580.7777	504.4892	456.7581	443.8547 (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	15.3399	15.3795	15.4186	15.6048	15.6401	15.8068	15.8068	15.8380	15.7422	15.6401	15.5688	15.4949
alpha	2.0227	2.0253	2.0279	2.0403	2.0427	2.0538	2.0538	2.0559	2.0495	2.0427	2.0379	2.0330
util living area	0.8460	0.8043	0.7425	0.6401	0.5220	0.3962	0.2998	0.3317	0.4939	0.6875	0.8037	0.8551 (86)
MIT	18.2483	18.6451	19.2233	19.9226	20.4474	20.7798	20.9112	20.8877	20.6350	19.9319	18.9946	18.1852 (87)
Th 2	20.0515	20.0537	20.0558	20.0661	20.0680	20.0769	20.0769	20.0786	20.0735	20.0680	20.0641	20.0601 (88)
util rest of house	0.8329	0.7884	0.7218	0.6122	0.4851	0.3487	0.2427	0.2727	0.4446	0.6560	0.7853	0.8428 (89)
MIT 2	16.8711	17.3583	18.0656	18.9088	19.5186	19.8889	20.0173	19.9999	19.7450	18.9435	17.8050	16.7965 (90)
Living area fraction	fLA = Living area / (4) =											0.5000 (91)
MIT	17.5597	18.0017	18.6445	19.4157	19.9830	20.3343	20.4642	20.4438	20.1900	19.4377	18.3998	17.4908 (92)
Temperature adjustment												0.0000
adjusted MIT	17.5597	18.0017	18.6445	19.4157	19.9830	20.3343	20.4642	20.4438	20.1900	19.4377	18.3998	17.4908 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.7900	0.7472	0.6866	0.5911	0.4816	0.3623	0.2671	0.2967	0.4511	0.6323	0.7459	0.8002 (94)
Useful gains	365.5664	396.9139	409.3978	399.8273	349.7053	260.6254	184.0584	189.7966	261.9812	319.0061	340.7029	355.1723 (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	688.4414	678.4844	627.3194	536.7043	421.7971	288.9314	194.7037	203.3510	308.1115	450.0443	578.0577	683.1533 (97)
Space heating kWh	240.2190	189.2153	162.1336	98.5515	53.6363	0.0000	0.0000	0.0000	0.0000	97.4924	170.8955	244.0178 (98a)
Space heating requirement - total per year (kWh/year)												1256.1614
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	240.2190	189.2153	162.1336	98.5515	53.6363	0.0000	0.0000	0.0000	0.0000	97.4924	170.8955	244.0178 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1256.1614
Space heating per m2												(98c) / (4) = 25.1232 (99)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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	240.2190	189.2153	162.1336	98.5515	53.6363	0.0000	0.0000	0.0000	0.0000	97.4924	170.8955	244.0178 (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)	260.2589	205.0004	175.6594	106.7730	58.1109	0.0000	0.0000	0.0000	0.0000	105.6256	185.1522	264.3747 (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)
Efficiency of water heater (217)m	84.5590	84.2971	83.8097	82.9978	81.9183	79.8000	79.8000	79.8000	79.8000	82.9474	84.0472	84.6166 (217)
Fuel for water heating, kWh/month	227.5073	201.9719	216.3642	193.6100	191.1491	177.9421	176.5248	182.9609	184.3137	196.4055	204.4788	225.0829 (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	15.4611	12.4034	11.1679	8.1821	6.3201	5.1636	5.7654	7.4941	9.7341	12.7716	14.4255	15.8908 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-8.3410	-12.7511	-19.8583	-24.2592	-27.9135	-26.7188	-26.4061	-24.0482	-20.2197	-15.4015	-9.5184	-7.1012 (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	-2.1176	-4.6136	-9.4730	-14.6839	-19.8675	-20.1193	-19.8717	-16.6074	-11.8988	-6.7319	-2.8698	-1.6623 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

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Annual totals kWh/year		
Space heating fuel - main system 1	1360.9549	(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	2378.3112	(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)	124.7797	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-353.0536	(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	3596.9922	(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	1360.9549	0.2100	285.8005 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2378.3112	0.2100	499.4454 (264)
Space and water heating			785.2459 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	124.7797	0.1443	18.0096 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-222.5368	0.1329	-29.5786
PV Unit electricity exported	-130.5168	0.1250	-16.3146
Total			-45.8932 (269)
Total CO2, kg/year			769.2915 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.3900 (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	1360.9549	1.1300	1537.8791 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2378.3112	1.1300	2687.4917 (278)
Space and water heating			4225.3707 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	124.7797	1.5338	191.3912 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-222.5368	1.4911	-331.8329
PV Unit electricity exported	-130.5168	0.4588	-59.8803
Total			-391.7133 (283)
Total Primary energy kWh/year			4155.1495 (286)
Target Primary Energy Rate (TPER)			83.1000 (287)

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Property Reference	1B2P Mid Floor		Issued on Date	24/11/2023	
Assessment Reference	Be Lean	Prop Type Ref			
Property					
SAP Rating	82 B	DER	17.42	TER	15.39
Environmental	88 B	% DER < TER	-13.19		
CO ₂ Emissions (t/year)	0.82	DFEE	33.95	TFEE	33.05
Compliance Check	See BREL	% DFEE < TFEE	-2.73		
% DPER < TPER	-18.15	DPER	98.18	TPER	83.10
Assessor Details	Mr. Michael Woodbridge			Assessor ID	M818-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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

		m ³ per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	3.0000	(17)
Infiltration rate	0.1500	(18)
Number of sides sheltered	3	(19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366 (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) =												81.0000 (23c)
Effective ac	0.2432	0.2403	0.2374	0.2229	0.2200	0.2054	0.2054	0.2025	0.2112	0.2200	0.2258	0.2316 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening			1.9800	1.2000	2.2560		(26)
Glazing (Uw = 1.20)			12.2400	1.1450	14.0153		(27)
External Wall	35.1000	12.2400	22.8600	0.1600	3.6576	70.0000	1600.2000 (29a)
Sheltered Wall	19.9800	1.8800	18.1000	0.1600	2.8960	70.0000	1267.0000 (29a)
Total net area of external elements Aum(A, m ²)			55.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	22.8249		(33)
Party Wall			35.8200	0.0000	0.0000	0.0000	0.0000 (32)
Party Floor 1			50.0000	0.0000	0.0000	0.0000	0.0000 (32a)
Party Ceiling 1			50.0000	0.0000	0.0000	0.0000	0.0000 (32b)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	2867.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							57.3440 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate				6.0000	0.0500	0.3000	

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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	20.2796	20.3466	20.4142	20.7586	20.8289	21.1876	21.1876	21.2608	21.0427	20.8289	20.6888	20.5506
alpha	2.3520	2.3564	2.3609	2.3839	2.3886	2.4125	2.4125	2.4174	2.4028	2.3886	2.3793	2.3700
util living area	0.8144	0.7640	0.6911	0.5730	0.4491	0.3252	0.2399	0.2658	0.4163	0.6223	0.7595	0.8245 (86)
MIT	19.1337	19.4764	19.9265	20.4307	20.7467	20.9175	20.9712	20.9625	20.8441	20.4133	19.7309	19.0903 (87)
Th 2	20.2659	20.2682	20.2705	20.2817	20.2840	20.2953	20.2953	20.2976	20.2908	20.2840	20.2795	20.2750 (88)
util rest of house	0.8019	0.7491	0.6725	0.5498	0.4211	0.2926	0.2032	0.2274	0.3801	0.5952	0.7422	0.8126 (89)
MIT 2	18.0669	18.4902	19.0427	19.6555	20.0236	20.2208	20.2739	20.2688	20.1439	19.6505	18.8209	18.0191 (90)
Living area fraction	fLA = Living area / (4) = 0.5000 (91)											
MIT	18.6003	18.9833	19.4846	20.0431	20.3851	20.5691	20.6226	20.6156	20.4940	20.0319	19.2759	18.5547 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.6003	18.9833	19.4846	20.0431	20.3851	20.5691	20.6226	20.6156	20.4940	20.0319	19.2759	18.5547 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.7690	0.7199	0.6510	0.5417	0.4251	0.3054	0.2204	0.2449	0.3906	0.5852	0.7153	0.7797 (94)
Useful gains	352.6572	376.9515	380.3163	358.2776	300.7390	214.4402	147.9765	153.6728	223.3131	291.4561	324.6718	344.0169 (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	561.6194	551.2748	506.5848	427.5264	332.0969	224.3798	151.2081	157.9200	242.0078	360.6516	468.7270	556.3217 (97)
Space heating kWh	155.4679	117.1453	93.9438	49.8591	23.3303	0.0000	0.0000	0.0000	0.0000	51.4815	103.7197	157.9548 (98a)
Space heating requirement - total per year (kWh/year)	752.9024											
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	155.4679	117.1453	93.9438	49.8591	23.3303	0.0000	0.0000	0.0000	0.0000	51.4815	103.7197	157.9548 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	752.9024											
Space heating per m2	(98c) / (4) = 15.0580 (99)											

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)											
Fraction of space heat from community system	1.0000 (302)											
Fraction of heat from community Boilers-Space and Water	1.0000 (303a)											
Factor for control and charging method (Table 4c(3)) for space heating	1.0000 (305)											
Factor for charging method (Table 4c(3)) for water heating	1.0000 (305a)											
Distribution loss factor (Table 12c) for community heating system	1.2500 (306)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating:												
Space heating requirement	155.4679	117.1453	93.9438	49.8591	23.3303	0.0000	0.0000	0.0000	0.0000	51.4815	103.7197	157.9548 (98)
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.25	194.3349	146.4316	117.4297	62.3239	29.1628	0.0000	0.0000	0.0000	0.0000	64.3518	129.6497	197.4435
307a	194.3349	146.4316	117.4297	62.3239	29.1628	0.0000	0.0000	0.0000	0.0000	64.3518	129.6497	197.4435 (307)
Space heating requirement	194.3349	146.4316	117.4297	62.3239	29.1628	0.0000	0.0000	0.0000	0.0000	64.3518	129.6497	197.4435 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)											
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating												
Annual water heating requirement	210.4221	186.3551	198.6174	179.7502	175.4482	156.3967	150.9118	161.9027	161.6235	180.8724	191.1341	209.9490 (64)
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.25	263.0276	232.9438	248.2717	224.6878	219.3102	195.4959	188.6397	202.3784	202.0293	226.0905	238.9176	262.4363
310a	263.0276	232.9438	248.2717	224.6878	219.3102	195.4959	188.6397	202.3784	202.0293	226.0905	238.9176	262.4363 (310)
Water heating fuel	263.0276	232.9438	248.2717	224.6878	219.3102	195.4959	188.6397	202.3784	202.0293	226.0905	238.9176	262.4363 (310)
Cooling System Energy Efficiency Ratio	0.0000 (314)											
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	11.1906	10.1076	11.1906	10.8296	11.1906	10.8296	11.1906	11.1906	10.8296	11.1906	10.8296	11.1906 (331)
Lighting	15.4303	12.3788	11.1457	8.1658	6.3075	5.1533	5.7539	7.4792	9.7147	12.7462	14.3968	15.8592 (332)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000 (333a)											
(333a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000 (334a)											
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000 (335a)											
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000 (333b)											
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000 (334b)											
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000 (335b)											
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year												
Space heating fuel - community heating												941.1279 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												2704.2289 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												9.4113 (313)
Space cooling fuel												0.0000 (321)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.6000, SFP = 0.8000)												
mechanical ventilation fans (SFP = 0.8000)												131.7600 (330a)
Total electricity for the above, kWh/year												131.7600 (331)
Electricity for lighting (calculated in Appendix L)												124.5314 (332)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (333)
Wind generation												0.0000 (334)
Hydro-electric generation (Appendix N)												0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (335)
Appendix Q - special features												
Energy saved or generated												-0.0000 (336)
Energy used												0.0000 (337)

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Total delivered energy for all uses

3901.6483 (338)

 12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			92.3000 (367)
Space and Water heating from Boilers	3949.4657	0.2100	214.1245 (367)
Electrical energy for heat distribution (space & water)	9.4113	0.0000	5.2687 (372)
Overall CO2 factor for heat network			0.2290 (386)
Total CO2 associated with community systems			834.6565 (373)
Space and water heating			834.6565 (376)
Pumps, fans and electric keep-hot	131.7600	0.1387	18.2767 (378)
Energy for lighting	124.5314	0.1443	17.9737 (379)
Total CO2, kg/year			870.9070 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			17.4200 (384)

 13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Boilers			92.3000 (467a)
Space and Water heating from Boilers	3949.4657	1.1300	1152.1935 (467)
Electrical energy for heat distribution (space & water)	9.4113	0.0000	55.9416 (472)
Overall CO2 factor for heat network			1.2396 (486)
Total CO2 associated with community systems			4518.8379 (473)
Space and water heating			4518.8379 (476)
Pumps, fans and electric keep-hot	131.7600	1.5128	199.3265 (478)
Energy for lighting	124.5314	1.5338	191.0104 (479)
Total Primary energy kWh/year			4909.1748 (483)
Dwelling Primary energy Rate (DPER)			98.1800 (484)

 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)
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
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3981 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3086 (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	0.3934	0.3857	0.3780	0.3394	0.3317	0.2931	0.2931	0.2854	0.3086	0.3317	0.3471	0.3626 (22b)
Effective ac	0.5774	0.5744	0.5714	0.5576	0.5550	0.5430	0.5430	0.5407	0.5476	0.5550	0.5603	0.5657 (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			1.8800	1.0000	1.8800		(26)
TER Opening Type (Uw = 1.20)			10.6200	1.1450	12.1603		(27)
External Wall	35.1000	10.6200	24.4800	0.1800	4.4064		(29a)
Sheltered Wall	19.9800	1.8800	18.1000	0.1800	3.2580		(29a)

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Total net area of external elements Aum(A, m2)	55.0800			(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	21.7047		(33)
Party Wall	35.8200	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 57.3440 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	6.0000	0.0500	0.3000
E4 Jamb	18.6000	0.0500	0.9300
E7 Party floor between dwellings (in blocks of flats)	37.3500	0.0700	2.6145
E18 Party wall between dwellings	10.8000	0.0600	0.6480
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	26.5400	0.0000	0.0000
E8 Balcony within a dwelling, wall insulation continuous	3.4500	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			4.4925 (36)
Point Thermal bridges			0.0000 (36a) =
Total fabric heat loss			(33) + (36) + (36a) = 26.1972 (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	25.7227	25.5888	25.4576	24.8412	24.7259	24.1891	24.1891	24.0897	24.3959	24.7259	24.9592	25.2031 (38)
Average = Sum(39)m / 12 =	51.9199	51.7860	51.6548	51.0384	50.9231	50.3863	50.3863	50.2869	50.5931	50.9231	51.1564	51.4003 (39)
												51.0379

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0384	1.0357	1.0331	1.0208	1.0185	1.0077	1.0077	1.0057	1.0119	1.0185	1.0231	1.0280 (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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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)

Daily hot water use	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)
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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)
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Primary loss 22.5120 (59)

23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
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Combi loss 0.0000 (61)

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)
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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)
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WWHRS -23.5819 (63a)

-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)
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PV diverter -0.0000 (63b)

-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)
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Solar input 0.0000 (63c)

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)
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FGHRS 0.0000 (63d)

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)
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Output from w/h 190.4575 (64)

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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Total per year (kWh/year) 1962.4258 (64)

Electric shower(s) 1962 (64)

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 92.9512 (65)

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

(66)m	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

74.4107	82.3832	74.4107	76.8910	74.4107	76.8910	74.4107	74.4107	74.4107	76.8910	74.4107	76.8910	74.4107 (67)
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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)
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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)
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Pumps, fans 3.0000 (70)

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)
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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)
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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)
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Total internal gains 391.4342 (73)

398.9876	406.5305	390.9364	376.9535	359.0632	343.5266	331.2988	332.4565	341.9357	356.5245	377.2760	391.4342 (73)
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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	10.6200	19.6403	0.6300	0.7000	0.7700	63.7446 (76)

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Solar gains	63.7446	124.6980	205.3599	299.5052	367.0548	375.7459	357.7254	307.2809	238.8421	147.9647	79.4821	52.4205 (83)
Total gains	462.7322	531.2285	596.2963	676.4586	726.1180	719.2726	689.0242	639.7374	580.7777	504.4892	456.7581	443.8547 (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	15.3399	15.3795	15.4186	15.6048	15.6401	15.8068	15.8068	15.8380	15.7422	15.6401	15.5688	15.4949
alpha	2.0227	2.0253	2.0279	2.0403	2.0427	2.0538	2.0538	2.0559	2.0495	2.0427	2.0379	2.0330
util living area	0.8460	0.8043	0.7425	0.6401	0.5220	0.3962	0.2998	0.3317	0.4939	0.6875	0.8037	0.8551 (86)
MIT	18.2483	18.6451	19.2233	19.9226	20.4474	20.7798	20.9112	20.8877	20.6350	19.9319	18.9946	18.1852 (87)
Th 2	20.0515	20.0537	20.0558	20.0661	20.0680	20.0769	20.0769	20.0786	20.0735	20.0680	20.0641	20.0601 (88)
util rest of house	0.8329	0.7884	0.7218	0.6122	0.4851	0.3487	0.2427	0.2727	0.4446	0.6560	0.7853	0.8428 (89)
MIT 2	16.8711	17.3583	18.0656	18.9088	19.5186	19.8889	20.0173	19.9999	19.7450	18.9435	17.8050	16.7965 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.5597	18.0017	18.6445	19.4157	19.9830	20.3343	20.4642	20.4438	20.1900	19.4377	18.3998	17.4908 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.5597	18.0017	18.6445	19.4157	19.9830	20.3343	20.4642	20.4438	20.1900	19.4377	18.3998	17.4908 (93)

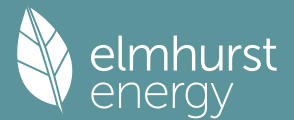
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.7900	0.7472	0.6866	0.5911	0.4816	0.3623	0.2671	0.2967	0.4511	0.6323	0.7459	0.8002 (94)
Useful gains	365.5664	396.9139	409.3978	399.8273	349.7053	260.6254	184.0584	189.7966	261.9812	319.0061	340.7029	355.1723 (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	688.4414	678.4844	627.3194	536.7043	421.7971	288.9314	194.7037	203.3510	308.1115	450.0443	578.0577	683.1533 (97)
Space heating kWh	240.2190	189.2153	162.1336	98.5515	53.6363	0.0000	0.0000	0.0000	0.0000	97.4924	170.8955	244.0178 (98a)
Space heating requirement - total per year (kWh/year)												1256.1614
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	240.2190	189.2153	162.1336	98.5515	53.6363	0.0000	0.0000	0.0000	0.0000	97.4924	170.8955	244.0178 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1256.1614
Space heating per m2												(98c) / (4) = 25.1232 (99)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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	240.2190	189.2153	162.1336	98.5515	53.6363	0.0000	0.0000	0.0000	0.0000	97.4924	170.8955	244.0178 (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)	260.2589	205.0004	175.6594	106.7730	58.1109	0.0000	0.0000	0.0000	0.0000	105.6256	185.1522	264.3747 (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)
Efficiency of water heater (217)m	84.5590	84.2971	83.8097	82.9978	81.9183	79.8000	79.8000	79.8000	79.8000	82.9474	84.0472	79.8000 (216)
Fuel for water heating, kWh/month	227.5073	201.9719	216.3642	193.6100	191.1491	177.9421	176.5248	182.9609	184.3137	196.4055	204.4788	225.0829 (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	15.4611	12.4034	11.1679	8.1821	6.3201	5.1636	5.7654	7.4941	9.7341	12.7716	14.4255	15.8908 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-8.3410	-12.7511	-19.8583	-24.2592	-27.9135	-26.7188	-26.4061	-24.0482	-20.2197	-15.4015	-9.5184	-7.1012 (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)	-2.1176	-4.6136	-9.4730	-14.6839	-19.8675	-20.1193	-19.8717	-16.6074	-11.8988	-6.7319	-2.8698	-1.6623 (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												1360.9549 (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												2378.3112 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												86.0000 (231)

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Electricity for lighting (calculated in Appendix L)	124.7797 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-353.0536 (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	3596.9922 (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	1360.9549	0.2100	285.8005 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2378.3112	0.2100	499.4454 (264)
Space and water heating			785.2459 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	124.7797	0.1443	18.0096 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-222.5368	0.1329	-29.5786
PV Unit electricity exported	-130.5168	0.1250	-16.3146
Total			-45.8932 (269)
Total CO2, kg/year			769.2915 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.3900 (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	1360.9549	1.1300	1537.8791 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2378.3112	1.1300	2687.4917 (278)
Space and water heating			4225.3707 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	124.7797	1.5338	191.3912 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-222.5368	1.4911	-331.8329
PV Unit electricity exported	-130.5168	0.4588	-59.8803
Total			-391.7133 (283)
Total Primary energy kWh/year			4155.1495 (286)
Target Primary Energy Rate (TPER)			83.1000 (287)

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Property Reference	1B2P Top Floor		Issued on Date	24/11/2023	
Assessment Reference	Be Green	Prop Type Ref			
Property					
SAP Rating	82 B	DER	4.69	TER	16.07
Environmental	97 A	% DER < TER			70.82
CO ₂ Emissions (t/year)	0.21	DFEE	36.40	TFEE	37.71
Compliance Check	See BREL	% DFEE < TFEE			3.48
% DPER < TPER	42.88	DPER	49.21	TPER	86.16
Assessor Details	Mr. Michael Woodbridge			Assessor ID	M818-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												81.0000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2432	0.2403	0.2374	0.2229	0.2200	0.2054	0.2054	0.2025	0.2112	0.2200	0.2258	0.2316 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening			1.9800	1.2000	2.2560		(26)
Glazing (Uw = 1.20)			12.2400	1.1450	14.0153		(27)
External Wall	35.1000	12.2400	22.8600	0.1600	3.6576	70.0000	1600.2000 (29a)
Sheltered Wall	19.9800	1.8800	18.1000	0.1600	2.8960	70.0000	1267.0000 (29a)
External Roof 1	50.0000		50.0000	0.1000	5.0000	9.0000	450.0000 (30)
Total net area of external elements Aum(A, m ²)			105.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.8249		(33)
Party Wall			35.8200	0.0000	0.0000	0.0000	0.0000 (32)
Party Floor 1			50.0000			0.0000	0.0000 (32d)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		3317.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							66.3440 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate				6.0000	0.0500	0.3000	

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E4 Jamb							18.6000	0.0500	0.9300			
E7 Party floor between dwellings (in blocks of flats)							16.9500	0.1000	1.6950			
E18 Party wall between dwellings							10.8000	0.0600	0.6480			
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)							13.2700	0.0000	0.0000			
E8 Balcony within a dwelling, wall insulation continuous							3.4500	0.0000	0.0000			
P4 Party wall - Roof (insulation at ceiling level)							13.2700	0.0000	0.0000			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												3.5730 (36)
Point Thermal bridges												0.0000
Total fabric heat loss										(33) + (36) + (36a) =		31.3979 (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	10.8354	10.7059	10.5764	9.9291	9.7996	9.1522	9.1522	9.0228	9.4112	9.7996	10.0586	10.3175 (38)
Average = Sum(39)m / 12 =												41.2946
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8447	0.8421	0.8395	0.8265	0.8239	0.8110	0.8110	0.8084	0.8162	0.8239	0.8291	0.8343 (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													0.0000 (42a)
Hot water usage for baths													59.1446 (42b)
Hot water usage for other uses													31.9383 (42c)
Average daily hot water use (litres/day)													83.9195 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	91.1299	89.0750	86.6424	83.5774	80.7004	77.1773	75.3856	78.7380	81.0492	84.5507	88.1451	91.0829 (44)	
Energy content (annual)	134.1589	117.8642	123.8102	109.1730	103.9906	89.2530	83.3033	92.6760	94.0131	108.9521	119.1310	133.7620 (45)	
Distribution loss (46)m = 0.15 x (45)m													1310.0875
Water storage loss:	20.1238	17.6796	18.5715	16.3759	15.5986	13.3880	12.4955	13.9014	14.1020	16.3428	17.8696	20.0643 (46)	
Store volume													110.0000 (47)
b) If manufacturer declared loss factor is not known : Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0152 (51)
Volume factor from Table 2a													1.0294 (52)
Temperature factor from Table 2b													0.6000 (53)
Enter (49) or (54) in (55)													1.0327 (55)
Total storage loss	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)	
If cylinder contains dedicated solar storage	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (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	189.4357	167.7916	179.0870	162.6667	159.2675	142.7467	138.5801	147.9528	147.5067	164.2289	172.6247	189.0388 (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	189.4357	167.7916	179.0870	162.6667	159.2675	142.7467	138.5801	147.9528	147.5067	164.2289	172.6247	189.0388 (64)	
12Total per year (kWh/year)													1960.9273 (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	88.8293	79.1318	85.3883	79.0950	78.7983	72.4716	71.9198	75.0362	74.0543	80.4480	82.4060	88.6973 (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	74.2626	82.2193	74.2626	76.7380	74.2626	76.7380	74.2626	74.2626	76.7380	74.2626	76.7380	74.2626 (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	119.3942	117.7556	114.7693	109.8541	105.9117	100.6550	96.6664	100.8551	102.8532	108.1291	114.4528	119.2168 (72)	
	389.2423	397.0883	382.2951	371.6590	354.8948	342.3892	329.4289	332.0898	340.4133	351.4102	370.5557	382.5685 (73)	

6. Solar gains

[Jan]													
		Area		Solar flux		g		FF		Access		Gains	
		m2		Table 6a		W/m2		or Table 6c		factor		W	
East		12.2400		19.6403		0.4500		0.8000		0.7700		59.9742 (76)	
Solar gains	59.9742	117.3223	193.2131	281.7897	345.3439	353.5209	336.5663	289.1055	224.7148	139.2127	74.7808	49.3199 (83)	
Total gains	449.2165	514.4105	575.5082	653.4487	700.2387	695.9101	665.9952	621.1953	565.1281	490.6229	445.3365	431.8884 (84)	

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Energy used 0.0000 (337)
 Total delivered energy for all uses 3485.0533 (338)

 12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			220.0000 (367)
Space and Water heating from Heat pump			76.4545 (367)
Electrical energy for heat distribution (space & water)	1605.9069	0.1555	5.1283 (372)
Overall CO2 factor for heat network	10.8184	0.0000	0.0674 (386)
Total CO2 associated with community systems			238.2322 (373)
Space and water heating			238.2322 (376)
Pumps, fans and electric keep-hot	131.7600	0.1387	18.2767 (378)
Energy for lighting	124.5314	0.1443	17.9737 (379)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-304.2334	0.1316	-40.0285
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-40.0285 (380)
Total CO2, kg/year			234.4542 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.6900 (384)

 13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			220.0000 (467a)
Space and Water heating from Heat pump			774.7878 (467)
Electrical energy for heat distribution (space & water)	1605.9069	1.5756	54.2997 (472)
Overall CO2 factor for heat network	10.8184	0.0000	0.7140 (486)
Total CO2 associated with community systems			2522.4656 (473)
Space and water heating			2522.4656 (476)
Pumps, fans and electric keep-hot	131.7600	1.5128	199.3265 (478)
Energy for lighting	124.5314	1.5338	191.0104 (479)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-304.2334	1.4861	-452.1206
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-452.1206 (480)
Total Primary energy kWh/year			2460.6819 (483)
Dwelling Primary energy Rate (DPER)			49.2100 (484)

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

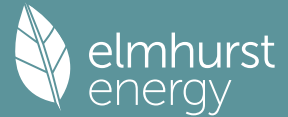
 1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000	2.7000 (2b)	135.0000 (1b) - (3b)
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)
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	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3981	(18)
Number of sides sheltered	3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3086 (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	0.3934 0.3857 0.3780 0.3394 0.3317 0.2931 0.2931 0.2854 0.3086 0.3317 0.3471 0.3626	(22b)
Effective ac	0.5774 0.5744 0.5714 0.5576 0.5550 0.5430 0.5430 0.5407 0.5476 0.5550 0.5603 0.5657	(25)

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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
TER Opaque door			1.8800	1.0000	1.8800		(26)
TER Opening Type (Uw = 1.20)			10.6200	1.1450	12.1603		(27)
External Wall	35.1000	10.6200	24.4800	0.1800	4.4064		(29a)
Sheltered Wall	19.9800	1.8800	18.1000	0.1800	3.2580		(29a)
External Roof 1	50.0000		50.0000	0.1100	5.5000		(30)
Total net area of external elements Aum(A, m ²)			105.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.2047		(33)
Party Wall			35.8200	0.0000	0.0000		(32)

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

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	6.0000	0.0500	0.3000
E4 Jamb	18.6000	0.0500	0.9300
E7 Party floor between dwellings (in blocks of flats)	16.9500	0.0700	1.1865
E18 Party wall between dwellings	10.8000	0.0600	0.6480
E3 Party wall - Intermediate floor between dwellings (in blocks of flats)	13.2700	0.0000	0.0000
E8 Balcony within a dwelling, wall insulation continuous	3.4500	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	13.2700	0.1200	1.5924

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

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 31.8616 (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	25.7227	25.5888	25.4576	24.8412	24.7259	24.1891	24.1891	24.0897	24.3959	24.7259	24.9592	25.2031
Average = Sum(39)m / 12 =	57.5843	57.4504	57.3192	56.7028	56.5875	56.0507	56.0507	55.9513	56.2575	56.5875	56.8208	57.0647

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1517	1.1490	1.1464	1.1341	1.1318	1.1210	1.1210	1.1190	1.1251	1.1318	1.1364	1.1413
HLP (average)												1.1340
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hot water usage for baths	60.5412	59.6421	58.3759	56.0413	54.2933	52.3549	51.3079	52.5652	53.9342	56.0083	58.3909	60.3365
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
Average daily hot water use (litres/day)												

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	146.4649	128.7554	135.2396	115.6701	109.8304	96.5080	93.6561	98.8808	101.5930	116.1907	127.0359	144.4801
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	21.9697	19.3133	20.2859	17.3505	16.4746	14.4762	14.0484	14.8321	15.2390	17.4286	19.0554	21.6720
Total = Sum(45)m =												1414.3051

Water storage loss:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Store volume												150.0000
a) If manufacturer declared loss factor is known (kWh/day):												1.3938
Temperature factor from Table 2b												0.5400
Enter (49) or (54) in (55)												0.7527

Total storage loss	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
If cylinder contains dedicated solar storage												
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total heat required for water heating calculated for each month	193.0598	170.8411	181.8345	160.7619	156.4254	141.5999	140.2510	145.4757	146.6849	162.7856	172.1278	191.0750
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Output from w/h	193.0598	170.8411	181.8345	160.7619	156.4254	141.5999	140.2510	145.4757	146.6849	162.7856	172.1278	191.0750
Total per year (kWh/year)												
12Total per year (kWh/year) = Sum(64)m =												1962.9225

Electric shower(s)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000
Heat gains from water heating, kWh/month	85.9755	76.4798	82.2431	74.5338	73.7945	68.1624	68.4166	70.1538	69.8532	75.9093	78.3129	85.3155

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
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.4107	82.3832	74.4107	76.8910	74.4107	76.8910	74.4107	74.4107	76.8910	74.4107	76.8910	74.4107
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
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
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
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
Water heating gains (Table 5)	115.5585	113.8092	110.5418	103.5191	99.1862	94.6700	91.9578	94.2927	97.0183	102.0287	108.7679	114.6714
Total internal gains	388.5546	396.3057	381.2156	368.4770	351.3173	336.5572	324.8683	325.6755	334.7314	348.4578	368.0239	381.1712

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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	10.6200	19.6403	0.6300	0.7000	0.7700	63.7446 (76)						
Solar gains	63.7446	124.6980	205.3599	299.5052	367.0548	375.7459	357.7254	307.2809	238.8421	147.9647	79.4821	52.4205 (83)
Total gains	452.2992	521.0037	586.5755	667.9822	718.3721	712.3032	682.5938	632.9563	573.5735	496.4225	447.5060	433.5917 (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	16.0017	16.0389	16.0757	16.2504	16.2835	16.4395	16.4395	16.4687	16.3791	16.2835	16.2167	16.1474
alpha	2.0668	2.0693	2.0717	2.0834	2.0856	2.0960	2.0960	2.0979	2.0919	2.0856	2.0811	2.0765
util living area	0.8764	0.8392	0.7825	0.6847	0.5667	0.4362	0.3328	0.3677	0.5389	0.7314	0.8392	0.8845 (86)
MIT	18.1114	18.5049	19.0939	19.8221	20.3858	20.7513	20.8991	20.8723	20.5911	19.8379	18.8690	18.0475 (87)
Th 2	19.9588	19.9610	19.9631	19.9731	19.9750	19.9837	19.9837	19.9853	19.9803	19.9750	19.9712	19.9673 (88)
util rest of house	0.8638	0.8235	0.7613	0.6545	0.5250	0.3802	0.2639	0.2969	0.4823	0.6981	0.8209	0.8727 (89)
MIT 2	16.6313	17.1169	17.8405	18.7210	19.3760	19.7794	19.9207	19.9016	19.6231	18.7654	17.5835	16.5553 (90)
Living area fraction	FLA = Living area / (4) = 0.5000 (91)											
MIT	17.3714	17.8109	18.4672	19.2715	19.8809	20.2653	20.4099	20.3869	20.1071	19.3017	18.2262	17.3014 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.3714	17.8109	18.4672	19.2715	19.8809	20.2653	20.4099	20.3869	20.1071	19.3017	18.2262	17.3014 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8237	0.7835	0.7255	0.6318	0.5210	0.3963	0.2935	0.3258	0.4898	0.6732	0.7827	0.8333 (94)
Useful gains	372.5811	408.2124	425.5832	422.0190	374.2378	282.2899	200.3397	206.2064	280.9307	334.1723	350.2785	361.3091 (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	752.7054	741.7354	685.9527	588.0943	462.9354	317.5463	213.5479	223.0739	337.9459	492.4058	632.2020	747.6284 (97)
Space heating kWh	282.8125	224.1275	193.7149	119.5742	65.9910	0.0000	0.0000	0.0000	0.0000	117.7257	202.9849	287.4216 (98a)
Space heating requirement - total per year (kWh/year)	1494.3523											
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	282.8125	224.1275	193.7149	119.5742	65.9910	0.0000	0.0000	0.0000	0.0000	117.7257	202.9849	287.4216 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1494.3523											
Space heating per m2	(98c) / (4) = 29.8870 (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	282.8125	224.1275	193.7149	119.5742	65.9910	0.0000	0.0000	0.0000	0.0000	117.7257	202.9849	287.4216 (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)	306.4057	242.8250	209.8753	129.5495	71.4962	0.0000	0.0000	0.0000	0.0000	127.5468	219.9186	311.3993 (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	193.0598	170.8411	181.8345	160.7619	156.4254	141.5999	140.2510	145.4757	146.6849	162.7856	172.1278	191.0750 (64)
Efficiency of water heater (217)m	84.9147	84.6696	84.2020	83.4056	82.2741	79.8000	79.8000	79.8000	79.8000	83.3451	84.4305	79.8000 (216)
Fuel for water heating, kWh/month	227.3573	201.7740	215.9504	192.7471	190.1272	177.4434	175.7531	182.3004	183.8156	195.3151	203.8691	224.8652 (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	15.4611	12.4034	11.1679	8.1821	6.3201	5.1636	5.7654	7.4941	9.7341	12.7716	14.4255	15.8908 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-11.1921	-16.8466	-25.8400	-31.0772	-35.3303	-33.6675	-33.2750	-30.5091	-25.9536	-20.1440	-12.6830	-9.5570 (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	-3.4498	-7.4638	-15.2239	-23.4431	-31.5631	-31.9058	-31.5138	-26.4087	-19.0123	-10.8428	-4.6606	-2.7118 (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)												

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(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												1619.0166	(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												2371.3179	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												124.7797	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-494.2751	(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												3706.8391	(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	1619.0166	0.2100	339.9935	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2371.3179	0.2100	497.9768	(264)
Space and water heating			837.9702	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	124.7797	0.1443	18.0096	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-286.0755	0.1332	-38.1104	
PV Unit electricity exported	-208.1996	0.1252	-26.0637	
Total			-64.1742	(269)
Total CO2, kg/year			803.7349	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			16.0700	(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	1619.0166	1.1300	1829.4888	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2371.3179	1.1300	2679.5893	(278)
Space and water heating			4509.0780	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	124.7797	1.5338	191.3912	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-286.0755	1.4923	-426.9027	
PV Unit electricity exported	-208.1996	0.4595	-95.6649	
Total			-522.5677	(283)
Total Primary energy kWh/year			4308.0024	(286)
Target Primary Energy Rate (TPER)			86.1600	(287)

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Property Reference	1B2P Top Floor		Issued on Date	24/11/2023	
Assessment Reference	Be Lean	Prop Type Ref			
Property					
SAP Rating	82 B	DER	16.90	TER	16.07
Environmental	88 B	% DER < TER	-5.16		
CO ₂ Emissions (t/year)	0.79	DFEE	36.40	TFEE	37.71
Compliance Check	See BREL	% DFEE < TFEE	3.48		
% DPER < TPER	-10.72	DPER	95.40	TPER	86.16
Assessor Details	Mr. Michael Woodbridge			Assessor ID	M818-0001
Client					

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

1. Overall dwelling characteristics

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

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (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)
Balanced mechanical ventilation with heat recovery	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366 (22b)
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) =												81.0000 (23c)
Effective ac	0.2432	0.2403	0.2374	0.2229	0.2200	0.2054	0.2054	0.2025	0.2112	0.2200	0.2258	0.2316 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening			1.9800	1.2000	2.2560		(26)
Glazing (Uw = 1.20)			12.2400	1.1450	14.0153		(27)
External Wall	35.1000	12.2400	22.8600	0.1600	3.6576	70.0000	1600.2000 (29a)
Sheltered Wall	19.9800	1.8800	18.1000	0.1600	2.8960	70.0000	1267.0000 (29a)
External Roof 1	50.0000		50.0000	0.1000	5.0000	9.0000	450.0000 (30)
Total net area of external elements Aum(A, m ²)			105.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.8249		(33)
Party Wall			35.8200	0.0000	0.0000	0.0000	0.0000 (32)
Party Floor 1			50.0000			0.0000	0.0000 (32d)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		3317.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							66.3440 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate				6.0000	0.0500	0.3000	

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E4 Jamb								18.6000	0.0500	0.9300		
E7 Party floor between dwellings (in blocks of flats)								16.9500	0.1000	1.6950		
E18 Party wall between dwellings								10.8000	0.0600	0.6480		
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)								13.2700	0.0000	0.0000		
E8 Balcony within a dwelling, wall insulation continuous								3.4500	0.0000	0.0000		
P4 Party wall - Roof (insulation at ceiling level)								13.2700	0.0000	0.0000		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)											3.5730 (36)	
Point Thermal bridges											0.0000	
Total fabric heat loss									(33) + (36) + (36a) =		31.3979 (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	10.8354	10.7059	10.5764	9.9291	9.7996	9.1522	9.1522	9.0228	9.4112	9.7996	10.0586	10.3175 (38)
Average = Sum(39)m / 12 =												41.2946
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8447	0.8421	0.8395	0.8265	0.8239	0.8110	0.8110	0.8084	0.8162	0.8239	0.8291	0.8343 (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													0.0000 (42a)
Hot water usage for baths	59.1916	58.2980	57.0269	55.1233	53.4077	51.0460	49.2542	51.4452	52.5951	54.9352	57.3681	59.1446 (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)													83.9195 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	91.1299	89.0750	86.6424	83.5774	80.7004	77.1773	75.3856	78.7380	81.0492	84.5507	88.1451	91.0829 (44)	
Energy content (annual)	134.1589	117.8642	123.8102	109.1730	103.9906	89.2530	83.3033	92.6760	94.0131	108.9521	119.1310	133.7620 (45)	
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =			1310.0875
Water storage loss:	20.1238	17.6796	18.5715	16.3759	15.5986	13.3880	12.4955	13.9014	14.1020	16.3428	17.8696	20.0643 (46)	
Store volume													110.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0152 (51)
Volume factor from Table 2a													1.0294 (52)
Temperature factor from Table 2b													0.6000 (53)
Enter (49) or (54) in (55)													1.0327 (55)
Total storage loss													
If cylinder contains dedicated solar storage	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)	
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	189.4357	167.7916	179.0870	162.6667	159.2675	142.7467	138.5801	147.9528	147.5067	164.2289	172.6247	189.0388 (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	189.4357	167.7916	179.0870	162.6667	159.2675	142.7467	138.5801	147.9528	147.5067	164.2289	172.6247	189.0388 (64)	
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =			1960.9273 (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	88.8293	79.1318	85.3883	79.0950	78.7983	72.4716	71.9198	75.0362	74.0543	80.4480	82.4060	88.6973 (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	74.2626	82.2193	74.2626	76.7380	74.2626	76.7380	74.2626	74.2626	76.7380	74.2626	76.7380	74.2626 (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)	119.3942	117.7556	114.7693	109.8541	105.9117	100.6550	96.6664	100.8551	102.8532	108.1291	114.4528	119.2168 (72)
Total internal gains	389.2423	397.0883	382.2951	371.6590	354.8948	342.3892	329.4289	332.0898	340.4133	351.4102	370.5557	382.5685 (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	12.2400	19.6403	0.4500	0.8000	0.7700	59.9742 (76)
Solar gains	59.9742	117.3223	193.2131	281.7897	345.3439	353.5209
Total gains	449.2165	514.4105	575.5082	653.4487	700.2387	695.9101
						336.5663
						289.1055
						224.7148
						139.2127
						74.7808
						49.3199 (83)
						431.8884 (84)

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Energy used 0.0000 (337)
 Total delivered energy for all uses 3789.2866 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			92.3000 (367)
Space and Water heating from Boilers	3827.7305	0.2100	246.1382 (367)
Electrical energy for heat distribution (space & water)	10.8184	0.0000	5.1283 (372)
Overall CO2 factor for heat network			0.2290 (386)
Total CO2 associated with community systems			808.9517 (373)
Space and water heating			808.9517 (376)
Pumps, fans and electric keep-hot	131.7600	0.1387	18.2767 (378)
Energy for lighting	124.5314	0.1443	17.9737 (379)
Total CO2, kg/year			845.2022 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			16.9000 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Boilers			92.3000 (467a)
Space and Water heating from Boilers	3827.7305	1.1300	1324.4582 (467)
Electrical energy for heat distribution (space & water)	10.8184	0.0000	54.2997 (472)
Overall CO2 factor for heat network			1.2396 (486)
Total CO2 associated with community systems			4379.6351 (473)
Space and water heating			4379.6351 (476)
Pumps, fans and electric keep-hot	131.7600	1.5128	199.3265 (478)
Energy for lighting	124.5314	1.5338	191.0104 (479)
Total Primary energy kWh/year			4769.9721 (483)
Dwelling Primary energy Rate (DPER)			95.4000 (484)

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)	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)
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	
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3981 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3086 (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	0.3934	0.3857	0.3780	0.3394	0.3317	0.2931	0.2931	0.2854	0.3086	0.3317	0.3471	0.3626 (22b)
Effective ac	0.5774	0.5744	0.5714	0.5576	0.5550	0.5430	0.5430	0.5407	0.5476	0.5550	0.5603	0.5657 (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			1.8800	1.0000	1.8800		(26)
TER Opening Type (Uw = 1.20)			10.6200	1.1450	12.1603		(27)
External Wall	35.1000	10.6200	24.4800	0.1800	4.4064		(29a)

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Sheltered Wall	19.9800	1.8800	18.1000	0.1800	3.2580	(29a)
External Roof 1	50.0000		50.0000	0.1100	5.5000	(30)
Total net area of external elements Aum(A, m2)			105.0800			(31)
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		27.2047	(33)
Party Wall			35.8200	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 66.3440 (35)

List of Thermal Bridges				
K1 Element		Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate		6.0000	0.0500	0.3000
E4 Jamb		18.6000	0.0500	0.9300
E7 Party floor between dwellings (in blocks of flats)		16.9500	0.0700	1.1865
E18 Party wall between dwellings		10.8000	0.0600	0.6480
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)		13.2700	0.0000	0.0000
E8 Balcony within a dwelling, wall insulation continuous		3.4500	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)		13.2700	0.1200	1.5924

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.6569 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 31.8616 (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
	25.7227	25.5888	25.4576	24.8412	24.7259	24.1891	24.1891	24.0897	24.3959	24.7259	24.9592	25.2031 (38)
Heat transfer coeff	57.5843	57.4504	57.3192	56.7028	56.5875	56.0507	56.0507	55.9513	56.2575	56.5875	56.8208	57.0647 (39)
Average = Sum(39)m / 12 =												56.7023

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1.1517	1.1490	1.1464	1.1341	1.1318	1.1210	1.1210	1.1190	1.1251	1.1318	1.1364	1.1413 (40)
HLP (average)												1.1340
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	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 (42a)
Hot water usage for baths	60.5412	59.6421	58.3759	56.0413	54.2933	52.3549	51.3079	52.5652	53.9342	56.0083	58.3909	60.3365	(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)													85.1660 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	92.4795	90.4190	87.9914	84.4955	81.5860	78.4863	77.4393	79.8580	82.3883	85.6238	89.1678	92.2748 (44)	
Energy conte	146.4649	128.7554	135.2396	115.6701	109.8304	96.5080	93.6561	98.8808	101.5930	116.1907	127.0359	144.4801 (45)	
Energy content (annual)										Total = Sum(45)m =		1414.3051	
Distribution loss (46)m = 0.15 x (45)m	21.9697	19.3133	20.2859	17.3505	16.4746	14.4762	14.0484	14.8321	15.2390	17.4286	19.0554	21.6720 (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	193.0598	170.8411	181.8345	160.7619	156.4254	141.5999	140.2510	145.4757	146.6849	162.7856	172.1278	191.0750 (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	193.0598	170.8411	181.8345	160.7619	156.4254	141.5999	140.2510	145.4757	146.6849	162.7856	172.1278	191.0750 (64)	
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		1962.9225 (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	85.9755	76.4798	82.2431	74.5338	73.7945	68.1624	68.4166	70.1538	69.8532	75.9093	78.3129	85.3155 (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	74.4107	82.3832	74.4107	76.8910	74.4107	76.8910	74.4107	74.4107	76.8910	74.4107	76.8910	74.4107 (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)	115.5585	113.8092	110.5418	103.5191	99.1862	94.6700	91.9578	94.2927	97.0183	102.0287	108.7679	114.6714 (72)
Total internal gains	388.5546	396.3057	381.2156	368.4770	351.3173	336.5572	324.8683	325.6755	334.7314	348.4578	368.0239	381.1712 (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	

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East	10.6200	19.6403	0.6300	0.7000	0.7700	63.7446 (76)						
Solar gains	63.7446	124.6980	205.3599	299.5052	367.0548	375.7459	357.7254	307.2809	238.8421	147.9647	79.4821	52.4205 (83)
Total gains	452.2992	521.0037	586.5755	667.9822	718.3721	712.3032	682.5938	632.9563	573.5735	496.4225	447.5060	433.5917 (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	16.0017	16.0389	16.0757	16.2504	16.2835	16.4395	16.4395	16.4687	16.3791	16.2835	16.2167	16.1474
alpha	2.0668	2.0693	2.0717	2.0834	2.0856	2.0960	2.0960	2.0979	2.0919	2.0856	2.0811	2.0765
util living area	0.8764	0.8392	0.7825	0.6847	0.5667	0.4362	0.3328	0.3677	0.5389	0.7314	0.8392	0.8845 (86)
MIT	18.1114	18.5049	19.0939	19.8221	20.3858	20.7513	20.8991	20.8723	20.5911	19.8379	18.8690	18.0475 (87)
Th 2	19.9588	19.9610	19.9631	19.9731	19.9750	19.9837	19.9837	19.9853	19.9803	19.9750	19.9712	19.9673 (88)
util rest of house	0.8638	0.8235	0.7613	0.6545	0.5250	0.3802	0.2639	0.2969	0.4823	0.6981	0.8209	0.8727 (89)
MIT 2	16.6313	17.1169	17.8405	18.7210	19.3760	19.7794	19.9207	19.9016	19.6231	18.7654	17.5835	16.5553 (90)
Living area fraction												fLA = Living area / (4) = 0.5000 (91)
MIT	17.3714	17.8109	18.4672	19.2715	19.8809	20.2653	20.4099	20.3869	20.1071	19.3017	18.2262	17.3014 (92)
Temperature adjustment												0.0000
adjusted MIT	17.3714	17.8109	18.4672	19.2715	19.8809	20.2653	20.4099	20.3869	20.1071	19.3017	18.2262	17.3014 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8237	0.7835	0.7255	0.6318	0.5210	0.3963	0.2935	0.3258	0.4898	0.6732	0.7827	0.8333 (94)
Useful gains	372.5811	408.2124	425.5832	422.0190	374.2378	282.2899	200.3397	206.2064	280.9307	334.1723	350.2785	361.3091 (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	752.7054	741.7354	685.9527	588.0943	462.9354	317.5463	213.5479	223.0739	337.9459	492.4058	632.2020	747.6284 (97)
Space heating kWh	282.8125	224.1275	193.7149	119.5742	65.9910	0.0000	0.0000	0.0000	0.0000	117.7257	202.9849	287.4216 (98a)
Space heating requirement - total per year (kWh/year)												1494.3523
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	282.8125	224.1275	193.7149	119.5742	65.9910	0.0000	0.0000	0.0000	0.0000	117.7257	202.9849	287.4216 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1494.3523
Space heating per m2												(98c) / (4) = 29.8870 (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	282.8125	224.1275	193.7149	119.5742	65.9910	0.0000	0.0000	0.0000	0.0000	117.7257	202.9849	287.4216 (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)	306.4057	242.8250	209.8753	129.5495	71.4962	0.0000	0.0000	0.0000	0.0000	127.5468	219.9186	311.3993 (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	193.0598	170.8411	181.8345	160.7619	156.4254	141.5999	140.2510	145.4757	146.6849	162.7856	172.1278	191.0750 (64)
Efficiency of water heater (217)m	84.9147	84.6696	84.2020	83.4056	82.2741	79.8000	79.8000	79.8000	79.8000	83.3451	84.4305	79.8000 (216)
Fuel for water heating, kWh/month	227.3573	201.7740	215.9504	192.7471	190.1272	177.4434	175.7531	182.3004	183.8156	195.3151	203.8691	224.8652 (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	7.3041	7.3041	7.0685	7.3041 (231)
Lighting	15.4611	12.4034	11.1679	8.1821	6.3201	5.1636	5.7654	7.4941	9.7341	12.7716	14.4255	15.8908 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-11.1921	-16.8466	-25.8400	-31.0772	-35.3303	-33.6675	-33.2750	-30.5091	-25.9536	-20.1440	-12.6830	-9.5570 (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	-3.4498	-7.4638	-15.2239	-23.4431	-31.5631	-31.9058	-31.5138	-26.4087	-19.0123	-10.8428	-4.6606	-2.7118 (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												1619.0166 (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												2371.3179 (219)
Space cooling fuel												0.0000 (221)

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Electricity for pumps and fans:	
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	124.7797 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-494.2751 (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	3706.8391 (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	1619.0166	0.2100	339.9935 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2371.3179	0.2100	497.9768 (264)
Space and water heating			837.9702 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	124.7797	0.1443	18.0096 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-286.0755	0.1332	-38.1104
PV Unit electricity exported	-208.1996	0.1252	-26.0637
Total			-64.1742 (269)
Total CO2, kg/year			803.7349 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			16.0700 (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	1619.0166	1.1300	1829.4888 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2371.3179	1.1300	2679.5893 (278)
Space and water heating			4509.0780 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	124.7797	1.5338	191.3912 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-286.0755	1.4923	-426.9027
PV Unit electricity exported	-208.1996	0.4595	-95.6649
Total			-522.5677 (283)
Total Primary energy kWh/year			4308.0024 (286)
Target Primary Energy Rate (TPER)			86.1600 (287)

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Property Reference	2B4P First Floor		Issued on Date	24/11/2023	
Assessment Reference	Be Green	Prop Type Ref			
Property					
SAP Rating	82 B	DER	4.46	TER	15.38
Environmental	96 A	% DER < TER		71.00	
CO ₂ Emissions (t/year)	0.31	DFEE	39.02	TFEE	43.91
Compliance Check	See BREL	% DFEE < TFEE		11.14	
% DPER < TPER	43.47	DPER	46.67	TPER	82.57
Assessor Details	Mr. Michael Woodbridge			Assessor ID	M818-0001
Client					

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

1. Overall dwelling characteristics

Ground floor	Area (m ²)	77.0900 (1b)	Storey height (m)	2.7000 (2b)	Volume (m ³)	208.1430 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)		77.0900				208.1430 (4)
Dwelling volume						(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 208.1430 (5)

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (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)
Balanced mechanical ventilation with heat recovery	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366 (22b)
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) =												81.0000 (23c)
Effective ac	0.2432	0.2403	0.2374	0.2229	0.2200	0.2054	0.2054	0.2025	0.2112	0.2200	0.2258	0.2316 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening			1.8800	1.2000	2.2560		(26)
Glazing (Uw = 1.20)			18.7200	1.1450	21.4351		(27)
Heatloss Floor 1			77.0900	0.1000	7.7090		(28b)
External Wall	48.5100	18.7200	29.7900	0.1600	4.7664	70.0000	2085.3000 (29a)
Sheltered Wall	36.7700	1.8800	34.8900	0.1600	5.5824	70.0000	2442.3000 (29a)
Total net area of external elements Aum(A, m ²)			162.3700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.7489		(33)
Party Wall			19.9500	0.0000	0.0000	0.0000	0.0000 (32)
Party Ceiling 1			77.0900			0.0000	0.0000 (32b)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =		4527.6000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K						58.7314	(35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate				8.7000	0.0500	0.4350	

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E4 Jamb	28.1200	0.0500	1.4060
E7 Party floor between dwellings (in blocks of flats)	31.5900	0.1000	3.1590
E16 Corner (normal)	8.1000	0.0900	0.7290
E18 Party wall between dwellings	8.1000	0.0600	0.4860
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	14.7800	0.0000	0.0000
E20 Exposed floor (normal)	31.5900	0.1000	3.1590

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 51.1229 (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	16.7060	16.5064	16.3068	15.3087	15.1090	14.1109	14.1109	13.9113	14.5102	15.1090	15.5083	15.9075 (38)
Average = Sum(39)m / 12 =	67.8289	67.6293	67.4297	66.4316	66.2319	65.2338	65.2338	65.0342	65.6331	66.2319	66.6312	67.0304 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8799	0.8773	0.8747	0.8617	0.8592	0.8462	0.8462	0.8436	0.8514	0.8592	0.8643	0.8695 (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 2.4053 (42)

Hot water usage for mixer showers 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42a)

Hot water usage for baths 72.7664 71.6679 70.1053 67.7651 65.6560 62.7527 60.5500 63.2435 64.6571 67.5338 70.5248 72.7086 (42b)

Hot water usage for other uses 39.2630 37.8352 36.4075 34.9797 33.5520 32.1242 32.1242 33.5520 34.9797 36.4075 37.8352 39.2630 (42c)

Average daily hot water use (litres/day) 103.1653 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	112.0293	109.5031	106.5127	102.7448	99.2080	94.8769	92.6743	96.7955	99.6368	103.9413	108.3600	111.9716 (44)
Energy content (annual)	164.9265	144.8948	152.2045	134.2104	127.8395	109.7220	102.4078	113.9301	115.5737	133.9389	146.4521	164.4385 (45)
Distribution loss (46)m = 0.15 x (45)m	24.7390	21.7342	22.8307	20.1316	19.1759	16.4583	15.3612	17.0895	17.3361	20.0908	21.9678	24.6658 (46)

Water storage loss:
 Store volume 110.0000 (47)

b) If manufacturer declared loss factor is not known :
 Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
 Volume factor from Table 2a 1.0294 (52)
 Temperature factor from Table 2b 0.6000 (53)
 Enter (49) or (54) in (55) 1.0327 (55)

Total storage loss	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)
If cylinder contains dedicated solar storage	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (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	220.2033	194.8222	207.4813	187.7041	183.1163	163.2157	157.6846	169.2069	169.0674	189.2157	199.9458	219.7153 (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 220.2033 194.8222 207.4813 187.7041 183.1163 163.2157 157.6846 169.2069 169.0674 189.2157 199.9458 219.7153 (64)
 Total per year (kWh/year) = Sum(64)m = 2261.3786 (64)
 2261 (64)

12Total per year (kWh/year)
 Electric shower(s) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)
 Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	99.0595	88.1195	94.8294	87.4199	86.7281	79.2775	78.2720	82.1032	81.2232	88.7561	91.4903	98.8972 (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	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	107.5608	119.0852	107.5608	111.1462	107.5608	111.1462	107.5608	107.5608	111.1462	107.5608	111.1462	107.5608 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	213.2514	215.4643	209.8879	198.0164	183.0308	168.9464	159.5372	157.3243	162.9007	174.7722	189.7578	203.8422 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266 (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)	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131 (71)
Water heating gains (Table 5)	133.1445	131.1302	127.4589	121.4165	116.5700	110.1077	105.2044	110.3537	112.8100	119.2959	127.0698	132.9264 (72)
Total internal gains	513.0366	524.7596	503.9875	489.6590	466.2415	449.2802	431.3823	434.3188	445.9368	460.7088	487.0537	503.4093 (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	12.9600	10.6334	0.4500	0.8000	0.7700	34.3805 (74)
East	5.7600	19.6403	0.4500	0.8000	0.7700	28.2232 (76)

Solar gains	62.6037	120.9134	202.5692	311.9380	404.0902	424.9764	399.8330	327.6085	239.9820	143.7227	77.6038	51.8707 (83)
Total gains	575.6403	645.6730	706.5567	801.5971	870.3317	874.2566	831.2153	761.9274	685.9189	604.4315	564.6575	555.2800 (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	18.5417	18.5965	18.6515	18.9318	18.9888	19.2794	19.2794	19.3385	19.1621	18.9888	18.8750	18.7626
alpha	2.2361	2.2398	2.2434	2.2621	2.2659	2.2853	2.2853	2.2892	2.2775	2.2659	2.2583	2.2508
util living area	0.8781	0.8453	0.7945	0.6944	0.5681	0.4270	0.3248	0.3632	0.5430	0.7378	0.8405	0.8853 (86)
MIT	18.4789	18.8143	19.3220	19.9969	20.5060	20.8192	20.9302	20.9082	20.6720	20.0130	19.1701	18.4357 (87)
Th 2	20.1846	20.1869	20.1891	20.2001	20.2024	20.2135	20.2135	20.2157	20.2090	20.2024	20.1979	20.1935 (88)
util rest of house												
	0.8680	0.8328	0.7779	0.6704	0.5348	0.3835	0.2720	0.3084	0.4982	0.7113	0.8258	0.8757 (89)
MIT 2	17.2075	17.6269	18.2594	19.0901	19.6932	20.0513	20.1629	20.1465	19.8990	19.1283	18.0856	17.1578 (90)
Living area fraction	FLA = Living area / (4) =											
MIT	17.6198	18.0120	18.6040	19.3842	19.9568	20.3003	20.4117	20.3935	20.1496	19.4152	18.4373	17.5722 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.6198	18.0120	18.6040	19.3842	19.9568	20.3003	20.4117	20.3935	20.1496	19.4152	18.4373	17.5722 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8274	0.7920	0.7399	0.6435	0.5240	0.3885	0.2856	0.3212	0.4946	0.6817	0.7864	0.8359 (94)
Useful gains	476.3103	511.3787	522.7725	515.7956	456.0346	339.6175	237.3875	244.7106	339.2824	412.0433	444.0326	464.1598 (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												
	903.4690	886.7521	816.1706	696.4795	546.8661	371.8535	248.6538	259.7155	397.0570	583.8491	755.4187	896.3453 (97)
Space heating kWh	317.8061	252.2509	218.2882	130.0924	67.5786	0.0000	0.0000	0.0000	0.0000	127.8236	224.1980	321.5460 (98a)
Space heating requirement - total per year (kWh/year)	1659.5838											
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	317.8061	252.2509	218.2882	130.0924	67.5786	0.0000	0.0000	0.0000	0.0000	127.8236	224.1980	321.5460 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1659.5838											
Space heating per m2	(98c) / (4) =											21.5279 (99)
9b. Energy requirements												
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (301)
Fraction of space heat from community system												1.0000 (302)
Fraction of heat from community Heat pump-Space and Water												1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system												1.2500 (306)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating:												
Space heating requirement	317.8061	252.2509	218.2882	130.0924	67.5786	0.0000	0.0000	0.0000	0.0000	127.8236	224.1980	321.5460 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.25												
307a	397.2576	315.3137	272.8603	162.6155	84.4733	0.0000	0.0000	0.0000	0.0000	159.7794	280.2475	401.9324
Space heating requirement	397.2576	315.3137	272.8603	162.6155	84.4733	0.0000	0.0000	0.0000	0.0000	159.7794	280.2475	401.9324 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating												
Annual water heating requirement	220.2033	194.8222	207.4813	187.7041	183.1163	163.2157	157.6846	169.2069	169.0674	189.2157	199.9458	219.7153 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.25												
310a	275.2541	243.5278	259.3516	234.6301	228.8954	204.0196	197.1058	211.5086	211.3342	236.5196	249.9323	274.6441
Water heating fuel	275.2541	243.5278	259.3516	234.6301	228.8954	204.0196	197.1058	211.5086	211.3342	236.5196	249.9323	274.6441 (310)
Cooling System Energy Efficiency Ratio												0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	17.2536	15.5839	17.2536	16.6971	17.2536	16.6971	17.2536	17.2536	16.6971	17.2536	16.6971	17.2536 (331)
Lighting	22.3490	17.9292	16.1433	11.8272	9.1357	7.4640	8.3339	10.8327	14.0706	18.4614	20.8521	22.9702 (332)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333a)m	-9.3019	-15.9797	-28.3684	-38.2600	-46.2540	-45.0295	-44.1523	-38.7960	-30.2021	-20.3778	-11.0191	-7.6421 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year												
Space heating fuel - community heating												2074.4797 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												2826.7232 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												20.7448 (313)
Space cooling fuel												0.0000 (321)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.6000, SFP = 0.8000)												
mechanical ventilation fans (SFP = 0.8000)												203.1476 (330a)
Total electricity for the above, kWh/year												203.1476 (331)
Electricity for lighting (calculated in Appendix L)												180.3694 (332)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-335.3828 (333)
Wind generation												0.0000 (334)
Hydro-electric generation (Appendix N)												0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (335)
Appendix Q - special features												

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Energy saved or generated	-0.0000 (336)
Energy used	0.0000 (337)
Total delivered energy for all uses	4949.3370 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			220.0000 (367)
Space and Water heating from Heat pump	2227.8195	0.1547	145.8717 (367)
Electrical energy for heat distribution (space & water)	20.7448	0.0000	7.1870 (372)
Overall CO2 factor for heat network			0.0681 (386)
Total CO2 associated with community systems			333.8697 (373)
Space and water heating			333.8697 (376)
Pumps, fans and electric keep-hot	203.1476	0.1387	28.1791 (378)
Energy for lighting	180.3694	0.1443	26.0329 (379)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-335.3828	0.1312	-44.0052
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-44.0052 (380)
Total CO2, kg/year			344.0764 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.4600 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			220.0000 (467a)
Space and Water heating from Heat pump	2227.8195	1.5727	1482.9969 (467)
Electrical energy for heat distribution (space & water)	20.7448	0.0000	75.6015 (472)
Overall CO2 factor for heat network			0.7166 (486)
Total CO2 associated with community systems			3512.0335 (473)
Space and water heating			3512.0335 (476)
Pumps, fans and electric keep-hot	203.1476	1.5128	307.3216 (478)
Energy for lighting	180.3694	1.5338	276.6566 (479)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-335.3828	1.4847	-497.9541
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-497.9541 (480)
Total Primary energy kWh/year			3598.0576 (483)
Dwelling Primary energy Rate (DPER)			46.6700 (484)

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	77.0900 (1b)	x 2.7000 (2b)	= 208.1430 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 208.1430 (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) = 0.1441 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3941 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3055 (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	0.3895	0.3818	0.3742	0.3360	0.3284	0.2902	0.2902	0.2825	0.3055	0.3284	0.3436	0.3589 (22b)
Effective ac	0.5758	0.5729	0.5700	0.5564	0.5539	0.5421	0.5421	0.5399	0.5467	0.5539	0.5590	0.5644 (25)

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513.4443 525.0291 503.9135 486.9936 463.0966 444.0451 427.7168 428.3744 440.8862 458.3324 485.1876 502.9446 (73)

6. Solar gains

[Jan]												Gains W
	Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d			
North	12.0400		10.6334		0.6300		0.7000		0.7700		39.1264 (74)	
East	5.3500		19.6403		0.6300		0.7000		0.7700		32.1124 (76)	
Solar gains	71.2388	137.5913	230.5103	354.9667	459.8324	483.6009	454.9886	372.7995	273.0842	163.5467	88.3079	59.0254 (83)
Total gains	584.6831	662.6204	734.4239	841.9603	922.9291	927.6460	882.7054	801.1739	713.9704	621.8791	573.4955	561.9700 (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	12.7521	12.7783	12.8041	12.9266	12.9498	13.0589	13.0589	13.0793	13.0167	12.9498	12.9030	12.8544
alpha	1.8501	1.8519	1.8536	1.8618	1.8633	1.8706	1.8706	1.8720	1.8678	1.8633	1.8602	1.8570
util living area	0.8998	0.8737	0.8328	0.7526	0.6437	0.5142	0.4080	0.4527	0.6288	0.7926	0.8726	0.9059 (86)
MIT	17.2994	17.6758	18.3107	19.1908	19.9700	20.5333	20.7871	20.7331	20.2722	19.2769	18.1592	17.2362 (87)
Th 2	19.8571	19.8591	19.8611	19.8707	19.8725	19.8808	19.8808	19.8823	19.8776	19.8725	19.8688	19.8651 (88)
util rest of house	0.8890	0.8603	0.8145	0.7245	0.6008	0.4503	0.3225	0.3662	0.5691	0.7625	0.8568	0.8958 (89)
MIT 2	15.6516	16.1137	16.8923	17.9572	18.8705	19.4983	19.7488	19.7075	19.2391	18.0868	16.7217	15.5754 (90)
Living area fraction	FLA = Living area / (4) =											
MIT	16.1860	16.6203	17.3523	18.3573	19.2271	19.8339	20.0855	20.0401	19.5742	18.4727	17.1879	16.1140 (92)
Temperature adjustment	0.0000											
adjusted MIT	16.1860	16.6203	17.3523	18.3573	19.2271	19.8339	20.0855	20.0401	19.5742	18.4727	17.1879	16.1140 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8395	0.8081	0.7618	0.6790	0.5730	0.4474	0.3391	0.3793	0.5508	0.7156	0.8055	0.8474 (94)
Useful gains	490.8448	535.4413	559.4989	571.7247	528.8624	415.0727	299.3224	303.9205	393.2462	444.9883	461.9642	476.2176 (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	1172.2480	1153.5389	1065.9522	920.1206	731.0190	504.0632	335.6829	350.0251	528.9110	764.5864	983.2717	1165.6573 (97)
Space heating kWh	506.9640	415.3616	376.8013	250.8451	150.4045	0.0000	0.0000	0.0000	0.0000	237.7809	375.3414	512.9431 (98a)
Space heating requirement - total per year (kWh/year)												2826.4420
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	506.9640	415.3616	376.8013	250.8451	150.4045	0.0000	0.0000	0.0000	0.0000	237.7809	375.3414	512.9431 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2826.4420
Space heating per m2												(98c) / (4) =
												36.6642 (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	506.9640	415.3616	376.8013	250.8451	150.4045	0.0000	0.0000	0.0000	0.0000	237.7809	375.3414	512.9431 (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)	549.2568	450.0126	408.2354	271.7715	162.9518	0.0000	0.0000	0.0000	0.0000	257.6175	406.6537	555.7347 (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	226.6496	200.3695	212.8499	187.2894	181.6135	163.7327	161.7298	168.1527	169.9839	189.4324	201.2618	224.2096 (64)
Efficiency of water heater (217)m	85.8100	85.6563	85.3262	84.7158	83.6401	79.8000	79.8000	79.8000	79.8000	84.5707	85.4367	79.8000 (216)
Fuel for water heating, kWh/month	264.1295	233.9226	249.4542	221.0797	217.1369	205.1788	202.6689	210.7177	213.0124	223.9930	235.5684	261.1495 (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	22.3453	17.9262	16.1406	11.8253	9.1342	7.4627	8.3325	10.8309	14.0683	18.4583	20.8487	22.9663 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-12.7199	-19.3676	-30.0378	-36.5264	-41.8612	-39.9877	-39.4991	-36.0418	-30.4191	-23.3061	-14.4829	-10.8362 (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	-3.4051	-7.4052	-15.1853	-23.5160	-31.8076	-32.2273	-31.8520	-26.6410	-19.1011	-10.8192	-4.6173	-2.6752 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												

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(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												3062.2340	(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												2738.0115	(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)												180.3393	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-544.3381	(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												5522.2467	(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	3062.2340	0.2100	643.0691	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2738.0115	0.2100	574.9824	(264)
Space and water heating			1218.0515	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	180.3393	0.1443	26.0285	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-335.0858	0.1330	-44.5705	
PV Unit electricity exported	-209.2522	0.1250	-26.1585	
Total			-70.7290	(269)
Total CO2, kg/year			1185.2803	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.3800	(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	3062.2340	1.1300	3460.3244	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2738.0115	1.1300	3093.9530	(278)
Space and water heating			6554.2774	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	180.3393	1.5338	276.6105	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-335.0858	1.4915	-499.7805	
PV Unit electricity exported	-209.2522	0.4588	-96.0107	
Total			-595.7912	(283)
Total Primary energy kWh/year			6365.1974	(286)
Target Primary Energy Rate (TPER)			82.5700	(287)

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Property Reference	2B4P First Floor		Issued on Date	24/11/2023	
Assessment Reference	Be Lean	Prop Type Ref			
Property					
SAP Rating	82 B	DER	15.26	TER	15.38
Environmental	87 B	% DER < TER	0.78		
CO ₂ Emissions (t/year)	1.09	DFEE	39.02	TFEE	43.91
Compliance Check	See BREL	% DFEE < TFEE	11.14		
% DPER < TPER	-4.63	DPER	86.39	TPER	82.57
Assessor Details	Mr. Michael Woodbridge			Assessor ID	M818-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	77.0900	2.7000	208.1430
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0900		208.1430
Dwelling volume			208.1430

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2432	0.2403	0.2374	0.2229	0.2200	0.2054	0.2054	0.2025	0.2112	0.2200	0.2258	0.2316 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening			1.8800	1.2000	2.2560		(26)
Glazing (Uw = 1.20)			18.7200	1.1450	21.4351		(27)
Heatloss Floor 1			77.0900	0.1000	7.7090		(28b)
External Wall	48.5100	18.7200	29.7900	0.1600	4.7664	70.0000	2085.3000 (29a)
Sheltered Wall	36.7700	1.8800	34.8900	0.1600	5.5824	70.0000	2442.3000 (29a)
Total net area of external elements Aum(A, m ²)			162.3700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.7489		(33)
Party Wall			19.9500	0.0000	0.0000	0.0000	0.0000 (32)
Party Ceiling 1			77.0900			0.0000	0.0000 (32b)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			4527.6000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							58.7314 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate				8.7000	0.0500	0.4350	

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E4 Jamb	28.1200	0.0500	1.4060
E7 Party floor between dwellings (in blocks of flats)	31.5900	0.1000	3.1590
E16 Corner (normal)	8.1000	0.0900	0.7290
E18 Party wall between dwellings	8.1000	0.0600	0.4860
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	14.7800	0.0000	0.0000
E20 Exposed floor (normal)	31.5900	0.1000	3.1590
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			9.3740 (36)
Point Thermal bridges			0.0000
Total fabric heat loss	(33) + (36) + (36a) =		51.1229 (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	16.7060	16.5064	16.3068	15.3087	15.1090	14.1109	14.1109	13.9113	14.5102	15.1090	15.5083	15.9075 (38)
Average = Sum(39)m / 12 =	67.8289	67.6293	67.4297	66.4316	66.2319	65.2338	65.2338	65.0342	65.6331	66.2319	66.6312	67.0304 (39)
HLP	0.8799	0.8773	0.8747	0.8617	0.8592	0.8462	0.8462	0.8436	0.8514	0.8592	0.8643	0.8695 (40)
HLP (average)												0.8611
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4053 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	72.7664	71.6679	70.1053	67.7651	65.6560	62.7527	60.5500	63.2435	64.6571	67.5338	70.5248	72.7086 (42b)
Hot water usage for other uses	39.2630	37.8352	36.4075	34.9797	33.5520	32.1242	32.1242	33.5520	34.9797	36.4075	37.8352	39.2630 (42c)
Average daily hot water use (litres/day)												103.1653 (43)
Daily hot water use	112.0293	109.5031	106.5127	102.7448	99.2080	94.8769	92.6743	96.7955	99.6368	103.9413	108.3600	111.9716 (44)
Energy conte	164.9265	144.8948	152.2045	134.2104	127.8395	109.7220	102.4078	113.9301	115.5737	133.9389	146.4521	164.4385 (45)
Energy content (annual)												1610.5388
Distribution loss (46)m = 0.15 x (45)m	24.7390	21.7342	22.8307	20.1316	19.1759	16.4583	15.3612	17.0895	17.3361	20.0908	21.9678	24.6658 (46)
Water storage loss:												110.0000 (47)
Store volume												0.0152 (51)
b) If manufacturer declared loss factor is not known :												1.0294 (52)
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.6000 (53)
Volume factor from Table 2a												1.0327 (55)
Temperature factor from Table 2b												
Enter (49) or (54) in (55)												
Total storage loss	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)
If cylinder contains dedicated solar storage	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (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	220.2033	194.8222	207.4813	187.7041	183.1163	163.2157	157.6846	169.2069	169.0674	189.2157	199.9458	219.7153 (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	220.2033	194.8222	207.4813	187.7041	183.1163	163.2157	157.6846	169.2069	169.0674	189.2157	199.9458	219.7153 (64)
12Total per year (kWh/year)												2261.3786 (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	99.0595	88.1195	94.8294	87.4199	86.7281	79.2775	78.2720	82.1032	81.2232	88.7561	91.4903	98.8972 (65)

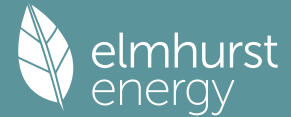
5. Internal gains (see Table 5 and 5a)

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	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	107.5608	119.0852	107.5608	111.1462	107.5608	111.1462	107.5608	107.5608	111.1462	107.5608	111.1462	107.5608 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	213.2514	215.4643	209.8879	198.0164	183.0308	168.9464	159.5372	157.3243	162.9007	174.7722	189.7578	203.8422 (68)
Pumps, fans	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266 (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)	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131 (71)
Total internal gains	133.1445	131.1302	127.4589	121.4165	116.5700	110.1077	105.2044	110.3537	112.8100	119.2959	127.0698	132.9264 (72)
	513.0366	524.7596	503.9875	489.6590	466.2415	449.2802	431.3823	434.3188	445.9368	460.7088	487.0537	503.4093 (73)

6. Solar gains

[Jan]			Area	Solar flux	g	FF	Access	Gains				
			m2	Table 6a	Specific data	Specific data	factor	W				
				W/m2	or Table 6b	or Table 6c	Table 6d					
North			12.9600	10.6334	0.4500	0.8000	0.7700	34.3805 (74)				
East			5.7600	19.6403	0.4500	0.8000	0.7700	28.2232 (76)				
Solar gains	62.6037	120.9134	202.5692	311.9380	404.0902	424.9764	399.8330	327.6085	239.9820	143.7227	77.6038	51.8707 (83)
Total gains	575.6403	645.6730	706.5567	801.5971	870.3317	874.2566	831.2153	761.9274	685.9189	604.4315	564.6575	555.2800 (84)

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7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	18.5417	18.5965	18.6515	18.9318	18.9888	19.2794	19.2794	19.3385	19.1621	18.9888	18.8750	18.7626
alpha	2.2361	2.2398	2.2434	2.2621	2.2659	2.2853	2.2853	2.2892	2.2775	2.2659	2.2583	2.2508
util living area	0.8781	0.8453	0.7945	0.6944	0.5681	0.4270	0.3248	0.3632	0.5430	0.7378	0.8405	0.8853 (86)
MIT	18.4789	18.8143	19.3220	19.9969	20.5060	20.8192	20.9302	20.9082	20.6720	20.0130	19.1701	18.4357 (87)
Th 2	20.1846	20.1869	20.1891	20.2001	20.2024	20.2135	20.2135	20.2157	20.2090	20.2024	20.1979	20.1935 (88)
util rest of house	0.8680	0.8328	0.7779	0.6704	0.5348	0.3835	0.2720	0.3084	0.4982	0.7113	0.8258	0.8757 (89)
MIT 2	17.2075	17.6269	18.2594	19.0901	19.6932	20.0513	20.1629	20.1465	19.8990	19.1283	18.0856	17.1578 (90)
Living area fraction	FLA = Living area / (4) = 0.3243 (91)											
MIT	17.6198	18.0120	18.6040	19.3842	19.9568	20.3003	20.4117	20.3935	20.1496	19.4152	18.4373	17.5722 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.6198	18.0120	18.6040	19.3842	19.9568	20.3003	20.4117	20.3935	20.1496	19.4152	18.4373	17.5722 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8274	0.7920	0.7399	0.6435	0.5240	0.3885	0.2856	0.3212	0.4946	0.6817	0.7864	0.8359 (94)
Useful gains	476.3103	511.3787	522.7725	515.7956	456.0346	339.6175	237.3875	244.7106	339.2824	412.0433	444.0326	464.1598 (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	903.4690	886.7521	816.1706	696.4795	546.8661	371.8535	248.6538	259.7155	397.0570	583.8491	755.4187	896.3453 (97)
Space heating kWh	317.8061	252.2509	218.2882	130.0924	67.5786	0.0000	0.0000	0.0000	0.0000	127.8236	224.1980	321.5460 (98a)
Space heating requirement - total per year (kWh/year)	1659.5838											
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	317.8061	252.2509	218.2882	130.0924	67.5786	0.0000	0.0000	0.0000	0.0000	127.8236	224.1980	321.5460 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1659.5838											
Space heating per m2	(98c) / (4) = 21.5279 (99)											
9b. Energy requirements												
Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)											
Fraction of space heat from community system	1.0000 (302)											
Fraction of heat from community Boilers-Space and Water	1.0000 (303a)											
Factor for control and charging method (Table 4c(3)) for space heating	1.0000 (305)											
Factor for charging method (Table 4c(3)) for water heating	1.0000 (305a)											
Distribution loss factor (Table 12c) for community heating system	1.2500 (306)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating:												
Space heating requirement	317.8061	252.2509	218.2882	130.0924	67.5786	0.0000	0.0000	0.0000	0.0000	127.8236	224.1980	321.5460 (98)
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.25												
307a	397.2576	315.3137	272.8603	162.6155	84.4733	0.0000	0.0000	0.0000	0.0000	159.7794	280.2475	401.9324
Space heating requirement	397.2576	315.3137	272.8603	162.6155	84.4733	0.0000	0.0000	0.0000	0.0000	159.7794	280.2475	401.9324 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)											
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating												
Annual water heating requirement	220.2033	194.8222	207.4813	187.7041	183.1163	163.2157	157.6846	169.2069	169.0674	189.2157	199.9458	219.7153 (64)
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.25												
310a	275.2541	243.5278	259.3516	234.6301	228.8954	204.0196	197.1058	211.5086	211.3342	236.5196	249.9323	274.6441
Water heating fuel	275.2541	243.5278	259.3516	234.6301	228.8954	204.0196	197.1058	211.5086	211.3342	236.5196	249.9323	274.6441 (310)
Cooling System Energy Efficiency Ratio	0.0000 (314)											
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	17.2536	15.5839	17.2536	16.6971	17.2536	16.6971	17.2536	17.2536	16.6971	17.2536	16.6971	17.2536 (331)
Lighting	22.3490	17.9292	16.1433	11.8272	9.1357	7.4640	8.3339	10.8327	14.0706	18.4614	20.8521	22.9702 (332)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year												
Space heating fuel - community heating	2074.4797 (307)											
Space heating fuel - secondary	0.0000 (309)											
Water heating fuel - community heating	2826.7232 (310)											
Efficiency of water heater	0.0000 (311)											
Electricity used for heat distribution	20.7448 (313)											
Space cooling fuel	0.0000 (321)											
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.6000, SFP = 0.8000)												
mechanical ventilation fans (SFP = 0.8000)	203.1476 (330a)											
Total electricity for the above, kWh/year	203.1476 (331)											
Electricity for lighting (calculated in Appendix L)	180.3694 (332)											
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation	0.0000 (333)											
Wind generation	0.0000 (334)											
Hydro-electric generation (Appendix N)	0.0000 (335a)											
Electricity generated - Micro CHP (Appendix N)	0.0000 (335)											
Appendix Q - special features												

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Energy saved or generated	-0.0000 (336)
Energy used	0.0000 (337)
Total delivered energy for all uses	5284.7199 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			92.3000 (367)
Space and Water heating from Boilers	5310.0790	0.2100	471.9835 (367)
Electrical energy for heat distribution (space & water)	20.7448	0.0000	7.1870 (372)
Overall CO2 factor for heat network			0.2290 (386)
Total CO2 associated with community systems			1122.3036 (373)
Space and water heating			1122.3036 (376)
Pumps, fans and electric keep-hot	203.1476	0.1387	28.1791 (378)
Energy for lighting	180.3694	0.1443	26.0329 (379)
Total CO2, kg/year			1176.5156 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			15.2600 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Boilers			92.3000 (467a)
Space and Water heating from Boilers	5310.0790	1.1300	2539.7206 (467)
Electrical energy for heat distribution (space & water)	20.7448	0.0000	75.6015 (472)
Overall CO2 factor for heat network			1.2397 (486)
Total CO2 associated with community systems			6075.9908 (473)
Space and water heating			6075.9908 (476)
Pumps, fans and electric keep-hot	203.1476	1.5128	307.3216 (478)
Energy for lighting	180.3694	1.5338	276.6566 (479)
Total Primary energy kWh/year			6659.9690 (483)
Dwelling Primary energy Rate (DPER)			86.3900 (484)

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	77.0900 (1b)	x 2.7000 (2b)	= 208.1430 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 208.1430 (5)

2. Ventilation rate

		Air changes 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) =	0.1441 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3941	(18)
Number of sides sheltered	3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3055 (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 infltr rate	0.3895	0.3818	0.3742	0.3360	0.3284	0.2902	0.2902	0.2825	0.3055	0.3284	0.3436	0.3589 (22b)
Effective ac	0.5758	0.5729	0.5700	0.5564	0.5539	0.5421	0.5421	0.5399	0.5467	0.5539	0.5590	0.5644 (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			1.8800	1.0000	1.8800		(26)
TER Opening Type (Uw = 1.20)			17.3900	1.1450	19.9122		(27)

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Heatloss Floor 1			77.0900	0.1300	10.0217	(28b)
External Wall	48.5100	17.3900	31.1200	0.1800	5.6016	(29a)
Sheltered Wall	36.7700	1.8800	34.8900	0.1800	6.2802	(29a)
Total net area of external elements Aum(A, m2)			162.3700			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		43.6957	(33)
Party Wall			19.9500	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 58.7314 (35)

List of Thermal Bridges				Length	Psi-value	Total
K1 Element				8.7000	0.0500	0.4350
E1 Steel lintel with perforated steel base plate				28.1200	0.0500	1.4060
E4 Jamb				31.5900	0.0700	2.2113
E7 Party floor between dwellings (in blocks of flats)				8.1000	0.0900	0.7290
E16 Corner (normal)				8.1000	0.0600	0.4860
E18 Party wall between dwellings				14.7800	0.0000	0.0000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)				31.5900	0.3200	10.1088
E20 Exposed floor (normal)						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)						15.3761 (36)
Point Thermal bridges						0.0000 (36a) =
Total fabric heat loss						(33) + (36) + (36a) = 59.0718 (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	39.5526	39.3503	39.1520	38.2208	38.0466	37.2355	37.2355	37.0853	37.5479	38.0466	38.3990	38.7675 (38)
Heat transfer coeff	98.6244	98.4221	98.2238	97.2926	97.1184	96.3073	96.3073	96.1571	96.6197	97.1184	97.4708	97.8393 (39)
Average = Sum(39)m / 12 =												97.2918
HLP	1.2793	1.2767	1.2741	1.2621	1.2598	1.2493	1.2493	1.2473	1.2533	1.2598	1.2644	1.2692 (40)
HLP (average)												1.2621
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.4053 (42)
Hot water usage for mixer showers													0.0000 (42a)
Hot water usage for baths													74.4255 (42b)
Hot water usage for other uses													39.2630 (42c)
Average daily hot water use (litres/day)													104.6978 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.6885	111.1554	108.1711	103.8734	100.2967	96.4861	95.1989	98.1723	101.2830	105.2605	109.6173	113.4368 (44)	
Energy conte	180.0547	158.2838	166.2550	142.1975	135.0186	118.6409	115.1349	121.5578	124.8920	142.8375	156.1699	177.6147 (45)	
Energy content (annual)												Total = Sum(45)m = 1738.6574	
Distribution loss (46)m = 0.15 x (45)m	27.0082	23.7426	24.9382	21.3296	20.2528	17.7961	17.2702	18.2337	18.7338	21.4256	23.4255	26.6422 (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	226.6496	200.3695	212.8499	187.2894	181.6135	163.7327	161.7298	168.1527	169.9839	189.4324	201.2618	224.2096 (62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)	
Output from w/h	226.6496	200.3695	212.8499	187.2894	181.6135	163.7327	161.7298	168.1527	169.9839	189.4324	201.2618	224.2096 (64)	
												Total per year (kWh/year) = Sum(64)m = 2287.2748 (64)	
												2287 (64)	
12Total per year (kWh/year)													
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)	
Heat gains from water heating, kWh/month	97.1441	86.2979	92.5557	83.3541	82.1696	75.5216	75.5583	77.6939	77.6001	84.7694	88.0000	96.3328 (65)	

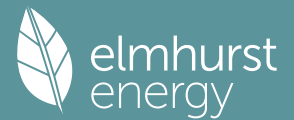
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	107.5429	119.0654	107.5429	111.1277	107.5429	111.1277	107.5429	107.5429	111.1277	107.5429	111.1277	107.5429 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	213.2514	215.4643	209.8879	198.0164	183.0308	168.9464	159.5372	157.3243	162.9007	174.7722	189.7578	203.8422 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266 (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)	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131 (71)
Water heating gains (Table 5)	130.5700	128.4195	124.4028	115.7696	110.4430	104.8911	101.5568	104.4273	107.7779	113.9374	122.2222	129.4796 (72)
Total internal gains	513.4443	525.0291	503.9135	486.9936	463.0966	444.0451	427.7168	428.3744	440.8862	458.3324	485.1876	502.9446 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a	g Specific data	FF Specific data	Access factor	Gains W
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Water heating fuel used	2738.0115 (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)	180.3393 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-544.3381 (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	5522.2467 (238)

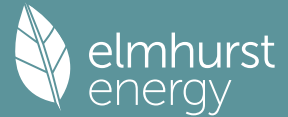
 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3062.2340	0.2100	643.0691 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2738.0115	0.2100	574.9824 (264)
Space and water heating			1218.0515 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	180.3393	0.1443	26.0285 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-335.0858	0.1330	-44.5705
PV Unit electricity exported	-209.2522	0.1250	-26.1585
Total			-70.7290 (269)
Total CO2, kg/year			1185.2803 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.3800 (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	3062.2340	1.1300	3460.3244 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2738.0115	1.1300	3093.9530 (278)
Space and water heating			6554.2774 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	180.3393	1.5338	276.6105 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-335.0858	1.4915	-499.7805
PV Unit electricity exported	-209.2522	0.4588	-96.0107
Total			-595.7912 (283)
Total Primary energy kWh/year			6365.1974 (286)
Target Primary Energy Rate (TPER)			82.5700 (287)

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Property Reference	2B4P Mid Floor		Issued on Date	24/11/2023	
Assessment Reference	Be Green	Prop Type Ref			
Property					
SAP Rating	82 B	DER	4.46	TER	15.38
Environmental	96 A	% DER < TER			71.00
CO ₂ Emissions (t/year)	0.31	DFEE	39.02	TFEE	43.91
Compliance Check	See BREL	% DFEE < TFEE			11.14
% DPER < TPER	43.47	DPER	46.67	TPER	82.57
Assessor Details	Mr. Michael Woodbridge			Assessor ID	M818-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	77.0900	2.7000	208.1430
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0900		208.1430
Dwelling volume			208.1430

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)

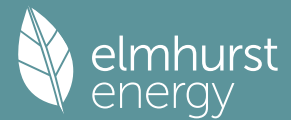
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												81.0000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2432	0.2403	0.2374	0.2229	0.2200	0.2054	0.2054	0.2025	0.2112	0.2200	0.2258	0.2316 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening			1.9800	1.2000	2.2560		(26)
Glazing (Uw = 1.20)			18.7200	1.1450	21.4351		(27)
Heatloss Floor 1			77.0900	0.1000	7.7090		(28b)
External Wall	48.5100	18.7200	29.7900	0.1600	4.7664	70.0000	2085.3000 (29a)
Sheltered Wall	36.7700	1.8800	34.8900	0.1600	5.5824	70.0000	2442.3000 (29a)
Total net area of external elements Aum(A, m ²)			162.3700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	41.7489	(33)
Party Wall			19.9500	0.0000	0.0000	0.0000	0.0000 (32)
Party Ceiling 1			77.0900			0.0000	0.0000 (32b)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =	4527.6000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							58.7314 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate				8.7000	0.0500	0.4350	

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E4 Jamb	28.1200	0.0500	1.4060
E7 Party floor between dwellings (in blocks of flats)	31.5900	0.1000	3.1590
E16 Corner (normal)	8.1000	0.0900	0.7290
E18 Party wall between dwellings	8.1000	0.0600	0.4860
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	14.7800	0.0000	0.0000
E20 Exposed floor (normal)	31.5900	0.1000	3.1590

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 51.1229 (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	16.7060	16.5064	16.3068	15.3087	15.1090	14.1109	14.1109	13.9113	14.5102	15.1090	15.5083	15.9075 (38)
Average = Sum(39)m / 12 =	67.8289	67.6293	67.4297	66.4316	66.2319	65.2338	65.2338	65.0342	65.6331	66.2319	66.6312	67.0304 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8799	0.8773	0.8747	0.8617	0.8592	0.8462	0.8462	0.8436	0.8514	0.8592	0.8643	0.8695 (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												2.4053 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths												72.7664 (42b)
Hot water usage for other uses												39.2630 (42c)
Average daily hot water use (litres/day)												103.1653 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	112.0293	109.5031	106.5127	102.7448	99.2080	94.8769	92.6743	96.7955	99.6368	103.9413	108.3600	111.9716 (44)
Energy content (annual)	164.9265	144.8948	152.2045	134.2104	127.8395	109.7220	102.4078	113.9301	115.5737	133.9389	146.4521	164.4385 (45)
Distribution loss (46)m = 0.15 x (45)m												24.7390 (46)
Water storage loss:												110.0000 (47)
Store volume												0.0152 (51)
b) If manufacturer declared loss factor is not known : Hot water storage loss factor from Table 2 (kWh/litre/day)												1.0294 (52)
Volume factor from Table 2a												0.6000 (53)
Temperature factor from Table 2b												1.0327 (55)
Enter (49) or (54) in (55)												32.0144 (56)
Total storage loss	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)
If cylinder contains dedicated solar storage	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (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	220.2033	194.8222	207.4813	187.7041	183.1163	163.2157	157.6846	169.2069	169.0674	189.2157	199.9458	219.7153 (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	220.2033	194.8222	207.4813	187.7041	183.1163	163.2157	157.6846	169.2069	169.0674	189.2157	199.9458	219.7153 (64)
12Total per year (kWh/year)												2261.3786 (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	99.0595	88.1195	94.8294	87.4199	86.7281	79.2775	78.2720	82.1032	81.2232	88.7561	91.4903	98.8972 (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	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	107.5608	119.0852	107.5608	111.1462	107.5608	111.1462	107.5608	107.5608	111.1462	107.5608	111.1462	107.5608 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	213.2514	215.4643	209.8879	198.0164	183.0308	168.9464	159.5372	157.3243	162.9007	174.7722	189.7578	203.8422 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266 (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)	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131 (71)
Water heating gains (Table 5)	133.1445	131.1302	127.4589	121.4165	116.5700	110.1077	105.2044	110.3537	112.8100	119.2959	127.0698	132.9264 (72)
Total internal gains	513.0366	524.7596	503.9875	489.6590	466.2415	449.2802	431.3823	434.3188	445.9368	460.7088	487.0537	503.4093 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m2	Table 6a	Specific data	Specific data	factor	W
		W/m2	or Table 6b	or Table 6c	Table 6d	
North	12.9600	10.6334	0.4500	0.8000	0.7700	34.3805 (74)
East	5.7600	19.6403	0.4500	0.8000	0.7700	28.2232 (76)
Solar gains	62.6037	120.9134	202.5692	311.9380	404.0902	424.9764
Total gains	575.6403	645.6730	706.5567	801.5971	870.3317	874.2566

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	18.5417	18.5965	18.6515	18.9318	18.9888	19.2794	19.2794	19.3385	19.1621	18.9888	18.8750	18.7626
alpha	2.2361	2.2398	2.2434	2.2621	2.2659	2.2853	2.2853	2.2892	2.2775	2.2659	2.2583	2.2508
util living area	0.8781	0.8453	0.7945	0.6944	0.5681	0.4270	0.3248	0.3632	0.5430	0.7378	0.8405	0.8853 (86)
MIT	18.4789	18.8143	19.3220	19.9969	20.5060	20.8192	20.9302	20.9082	20.6720	20.0130	19.1701	18.4357 (87)
Th 2	20.1846	20.1869	20.1891	20.2001	20.2024	20.2135	20.2135	20.2157	20.2090	20.2024	20.1979	20.1935 (88)
util rest of house	0.8680	0.8328	0.7779	0.6704	0.5348	0.3835	0.2720	0.3084	0.4982	0.7113	0.8258	0.8757 (89)
MIT 2	17.2075	17.6269	18.2594	19.0901	19.6932	20.0513	20.1629	20.1465	19.8990	19.1283	18.0856	17.1578 (90)
Living area fraction	FLA = Living area / (4) = 0.3243 (91)											
MIT	17.6198	18.0120	18.6040	19.3842	19.9568	20.3003	20.4117	20.3935	20.1496	19.4152	18.4373	17.5722 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.6198	18.0120	18.6040	19.3842	19.9568	20.3003	20.4117	20.3935	20.1496	19.4152	18.4373	17.5722 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8274	0.7920	0.7399	0.6435	0.5240	0.3885	0.2856	0.3212	0.4946	0.6817	0.7864	0.8359 (94)
Useful gains	476.3103	511.3787	522.7725	515.7956	456.0346	339.6175	237.3875	244.7106	339.2824	412.0433	444.0326	464.1598 (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	903.4690	886.7521	816.1706	696.4795	546.8661	371.8535	248.6538	259.7155	397.0570	583.8491	755.4187	896.3453 (97)
Space heating kWh	317.8061	252.2509	218.2882	130.0924	67.5786	0.0000	0.0000	0.0000	0.0000	127.8236	224.1980	321.5460 (98a)
Space heating requirement - total per year (kWh/year)	1659.5838											
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	317.8061	252.2509	218.2882	130.0924	67.5786	0.0000	0.0000	0.0000	0.0000	127.8236	224.1980	321.5460 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1659.5838											
Space heating per m2	(98c) / (4) = 21.5279 (99)											

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)											
Fraction of space heat from community system	1.0000 (302)											
Fraction of heat from community Heat pump-Space and Water	1.0000 (303a)											
Factor for control and charging method (Table 4c(3)) for space heating	1.0000 (305)											
Factor for charging method (Table 4c(3)) for water heating	1.0000 (305a)											
Distribution loss factor (Table 12c) for community heating system	1.2500 (306)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating:												
Space heating requirement	317.8061	252.2509	218.2882	130.0924	67.5786	0.0000	0.0000	0.0000	0.0000	127.8236	224.1980	321.5460 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.25	397.2576	315.3137	272.8603	162.6155	84.4733	0.0000	0.0000	0.0000	0.0000	159.7794	280.2475	401.9324
307a	397.2576	315.3137	272.8603	162.6155	84.4733	0.0000	0.0000	0.0000	0.0000	159.7794	280.2475	401.9324 (307)
Space heating requirement	397.2576	315.3137	272.8603	162.6155	84.4733	0.0000	0.0000	0.0000	0.0000	159.7794	280.2475	401.9324 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)											
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating												
Annual water heating requirement	220.2033	194.8222	207.4813	187.7041	183.1163	163.2157	157.6846	169.2069	169.0674	189.2157	199.9458	219.7153 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.25	275.2541	243.5278	259.3516	234.6301	228.8954	204.0196	197.1058	211.5086	211.3342	236.5196	249.9323	274.6441
310a	275.2541	243.5278	259.3516	234.6301	228.8954	204.0196	197.1058	211.5086	211.3342	236.5196	249.9323	274.6441 (310)
Water heating fuel	275.2541	243.5278	259.3516	234.6301	228.8954	204.0196	197.1058	211.5086	211.3342	236.5196	249.9323	274.6441 (310)
Cooling System Energy Efficiency Ratio	0.0000 (314)											
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	17.2536	15.5839	17.2536	16.6971	17.2536	16.6971	17.2536	17.2536	16.6971	17.2536	16.6971	17.2536 (331)
Lighting	22.3490	17.9292	16.1433	11.8272	9.1357	7.4640	8.3339	10.8327	14.0706	18.4614	20.8521	22.9702 (332)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333a)m	-9.3019	-15.9797	-28.3684	-38.2600	-46.2540	-45.0295	-44.1523	-38.7960	-30.2021	-20.3778	-11.0191	-7.6421 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year												
Space heating fuel - community heating												2074.4797 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												2826.7232 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												20.7448 (313)
Space cooling fuel												0.0000 (321)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.6000, SFP = 0.8000)												
mechanical ventilation fans (SFP = 0.8000)												203.1476 (330a)
Total electricity for the above, kWh/year												203.1476 (331)
Electricity for lighting (calculated in Appendix L)												180.3694 (332)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-335.3828 (333)
Wind generation												0.0000 (334)
Hydro-electric generation (Appendix N)												0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (335)
Appendix Q - special features												

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Energy saved or generated	-0.0000 (336)
Energy used	0.0000 (337)
Total delivered energy for all uses	4949.3370 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			220.0000 (367)
Space and Water heating from Heat pump	2227.8195	0.1547	145.8717 (367)
Electrical energy for heat distribution (space & water)	20.7448	0.0000	7.1870 (372)
Overall CO2 factor for heat network			0.0681 (386)
Total CO2 associated with community systems			333.8697 (373)
Space and water heating			333.8697 (376)
Pumps, fans and electric keep-hot	203.1476	0.1387	28.1791 (378)
Energy for lighting	180.3694	0.1443	26.0329 (379)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-335.3828	0.1312	-44.0052
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-44.0052 (380)
Total CO2, kg/year			344.0764 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.4600 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			220.0000 (467a)
Space and Water heating from Heat pump	2227.8195	1.5727	1482.9969 (467)
Electrical energy for heat distribution (space & water)	20.7448	0.0000	75.6015 (472)
Overall CO2 factor for heat network			0.7166 (486)
Total CO2 associated with community systems			3512.0335 (473)
Space and water heating			3512.0335 (476)
Pumps, fans and electric keep-hot	203.1476	1.5128	307.3216 (478)
Energy for lighting	180.3694	1.5338	276.6566 (479)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-335.3828	1.4847	-497.9541
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-497.9541 (480)
Total Primary energy kWh/year			3598.0576 (483)
Dwelling Primary energy Rate (DPER)			46.6700 (484)

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	77.0900 (1b)	x 2.7000 (2b)	= 208.1430 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 208.1430 (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) = 0.1441 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3941 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3055 (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	0.3895	0.3818	0.3742	0.3360	0.3284	0.2902	0.2902	0.2825	0.3055	0.3284	0.3436	0.3589 (22b)
Effective ac	0.5758	0.5729	0.5700	0.5564	0.5539	0.5421	0.5421	0.5399	0.5467	0.5539	0.5590	0.5644 (25)

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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
TER Opaque door			1.8800	1.0000	1.8800		(26)
TER Opening Type (Uw = 1.20)			17.3900	1.1450	19.9122		(27)
Heatloss Floor 1			77.0900	0.1300	10.0217		(28b)
External Wall	48.5100	17.3900	31.1200	0.1800	5.6016		(29a)
Sheltered Wall	36.7700	1.8800	34.8900	0.1800	6.2802		(29a)
Total net area of external elements Aum(A, m ²)			162.3700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26) ... (30) + (32) = 43.6957		(33)
Party Wall			19.9500	0.0000	0.0000		(32)

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

58.7314 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	8.7000	0.0500	0.4350
E4 Jamb	28.1200	0.0500	1.4060
E7 Party floor between dwellings (in blocks of flats)	31.5900	0.0700	2.2113
E16 Corner (normal)	8.1000	0.0900	0.7290
E18 Party wall between dwellings	8.1000	0.0600	0.4860
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	14.7800	0.0000	0.0000
E20 Exposed floor (normal)	31.5900	0.3200	10.1088

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

15.3761 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 59.0718 (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	39.5526	39.3503	39.1520	38.2208	38.0466	37.2355	37.2355	37.0853	37.5479	38.0466	38.3990	38.7675 (38)
Average = Sum(39)m / 12 =	98.6244	98.4221	98.2238	97.2926	97.1184	96.3073	96.3073	96.1571	96.6197	97.1184	97.4708	97.8393 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2793	1.2767	1.2741	1.2621	1.2598	1.2493	1.2493	1.2473	1.2533	1.2598	1.2644	1.2692 (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													2.4053 (42)
Hot water usage for mixer showers													(42a)
Hot water usage for baths													(42b)
Hot water usage for other uses													(42c)
Average daily hot water use (litres/day)													(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy content (annual)	113.6885	111.1554	108.1711	103.8734	100.2967	96.4861	95.1989	98.1723	101.2830	105.2605	109.6173	113.4368 (44)	
Distribution loss (46)m = 0.15 x (45)m	180.0547	158.2838	166.2550	142.1975	135.0186	118.6409	115.1349	121.5578	124.8920	142.8375	156.1699	177.6147 (45)	
Water storage loss:	27.0082	23.7426	24.9382	21.3296	20.2528	17.7961	17.2702	18.2337	18.7338	21.4256	23.4255	26.6422 (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	226.6496	200.3695	212.8499	187.2894	181.6135	163.7327	161.7298	168.1527	169.9839	189.4324	201.2618	224.2096 (62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)	
Output from w/h	226.6496	200.3695	212.8499	187.2894	181.6135	163.7327	161.7298	168.1527	169.9839	189.4324	201.2618	224.2096 (64)	
12Total per year (kWh/year)													2287.2748 (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	97.1441	86.2979	92.5557	83.3541	82.1696	75.5216	75.5583	77.6939	77.6001	84.7694	88.0000	96.3328 (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	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	107.5429	119.0654	107.5429	111.1277	107.5429	107.5429	107.5429	107.5429	111.1277	107.5429	111.1277	107.5429 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	213.2514	215.4643	209.8879	198.0164	183.0308	168.9464	159.5372	157.3243	162.9007	174.7722	189.7578	203.8422 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266 (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)	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131 (71)
Water heating gains (Table 5)	130.5700	128.4195	124.4028	115.7696	110.4430	104.8911	101.5568	104.4273	107.7779	113.9374	122.2222	129.4796 (72)
Total internal gains												

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(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												3062.2340	(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												2738.0115	(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)												180.3393	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-544.3381	(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												5522.2467	(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	3062.2340	0.2100	643.0691	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2738.0115	0.2100	574.9824	(264)
Space and water heating			1218.0515	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	180.3393	0.1443	26.0285	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-335.0858	0.1330	-44.5705	
PV Unit electricity exported	-209.2522	0.1250	-26.1585	
Total			-70.7290	(269)
Total CO2, kg/year			1185.2803	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.3800	(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	3062.2340	1.1300	3460.3244	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2738.0115	1.1300	3093.9530	(278)
Space and water heating			6554.2774	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	180.3393	1.5338	276.6105	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-335.0858	1.4915	-499.7805	
PV Unit electricity exported	-209.2522	0.4588	-96.0107	
Total			-595.7912	(283)
Total Primary energy kWh/year			6365.1974	(286)
Target Primary Energy Rate (TPER)			82.5700	(287)

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Property Reference	2B4P Mid Floor		Issued on Date	24/11/2023	
Assessment Reference	Be Lean	Prop Type Ref			
Property					
SAP Rating	82 B	DER	15.26	TER	15.38
Environmental	87 B	% DER < TER	0.78		
CO ₂ Emissions (t/year)	1.09	DFEE	39.02	TFEE	43.91
Compliance Check	See BREL	% DFEE < TFEE	11.14		
% DPER < TPER	-4.63	DPER	86.39	TPER	82.57
Assessor Details	Mr. Michael Woodbridge			Assessor ID	M818-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	77.0900	2.7000	208.1430
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0900		208.1430
Dwelling volume			208.1430

2. Ventilation rate

	Value	Reference
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	3.0000	(17)
Infiltration rate	0.1500	(18)
Number of sides sheltered	3	(19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2432	0.2403	0.2374	0.2229	0.2200	0.2054	0.2054	0.2025	0.2112	0.2200	0.2258	0.2316 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening			1.8800	1.2000	2.2560		(26)
Glazing (Uw = 1.20)			18.7200	1.1450	21.4351		(27)
Heatloss Floor 1			77.0900	0.1000	7.7090		(28b)
External Wall	48.5100	18.7200	29.7900	0.1600	4.7664	70.0000	2085.3000 (29a)
Sheltered Wall	36.7700	1.8800	34.8900	0.1600	5.5824	70.0000	2442.3000 (29a)
Total net area of external elements Aum(A, m ²)			162.3700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.7489		(33)
Party Wall			19.9500	0.0000	0.0000	0.0000	0.0000 (32)
Party Ceiling 1			77.0900			0.0000	0.0000 (32b)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			4527.6000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							58.7314 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate				8.7000	0.0500	0.4350	

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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	18.5417	18.5965	18.6515	18.9318	18.9888	19.2794	19.2794	19.3385	19.1621	18.9888	18.8750	18.7626
alpha	2.2361	2.2398	2.2434	2.2621	2.2659	2.2853	2.2853	2.2892	2.2775	2.2659	2.2583	2.2508
util living area	0.8781	0.8453	0.7945	0.6944	0.5681	0.4270	0.3248	0.3632	0.5430	0.7378	0.8405	0.8853 (86)
MIT	18.4789	18.8143	19.3220	19.9969	20.5060	20.8192	20.9302	20.9082	20.6720	20.0130	19.1701	18.4357 (87)
Th 2	20.1846	20.1869	20.1891	20.2001	20.2024	20.2135	20.2135	20.2157	20.2090	20.2024	20.1979	20.1935 (88)
util rest of house												
MIT 2	0.8680	0.8328	0.7779	0.6704	0.5348	0.3835	0.2720	0.3084	0.4982	0.7113	0.8258	0.8757 (89)
Living area fraction	17.2075	17.6269	18.2594	19.0901	19.6932	20.0513	20.1629	20.1465	19.8990	19.1283	18.0856	17.1578 (90)
MIT	17.6198	18.0120	18.6040	19.3842	19.9568	20.3003	20.4117	20.3935	20.1496	19.4152	18.4373	17.5722 (92)
Temperature adjustment												0.0000
adjusted MIT	17.6198	18.0120	18.6040	19.3842	19.9568	20.3003	20.4117	20.3935	20.1496	19.4152	18.4373	17.5722 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8274	0.7920	0.7399	0.6435	0.5240	0.3885	0.2856	0.3212	0.4946	0.6817	0.7864	0.8359 (94)
Useful gains	476.3103	511.3787	522.7725	515.7956	456.0346	339.6175	237.3875	244.7106	339.2824	412.0433	444.0326	464.1598 (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												
903.4690	886.7521	816.1706	696.4795	546.8661	371.8535	248.6538	259.7155	397.0570	583.8491	755.4187	896.3453 (97)	
Space heating kWh												
317.8061	252.2509	218.2882	130.0924	67.5786	0.0000	0.0000	0.0000	0.0000	0.0000	127.8236	224.1980	321.5460 (98a)
Space heating requirement - total per year (kWh/year)												1659.5838
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	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh												
317.8061	252.2509	218.2882	130.0924	67.5786	0.0000	0.0000	0.0000	0.0000	0.0000	127.8236	224.1980	321.5460 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1659.5838
Space heating per m2										(98c) / (4) =		21.5279 (99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (301)

Fraction of space heat from community system 1.0000 (302)

Fraction of heat from community Boilers-Space and Water 1.0000 (303a)

Factor for control and charging method (Table 4c(3)) for space heating 1.0000 (305)

Factor for charging method (Table 4c(3)) for water heating 1.0000 (305a)

Distribution loss factor (Table 12c) for community heating system 1.2500 (306)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

Space heating:

Space heating requirement

317.8061 252.2509 218.2882 130.0924 67.5786 0.0000 0.0000 0.0000 0.0000 127.8236 224.1980 321.5460 (98)

Space heat from Boilers = (98) x 1.00 x 1.00 x 1.25

397.2576 315.3137 272.8603 162.6155 84.4733 0.0000 0.0000 0.0000 0.0000 159.7794 280.2475 401.9324

307a

Space heating requirement

397.2576 315.3137 272.8603 162.6155 84.4733 0.0000 0.0000 0.0000 0.0000 159.7794 280.2475 401.9324 (307)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0.0000 (308)

Space heating fuel for secondary/supplementary system

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (309)

Water heating

Annual water heating requirement

220.2033 194.8222 207.4813 187.7041 183.1163 163.2157 157.6846 169.2069 169.0674 189.2157 199.9458 219.7153 (64)

Water heat from Boilers = (64) x 1.00 x 1.00 x 1.25

275.2541 243.5278 259.3516 234.6301 228.8954 204.0196 197.1058 211.5086 211.3342 236.5196 249.9323 274.6441

310a

Water heating fuel

275.2541 243.5278 259.3516 234.6301 228.8954 204.0196 197.1058 211.5086 211.3342 236.5196 249.9323 274.6441 (310)

Cooling System Energy Efficiency Ratio

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (314)

Space coolin

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (315)

Pumps and Fa

17.2536 15.5839 17.2536 16.6971 17.2536 16.6971 17.2536 17.2536 16.6971 17.2536 16.6971 17.2536 (331)

Lighting

22.3490 17.9292 16.1433 11.8272 9.1357 7.4640 8.3339 10.8327 14.0706 18.4614 20.8521 22.9702 (332)

Electricity generated by PVs (Appendix M) (negative quantity)

(333a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (333a)

Electricity generated by wind turbines (Appendix M) (negative quantity)

(334a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (334a)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity)

(335a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (335a)

Electricity generated by PVs (Appendix M) (negative quantity)

(333b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (333b)

Electricity generated by wind turbines (Appendix M) (negative quantity)

(334b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (334b)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity)

(335b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (335b)

Annual totals kWh/year

Space heating fuel - community heating 2074.4797 (307)

Space heating fuel - secondary 0.0000 (309)

Water heating fuel - community heating 2826.7232 (310)

Efficiency of water heater 0.0000 (311)

Electricity used for heat distribution 20.7448 (313)

Space cooling fuel 0.0000 (321)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.6000, SFP = 0.8000)

mechanical ventilation fans (SFP = 0.8000) 203.1476 (330a)

Total electricity for the above, kWh/year 203.1476 (331)

Electricity for lighting (calculated in Appendix L) 180.3694 (332)

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

PV generation 0.0000 (333)

Wind generation 0.0000 (334)

Hydro-electric generation (Appendix N) 0.0000 (335a)

Electricity generated - Micro CHP (Appendix N) 0.0000 (335)

Appendix Q - special features

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Energy saved or generated	-0.0000 (336)
Energy used	0.0000 (337)
Total delivered energy for all uses	5284.7199 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			92.3000 (367)
Space and Water heating from Boilers	5310.0790	0.2100	471.9835 (367)
Electrical energy for heat distribution (space & water)	20.7448	0.0000	7.1870 (372)
Overall CO2 factor for heat network			0.2290 (386)
Total CO2 associated with community systems			1122.3036 (373)
Space and water heating			1122.3036 (376)
Pumps, fans and electric keep-hot	203.1476	0.1387	28.1791 (378)
Energy for lighting	180.3694	0.1443	26.0329 (379)
Total CO2, kg/year			1176.5156 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			15.2600 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Boilers			92.3000 (467a)
Space and Water heating from Boilers	5310.0790	1.1300	2539.7206 (467)
Electrical energy for heat distribution (space & water)	20.7448	0.0000	75.6015 (472)
Overall CO2 factor for heat network			1.2397 (486)
Total CO2 associated with community systems			6075.9908 (473)
Space and water heating			6075.9908 (476)
Pumps, fans and electric keep-hot	203.1476	1.5128	307.3216 (478)
Energy for lighting	180.3694	1.5338	276.6566 (479)
Total Primary energy kWh/year			6659.9690 (483)
Dwelling Primary energy Rate (DPER)			86.3900 (484)

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	77.0900 (1b)	x 2.7000 (2b)	= 208.1430 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 208.1430 (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) = 0.1441 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3941 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3055 (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 infltr rate	0.3895	0.3818	0.3742	0.3360	0.3284	0.2902	0.2902	0.2825	0.3055	0.3284	0.3436	0.3589 (22b)
Effective ac	0.5758	0.5729	0.5700	0.5564	0.5539	0.5421	0.5421	0.5399	0.5467	0.5539	0.5590	0.5644 (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			1.8800	1.0000	1.8800		(26)
TER Opening Type (Uw = 1.20)			17.3900	1.1450	19.9122		(27)

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Heatloss Floor 1				77.0900	0.1300	10.0217	(28b)
External Wall	48.5100	17.3900		31.1200	0.1800	5.6016	(29a)
Sheltered Wall	36.7700	1.8800		34.8900	0.1800	6.2802	(29a)
Total net area of external elements Aum(A, m2)				162.3700			(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =		43.6957	(33)
Party Wall				19.9500	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 58.7314 (35)

List of Thermal Bridges				Length	Psi-value	Total	
K1 Element				8.7000	0.0500	0.4350	
E1 Steel lintel with perforated steel base plate				28.1200	0.0500	1.4060	
E4 Jamb				31.5900	0.0700	2.2113	
E7 Party floor between dwellings (in blocks of flats)				8.1000	0.0900	0.7290	
E16 Corner (normal)				8.1000	0.0600	0.4860	
E18 Party wall between dwellings				14.7800	0.0000	0.0000	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)				31.5900	0.3200	10.1088	
E20 Exposed floor (normal)							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.3761 (36)
Point Thermal bridges							(36a) = 0.0000
Total fabric heat loss							(33) + (36) + (36a) = 59.0718 (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
	39.5526	39.3503	39.1520	38.2208	38.0466	37.2355	37.2355	37.0853	37.5479	38.0466	38.3990	38.7675 (38)
Heat transfer coeff	98.6244	98.4221	98.2238	97.2926	97.1184	96.3073	96.3073	96.1571	96.6197	97.1184	97.4708	97.8393 (39)
Average = Sum(39)m / 12 =												97.2918
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1.2793	1.2767	1.2741	1.2621	1.2598	1.2493	1.2493	1.2473	1.2533	1.2598	1.2644	1.2692 (40)
HLP (average)												1.2621
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.4053 (42)
Hot water usage for mixer showers													0.0000 (42a)
Hot water usage for baths													74.4255 (42b)
Hot water usage for other uses													39.2630 (42c)
Average daily hot water use (litres/day)													104.6978 (43)
Daily hot water use													113.6885 (44)
Energy conte													180.0547 (45)
Energy content (annual)													158.2838 (45)
Distribution loss (46)m = 0.15 x (45)m													27.0082 (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 (56)
If cylinder contains dedicated solar storage													23.3325 (57)
Primary loss													23.2624 (59)
Combi loss													0.0000 (61)
Total heat required for water heating calculated for each month													226.6496 (62)
WWHRs													0.0000 (63a)
PV diverter													-0.0000 (63b)
Solar input													0.0000 (63c)
FGHRs													0.0000 (63d)
Output from w/h													226.6496 (64)
Total per year (kWh/year) = Sum(64)m =													2287.2748 (64)
12Total per year (kWh/year)													2287 (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													97.1441 (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	
	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664 (66)	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	107.5429	119.0654	107.5429	111.1277	107.5429	111.1277	107.5429	107.5429	111.1277	107.5429	111.1277	107.5429 (67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	213.2514	215.4643	209.8879	198.0164	183.0308	168.9464	159.5372	157.3243	162.9007	174.7722	189.7578	203.8422 (68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266 (69)	
Pumps, fans													3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)													-96.2131 (71)
Water heating gains (Table 5)													130.5700 (72)
Total internal gains	513.4443	525.0291	503.9135	486.9936	463.0966	444.0451	427.7168	428.3744	440.8862	458.3324	485.1876	502.9446 (73)	

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a	g Specific data	FF Specific data	Access factor	Gains W
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Water heating fuel used	2738.0115 (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)	180.3393 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-544.3381 (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	5522.2467 (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	3062.2340	0.2100	643.0691 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2738.0115	0.2100	574.9824 (264)
Space and water heating			1218.0515 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	180.3393	0.1443	26.0285 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-335.0858	0.1330	-44.5705
PV Unit electricity exported	-209.2522	0.1250	-26.1585
Total			-70.7290 (269)
Total CO2, kg/year			1185.2803 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.3800 (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	3062.2340	1.1300	3460.3244 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2738.0115	1.1300	3093.9530 (278)
Space and water heating			6554.2774 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	180.3393	1.5338	276.6105 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-335.0858	1.4915	-499.7805
PV Unit electricity exported	-209.2522	0.4588	-96.0107
Total			-595.7912 (283)
Total Primary energy kWh/year			6365.1974 (286)
Target Primary Energy Rate (TPER)			82.5700 (287)

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Property Reference	2B4P Top Floor		Issued on Date	24/11/2023	
Assessment Reference	Be Green	Prop Type Ref			
Property					
SAP Rating	83 B	DER	4.18	TER	16.97
Environmental	97 A	% DER < TER		75.37	
CO ₂ Emissions (t/year)	0.28	DFEE	38.27	TFEE	50.98
Compliance Check	See BREL	% DFEE < TFEE		24.92	
% DPER < TPER	52.09	DPER	43.66	TPER	91.13
Assessor Details	Mr. Michael Woodbridge			Assessor ID	M818-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	77.0900	2.7000	208.1430
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0900		208.1430
Dwelling volume			208.1430

2. Ventilation rate

	Value	Reference
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes		
Pressure Test Method	Blower Door		
Measured/design AP50			3.0000 (17)
Infiltration rate			0.1500 (18)
Number of sides sheltered			3 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												81.0000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2432	0.2403	0.2374	0.2229	0.2200	0.2054	0.2054	0.2025	0.2112	0.2200	0.2258	0.2316 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening			1.8800	1.2000	2.2560		(26)
Glazing (Uw = 1.20)			18.7200	1.1450	21.4351		(27)
External Wall	48.5100	18.7200	29.7900	0.1600	4.7664	70.0000	2085.3000 (29a)
Sheltered Wall	36.7700	1.8800	34.8900	0.1600	5.5824	70.0000	2442.3000 (29a)
External Roof 1	77.0900		77.0900	0.1000	7.7090	9.0000	693.8100 (30)
Total net area of external elements Aum(A, m ²)			162.3700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.7489		(33)
Party Wall			19.9500	0.0000	0.0000	0.0000	0.0000 (32)
Party Floor 1			77.0900			80.0000	6167.2000 (32d)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =	11388.6100 (34)	
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							147.7314 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate				8.7000	0.0500	0.4350	

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Appendix Q - special features
 Energy saved or generated
 Energy used
 Total delivered energy for all uses

-0.0000 (336)
 0.0000 (337)
 4624.2064 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			220.0000 (367)
Space and Water heating from Heat pump		0.1564	124.3835 (367)
Electrical energy for heat distribution (space & water)	2080.0329	0.0000	6.7143 (372)
Overall CO2 factor for heat network	17.4935		0.0682 (386)
Total CO2 associated with community systems			311.9088 (373)
Space and water heating			311.9088 (376)
Pumps, fans and electric keep-hot	203.1476	0.1387	28.1791 (378)
Energy for lighting	180.3694	0.1443	26.0329 (379)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-335.3828	0.1312	-44.0052
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-44.0052 (380)
Total CO2, kg/year			322.1155 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.1800 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			220.0000 (467a)
Space and Water heating from Heat pump		1.5791	1255.6409 (467)
Electrical energy for heat distribution (space & water)	2080.0329	0.0000	70.5997 (472)
Overall CO2 factor for heat network	17.4935		0.7167 (486)
Total CO2 associated with community systems			3279.6756 (473)
Space and water heating			3279.6756 (476)
Pumps, fans and electric keep-hot	203.1476	1.5128	307.3216 (478)
Energy for lighting	180.3694	1.5338	276.6566 (479)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-335.3828	1.4847	-497.9541
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-497.9541 (480)
Total Primary energy kWh/year			3365.6997 (483)
Dwelling Primary energy Rate (DPER)			43.6600 (484)

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	77.0900 (1b)	x 2.7000 (2b)	= 208.1430 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 208.1430 (5)

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)	
Number of open flues	0 * 20 =	0.0000 (6b)	
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)	
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)	
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)	
Number of blocked chimneys	0 * 20 =	0.0000 (6f)	
Number of intermittent extract fans	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) =	0.1441 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3941	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3055 (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	0.3895	0.3818	0.3742	0.3360	0.3284	0.2902	0.2902	0.2825	0.3055	0.3284	0.3436	0.3589 (22b)
Effective ac	0.5758	0.5729	0.5700	0.5564	0.5539	0.5421	0.5421	0.5399	0.5467	0.5539	0.5590	0.5644 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.8800	1.0000	1.8800			(26)
TER Opening Type (Uw = 1.20)			17.3900	1.1450	19.9122			(27)
External Wall	48.5100	17.3900	31.1200	0.1800	5.6016			(29a)
Sheltered Wall	36.7700	1.8800	34.8900	0.1800	6.2802			(29a)
External Roof 1	77.0900		77.0900	0.1100	8.4799			(30)
Total net area of external elements Aum(A, m2)			162.3700					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	42.1539		(33)
Party Wall			19.9500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 147.7314 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	8.7000	0.0500	0.4350
E4 Jamb	28.1200	0.0500	1.4060
E7 Party floor between dwellings (in blocks of flats)	31.5900	0.0700	2.2113
E16 Corner (normal)	8.1000	0.0900	0.7290
E18 Party wall between dwellings	8.1000	0.0600	0.4860
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	14.7800	0.0000	0.0000
E15 Flat roof with parapet	31.5900	0.5600	17.6904
P4 Party wall - Roof (insulation at ceiling level)	14.7800	0.1200	1.7736

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 24.7313 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 66.8852 (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	39.5526	39.3503	39.1520	38.2208	38.0466	37.2355	37.2355	37.0853	37.5479	38.0466	38.3990	38.7675
Average = Sum(39)m / 12 =	106.4378	106.2355	106.0372	105.1060	104.9318	104.1207	104.1207	103.9705	104.4331	104.9318	105.2842	105.6527

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.3807	1.3781	1.3755	1.3634	1.3612	1.3506	1.3506	1.3487	1.3547	1.3612	1.3657	1.3705
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.4053 (42)

Hot water usage for mixer showers (42a)
 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

Hot water usage for baths (42b)
 74.4255 73.3202 71.7636 68.8937 66.7447 64.3618 63.0747 64.6203 66.3033 68.8530 71.7821 74.1739

Hot water usage for other uses (42c)
 39.2630 37.8352 36.4075 34.9797 33.5520 32.1242 32.1242 33.5520 34.9797 36.4075 37.8352 39.2630

Average daily hot water use (litres/day) (43)
 104.6978

Daily hot water use (44)
 113.6885 111.1554 108.1711 103.8734 100.2967 96.4861 95.1989 98.1723 101.2830 105.2605 109.6173 113.4368

Energy conte (45)
 180.0547 158.2838 166.2550 142.1975 135.0186 118.6409 115.1349 121.5578 124.8920 142.8375 156.1699 177.6147

Energy content (annual) (45)
 Total = Sum(45)m = 1738.6574

Distribution loss (46)m = 0.15 x (45)m (46)
 27.0082 23.7426 24.9382 21.3296 20.2528 17.7961 17.2702 18.2337 18.7338 21.4256 23.4255 26.6422

Water storage loss:
 Store volume (47)
 150.0000

a) If manufacturer declared loss factor is known (kWh/day):
 Temperature factor from Table 2b (48)
 1.3938
 Enter (49) or (54) in (55) (49)
 0.5400
 Total storage loss (55)
 0.7527

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 (57)
 23.3325 21.0745 23.3325 22.5798 23.3325 22.5798 23.3325 23.3325 22.5798 23.3325 22.5798 23.3325

Primary loss (59)
 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624

Combi loss (61)
 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

Total heat required for water heating calculated for each month (62)
 226.6496 200.3695 212.8499 187.2894 181.6135 163.7327 161.7298 168.1527 169.9839 189.4324 201.2618 224.2096

WWHRS (63a)
 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

FV diverter (63b)
 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000

Solar input (63c)
 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

FGHRS (63d)
 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

Output from w/h (64)
 226.6496 200.3695 212.8499 187.2894 181.6135 163.7327 161.7298 168.1527 169.9839 189.4324 201.2618 224.2096

Total per year (kWh/year) = Sum(64)m = (64)
 2287.2748

12Total per year (kWh/year) (64)
 2287

Electric shower(s) (64a)
 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

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

Heat gains from water heating, kWh/month (65)
 97.1441 86.2979 92.5557 83.3541 82.1696 75.5216 75.5583 77.6939 77.6001 84.7694 88.0000 96.3328

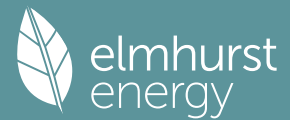
5. Internal gains (see Table 5 and 5a)

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	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	107.5429	119.0654	107.5429	111.1277	107.5429	111.1277	107.5429	107.5429	111.1277	107.5429	111.1277	107.5429
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	213.2514	215.4643	209.8879	198.0164	183.0308	168.9464	159.5372	157.3243	162.9007	174.7722	189.7578	203.8422
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000
Losses e.g. evaporation (negative values) (Table 5)	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131

Water heating gains (Table 5)

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Total internal gains	130.5700	128.4195	124.4028	115.7696	110.4430	104.8911	101.5568	104.4273	107.7779	113.9374	122.2222	129.4796 (72)
	513.4443	525.0291	503.9135	486.9936	463.0966	444.0451	427.7168	428.3744	440.8862	458.3324	485.1876	502.9446 (73)

6. Solar gains

[Jan]	Area m2				Solar flux Table 6a W/m2		Specific data or Table 6b g		Specific data or Table 6c FF		Access factor Table 6d		Gains W	
North	12.0400				10.6334		0.6300		0.7000		0.7700		39.1264 (74)	
East	5.3500				19.6403		0.6300		0.7000		0.7700		32.1124 (76)	
Solar gains	71.2388	137.5913	230.5103	354.9667	459.8324	483.6009	454.9886	372.7995	273.0842	163.5467	88.3079	59.0254 (83)		
Total gains	584.6831	662.6204	734.4239	841.9603	922.9291	927.6460	882.7054	801.1739	713.9704	621.8791	573.4955	561.9700 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	29.7216	29.7782	29.8339	30.0982	30.1482	30.3830	30.3830	30.4269	30.2921	30.1482	30.0473	29.9425	
alpha	2.9814	2.9852	2.9889	3.0065	3.0099	3.0255	3.0255	3.0285	3.0195	3.0099	3.0032	2.9962	
util living area	0.9753	0.9630	0.9394	0.8790	0.7711	0.6173	0.4820	0.5393	0.7547	0.9116	0.9626	0.9780 (86)	
MIT	18.6640	18.9238	19.3577	19.9667	20.4863	20.8172	20.9364	20.9099	20.6459	19.9802	19.2298	18.6228 (87)	
Th 2	19.7782	19.7802	19.7822	19.7915	19.7932	19.8014	19.8014	19.8029	19.7982	19.7932	19.7897	19.7860 (88)	
util rest of house	0.9701	0.9553	0.9262	0.8517	0.7186	0.5300	0.3650	0.4201	0.6792	0.8855	0.9534	0.9733 (89)	
MIT 2	17.0960	17.4252	17.9717	18.7248	19.3290	19.6764	19.7736	19.7597	19.5230	18.7602	17.8226	17.0484 (90)	
Living area fraction	fLA = Living area / (4) =												0.3243 (91)
MIT	17.6045	17.9112	18.4212	19.1276	19.7043	20.0463	20.1507	20.1327	19.8871	19.1559	18.2789	17.5590 (92)	
Temperature adjustment													0.0000
adjusted MIT	17.6045	17.9112	18.4212	19.1276	19.7043	20.0463	20.1507	20.1327	19.8871	19.1559	18.2789	17.5590 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9567	0.9388	0.9066	0.8334	0.7142	0.5491	0.4008	0.4550	0.6856	0.8679	0.9373	0.9609 (94)	
Useful gains	559.3737	622.0350	665.8490	701.7151	659.1598	509.3987	353.7804	364.5400	489.4811	539.7528	537.5305	539.9914 (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	1416.0966	1382.2513	1264.0866	1074.9787	839.9060	567.0774	369.6976	388.0893	604.3684	897.7839	1176.9626	1411.4121 (97)	
Space heating kWh	637.4018	510.8654	445.0888	268.7498	134.4752	0.0000	0.0000	0.0000	0.0000	266.3751	460.3911	648.3370 (98a)	
Space heating requirement - total per year (kWh/year)													3371.6841
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	637.4018	510.8654	445.0888	268.7498	134.4752	0.0000	0.0000	0.0000	0.0000	266.3751	460.3911	648.3370 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)													3371.6841
Space heating per m2													(98c) / (4) =
													43.7370 (99)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	637.4018	510.8654	445.0888	268.7498	134.4752	0.0000	0.0000	0.0000	0.0000	266.3751	460.3911	648.3370 (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)	690.5762	553.4836	482.2197	291.1698	145.6936	0.0000	0.0000	0.0000	0.0000	288.5971	498.7986	702.4236 (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	226.6496	200.3695	212.8499	187.2894	181.6135	163.7327	161.7298	168.1527	169.9839	189.4324	201.2618	224.2096 (64)	
Efficiency of water heater													79.8000 (216)
(217)m	86.2484	86.0654	85.6741	84.8690	83.3959	79.8000	79.8000	79.8000	79.8000	84.8241	85.8547	86.2990 (217)	
Fuel for water heating, kWh/month	262.7869	232.8106	248.4414	220.6805	217.7727	205.1788	202.6689	210.7177	213.0124	223.3237	234.4215	259.8055 (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	22.3453	17.9262	16.1406	11.8253	9.1342	7.4627	8.3325	10.8309	14.0683	18.4583	20.8487	22.9663 (232)	
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.7199	-19.3676	-30.0378	-36.5264	-41.8612	-39.9877	-39.4991	-36.0418	-30.4191	-23.3061	-14.4829	-10.8362 (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)													

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(233b)m	-3.4051	-7.4052	-15.1853	-23.5160	-31.8076	-32.2273	-31.8520	-26.6410	-19.1011	-10.8192	-4.6173	-2.6752	(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												3652.9622	(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												2731.6206	(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)												180.3393	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-544.3381	(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												6106.5841	(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	3652.9622	0.2100	767.1221	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2731.6206	0.2100	573.6403	(264)
Space and water heating			1340.7624	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	180.3393	0.1443	26.0285	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-335.0858	0.1330	-44.5705	
PV Unit electricity exported	-209.2522	0.1250	-26.1585	
Total			-70.7290	(269)
Total CO2, kg/year			1307.9912	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			16.9700	(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	3652.9622	1.1300	4127.8473	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2731.6206	1.1300	3086.7313	(278)
Space and water heating			7214.5786	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	180.3393	1.5338	276.6105	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-335.0858	1.4915	-499.7805	
PV Unit electricity exported	-209.2522	0.4588	-96.0107	
Total			-595.7912	(283)
Total Primary energy kWh/year			7025.4987	(286)
Target Primary Energy Rate (TPER)			91.1300	(287)

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Property Reference	2B4P Top Floor		Issued on Date	24/11/2023	
Assessment Reference	Be Lean	Prop Type Ref			
Property					
SAP Rating	83 B	DER	14.30	TER	16.97
Environmental	88 B	% DER < TER	15.73		
CO ₂ Emissions (t/year)	1	DFEE	38.27	TFEE	50.98
Compliance Check	See BREL	% DFEE < TFEE	24.92		
% DPER < TPER	10.94	DPER	81.16	TPER	91.13
Assessor Details	Mr. Michael Woodbridge			Assessor ID	M818-0001
Client					

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

1. Overall dwelling characteristics

Ground floor	Area (m ²)	77.0900 (1b)	Storey height (m)	2.7000 (2b)	Volume (m ³)	208.1430 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)		77.0900				(4)
Dwelling volume						(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 208.1430 (5)

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (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 infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2432	0.2403	0.2374	0.2229	0.2200	0.2054	0.2054	0.2025	0.2112	0.2200	0.2258	0.2316 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening			1.8800	1.2000	2.2560		(26)
Glazing (Uw = 1.20)			18.7200	1.1450	21.4351		(27)
External Wall	48.5100	18.7200	29.7900	0.1600	4.7664	70.0000	2085.3000 (29a)
Sheltered Wall	36.7700	1.8800	34.8900	0.1600	5.5824	70.0000	2442.3000 (29a)
External Roof 1	77.0900		77.0900	0.1000	7.7090	9.0000	693.8100 (30)
Total net area of external elements Aum(A, m ²)			162.3700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.7489		(33)
Party Wall			19.9500	0.0000	0.0000	0.0000	0.0000 (32)
Party Floor 1			77.0900			80.0000	6167.2000 (32d)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =	11388.6100		(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K					147.7314		(35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate				8.7000	0.0500	0.4350	

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Appendix Q - special features	
Energy saved or generated	-0.0000 (336)
Energy used	0.0000 (337)
Total delivered energy for all uses	4959.5893 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			92.3000 (367)
Space and Water heating from Boilers	4957.8249	0.2100	398.0101 (367)
Electrical energy for heat distribution (space & water)	17.4935	0.0000	6.7143 (372)
Overall CO2 factor for heat network			0.2290 (386)
Total CO2 associated with community systems			1047.8575 (373)
Space and water heating			1047.8575 (376)
Pumps, fans and electric keep-hot	203.1476	0.1387	28.1791 (378)
Energy for lighting	180.3694	0.1443	26.0329 (379)
Total CO2, kg/year			1102.0694 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			14.3000 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Boilers			92.3000 (467a)
Space and Water heating from Boilers	4957.8249	1.1300	2141.6734 (467)
Electrical energy for heat distribution (space & water)	17.4935	0.0000	70.5997 (472)
Overall CO2 factor for heat network			1.2397 (486)
Total CO2 associated with community systems			5672.9418 (473)
Space and water heating			5672.9418 (476)
Pumps, fans and electric keep-hot	203.1476	1.5128	307.3216 (478)
Energy for lighting	180.3694	1.5338	276.6566 (479)
Total Primary energy kWh/year			6256.9200 (483)
Dwelling Primary energy Rate (DPER)			81.1600 (484)

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	77.0900 (1b)	2.7000 (2b)	208.1430 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0900		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 208.1430 (5)

2. Ventilation rate

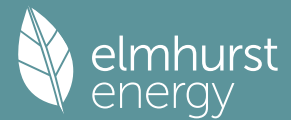
		m3 per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number 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) = 0.1441 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3941 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3055 (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	0.3895	0.3818	0.3742	0.3360	0.3284	0.2902	0.2902	0.2825	0.3055	0.3284	0.3436	0.3589 (22b)
Effective ac	0.5758	0.5729	0.5700	0.5564	0.5539	0.5421	0.5421	0.5399	0.5467	0.5539	0.5590	0.5644 (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			1.8800	1.0000	1.8800		(26)

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TER Opening Type (Uw = 1.20)			17.3900	1.1450	19.9122	(27)
External Wall	48.5100	17.3900	31.1200	0.1800	5.6016	(29a)
Sheltered Wall	36.7700	1.8800	34.8900	0.1800	6.2802	(29a)
External Roof 1	77.0900		77.0900	0.1100	8.4799	(30)
Total net area of external elements Aum(A, m2)			162.3700			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.1539	(33)
Party Wall			19.9500	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 147.7314 (35)

List of Thermal Bridges				Length	Psi-value	Total
K1 Element						
E1 Steel lintel with perforated steel base plate			8.7000	0.0500	0.4350	
E4 Jamb			28.1200	0.0500	1.4060	
E7 Party floor between dwellings (in blocks of flats)			31.5900	0.0700	2.2113	
E16 Corner (normal)			8.1000	0.0900	0.7290	
E18 Party wall between dwellings			8.1000	0.0600	0.4860	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)			14.7800	0.0000	0.0000	
E15 Flat roof with parapet			31.5900	0.5600	17.6904	
P4 Party wall - Roof (insulation at ceiling level)			14.7800	0.1200	1.7736	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 24.7313 (36)

Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 66.8852 (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	39.5526	39.3503	39.1520	38.2208	38.0466	37.2355	37.2355	37.0853	37.5479	38.0466	38.3990	38.7675 (38)
Heat transfer coeff	106.4378	106.2355	106.0372	105.1060	104.9318	104.1207	104.1207	103.9705	104.4331	104.9318	105.2842	105.6527 (39)
Average = Sum(39)m / 12 =												105.1052

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3807	1.3781	1.3755	1.3634	1.3612	1.3506	1.3506	1.3487	1.3547	1.3612	1.3657	1.3705 (40)
HLP (average)												1.3634
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.4053 (42)												
Hot water usage for mixer showers 0.0000 (42a)												
Hot water usage for baths 74.4255 (42b)												
Hot water usage for other uses 39.2630 (42c)												
Average daily hot water use (litres/day) 104.6978 (43)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.6885	111.1554	108.1711	103.8734	100.2967	96.4861	95.1989	98.1723	101.2830	105.2605	109.6173	113.4368 (44)
Energy conte	180.0547	158.2838	166.2550	142.1975	135.0186	118.6409	115.1349	121.5578	124.8920	142.8375	156.1699	177.6147 (45)
Energy content (annual)												Total = Sum(45)m = 1738.6574
Distribution loss (46)m = 0.15 x (45)m												
	27.0082	23.7426	24.9382	21.3296	20.2528	17.7961	17.2702	18.2337	18.7338	21.4256	23.4255	26.6422 (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 (56)												
If cylinder contains dedicated solar storage 23.3325 (57)												
Primary loss 23.2624 (59)												
Combi loss 0.0000 (61)												
Total heat required for water heating calculated for each month 226.6496 (62)												
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h 226.6496 (64)												
Total per year (kWh/year) = Sum(64)m = 2287.2748 (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 97.1441 (65)												

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

Metabolic gains (Table 5), Watts												
(66)m	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664	120.2664 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	107.5429	119.0654	107.5429	111.1277	107.5429	111.1277	107.5429	107.5429	111.1277	107.5429	111.1277	107.5429 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	213.2514	215.4643	209.8879	198.0164	183.0308	168.9464	159.5372	157.3243	162.9007	174.7722	189.7578	203.8422 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266	35.0266 (69)
Pumps, fans 3.0000 (70)												
Losses e.g. evaporation (negative values) (Table 5)												
	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131	-96.2131 (71)
Water heating gains (Table 5)												
	130.5700	128.4195	124.4028	115.7696	110.4430	104.8911	101.5568	104.4273	107.7779	113.9374	122.2222	129.4796 (72)
Total internal gains	513.4443	525.0291	503.9135	486.9936	463.0966	444.0451	427.7168	428.3744	440.8862	458.3324	485.1876	502.9446 (73)

6. Solar gains

Full SAP Calculation Printout



Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	79.8000
Water heating fuel used	2731.6206 (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)	180.3393 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-544.3381 (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	6106.5841 (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	3652.9622	0.2100	767.1221 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2731.6206	0.2100	573.6403 (264)
Space and water heating			1340.7624 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	180.3393	0.1443	26.0285 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-335.0858	0.1330	-44.5705
PV Unit electricity exported	-209.2522	0.1250	-26.1585
Total			-70.7290 (269)
Total CO2, kg/year			1307.9912 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			16.9700 (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	3652.9622	1.1300	4127.8473 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2731.6206	1.1300	3086.7313 (278)
Space and water heating			7214.5786 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	180.3393	1.5338	276.6105 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-335.0858	1.4915	-499.7805
PV Unit electricity exported	-209.2522	0.4588	-96.0107
Total			-595.7912 (283)
Total Primary energy kWh/year			7025.4987 (286)
Target Primary Energy Rate (TPER)			91.1300 (287)

Full SAP Calculation Printout



Property Reference	3B5P First Floor		Issued on Date	24/11/2023	
Assessment Reference	Be Green	Prop Type Ref			
Property					
SAP Rating	85 B	DER	3.44	TER	11.60
Environmental	97 A	% DER < TER			70.34
CO ₂ Emissions (t/year)	0.28	DFEE	28.13	TFEE	28.53
Compliance Check	See BREL	% DFEE < TFEE			1.39
% DPER < TPER	41.87	DPER	36.18	TPER	62.24
Assessor Details	Mr. Michael Woodbridge			Assessor ID	M818-0001
Client					

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

1. Overall dwelling characteristics

Ground floor		Area (m ²)	Storey height (m)	Volume (m ³)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.0000	89.0000 (1b)	x 2.7000 (2b)	= 240.3000 (1b) - (3b)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 240.3000 (5)

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	3.0000	(17)
Infiltration rate	0.1500	(18)
Number of sides sheltered	3	(19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (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 infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												81.0000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2432	0.2403	0.2374	0.2229	0.2200	0.2054	0.2054	0.2025	0.2112	0.2200	0.2258	0.2316 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening			1.8800	1.2000	2.2560		(26)
Glazing (Uw = 1.20)			12.9600	1.1450	14.8397		(27)
External Wall	57.2400	12.9600	44.2800	0.1600	7.0848	70.0000	3099.6000 (29a)
Sheltered Wall	18.3600	1.8800	16.4800	0.1600	2.6368	70.0000	1153.6000 (29a)
Total net area of external elements Aum(A, m ²)			75.6000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	26.8173	(33)
Party Wall			38.8500	0.0000	0.0000	0.0000	0.0000 (32)
Party Floor 1			89.0000	0.0000	0.0000	0.0000	0.0000 (32a)
Party Ceiling 1			89.0000	0.0000	0.0000	0.0000	0.0000 (32b)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =	4253.2000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							47.7888 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate				6.3000	0.0500	0.3150	

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Appendix Q - special features	
Energy saved or generated	-0.0000 (336)
Energy used	0.0000 (337)
Total delivered energy for all uses	4379.1959 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			220.0000 (367)
Space and Water heating from Heat pump		0.1550	94.8526 (367)
Electrical energy for heat distribution (space & water)	1945.9673	0.0000	6.2180 (372)
Overall CO2 factor for heat network			0.0675 (386)
Total CO2 associated with community systems			288.8561 (373)
Space and water heating			288.8561 (376)
Pumps, fans and electric keep-hot	234.5328	0.1387	32.5326 (378)
Energy for lighting	207.7525	0.1443	29.9851 (379)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-344.2175	0.1311	-45.1317
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-45.1317 (380)
Total CO2, kg/year			306.2421 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.4400 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			220.0000 (467a)
Space and Water heating from Heat pump		1.5740	962.9843 (467)
Electrical energy for heat distribution (space & water)	1945.9673	0.0000	65.8127 (472)
Overall CO2 factor for heat network			0.7141 (486)
Total CO2 associated with community systems			3057.2998 (473)
Space and water heating			3057.2998 (476)
Pumps, fans and electric keep-hot	234.5328	1.5128	354.8012 (478)
Energy for lighting	207.7525	1.5338	318.6577 (479)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-344.2175	1.4844	-510.9481
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-510.9481 (480)
Total Primary energy kWh/year			3219.8107 (483)
Dwelling Primary energy Rate (DPER)			36.1800 (484)

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	89.0000 (1b)	x 2.7000 (2b)	= 240.3000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.3000 (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)
Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1248 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3748	(18)
Number of sides sheltered	3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2905 (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	0.3704	0.3631	0.3559	0.3196	0.3123	0.2760	0.2760	0.2687	0.2905	0.3123	0.3268	0.3413 (22b)
Effective ac	0.5686	0.5659	0.5633	0.5511	0.5488	0.5381	0.5381	0.5361	0.5422	0.5488	0.5534	0.5583 (25)

Full SAP Calculation Printout



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	
TER Opaque door			1.8800	1.0000	1.8800			(26)
TER Opening Type (Uw = 1.20)			12.9600	1.1450	14.8397			(27)
External Wall	57.2400	12.9600	44.2800	0.1800	7.9704			(29a)
Sheltered Wall	18.3600	1.8800	16.4800	0.1800	2.9664			(29a)
Total net area of external elements Aum(A, m ²)			75.6000					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	27.6565		(33)
Party Wall			38.8500	0.0000	0.0000			(32)

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

47.7888 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	6.3000	0.0500	0.3150
E4 Jamb	23.4000	0.0500	1.1700
E7 Party floor between dwellings (in blocks of flats)	49.6200	0.0700	3.4734
E8 Balcony within a dwelling, wall insulation continuous	6.3800	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860
E18 Party wall between dwellings	10.8000	0.0600	0.6480
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	28.6000	0.0000	0.0000
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)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 33.5059 (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	45.0890	44.8778	44.6708	43.6983	43.5164	42.6694	42.6694	42.5125	42.9956	43.5164	43.8844	44.2692 (38)
Average = Sum(39)m / 12 =	78.5949	78.3837	78.1767	77.2042	77.0223	76.1753	76.1753	76.0184	76.5015	77.0223	77.3903	77.7751 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8831	0.8807	0.8784	0.8675	0.8654	0.8559	0.8559	0.8541	0.8596	0.8654	0.8696	0.8739 (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													2.6118 (42)
Hot water usage for mixer showers	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 (42a)
Hot water usage for baths	78.4333	77.2685	75.6281	72.6036	70.3389	67.8277	66.4713	68.1002	69.8737	72.5608	75.6476	78.1682 (42b)	
Hot water usage for other uses	41.3773	39.8727	38.3680	36.8634	35.3588	33.8541	33.8541	35.3588	36.8634	38.3680	39.8727	41.3773 (42c)	
Average daily hot water use (litres/day)													110.3358 (43)
Daily hot water use	119.8106	117.1411	113.9962	109.4670	105.6977	101.6819	100.3254	103.4589	106.7371	110.9288	115.5202	119.5455 (44)	
Energy conte	189.7507	166.8074	175.2079	149.8549	142.2894	125.0297	121.3349	128.1038	131.6175	150.5293	164.5797	187.1793 (45)	
Energy content (annual)													Total = Sum(45)m = 1832.2846
Distribution loss (46)m = 0.15 x (45)m	28.4626	25.0211	26.2812	22.4782	21.3434	18.7545	18.2002	19.2156	19.7426	22.5794	24.6870	28.0769 (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	236.3456	208.8931	221.8028	194.9467	188.8843	170.1215	167.9298	174.6987	176.7094	197.1242	209.6716	233.7742 (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	236.3456	208.8931	221.8028	194.9467	188.8843	170.1215	167.9298	174.6987	176.7094	197.1242	209.6716	233.7742 (64)	
Total per year (kWh/year)													Total per year (kWh/year) = Sum(64)m = 2380.9020 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month	100.3680	89.1320	95.5325	85.9002	84.5872	77.6458	77.6198	79.8704	79.8363	87.3269	90.7962	99.5130 (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	130.5892	130.5892	130.5892	130.5892	130.5892	130.5892	130.5892	130.5892	130.5892	130.5892	130.5892	130.5892 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	127.2812	140.9185	127.2812	131.5239	127.2812	131.5239	127.2812	127.2812	131.5239	127.2812	131.5239	127.2812 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	237.2259	239.6876	233.4843	220.2782	203.6078	187.9400	177.4730	175.0113	181.2146	194.4208	211.0911	226.7589 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.0589	36.0589	36.0589	36.0589	36.0589	36.0589	36.0589	36.0589	36.0589	36.0589	36.0589	36.0589 (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)	-104.4714	-104.4714	-104.4714	-104.4714	-104.4714	-104.4714	-104.4714	-104.4714	-104.4714	-104.4714	-104.4714	-104.4714 (71)
Water heating gains (Table 5)	134.9033	132.6370	128.4039	119.3059	113.6924	107.8415	104.3277	107.3527	110.8837	117.3749	126.1059	133.7541 (72)

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Total internal gains
564.5871 578.4198 554.3462 536.2847 509.7582 489.4821 471.2586 471.8220 485.7990 504.2536 533.8976 552.9709 (73)

6. Solar gains

[Jan]												Gains W
	Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d			
North	10.8000		10.6334		0.6300		0.7000		0.7700		35.0968 (74)	
West	2.1600		19.6403		0.6300		0.7000		0.7700		12.9650 (80)	
Solar gains	48.0618	92.4341	155.7394	243.9835	321.2634	340.4243	319.2368	258.0475	185.6085	109.9347	59.4623	39.9202 (83)
Total gains	612.6489	670.8538	710.0856	780.2682	831.0216	829.9065	790.4954	729.8695	671.4076	614.1883	593.3599	592.8911 (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	15.0321	15.0726	15.1125	15.3029	15.3390	15.5096	15.5096	15.5416	15.4434	15.3390	15.2660	15.1905
alpha	2.0021	2.0048	2.0075	2.0202	2.0226	2.0340	2.0340	2.0361	2.0296	2.0226	2.0177	2.0127
util living area	0.8709	0.8448	0.8065	0.7269	0.6184	0.4849	0.3779	0.4166	0.5868	0.7530	0.8381	0.8773 (86)
MIT	17.9940	18.3133	18.8296	19.5705	20.2106	20.6661	20.8572	20.8209	20.4761	19.6797	18.7496	17.9482 (87)
Th 2	20.1819	20.1839	20.1859	20.1952	20.1970	20.2051	20.2051	20.2067	20.2020	20.1970	20.1935	20.1898 (88)
util rest of house	0.8611	0.8332	0.7916	0.7053	0.5868	0.4399	0.3199	0.3578	0.5435	0.7288	0.8243	0.8680 (89)
MIT 2	16.6509	17.0478	17.6899	18.6023	19.3699	19.8963	20.0966	20.0655	19.6947	18.7515	17.6016	16.5959 (90)
Living area fraction	fLA = Living area / (4) = 0.2809 (91)											
MIT	17.0282	17.4033	18.0100	18.8743	19.6060	20.1126	20.3103	20.2777	19.9142	19.0122	17.9241	16.9758 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.0282	17.4033	18.0100	18.8743	19.6060	20.1126	20.3103	20.2777	19.9142	19.0122	17.9241	16.9758 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8115	0.7830	0.7427	0.6645	0.5614	0.4344	0.3279	0.3633	0.5265	0.6869	0.7751	0.8192 (94)
Useful gains	497.1925	525.2556	527.3798	518.4729	466.5402	360.5047	259.1812	265.1476	353.4737	421.8741	459.9227	485.6863 (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	1000.3718	980.0538	899.8133	770.0591	608.9408	419.9219	282.6310	294.7770	444.7946	647.9294	837.6795	993.6381 (97)
Space heating kWh	374.3654	305.6244	277.0906	181.1420	105.9460	0.0000	0.0000	0.0000	0.0000	168.1851	271.9849	377.9162 (98a)
Space heating requirement - total per year (kWh/year)	2062.2547											
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	374.3654	305.6244	277.0906	181.1420	105.9460	0.0000	0.0000	0.0000	0.0000	168.1851	271.9849	377.9162 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	2062.2547											
Space heating per m2	(98c) / (4) = 23.1714 (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	374.3654	305.6244	277.0906	181.1420	105.9460	0.0000	0.0000	0.0000	0.0000	168.1851	271.9849	377.9162 (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)	405.5963	331.1207	300.2065	196.2535	114.7844	0.0000	0.0000	0.0000	0.0000	182.2157	294.6749	409.4433 (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	236.3456	208.8931	221.8028	194.9467	188.8843	170.1215	167.9298	174.6987	176.7094	197.1242	209.6716	233.7742 (64)
Efficiency of water heater (217)m	85.0863	84.9119	84.5600	83.8954	82.8162	79.8000	79.8000	79.8000	79.8000	83.7058	84.6443	85.1306 (217)
Fuel for water heating, kWh/month	277.7718	246.0115	262.3022	232.3688	228.0766	213.1849	210.4384	218.9206	221.4403	235.4965	247.7089	274.6064 (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	26.4465	21.2164	19.1030	13.9957	10.8107	8.8324	9.8618	12.8188	16.6504	21.8462	24.6752	27.1815 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-14.6145	-22.2111	-34.3803	-41.7161	-47.7204	-45.5455	-44.9867	-41.0939	-34.7471	-26.6913	-16.6257	-12.4545 (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	-4.0017	-8.6979	-17.8296	-27.6026	-37.3299	-37.8263	-37.3877	-31.2730	-22.4238	-12.7062	-5.4254	-3.1444 (233b)

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Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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												2234.2954	(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												2868.3268	(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)												213.4385	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-628.4354	(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												4773.6253	(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	2234.2954	0.2100	469.2020 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2868.3268	0.2100	602.3486 (264)
Space and water heating			1071.5507 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	213.4385	0.1443	30.8058 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-382.7871	0.1331	-50.9318
PV Unit electricity exported	-245.6484	0.1250	-30.7099
Total			-81.6417 (269)
Total CO2, kg/year			1032.6439 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.6000 (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	2234.2954	1.1300	2524.7538 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2868.3268	1.1300	3241.2093 (278)
Space and water heating			5765.9631 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	213.4385	1.5338	327.3792 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-382.7871	1.4917	-570.9890
PV Unit electricity exported	-245.6484	0.4589	-112.7158
Total			-683.7047 (283)
Total Primary energy kWh/year			5539.7383 (286)
Target Primary Energy Rate (TPER)			62.2400 (287)

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Property Reference	3B5P First Floor		Issued on Date	24/11/2023	
Assessment Reference	Be Lean	Prop Type Ref			
Property					
SAP Rating	85 B	DER	11.72	TER	11.60
Environmental	90 B	% DER < TER			
CO ₂ Emissions (t/year)	0.97	DFEE	28.13	TFEE	28.53
Compliance Check	See BREL	% DFEE < TFEE			
% DPER < TPER	-7.96	DPER	67.20	TPER	62.24
Assessor Details	Mr. Michael Woodbridge			Assessor ID	M818-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	89.0000	2.7000	240.3000
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.0000		
Dwelling volume			240.3000

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)

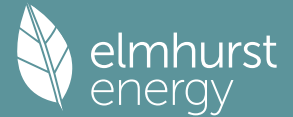
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2432	0.2403	0.2374	0.2229	0.2200	0.2054	0.2054	0.2025	0.2112	0.2200	0.2258	0.2316 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening			1.8800	1.2000	2.2560		(26)
Glazing (Uw = 1.20)			12.9600	1.1450	14.8397		(27)
External Wall	57.2400	12.9600	44.2800	0.1600	7.0848	70.0000	3099.6000 (29a)
Sheltered Wall	18.3600	1.8800	16.4800	0.1600	2.6368	70.0000	1153.6000 (29a)
Total net area of external elements Aum(A, m ²)			75.6000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	26.8173			(33)
Party Wall			38.8500	0.0000	0.0000	0.0000	0.0000 (32)
Party Floor 1			89.0000	0.0000	0.0000	0.0000	0.0000 (32a)
Party Ceiling 1			89.0000	0.0000	0.0000	0.0000	0.0000 (32b)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				4253.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							47.7888 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate				6.3000	0.0500	0.3150	

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7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	22.1069	22.2027	22.2992	22.7950	22.8968	23.4199	23.4199	23.5273	23.2078	22.8968	22.6941	22.4949
alpha	2.4738	2.4802	2.4866	2.5197	2.5265	2.5613	2.5613	2.5685	2.5472	2.5265	2.5129	2.4997
util living area	0.8362	0.8032	0.7563	0.6574	0.5348	0.3923	0.2932	0.3233	0.4887	0.6800	0.7890	0.8430 (86)
MIT	19.1916	19.4480	19.8139	20.3241	20.6845	20.8993	20.9650	20.9545	20.8152	20.3733	19.7586	19.1767 (87)
Th 2	20.4296	20.4319	20.4342	20.4459	20.4483	20.4600	20.4600	20.4623	20.4553	20.4483	20.4436	20.4389 (88)
util rest of house	0.8269	0.7925	0.7430	0.6395	0.5112	0.3633	0.2594	0.2884	0.4580	0.6594	0.7762	0.8342 (89)
MIT 2	18.2571	18.5788	19.0368	19.6720	20.1054	20.3611	20.4305	20.4229	20.2675	19.7421	18.9798	18.2447 (90)
Living area fraction	FLA = Living area / (4) = 0.2809 (91)											
MIT	18.5196	18.8229	19.2551	19.8552	20.2681	20.5123	20.5806	20.5722	20.4213	19.9194	19.1985	18.5065 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.5196	18.8229	19.2551	19.8552	20.2681	20.5123	20.5806	20.5722	20.4213	19.9194	19.1985	18.5065 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.7907	0.7579	0.7121	0.6192	0.5033	0.3662	0.2671	0.2956	0.4561	0.6382	0.7439	0.7984 (94)
Useful gains	474.1357	492.2298	482.6809	454.7188	388.3254	281.5358	195.4449	202.4682	291.2549	378.3215	431.8375	464.9140 (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	759.9297	740.8650	675.7819	567.7957	442.1005	298.2532	200.8072	209.5127	321.8011	480.8666	629.8439	751.3830 (97)
Space heating kWh	212.6307	167.0828	143.6671	81.4154	40.0087	0.0000	0.0000	0.0000	0.0000	76.2936	142.5646	213.1329 (98a)
Space heating requirement - total per year (kWh/year)	1076.7959											
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	212.6307	167.0828	143.6671	81.4154	40.0087	0.0000	0.0000	0.0000	0.0000	76.2936	142.5646	213.1329 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1076.7959											
Space heating per m2	(98c) / (4) = 12.0988 (99)											
9b. Energy requirements												
Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)											
Fraction of space heat from community system	1.0000 (302)											
Fraction of heat from community Boilers-Space and Water	1.0000 (303a)											
Factor for control and charging method (Table 4c(3)) for space heating	1.0000 (305)											
Factor for charging method (Table 4c(3)) for water heating	1.0000 (305a)											
Distribution loss factor (Table 12c) for community heating system	1.2500 (306)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating:												
Space heating requirement	212.6307	167.0828	143.6671	81.4154	40.0087	0.0000	0.0000	0.0000	0.0000	76.2936	142.5646	213.1329 (98)
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.25	265.7884	208.8535	179.5839	101.7692	50.0108	0.0000	0.0000	0.0000	0.0000	95.3670	178.2058	266.4162
307a	265.7884	208.8535	179.5839	101.7692	50.0108	0.0000	0.0000	0.0000	0.0000	95.3670	178.2058	266.4162 (307)
Space heating requirement	265.7884	208.8535	179.5839	101.7692	50.0108	0.0000	0.0000	0.0000	0.0000	95.3670	178.2058	266.4162 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)											
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating												
Annual water heating requirement	229.0847	202.6249	215.6776	194.9313	190.0005	169.1243	163.1993	175.3420	175.2911	196.4283	207.8323	228.5704 (64)
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.25	286.3558	253.2811	269.5969	243.6642	237.5007	211.4053	203.9991	219.1775	219.1138	245.5354	259.7904	285.7130
310a	286.3558	253.2811	269.5969	243.6642	237.5007	211.4053	203.9991	219.1775	219.1138	245.5354	259.7904	285.7130
Water heating fuel	286.3558	253.2811	269.5969	243.6642	237.5007	211.4053	203.9991	219.1775	219.1138	245.5354	259.7904	285.7130 (310)
Cooling System Energy Efficiency Ratio	0.0000 (314)											
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	19.9192	17.9916	19.9192	19.2767	19.9192	19.2767	19.9192	19.9192	19.2767	19.9192	19.2767	19.9192 (331)
Lighting	25.7420	20.6512	18.5941	13.6228	10.5227	8.5971	9.5991	12.4773	16.2068	21.2642	24.0178	26.4574 (332)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year												
Space heating fuel - community heating	1345.9948 (307)											
Space heating fuel - secondary	0.0000 (309)											
Water heating fuel - community heating	2935.1332 (310)											
Efficiency of water heater	0.0000 (311)											
Electricity used for heat distribution	13.4599 (313)											
Space cooling fuel	0.0000 (321)											
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.6000, SFP = 0.8000)												
mechanical ventilation fans (SFP = 0.8000)	234.5328 (330a)											
Total electricity for the above, kWh/year	234.5328 (331)											
Electricity for lighting (calculated in Appendix L)	207.7525 (332)											
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation	0.0000 (333)											
Wind generation	0.0000 (334)											
Hydro-electric generation (Appendix N)	0.0000 (335a)											
Electricity generated - Micro CHP (Appendix N)	0.0000 (335)											

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Appendix Q - special features
 Energy saved or generated
 Energy used
 Total delivered energy for all uses

-0.0000 (336)
 0.0000 (337)
 4723.4134 (338)

 12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			92.3000 (367)
Space and Water heating from Boilers	4638.2752	0.2100	306.2393 (367)
Electrical energy for heat distribution (space & water)	13.4599	0.0000	6.2180 (372)
Overall CO2 factor for heat network			0.2290 (386)
Total CO2 associated with community systems			980.2558 (373)
Space and water heating			980.2558 (376)
Pumps, fans and electric keep-hot	234.5328	0.1387	32.5326 (378)
Energy for lighting	207.7525	0.1443	29.9851 (379)
Total CO2, kg/year			1042.7735 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			11.7200 (384)

 13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Boilers			92.3000 (467a)
Space and Water heating from Boilers	4638.2752	1.1300	1647.8593 (467)
Electrical energy for heat distribution (space & water)	13.4599	0.0000	65.8127 (472)
Overall CO2 factor for heat network			1.2396 (486)
Total CO2 associated with community systems			5307.0637 (473)
Space and water heating			5307.0637 (476)
Pumps, fans and electric keep-hot	234.5328	1.5128	354.8012 (478)
Energy for lighting	207.7525	1.5338	318.6577 (479)
Total Primary energy kWh/year			5980.5227 (483)
Dwelling Primary energy Rate (DPER)			67.2000 (484)

 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	89.0000 (1b)	2.7000 (2b)	240.3000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.0000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 240.3000 (5)

 2. Ventilation rate

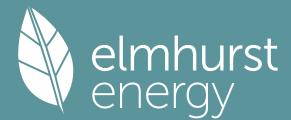
		m3 per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number 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) =	0.1248 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3748	(18)
Number of sides sheltered	3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2905 (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	0.3704	0.3631	0.3559	0.3196	0.3123	0.2760	0.2760	0.2687	0.2905	0.3123	0.3268	0.3413 (22b)
Effective ac	0.5686	0.5659	0.5633	0.5511	0.5488	0.5381	0.5381	0.5361	0.5422	0.5488	0.5534	0.5583 (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			1.8800	1.0000	1.8800		(26)

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TER Opening Type (Uw = 1.20)				12.9600	1.1450	14.8397	(27)
External Wall	57.2400	12.9600		44.2800	0.1800	7.9704	(29a)
Sheltered Wall	18.3600	1.8800		16.4800	0.1800	2.9664	(29a)
Total net area of external elements Aum(A, m ²)				75.6000			(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =		27.6565	(33)
Party Wall				38.8500	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 47.7888 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element			
E1 Steel lintel with perforated steel base plate	6.3000	0.0500	0.3150
E4 Jamb	23.4000	0.0500	1.1700
E7 Party floor between dwellings (in blocks of flats)	49.6200	0.0700	3.4734
E8 Balcony within a dwelling, wall insulation continuous	6.3800	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860
E18 Party wall between dwellings	10.8000	0.0600	0.6480
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	28.6000	0.0000	0.0000
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) 5.8494 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 33.5059 (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	45.0890	44.8778	44.6708	43.6983	43.5164	42.6694	42.6694	42.5125	42.9956	43.5164	43.8844	44.2692
Average = Sum(39)m / 12 =	78.5949	78.3837	78.1767	77.2042	77.0223	76.1753	76.1753	76.0184	76.5015	77.0223	77.3903	77.7751

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8831	0.8807	0.8784	0.8675	0.8654	0.8559	0.8559	0.8541	0.8596	0.8654	0.8696	0.8739
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6118 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	78.4333	77.2685	75.6281	72.6036	70.3389	67.8277	66.4713	68.1002	69.8737	72.5608	75.6476	78.1682	(42b)
Hot water usage for other uses	41.3773	39.8727	38.3680	36.8634	35.3588	33.8541	33.8541	35.3588	36.8634	38.3680	39.8727	41.3773	(42c)
Average daily hot water use (litres/day)													110.3358 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	119.8106	117.1411	113.9962	109.4670	105.6977	101.6819	100.3254	103.4589	106.7371	110.9288	115.5202	119.5455
Energy content (annual)	189.7507	166.8074	175.2079	149.8549	142.2894	125.0297	121.3349	128.1038	131.6175	150.5293	164.5797	187.1793
Distribution loss (46)m = 0.15 x (45)m	28.4626	25.0211	26.2812	22.4782	21.3434	18.7545	18.2002	19.2156	19.7426	22.5794	24.6870	28.0769

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 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 236.3456 208.8931 221.8028 194.9467 188.8843 170.1215 167.9298 174.6987 176.7094 197.1242 209.6716 233.7742 (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 236.3456 208.8931 221.8028 194.9467 188.8843 170.1215 167.9298 174.6987 176.7094 197.1242 209.6716 233.7742 (64)

Total per year (kWh/year) = Sum(64)m = 2380.9020 (64)

12Total per year (kWh/year) 2381 (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 0.0000 (64a)

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

Heat gains from water heating, kWh/month 100.3680 89.1320 95.5325 85.9002 84.5872 77.6458 77.6198 79.8704 79.8363 87.3269 90.7962 99.5130 (65)

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

Metabolic gains (Table 5), Watts													
(66)m	130.5892	130.5892	130.5892	130.5892	130.5892	130.5892	130.5892	130.5892	130.5892	130.5892	130.5892	130.5892	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	127.2812	140.9185	127.2812	131.5239	127.2812	131.5239	127.2812	127.2812	131.5239	127.2812	131.5239	127.2812	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	237.2259	239.6876	233.4843	220.2782	203.6078	187.9400	177.4730	175.0113	181.2146	194.4208	211.0911	226.7589	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.0589	36.0589	36.0589	36.0589	36.0589	36.0589	36.0589	36.0589	36.0589	36.0589	36.0589	36.0589	
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	
Losses e.g. evaporation (negative values) (Table 5)	-104.4714	-104.4714	-104.4714	-104.4714	-104.4714	-104.4714	-104.4714	-104.4714	-104.4714	-104.4714	-104.4714	-104.4714	
Water heating gains (Table 5)	134.9033	132.6370	128.4039	119.3059	113.6924	107.8415	104.3277	107.3527	110.8837	117.3749	126.1059	133.7541	
Total internal gains	564.5871	578.4198	554.3462	536.2847	509.7582	489.4821	471.2586	471.8220	485.7990	504.2536	533.8976	552.9709	

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
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Efficiency of water heater	79.8000	
Water heating fuel used	2868.3268	(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)	213.4385	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-628.4354	(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	4773.6253	(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	2234.2954	0.2100	469.2020 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2868.3268	0.2100	602.3486 (264)
Space and water heating			1071.5507 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	213.4385	0.1443	30.8058 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-382.7871	0.1331	-50.9318
PV Unit electricity exported	-245.6484	0.1250	-30.7099
Total			-81.6417 (269)
Total CO2, kg/year			1032.6439 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.6000 (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	2234.2954	1.1300	2524.7538 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2868.3268	1.1300	3241.2093 (278)
Space and water heating			5765.9631 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	213.4385	1.5338	327.3792 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-382.7871	1.4917	-570.9890
PV Unit electricity exported	-245.6484	0.4589	-112.7158
Total			-683.7047 (283)
Total Primary energy kWh/year			5539.7383 (286)
Target Primary Energy Rate (TPER)			62.2400 (287)

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Property Reference	3B5P Mid Floor		Issued on Date	24/11/2023	
Assessment Reference	Be Green	Prop Type Ref			
Property					
SAP Rating	85 B	DER	3.44	TER	11.24
Environmental	97 A	% DER < TER	69.40		
CO ₂ Emissions (t/year)	0.28	DFEE	28.13	TFEE	28.53
Compliance Check	See BREL	% DFEE < TFEE	1.39		
% DPER < TPER	39.41	DPER	36.18	TPER	59.71
Assessor Details	Mr. Michael Woodbridge			Assessor ID	M818-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	89.0000	2.7000	240.3000
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.0000		
Dwelling volume			240.3000

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366 (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) =												81.0000 (23c)
Effective ac	0.2432	0.2403	0.2374	0.2229	0.2200	0.2054	0.2054	0.2025	0.2112	0.2200	0.2258	0.2316 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening			1.8800	1.2000	2.2560		(26)
Glazing (Uw = 1.20)			12.9600	1.1450	14.8397		(27)
External Wall	57.2400	12.9600	44.2800	0.1600	7.0848	70.0000	3099.6000 (29a)
Sheltered Wall	18.3600	1.8800	16.4800	0.1600	2.6368	70.0000	1153.6000 (29a)
Total net area of external elements Aum(A, m ²)			75.6000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	26.8173	(33)
Party Wall			38.8500	0.0000	0.0000	0.0000	0.0000 (32)
Party Floor 1			89.0000	0.0000	0.0000	0.0000	0.0000 (32a)
Party Ceiling 1			89.0000	0.0000	0.0000	0.0000	0.0000 (32b)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =	4253.2000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							47.7888 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate				6.3000	0.0500	0.3150	

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E4 Jamb	23.4000	0.0500	1.1700
E7 Party floor between dwellings (in blocks of flats)	49.6200	0.1000	4.9620
E8 Balcony within a dwelling, wall insulation continuous	6.3800	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860
E18 Party wall between dwellings	10.8000	0.0600	0.6480
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	28.6000	0.0000	0.0000
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)			7.3380 (36)
Point Thermal bridges			0.0000 (36a) =
Total fabric heat loss		(33) + (36) + (36a) =	34.1553 (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	19.2870	19.0565	18.8261	17.6738	17.4433	16.2910	16.2910	16.0605	16.7519	17.4433	17.9042	18.3652 (38)
Heat transfer coeff	53.4423	53.2118	52.9814	51.8291	51.5986	50.4463	50.4463	50.2158	50.9072	51.5986	52.0595	52.5204 (39)
Average = Sum(39)m / 12 =	51.7714											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.6005	0.5979	0.5953	0.5823	0.5798	0.5668	0.5668	0.5642	0.5720	0.5798	0.5849	0.5901 (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													2.6118 (42)
Hot water usage for mixer showers													0.0000 (42a)
Hot water usage for baths													76.6849 (42b)
Hot water usage for other uses													41.3773 (42c)
Average daily hot water use (litres/day)													108.7208 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	118.0621	115.3999	112.2485	108.2776	104.5504	99.9861	97.6648	102.0080	105.0023	109.5386	114.1952	118.0013 (44)	
Energy content (annual)	173.8079	152.6974	160.4007	141.4376	134.7237	115.6306	107.9225	120.0652	121.7974	141.1515	154.3386	173.2936 (45)	
Distribution loss (46)m = 0.15 x (45)m													26.0712 (46)
Water storage loss:													110.0000 (47)
Store volume													0.0152 (51)
b) If manufacturer declared loss factor is not known :													1.0294 (52)
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.6000 (53)
Volume factor from Table 2a													1.0327 (55)
Temperature factor from Table 2b													
Enter (49) or (54) in (55)													
Total storage loss													32.0144 (56)
If cylinder contains dedicated solar storage													32.0144 (57)
Primary loss													23.2624 (59)
Combi loss													0.0000 (61)
Total heat required for water heating calculated for each month													229.0847 (62)
MWHRs													0.0000 (63a)
PV diverter													-0.0000 (63b)
Solar input													0.0000 (63c)
FGHRs													0.0000 (63d)
Output from w/h													229.0847 (64)
12Total per year (kWh/year)													2348.1066 (64)
Electric shower(s)													2348 (64)
Heat gains from water heating, kWh/month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	102.0126	90.7138	97.5547	89.8230	89.0171	81.2421	80.1057	84.1431	83.2926	91.1543	94.1125	101.8416 (65)	

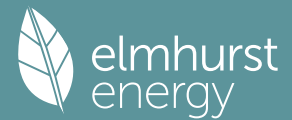
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	130.5892	130.5892	130.5892	130.5892	130.5892	130.5892	130.5892	130.5892	130.5892	130.5892	130.5892	130.5892 (66)	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													123.8904 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													237.2259 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													36.0589 (69)
Pumps, fans													0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)													-104.4714 (71)
Water heating gains (Table 5)													137.1136 (72)
Total internal gains													560.4067 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
North	10.8000	10.6334	0.4500	0.8000	0.7700	28.6504 (74)						
West	2.1600	19.6403	0.4500	0.8000	0.7700	10.5837 (80)						
Solar gains	39.2341	75.4564	127.1342	199.1702	262.2559	277.8974	260.6015	210.6510	151.5171	89.7426	48.5406	32.5879 (83)
Total gains	599.6409	649.4759	677.8076	734.3993	771.5775	768.8705	731.8105	684.8251	638.6128	592.7498	580.5404	582.2978 (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	22.1069	22.2027	22.2992	22.7950	22.8968	23.4199	23.4199	23.5273	23.2078	22.8968	22.6941	22.4949
alpha	2.4738	2.4802	2.4866	2.5197	2.5265	2.5613	2.5613	2.5685	2.5472	2.5265	2.5129	2.4997
util living area	0.8362	0.8032	0.7563	0.6574	0.5348	0.3923	0.2932	0.3233	0.4887	0.6800	0.7890	0.8430 (86)
MIT	19.1916	19.4480	19.8139	20.3241	20.6845	20.8993	20.9650	20.9545	20.8152	20.3733	19.7586	19.1767 (87)
Th 2	20.4296	20.4319	20.4342	20.4459	20.4483	20.4600	20.4600	20.4623	20.4553	20.4483	20.4436	20.4389 (88)
util rest of house	0.8269	0.7925	0.7430	0.6395	0.5112	0.3633	0.2594	0.2884	0.4580	0.6594	0.7762	0.8342 (89)
MIT 2	18.2571	18.5788	19.0368	19.6720	20.1054	20.3611	20.4305	20.4229	20.2675	19.7421	18.9798	18.2447 (90)
Living area fraction												FLA = Living area / (4) = 0.2809 (91)
MIT	18.5196	18.8229	19.2551	19.8552	20.2681	20.5123	20.5806	20.5722	20.4213	19.9194	19.1985	18.5065 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5196	18.8229	19.2551	19.8552	20.2681	20.5123	20.5806	20.5722	20.4213	19.9194	19.1985	18.5065 (93)

 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.7907	0.7579	0.7121	0.6192	0.5033	0.3662	0.2671	0.2956	0.4561	0.6382	0.7439	0.7984 (94)
Useful gains	474.1357	492.2298	482.6809	454.7188	388.3254	281.5358	195.4449	202.4682	291.2549	378.3215	431.8375	464.9140 (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	759.9297	740.8650	675.7819	567.7957	442.1005	298.2532	200.8072	209.5127	321.8011	480.8666	629.8439	751.3830 (97)
Space heating kWh	212.6307	167.0828	143.6671	81.4154	40.0087	0.0000	0.0000	0.0000	0.0000	76.2936	142.5646	213.1329 (98a)
Space heating requirement - total per year (kWh/year)												1076.7959
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	212.6307	167.0828	143.6671	81.4154	40.0087	0.0000	0.0000	0.0000	0.0000	76.2936	142.5646	213.1329 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1076.7959
Space heating per m2												(98c) / (4) = 12.0988 (99)

 9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (301)
Fraction of space heat from community system												1.0000 (302)
Fraction of heat from community Heat pump-Space and Water												1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system												1.2500 (306)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating:												
Space heating requirement	212.6307	167.0828	143.6671	81.4154	40.0087	0.0000	0.0000	0.0000	0.0000	76.2936	142.5646	213.1329 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.25												
307a	265.7884	208.8535	179.5839	101.7692	50.0108	0.0000	0.0000	0.0000	0.0000	95.3670	178.2058	266.4162
Space heating requirement	265.7884	208.8535	179.5839	101.7692	50.0108	0.0000	0.0000	0.0000	0.0000	95.3670	178.2058	266.4162 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating												
Annual water heating requirement	229.0847	202.6249	215.6776	194.9313	190.0005	169.1243	163.1993	175.3420	175.2911	196.4283	207.8323	228.5704 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.25												
310a	286.3558	253.2811	269.5969	243.6642	237.5007	211.4053	203.9991	219.1775	219.1138	245.5354	259.7904	285.7130
Water heating fuel	286.3558	253.2811	269.5969	243.6642	237.5007	211.4053	203.9991	219.1775	219.1138	245.5354	259.7904	285.7130 (310)
Cooling System Energy Efficiency Ratio												0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	19.9192	17.9916	19.9192	19.2767	19.9192	19.2767	19.9192	19.9192	19.2767	19.9192	19.2767	19.9192 (331)
Lighting	25.7420	20.6512	18.5941	13.6228	10.5227	8.5971	9.5991	12.4773	16.2068	21.2642	24.0178	26.4574 (332)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333a)m	-9.3985	-16.2208	-28.9520	-39.2785	-47.7032	-46.5206	-45.6049	-39.9595	-30.9600	-20.7498	-11.1550	-7.7146 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year												
Space heating fuel - community heating												1345.9948 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												2935.1332 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												13.4599 (313)
Space cooling fuel												0.0000 (321)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.6000, SFP = 0.8000)												
mechanical ventilation fans (SFP = 0.8000)												234.5328 (330a)
Total electricity for the above, kWh/year												234.5328 (331)
Electricity for lighting (calculated in Appendix L)												207.7525 (332)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-344.2175 (333)
Wind generation												0.0000 (334)
Hydro-electric generation (Appendix N)												0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (335)

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Appendix Q - special features	
Energy saved or generated	-0.0000 (336)
Energy used	0.0000 (337)
Total delivered energy for all uses	4379.1959 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			220.0000 (367)
Space and Water heating from Heat pump			94.8526 (367)
Electrical energy for heat distribution (space & water)	1945.9673	0.1550	6.2180 (372)
Overall CO2 factor for heat network	13.4599	0.0000	0.0675 (386)
Total CO2 associated with community systems			288.8561 (373)
Space and water heating			288.8561 (376)
Pumps, fans and electric keep-hot	234.5328	0.1387	32.5326 (378)
Energy for lighting	207.7525	0.1443	29.9851 (379)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-344.2175	0.1311	-45.1317
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-45.1317 (380)
Total CO2, kg/year			306.2421 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.4400 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			220.0000 (467a)
Space and Water heating from Heat pump			962.9843 (467)
Electrical energy for heat distribution (space & water)	1945.9673	1.5740	65.8127 (472)
Overall CO2 factor for heat network	13.4599	0.0000	0.7141 (486)
Total CO2 associated with community systems			3057.2998 (473)
Space and water heating			3057.2998 (476)
Pumps, fans and electric keep-hot	234.5328	1.5128	354.8012 (478)
Energy for lighting	207.7525	1.5338	318.6577 (479)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-344.2175	1.4844	-510.9481
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-510.9481 (480)
Total Primary energy kWh/year			3219.8107 (483)
Dwelling Primary energy Rate (DPER)			36.1800 (484)

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	89.0000 (1b)	x 2.7000 (2b)	= 240.3000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.3000 (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)
		Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1248 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3748 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2905 (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	0.3704	0.3631	0.3559	0.3196	0.3123	0.2760	0.2760	0.2687	0.2905	0.3123	0.3268	0.3413 (22b)
Effective ac	0.5686	0.5659	0.5633	0.5511	0.5488	0.5381	0.5381	0.5361	0.5422	0.5488	0.5534	0.5583 (25)

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Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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												2234.2954	(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												2868.3268	(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)												213.4385	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-879.8096	(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												4522.2511	(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	2234.2954	0.2100	469.2020 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2868.3268	0.2100	602.3486 (264)
Space and water heating			1071.5507 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	213.4385	0.1443	30.8058 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-489.0431	0.1334	-65.2317
PV Unit electricity exported	-390.7665	0.1252	-48.9303
Total			-114.1619 (269)
Total CO2, kg/year			1000.1238 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.2400 (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	2234.2954	1.1300	2524.7538 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2868.3268	1.1300	3241.2093 (278)
Space and water heating			5765.9631 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	213.4385	1.5338	327.3792 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-489.0431	1.4929	-730.0949
PV Unit electricity exported	-390.7665	0.4596	-179.5947
Total			-909.6896 (283)
Total Primary energy kWh/year			5313.7534 (286)
Target Primary Energy Rate (TPER)			59.7100 (287)

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Property Reference	3B5P Mid Floor		Issued on Date	24/11/2023	
Assessment Reference	Be Lean	Prop Type Ref			
Property					
SAP Rating	85 B	DER	11.21	TER	11.24
Environmental	90 B	% DER < TER	0.27		
CO ₂ Emissions (t/year)	0.92	DFEE	28.13	TFEE	28.53
Compliance Check	See BREL	% DFEE < TFEE	1.39		
% DPER < TPER	-2.92	DPER	61.46	TPER	59.71
Assessor Details	Mr. Michael Woodbridge			Assessor ID	M818-0001
Client					

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

1. Overall dwelling characteristics

Ground floor		Area (m ²)	Storey height (m)	Volume (m ³)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.0000	89.0000 (1b)	x 2.7000 (2b)	= 240.3000 (1b) - (3b)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 240.3000 (5)

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	3.0000	(17)
Infiltration rate	0.1500	(18)
Number of sides sheltered	3	(19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (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)
Balanced mechanical ventilation with heat recovery	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366 (22b)
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) =												81.0000 (23c)
Effective ac	0.2432	0.2403	0.2374	0.2229	0.2200	0.2054	0.2054	0.2025	0.2112	0.2200	0.2258	0.2316 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening			1.8800	1.2000	2.2560		(26)
Glazing (Uw = 1.20)			12.9600	1.1450	14.8397		(27)
External Wall	57.2400	12.9600	44.2800	0.1600	7.0848	70.0000	3099.6000 (29a)
Sheltered Wall	18.3600	1.8800	16.4800	0.1600	2.6368	70.0000	1153.6000 (29a)
Total net area of external elements Aum(A, m ²)			75.6000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	26.8173	(33)
Party Wall			38.8500	0.0000	0.0000	0.0000	0.0000 (32)
Party Floor 1			89.0000	0.0000	0.0000	0.0000	0.0000 (32a)
Party Ceiling 1			89.0000	0.0000	0.0000	0.0000	0.0000 (32b)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =	4253.2000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							47.7888 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate				6.3000	0.0500	0.3150	

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Appendix Q - special features	
Energy saved or generated	-0.0000 (336)
Energy used	0.0000 (337)
Total delivered energy for all uses	4379.1959 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			92.3000 (367)
Space and Water heating from Boilers	4638.2752	0.2100	306.2393 (367)
Electrical energy for heat distribution (space & water)	13.4599	0.0000	6.2180 (372)
Overall CO2 factor for heat network			0.2290 (386)
Total CO2 associated with community systems			980.2558 (373)
Space and water heating			980.2558 (376)
Pumps, fans and electric keep-hot	234.5328	0.1387	32.5326 (378)
Energy for lighting	207.7525	0.1443	29.9851 (379)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-344.2175	0.1311	-45.1317
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-45.1317 (380)
Total CO2, kg/year			997.6419 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			11.2100 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Boilers			92.3000 (467a)
Space and Water heating from Boilers	4638.2752	1.1300	1647.8593 (467)
Electrical energy for heat distribution (space & water)	13.4599	0.0000	65.8127 (472)
Overall CO2 factor for heat network			1.2396 (486)
Total CO2 associated with community systems			5307.0637 (473)
Space and water heating			5307.0637 (476)
Pumps, fans and electric keep-hot	234.5328	1.5128	354.8012 (478)
Energy for lighting	207.7525	1.5338	318.6577 (479)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-344.2175	1.4844	-510.9481
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-510.9481 (480)
Total Primary energy kWh/year			5469.5746 (483)
Dwelling Primary energy Rate (DPER)			61.4600 (484)

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	89.0000 (1b)	x 2.7000 (2b)	= 240.3000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.3000 (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)
		Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1248 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3748	(18)
Number of sides sheltered	3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2905 (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	0.3704	0.3631	0.3559	0.3196	0.3123	0.2760	0.2760	0.2687	0.2905	0.3123	0.3268	0.3413 (22b)
Effective ac	0.5686	0.5659	0.5633	0.5511	0.5488	0.5381	0.5381	0.5361	0.5422	0.5488	0.5534	0.5583 (25)

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Total internal gains
564.5871 578.4198 554.3462 536.2847 509.7582 489.4821 471.2586 471.8220 485.7990 504.2536 533.8976 552.9709 (73)

6. Solar gains

[Jan]												Gains W
	Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d			
North	10.8000		10.6334		0.6300		0.7000		0.7700		35.0968 (74)	
West	2.1600		19.6403		0.6300		0.7000		0.7700		12.9650 (80)	
Solar gains	48.0618	92.4341	155.7394	243.9835	321.2634	340.4243	319.2368	258.0475	185.6085	109.9347	59.4623	39.9202 (83)
Total gains	612.6489	670.8538	710.0856	780.2682	831.0216	829.9065	790.4954	729.8695	671.4076	614.1883	593.3599	592.8911 (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	15.0321	15.0726	15.1125	15.3029	15.3390	15.5096	15.5096	15.5416	15.4434	15.3390	15.2660	15.1905
alpha	2.0021	2.0048	2.0075	2.0202	2.0226	2.0340	2.0340	2.0361	2.0296	2.0226	2.0177	2.0127
util living area	0.8709	0.8448	0.8065	0.7269	0.6184	0.4849	0.3779	0.4166	0.5868	0.7530	0.8381	0.8773 (86)
MIT	17.9940	18.3133	18.8296	19.5705	20.2106	20.6661	20.8572	20.8209	20.4761	19.6797	18.7496	17.9482 (87)
Th 2	20.1819	20.1839	20.1859	20.1952	20.1970	20.2051	20.2051	20.2067	20.2020	20.1970	20.1935	20.1898 (88)
util rest of house	0.8611	0.8332	0.7916	0.7053	0.5868	0.4399	0.3199	0.3578	0.5435	0.7288	0.8243	0.8680 (89)
MIT 2	16.6509	17.0478	17.6899	18.6023	19.3699	19.8963	20.0966	20.0655	19.6947	18.7515	17.6016	16.5959 (90)
Living area fraction	fLA = Living area / (4) = 0.2809 (91)											
MIT	17.0282	17.4033	18.0100	18.8743	19.6060	20.1126	20.3103	20.2777	19.9142	19.0122	17.9241	16.9758 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.0282	17.4033	18.0100	18.8743	19.6060	20.1126	20.3103	20.2777	19.9142	19.0122	17.9241	16.9758 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8115	0.7830	0.7427	0.6645	0.5614	0.4344	0.3279	0.3633	0.5265	0.6869	0.7751	0.8192 (94)
Useful gains	497.1925	525.2556	527.3798	518.4729	466.5402	360.5047	259.1812	265.1476	353.4737	421.8741	459.9227	485.6863 (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	1000.3718	980.0538	899.8133	770.0591	608.9408	419.9219	282.6310	294.7770	444.7946	647.9294	837.6795	993.6381 (97)
Space heating kWh	374.3654	305.6244	277.0906	181.1420	105.9460	0.0000	0.0000	0.0000	0.0000	168.1851	271.9849	377.9162 (98a)
Space heating requirement - total per year (kWh/year)	2062.2547											
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	374.3654	305.6244	277.0906	181.1420	105.9460	0.0000	0.0000	0.0000	0.0000	168.1851	271.9849	377.9162 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	2062.2547											
Space heating per m2	(98c) / (4) = 23.1714 (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	374.3654	305.6244	277.0906	181.1420	105.9460	0.0000	0.0000	0.0000	0.0000	168.1851	271.9849	377.9162 (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)	405.5963	331.1207	300.2065	196.2535	114.7844	0.0000	0.0000	0.0000	0.0000	182.2157	294.6749	409.4433 (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	236.3456	208.8931	221.8028	194.9467	188.8843	170.1215	167.9298	174.6987	176.7094	197.1242	209.6716	233.7742 (64)
Efficiency of water heater	79.8000 (216)											
(217)m	85.0863	84.9119	84.5600	83.8954	82.8162	79.8000	79.8000	79.8000	79.8000	83.7058	84.6443	85.1306 (217)
Fuel for water heating, kWh/month	277.7718	246.0115	262.3022	232.3688	228.0766	213.1849	210.4384	218.9206	221.4403	235.4965	247.7089	274.6064 (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	26.4465	21.2164	19.1030	13.9957	10.8107	8.8324	9.8618	12.8188	16.6504	21.8462	24.6752	27.1815 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-19.5521	-29.2263	-44.5039	-53.0954	-59.9444	-56.9265	-56.2247	-51.7368	-44.3073	-34.7356	-22.0749	-16.7153 (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	-6.5106	-14.0463	-28.5899	-43.9508	-59.1259	-59.7941	-59.0995	-49.5769	-35.7319	-20.4209	-8.7967	-5.1232 (233b)

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Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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												2234.2954	(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												2868.3268	(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)												213.4385	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-879.8096	(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												4522.2511	(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	2234.2954	0.2100	469.2020 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2868.3268	0.2100	602.3486 (264)
Space and water heating			1071.5507 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	213.4385	0.1443	30.8058 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-489.0431	0.1334	-65.2317
PV Unit electricity exported	-390.7665	0.1252	-48.9303
Total			-114.1619 (269)
Total CO2, kg/year			1000.1238 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.2400 (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	2234.2954	1.1300	2524.7538 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2868.3268	1.1300	3241.2093 (278)
Space and water heating			5765.9631 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	213.4385	1.5338	327.3792 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-489.0431	1.4929	-730.0949
PV Unit electricity exported	-390.7665	0.4596	-179.5947
Total			-909.6896 (283)
Total Primary energy kWh/year			5313.7534 (286)
Target Primary Energy Rate (TPER)			59.7100 (287)

Full SAP Calculation Printout



Property Reference	3B5P Top Floor		Issued on Date	24/11/2023	
Assessment Reference	Be Green	Prop Type Ref			
Property					
SAP Rating	84 B	DER	3.67	TER	13.71
Environmental	97 A	% DER < TER		73.23	
CO ₂ Emissions (t/year)	0.3	DFEE	31.20	TFEE	40.46
Compliance Check	See BREL	% DFEE < TFEE		22.87	
% DPER < TPER	47.23	DPER	38.53	TPER	73.02
Assessor Details	Mr. Michael Woodbridge			Assessor ID	M818-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	89.0000	2.7000	240.3000
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.0000		240.3000
Dwelling volume			240.3000

2. Ventilation rate

	Value	Reference
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	3.0000	(17)
Infiltration rate	0.1500	(18)
Number of sides sheltered	3	(19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												81.0000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2432	0.2403	0.2374	0.2229	0.2200	0.2054	0.2054	0.2025	0.2112	0.2200	0.2258	0.2316 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening			1.8800	1.2000	2.2560		(26)
Glazing (Uw = 1.20)			12.9600	1.1450	14.8397		(27)
External Wall	57.2400	12.9600	44.2800	0.1600	7.0848	70.0000	3099.6000 (29a)
Sheltered Wall	18.3600	1.8800	16.4800	0.1600	2.6368	70.0000	1153.6000 (29a)
External Roof 1	89.0000		89.0000	0.1000	8.9000	9.0000	801.0000 (30)
Total net area of external elements Aum(A, m ²)			164.6000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.7173		(33)
Party Wall			38.8500	0.0000	0.0000	0.0000	0.0000 (32)
Party Floor 1			89.0000			0.0000	0.0000 (32d)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =	5054.2000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K						56.7888	(35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate				6.3000	0.0500	0.3150	

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Hydro-electric generation (Appendix N)	0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (335)
Appendix Q - special features	
Energy saved or generated	-0.0000 (336)
Energy used	0.0000 (337)
Total delivered energy for all uses	4665.8837 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			220.0000 (367)
Space and Water heating from Heat pump		0.1549	114.9728 (367)
Electrical energy for heat distribution (space & water)	2076.2799	0.0000	6.6607 (372)
Overall CO2 factor for heat network	16.3268		0.0677 (386)
Total CO2 associated with community systems			309.4190 (373)
Space and water heating			309.4190 (376)
Pumps, fans and electric keep-hot	234.5328	0.1387	32.5326 (378)
Energy for lighting	207.7525	0.1443	29.9851 (379)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-344.2175	0.1311	-45.1317
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-45.1317 (380)
Total CO2, kg/year			326.8051 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.6700 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			220.0000 (467a)
Space and Water heating from Heat pump		1.5736	1167.7884 (467)
Electrical energy for heat distribution (space & water)	2076.2799	0.0000	70.3184 (472)
Overall CO2 factor for heat network	16.3268		0.7151 (486)
Total CO2 associated with community systems			3266.6097 (473)
Space and water heating			3266.6097 (476)
Pumps, fans and electric keep-hot	234.5328	1.5128	354.8012 (478)
Energy for lighting	207.7525	1.5338	318.6577 (479)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-344.2175	1.4844	-510.9481
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-510.9481 (480)
Total Primary energy kWh/year			3429.1206 (483)
Dwelling Primary energy Rate (DPER)			38.5300 (484)

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	89.0000 (1b)	x 2.7000 (2b)	= 240.3000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.3000 (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) =	0.1248 (8)
Pressure Test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3748	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2905 (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												

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(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	-6.5106	-14.0463	-28.5899	-43.9508	-59.1259	-59.7941	-59.0995	-49.5769	-35.7319	-20.4209	-8.7967	-5.1232	(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													3303.6046 (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													2847.7785 (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)													213.4385 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-879.8096 (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													5571.0121 (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	3303.6046	0.2100	693.7570	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2847.7785	0.2100	598.0335	(264)
Space and water heating			1291.7905	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	213.4385	0.1443	30.8058	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-489.0431	0.1334	-65.2317	
PV Unit electricity exported	-390.7665	0.1252	-48.9303	
Total			-114.1619	(269)
Total CO2, kg/year			1220.3636	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.7100	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3303.6046	1.1300	3733.0732	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2847.7785	1.1300	3217.9897	(278)
Space and water heating			6951.0630	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	213.4385	1.5338	327.3792	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-489.0431	1.4929	-730.0949	
PV Unit electricity exported	-390.7665	0.4596	-179.5947	
Total			-909.6896	(283)
Total Primary energy kWh/year			6498.8533	(286)
Target Primary Energy Rate (TPER)			73.0200	(287)

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Property Reference	3B5P Top Floor		Issued on Date	24/11/2023	
Assessment Reference	Be Lean	Prop Type Ref			
Property					
SAP Rating	84 B	DER	12.45	TER	13.71
Environmental	89 B	% DER < TER	9.19		
CO ₂ Emissions (t/year)	1.03	DFEE	31.20	TFEE	40.46
Compliance Check	See BREL	% DFEE < TFEE	22.87		
% DPER < TPER	2.50	DPER	71.19	TPER	73.02
Assessor Details	Mr. Michael Woodbridge			Assessor ID	M818-0001
Client					

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

1. Overall dwelling characteristics

Ground floor	Area (m ²)	Storey height (m)	Volume (m ³)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.0000	2.7000 (2b)	240.3000 (1b) - (3b)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 240.3000 (5)

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	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)	Air changes per hour	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes		
Pressure Test Method	Blower Door		
Measured/design AP50			3.0000 (17)
Infiltration rate			0.1500 (18)
Number of sides sheltered			3 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (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)
Balanced mechanical ventilation with heat recovery	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366 (22b)
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) =												81.0000 (23c)
Effective ac	0.2432	0.2403	0.2374	0.2229	0.2200	0.2054	0.2054	0.2025	0.2112	0.2200	0.2258	0.2316 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening			1.8800	1.2000	2.2560		(26)
Glazing (Uw = 1.20)			12.9600	1.1450	14.8397		(27)
External Wall	57.2400	12.9600	44.2800	0.1600	7.0848	70.0000	3099.6000 (29a)
Sheltered Wall	18.3600	1.8800	16.4800	0.1600	2.6368	70.0000	1153.6000 (29a)
External Roof 1	89.0000		89.0000	0.1000	8.9000	9.0000	801.0000 (30)
Total net area of external elements Aum(A, m ²)			164.6000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.7173		(33)
Party Wall			38.8500	0.0000	0.0000	0.0000	0.0000 (32)
Party Floor 1			89.0000			0.0000	0.0000 (32d)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		5054.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							56.7888 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate				6.3000	0.0500	0.3150	

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Solar gains	39.2341	75.4564	127.1342	199.1702	262.2559	277.8974	260.6015	210.6510	151.5171	89.7426	48.5406	32.5879 (83)
Total gains	599.6409	649.4759	677.8076	734.3993	771.5775	768.8705	731.8105	684.8251	638.6128	592.7498	580.5404	582.2978 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T_{hi} (C)												21.0000 (85)
Utilisation factor for gains for living area, $n_{il,m}$ (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	23.5789	23.6706	23.7629	24.2356	24.3324	24.8282	24.8282	24.9298	24.6275	24.3324	24.1395	23.9497
alpha	2.5719	2.5780	2.5842	2.6157	2.6222	2.6552	2.6552	2.6620	2.6418	2.6222	2.6093	2.5966
util living area	0.8707	0.8417	0.7993	0.7064	0.5838	0.4347	0.3269	0.3601	0.5366	0.7283	0.8296	0.8770 (86)
MIT	19.1129	19.3662	19.7378	20.2639	20.6513	20.8872	20.9611	20.9491	20.7940	20.3188	19.6818	19.0934 (87)
Th 2	20.3683	20.3706	20.3729	20.3844	20.3867	20.3983	20.3983	20.4006	20.3937	20.3867	20.3821	20.3775 (88)
util rest of house	0.8617	0.8311	0.7856	0.6868	0.5567	0.3998	0.2854	0.3173	0.5007	0.7061	0.8167	0.8685 (89)
MIT 2	18.1120	18.4302	18.8959	19.5503	20.0145	20.2911	20.3673	20.3588	20.1899	19.6280	18.8379	18.0936 (90)
Living area fraction									fLA = Living area / (4) =			0.2809 (91)
MIT	18.3932	18.6932	19.1324	19.7508	20.1934	20.4586	20.5341	20.5246	20.3596	19.8221	19.0749	18.3745 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3932	18.6932	19.1324	19.7508	20.1934	20.4586	20.5341	20.5246	20.3596	19.8221	19.0749	18.3745 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	496.4632	518.1365	511.5879	488.4513	422.6520	310.1454	215.8152	223.4809	318.3877	405.3314	455.7802	486.3889 (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	839.1405	818.0977	746.3366	628.5748	490.0551	331.2800	222.4579	232.2808	356.8412	532.1009	696.4567	830.9143 (97)
Space heating kWh	254.9519	201.5739	174.6530	100.8889	50.1479	0.0000	0.0000	0.0000	0.0000	94.3165	173.2871	256.3269 (98a)
Space heating requirement - total per year (kWh/year)												1306.1461
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	254.9519	201.5739	174.6530	100.8889	50.1479	0.0000	0.0000	0.0000	0.0000	94.3165	173.2871	256.3269 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1306.1461
Space heating per m2												(98c) / (4) = 14.6758 (99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Boilers-Space and Water	1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating	1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.2500 (306)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	254.9519
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.25	318.6898
307a	318.6898
Space heating requirement	318.6898
310a	286.3558
Water heating fuel	286.3558
Annual water heating requirement	229.0847
310a	286.3558
Water heating fuel	286.3558
Space coolin	0.0000
Pumps and Fa	19.9192
Lighting	25.7420
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000
(333a)m	0.0000
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000
(334a)m	0.0000
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000
(335a)m	0.0000
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000
(333b)m	0.0000
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000
(334b)m	0.0000
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000
(335b)m	0.0000
Annual totals kWh/year	
Space heating fuel - community heating	1632.6826 (307)
Space heating fuel - secondary	0.0000 (309)
Water heating fuel - community heating	2935.1332 (310)
Efficiency of water heater	0.0000 (311)
Electricity used for heat distribution	16.3268 (313)
Space cooling fuel	0.0000 (321)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.6000, SFP = 0.8000)	
mechanical ventilation fans (SFP = 0.8000)	234.5328 (330a)
Total electricity for the above, kWh/year	234.5328 (331)
Electricity for lighting (calculated in Appendix L)	207.7525 (332)
Energy saving/generation technologies (Appendices M, N and Q)	
PV generation	0.0000 (333)
Wind generation	0.0000 (334)

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Hydro-electric generation (Appendix N)	0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (335)
Appendix Q - special features	
Energy saved or generated	-0.0000 (336)
Energy used	0.0000 (337)
Total delivered energy for all uses	5010.1011 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			92.3000 (367)
Space and Water heating from Boilers	4948.8795	0.2100	371.4662 (367)
Electrical energy for heat distribution (space & water)	16.3268	0.0000	6.6607 (372)
Overall CO2 factor for heat network			0.2290 (386)
Total CO2 associated with community systems			1045.9254 (373)
Space and water heating			1045.9254 (376)
Pumps, fans and electric keep-hot	234.5328	0.1387	32.5326 (378)
Energy for lighting	207.7525	0.1443	29.9851 (379)
Total CO2, kg/year			1108.4431 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			12.4500 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Boilers			92.3000 (467a)
Space and Water heating from Boilers	4948.8795	1.1300	1998.8422 (467)
Electrical energy for heat distribution (space & water)	16.3268	0.0000	70.3184 (472)
Overall CO2 factor for heat network			1.2397 (486)
Total CO2 associated with community systems			5662.5523 (473)
Space and water heating			5662.5523 (476)
Pumps, fans and electric keep-hot	234.5328	1.5128	354.8012 (478)
Energy for lighting	207.7525	1.5338	318.6577 (479)
Total Primary energy kWh/year			6336.0113 (483)
Dwelling Primary energy Rate (DPER)			71.1900 (484)

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	89.0000 (1b)	2.7000 (2b)	240.3000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.0000		240.3000 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 240.3000 (5)

2. Ventilation rate

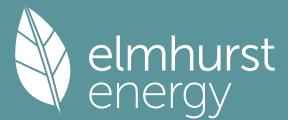
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number 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) = 0.1248 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3748 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2905 (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	0.3704	0.3631	0.3559	0.3196	0.3123	0.2760	0.2760	0.2687	0.2905	0.3123	0.3268	0.3413 (22b)
Effective ac	0.5686	0.5659	0.5633	0.5511	0.5488	0.5381	0.5381	0.5361	0.5422	0.5488	0.5534	0.5583 (25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K
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	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K
TER Opaque door			1.8800	1.0000	1.8800		(26)
TER Opening Type (Uw = 1.20)			12.9600	1.1450	14.8397		(27)
External Wall	57.2400	12.9600	44.2800	0.1800	7.9704		(29a)
Sheltered Wall	18.3600	1.8800	16.4800	0.1800	2.9664		(29a)
External Roof 1	89.0000		89.0000	0.1100	9.7900		(30)
Total net area of external elements Aum(A, m2)			164.6000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.4465		(33)
Party Wall			38.8500	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 56.7888 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element			
E1 Steel lintel with perforated steel base plate	6.3000	0.0500	0.3150
E4 Jamb	23.4000	0.0500	1.1700
E7 Party floor between dwellings (in blocks of flats)	21.6200	0.0700	1.5134
E8 Balcony within a dwelling, wall insulation continuous	6.3800	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860
E18 Party wall between dwellings	10.8000	0.0600	0.6480
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	14.3000	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	2.7000	-0.0900	-0.2430
E15 Flat roof with parapet	28.0000	0.5600	15.6800
P4 Party wall - Roof (insulation at ceiling level)	14.3000	0.1200	1.7160

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 21.2854 (36)

Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 58.7319 (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	45.0890	44.8778	44.6708	43.6983	43.5164	42.6694	42.6694	42.5125	42.9956	43.5164	43.8844	44.2692 (38)

Average = Sum(39)m / 12 = 102.4293 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1665	1.1642	1.1618	1.1509	1.1489	1.1393	1.1393	1.1376	1.1430	1.1489	1.1530	1.1573 (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 2.6118 (42)
 Hot water usage for mixer showers 0.0000 (42a)

Hot water usage for baths 78.4333 (42b)
 Hot water usage for other uses 41.3773 (42c)

Average daily hot water use (litres/day) 110.3358 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	119.8106	117.1411	113.9962	109.4670	105.6977	101.6819	100.3254	103.4589	106.7371	110.9288	115.5202	119.5455 (44)
Energy content (annual)	189.7507	166.8074	175.2079	149.8549	142.2894	125.0297	121.3349	128.1038	131.6175	150.5293	164.5797	187.1793 (45)
Distribution loss (46)m = 0.15 x (45)m	28.4626	25.0211	26.2812	22.4782	21.3434	18.7545	18.2002	19.2156	19.7426	22.5794	24.6870	28.0769 (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 (56)

If cylinder contains dedicated solar storage 23.3325 (57)

Primary loss 23.2624 (59)

Combi loss 0.0000 (61)

Total heat required for water heating calculated for each month 236.3456 (62)

WWHRS 0.0000 (63a)

PV diverter -0.0000 (63b)

Solar input 0.0000 (63c)

FGHRS 0.0000 (63d)

Output from w/h 236.3456 (64)

Total per year (kWh/year) = Sum(64)m = 2380.9020 (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 100.3680 (65)

Electric shower(s) 0.0000 (64a)

Heat gains from water heating, kWh/month 100.3680 (65)

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

Metabolic gains (Table 5), Watts 130.5892 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 127.2812 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 237.2259 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 36.0589 (69)

Pumps, fans 3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5) -104.4714 (71)

Water heating gains (Table 5) 134.9033 (72)

Total internal gains 564.5871 (73)

Water heating gains (Table 5) 134.9033 (72)

Total internal gains 564.5871 (73)

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(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year														
Space heating fuel - main system 1													3303.6046	(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													2847.7785	(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)													213.4385	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-879.8096	(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													5571.0121	(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	3303.6046	0.2100	693.7570	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2847.7785	0.2100	598.0335	(264)
Space and water heating			1291.7905	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	213.4385	0.1443	30.8058	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-489.0431	0.1334	-65.2317	
PV Unit electricity exported	-390.7665	0.1252	-48.9303	
Total			-114.1619	(269)
Total CO2, kg/year			1220.3636	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.7100	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3303.6046	1.1300	3733.0732	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2847.7785	1.1300	3217.9897	(278)
Space and water heating			6951.0630	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	213.4385	1.5338	327.3792	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-489.0431	1.4929	-730.0949	
PV Unit electricity exported	-390.7665	0.4596	-179.5947	
Total			-909.6896	(283)
Total Primary energy kWh/year			6498.8533	(286)
Target Primary Energy Rate (TPER)			73.0200	(287)

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Property Reference	Duplex	Issued on Date	24/11/2023
Assessment Reference	Be Green	Prop Type Ref	
Property			
SAP Rating	84 B	DER	3.61
Environmental	97 A	% DER < TER	70.67
CO ₂ Emissions (t/year)	0.25	DFEE	26.62
Compliance Check	See BREL	% DFEE < TFEE	12.17
% DPER < TPER	41.88	DPER	38.06
Assessor Details	Mr. Michael Woodbridge	Assessor ID	M818-0001
Client			

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	37.4000 (1b)	2.4000 (2b)	89.7600 (1b) - (3b)
First floor	37.4000 (1c)	2.7000 (2c)	100.9800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	190.7400 (5)

2. Ventilation rate

	m3 per hour											
Number of open chimneys	0 * 80 =	0.0000 (6a)										
Number of open flues	0 * 20 =	0.0000 (6b)										
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)										
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)										
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)										
Number of blocked chimneys	0 * 20 =	0.0000 (6f)										
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)										
Number of passive vents	0 * 10 =	0.0000 (7b)										
Number of flueless gas fires	0 * 40 =	0.0000 (7c)										
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)										
Pressure test	Yes											
Pressure Test Method	Blower Door											
Measured/design AP50	3.0000 (17)											
Infiltration rate	0.1500 (18)											
Number of sides sheltered	2 (19)											
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)										
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (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) =												81.0000 (23c)
Effective ac	0.2576	0.2544	0.2512	0.2352	0.2321	0.2161	0.2161	0.2129	0.2225	0.2321	0.2384	0.2448 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening			1.8800	1.2000	2.2560		(26)
Glazing (Uw = 1.20)			16.0000	1.1450	18.3206		(27)
External Wall	35.7000	17.8800	17.8200	0.1600	2.8512	70.0000	1247.4000 (29a)
External Roof 1	37.4000		37.4000	0.1000	3.7400	9.0000	336.6000 (30)
Total net area of external elements Aum(A, m ²)			73.1000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.1678		(33)
Party Wall			38.8500	0.0000	0.0000	0.0000	0.0000 (32)
Party Floor 1			89.0000			0.0000	0.0000 (32a)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =	1584.0000 (34)	
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							21.1765 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate				6.3000	0.0500	0.3150	

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Electricity generated - Micro CHP (Appendix N)	0.0000 (335)
Appendix Q - special features	
Energy saved or generated	-0.0000 (336)
Energy used	0.0000 (337)
Total delivered energy for all uses	3941.4464 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			220.0000 (367)
Space and Water heating from Heat pump	1778.2930	0.1545	78.0342 (367)
Electrical energy for heat distribution (space & water)	11.1100	0.0000	5.6585 (372)
Overall CO2 factor for heat network			0.0672 (386)
Total CO2 associated with community systems			262.8647 (373)
Space and water heating			262.8647 (376)
Pumps, fans and electric keep-hot	186.1622	0.1387	25.8230 (378)
Energy for lighting	176.1235	0.1443	25.4201 (379)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-333.0839	0.1312	-43.7125
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-43.7125 (380)
Total CO2, kg/year			270.3952 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.6100 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			220.0000 (467a)
Space and Water heating from Heat pump	1778.2930	1.5721	793.8926 (467)
Electrical energy for heat distribution (space & water)	11.1100	0.0000	60.0531 (472)
Overall CO2 factor for heat network			0.7131 (486)
Total CO2 associated with community systems			2789.7392 (473)
Space and water heating			2789.7392 (476)
Pumps, fans and electric keep-hot	186.1622	1.5128	281.6262 (478)
Energy for lighting	176.1235	1.5338	270.1441 (479)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-333.0839	1.4848	-494.5744
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-494.5744 (480)
Total Primary energy kWh/year			2846.9351 (483)
Dwelling Primary energy Rate (DPER)			38.0600 (484)

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	37.4000 (1b)	x 2.4000 (2b)	= 89.7600 (1b) - (3b)
First floor	37.4000 (1c)	x 2.7000 (2c)	= 100.9800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 190.7400 (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) = 0.1573 (8)
Pressure Test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.4073 (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) =	0.3462 (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												

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(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-5.3582	-11.5703	-23.5660	-36.2490	-48.7813	-49.3301	-48.7529	-40.8887	-29.4613	-16.8248	-7.2414	-4.2154	(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												1929.4377	(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												2733.4286	(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)												176.4018	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-739.4355	(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												4185.8326	(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	1929.4377	0.2100	405.1819	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2733.4286	0.2100	574.0200	(264)
Space and water heating			979.2019	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	176.4018	0.1443	25.4602	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-417.1961	0.1333	-55.6225	
PV Unit electricity exported	-322.2394	0.1252	-40.3452	
Total			-95.9677	(269)
Total CO2, kg/year			920.6237	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.3100	(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	1929.4377	1.1300	2180.2646	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2733.4286	1.1300	3088.7743	(278)
Space and water heating			5269.0389	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	176.4018	1.5338	270.5709	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-417.1961	1.4927	-622.7374	
PV Unit electricity exported	-322.2394	0.4595	-148.0838	
Total			-770.8212	(283)
Total Primary energy kWh/year			4898.8894	(286)
Target Primary Energy Rate (TPER)			65.4900	(287)

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Property Reference	Duplex		Issued on Date	24/11/2023	
Assessment Reference	Be Lean	Prop Type Ref			
Property					
SAP Rating	84 B	DER	12.66	TER	12.31
Environmental	90 B	% DER < TER			
CO ₂ Emissions (t/year)	0.9	DFEE	26.62	TFEE	30.30
Compliance Check	See BREL	% DFEE < TFEE			
% DPER < TPER	-10.26	DPER	72.21	TPER	65.49
Assessor Details	Mr. Michael Woodbridge			Assessor ID	M818-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	37.4000 (1b)	2.4000 (2b)	89.7600 (1b) - (3b)
First floor	37.4000 (1c)	2.7000 (2c)	100.9800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	190.7400 (5)

2. Ventilation rate

	m3 per hour											
Number of open chimneys	0 * 80 =											0.0000 (6a)
Number of open flues	0 * 20 =											0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =											0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =											0.0000 (6d)
Number of flues attached to other heater	0 * 35 =											0.0000 (6e)
Number of blocked chimneys	0 * 20 =											0.0000 (6f)
Number of intermittent extract fans	0 * 10 =											0.0000 (7a)
Number of passive vents	0 * 10 =											0.0000 (7b)
Number of flueless gas fires	0 * 40 =											0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =											0.0000 (8)
Pressure test												Yes
Pressure Test Method												Blower Door
Measured/design AP50												3.0000 (17)
Infiltration rate												0.1500 (18)
Number of sides sheltered												2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =											0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =											0.1275 (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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (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) =												81.0000 (23c)
Effective ac	0.2576	0.2544	0.2512	0.2352	0.2321	0.2161	0.2161	0.2129	0.2225	0.2321	0.2384	0.2448 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening			1.8800	1.2000	2.2560		(26)
Glazing (Uw = 1.20)			16.0000	1.1450	18.3206		(27)
External Wall	35.7000	17.8800	17.8200	0.1600	2.8512	70.0000	1247.4000 (29a)
External Roof 1	37.4000		37.4000	0.1000	3.7400	9.0000	336.6000 (30)
Total net area of external elements Aum(A, m ²)			73.1000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.1678		(33)
Party Wall			38.8500	0.0000	0.0000	0.0000	0.0000 (32)
Party Floor 1			89.0000			0.0000	0.0000 (32a)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		1584.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							21.1765 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate				6.3000	0.0500	0.3150	

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Electricity generated - Micro CHP (Appendix N)	0.0000 (335)
Appendix Q - special features	
Energy saved or generated	-0.0000 (336)
Energy used	0.0000 (337)
Total delivered energy for all uses	4274.5303 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			92.3000 (367)
Space and Water heating from Boilers	4238.6182	0.2100	252.7733 (367)
Electrical energy for heat distribution (space & water)	11.1100	0.0000	5.6585 (372)
Overall CO2 factor for heat network			0.2290 (386)
Total CO2 associated with community systems			895.7684 (373)
Space and water heating			895.7684 (376)
Pumps, fans and electric keep-hot	186.1622	0.1387	25.8230 (378)
Energy for lighting	176.1235	0.1443	25.4201 (379)
Total CO2, kg/year			947.0114 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			12.6600 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Boilers			92.3000 (467a)
Space and Water heating from Boilers	4238.6182	1.1300	1360.1609 (467)
Electrical energy for heat distribution (space & water)	11.1100	0.0000	60.0531 (472)
Overall CO2 factor for heat network			1.2396 (486)
Total CO2 associated with community systems			4849.6917 (473)
Space and water heating			4849.6917 (476)
Pumps, fans and electric keep-hot	186.1622	1.5128	281.6262 (478)
Energy for lighting	176.1235	1.5338	270.1441 (479)
Total Primary energy kWh/year			5401.4620 (483)
Dwelling Primary energy Rate (DPER)			72.2100 (484)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	37.4000 (1b)	x 2.4000 (2b)	= 89.7600 (1b) - (3b)
First floor	37.4000 (1c)	x 2.7000 (2c)	= 100.9800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 190.7400 (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) = 0.1573 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4073 (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) = 0.3462 (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	0.4414	0.4327	0.4241	0.3808	0.3722	0.3289	0.3289	0.3202	0.3462	0.3722	0.3895	0.4068 (22b)
Effective ac	0.5974	0.5936	0.5899	0.5725	0.5692	0.5541	0.5541	0.5513	0.5599	0.5692	0.5758	0.5827 (25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K
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[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	4.5000	10.6334	0.6300	0.7000	0.7700	14.6237 (74)
South	11.5000	46.7521	0.6300	0.7000	0.7700	164.3124 (78)

Solar gains	178.9361	297.0480	390.2756	463.7023	506.4735	498.5262	482.3128	450.1361	415.1780	323.5179	212.8065	154.1721 (83)
Total gains	683.2662	812.6865	885.2321	942.0494	961.4221	934.7468	902.5471	871.0437	848.3455	773.8524	689.4603	648.2378 (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	5.9687	5.9880	6.0071	6.0984	6.1158	6.1980	6.1980	6.2135	6.1661	6.1158	6.0807	6.0445
alpha	1.3979	1.3992	1.4005	1.4066	1.4077	1.4132	1.4132	1.4142	1.4111	1.4077	1.4054	1.4030
util living area	0.7416	0.6882	0.6357	0.5621	0.4777	0.3768	0.2913	0.3097	0.4257	0.5748	0.6900	0.7535 (86)
MIT	17.1074	17.6391	18.3020	19.1206	19.8494	20.4334	20.7259	20.6890	20.2753	19.3357	18.1066	17.0107 (87)
Th 2	20.0954	20.0981	20.1007	20.1130	20.1153	20.1260	20.1260	20.1280	20.1219	20.1153	20.1106	20.1057 (88)
util rest of house	0.7282	0.6729	0.6175	0.5396	0.4487	0.3383	0.2431	0.2617	0.3878	0.5486	0.6724	0.7406 (89)
MIT 2	15.7578	16.3806	17.1603	18.1206	18.9588	19.6145	19.9181	19.8853	19.4477	18.3877	16.9516	15.6486 (90)
Living area fraction	fLA = Living area / (4) = 0.3289 (91)											
MIT	16.2016	16.7945	17.5358	18.4494	19.2517	19.8838	20.1838	20.1497	19.7199	18.6995	17.3315	16.0966 (92)
Temperature adjustment	0.0000											
adjusted MIT	16.2016	16.7945	17.5358	18.4494	19.2517	19.8838	20.1838	20.1497	19.7199	18.6995	17.3315	16.0966 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.6541	0.6043	0.5568	0.4922	0.4178	0.3270	0.2464	0.2630	0.3691	0.5009	0.6050	0.6660 (94)
Ext temp.	446.9453	491.0990	492.8725	463.6562	401.6604	305.6332	222.3862	229.0558	313.1301	387.6513	417.0937	431.6968 (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	877.3635	874.0069	808.3345	688.9942	543.3060	375.1012	254.4136	265.5268	401.0246	582.7187	740.3499	865.9975 (97)
Space heating requirement - total per year (kWh/year)	320.2311	257.3141	234.7038	162.2434	105.3843	0.0000	0.0000	0.0000	0.0000	145.1301	232.7445	323.1198 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98c)
Space heating kWh	320.2311	257.3141	234.7038	162.2434	105.3843	0.0000	0.0000	0.0000	0.0000	145.1301	232.7445	323.1198 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1780.8710											
Space heating per m2	(98c) / (4) = 23.8084 (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 requirement	320.2311	257.3141	234.7038	162.2434	105.3843	0.0000	0.0000	0.0000	0.0000	145.1301	232.7445	323.1198 (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)	346.9460	278.7802	254.2836	175.7783	114.1759	0.0000	0.0000	0.0000	0.0000	157.2374	252.1609	350.0756 (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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Water heating requirement	224.3710	198.3664	210.7459	185.4898	179.9048	162.2313	160.2727	166.6144	168.4033	187.6248	199.2854	221.9618 (64)
Efficiency of water heater (217)m	84.8571	84.6443	84.3018	83.7609	82.9038	79.8000	79.8000	79.8000	79.8000	83.4906	84.4087	79.8000 (216)
Fuel for water heating, kWh/month	264.4104	234.3529	249.9897	221.4516	217.0043	203.2973	200.8430	208.7900	211.0318	224.7255	236.0957	261.4365 (219)
Space cooling fuel requirement	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	21.8574	17.5348	15.7882	11.5671	8.9347	7.2998	8.1506	10.5944	13.7611	18.0553	20.3934	22.4649 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000 (233a)											
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000 (234a)											
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000 (235a)											
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000 (235c)											
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000 (233b)											
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000 (234b)											
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000 (235b)											
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000 (235d)											
Annual totals kWh/year												

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Space heating fuel - main system 1	1929.4377 (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	2733.4286 (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)	176.4018 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-739.4355 (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	4185.8326 (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	1929.4377	0.2100	405.1819 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2733.4286	0.2100	574.0200 (264)
Space and water heating			979.2019 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	176.4018	0.1443	25.4602 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-417.1961	0.1333	-55.6225
PV Unit electricity exported	-322.2394	0.1252	-40.3452
Total			-95.9677 (269)
Total CO2, kg/year			920.6237 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.3100 (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	1929.4377	1.1300	2180.2646 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2733.4286	1.1300	3088.7743 (278)
Space and water heating			5269.0389 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	176.4018	1.5338	270.5709 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-417.1961	1.4927	-622.7374
PV Unit electricity exported	-322.2394	0.4595	-148.0838
Total			-770.8212 (283)
Total Primary energy kWh/year			4898.8894 (286)
Target Primary Energy Rate (TPER)			65.4900 (287)

Appendix C – Be Lean and Be Green BRUKLs

Project name

Shell and Core

Welling United FC Commercial and Football Facilities BE LEAN

As designed

Date: Thu Nov 30 16:32:09 2023

Administrative information

Building Details

Address: Park View Road, Welling, London, DA16 1SY

Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.e.0

Interface to calculation engine: Virtual Environment

Interface to calculation engine version: v7.0.23

BRUKL compliance module version: v6.1.e.1

Certifier details

Name: MWL

Telephone number: 02084 469696

Address: Lymehouse Studios, 30-31 Lyme Street, London, NW1 0EE

Foundation area [m²]: 671.41

The CO₂ emission and primary energy rates of the building must not exceed the targets

The building does not comply with England Building Regulations Part L 2021

Target CO ₂ emission rate (TER), kgCO ₂ /m ² annum	20.98
Building CO ₂ emission rate (BER), kgCO ₂ /m ² annum	22.3
Target primary energy rate (TPER), kWh _{PE} /m ² annum	226.9
Building primary energy rate (BPER), kWh _{PE} /m ² annum	242.14
Do the building's emission and primary energy rates exceed the targets?	BER > TER BPER > TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	U _a -Limit	U _a -Calc	U _i -Calc	First surface with maximum value
Walls*	0.26	0.16	0.16	00000006_W1
Floors	0.18	0.08	0.1	0100001B_F_A4
Pitched roofs	0.16	-	-	No heat loss pitched roofs
Flat roofs	0.18	0.1	0.1	00000006_C
Windows** and roof windows	1.6	1.2	1.2	0000004A_W1_O0
Rooflights***	2.2	-	-	No external rooflights
Personnel doors [^]	1.6	1.2	1.2	00000007_W1_O0
Vehicle access & similar large doors	1.3	-	-	No external vehicle access doors
High usage entrance doors	3	-	-	No external high usage entrance doors

U_a-Limit = Limiting area-weighted average U-values [W/(m²K)]U_i-Calc = Calculated maximum individual element U-values [W/(m²K)]U_a-Calc = Calculated area-weighted average U-values [W/(m²K)]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.

[^] For fire doors, limiting U-value is 1.8 W/m²K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
m ³ /(h.m ²) at 50 Pa	8	3

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- 00. UFH via ASHP_E BE LEAN

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.64	-	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

2- 01. VRV_MVHR Be LEAN

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.64	7.6	-	-	-
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

3- 03. ElePanels_Extract Be LEAN

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1.34	-	-	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

4- 02. ElePanels_NatVent Be LEAN

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1.34	-	-	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

5- 00. DHW - ASHP BE LEAN

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.86	-	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

1- SYST0014-DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0.015
Standard value	N/A	N/A

2- SYST0005-DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

ID	System type in the Approved Documents
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter

NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

Zone name	ID of system type	SFP [W/(l/s)]									HR efficiency	
		A	B	C	D	E	F	G	H	I	Zone	Standard
	Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1		
01_Kitchen		-	-	-	-	-	-	-	-	0.8	-	N/A
00_Public W/C		0.3	-	-	-	-	-	-	-	-	-	N/A
00_Public W/C		0.3	-	-	-	-	-	-	-	-	-	N/A
01_Public W/C		0.3	-	-	-	-	-	-	-	-	-	N/A
01_Public W/C		0.3	-	-	-	-	-	-	-	-	-	N/A
00_First Aid		-	-	-	-	1	-	-	-	-	0.85	N/A
00_Changing Room		-	-	-	-	1	-	-	-	-	0.85	N/A
00_Officials Room M		-	-	-	-	1	-	-	-	-	0.85	N/A
00_Physiotherapy Room		-	-	-	-	1	-	-	-	-	0.85	N/A
00_Officials Room W		-	-	-	-	1	-	-	-	-	0.85	N/A
00_Changing Room		-	-	-	-	1	-	-	-	-	0.85	N/A
00_Club Office		-	-	-	-	1	-	-	-	-	0.85	N/A
00_Reception		-	-	-	-	1	-	-	-	-	0.85	N/A
00_Commercial 95sqm		-	-	-	-	1	-	-	-	-	0.85	N/A
00_Welling United FC Club Bar		-	-	-	-	1	-	-	-	-	0.85	N/A
00_Welling United FC Shop & Tickets		-	-	-	-	1	-	-	-	-	0.85	N/A
00_Commercial 109.3sqm		-	-	-	-	1	-	-	-	-	0.85	N/A
00_Officials Room		-	-	-	-	1	-	-	-	-	0.85	N/A
01_Club Office		-	-	-	-	1	-	-	-	-	0.85	N/A
01_Hospitality/ Classroom		-	-	-	-	1	-	-	-	-	0.85	N/A
01_Club/ VIP		-	-	-	-	1	-	-	-	-	0.85	N/A
01_Hospitality/ Classroom		-	-	-	-	1	-	-	-	-	0.85	N/A
01_Hospitality/ Classroom		-	-	-	-	1	-	-	-	-	0.85	N/A
00_Changing Room		-	-	-	-	1	-	-	-	-	0.85	N/A
00_Changing Room		-	-	-	-	1	-	-	-	-	0.85	N/A
00_Club Office		-	-	-	-	1	-	-	-	-	0.85	N/A
00_Public W/C		0.3	-	-	-	-	-	-	-	-	-	N/A
00_Public W/C		0.3	-	-	-	-	-	-	-	-	-	N/A
00_Changing Room		0.3	-	-	-	-	-	-	-	-	-	N/A
00_W/C		0.3	-	-	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency		
	ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1			
00_Public W/C	0.3	-	-	-	-	-	-	-	-	-	-	N/A
00_Public W/C	0.3	-	-	-	-	-	-	-	-	-	-	N/A
00_Public W/C	0.3	-	-	-	-	-	-	-	-	-	-	N/A
00_W/C	0.3	-	-	-	-	-	-	-	-	-	-	N/A
00_W/C	0.3	-	-	-	-	-	-	-	-	-	-	N/A
00_W/C	0.3	-	-	-	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
00_Unallocated	NO
00_General Storage	NO
00_General Storage	NO
00_Core	NO
00_Officials Room Lobby	NO
00_Plant Room	NO
00_Circulation	NO
00_Core	NO
00_Club Refuse	NO
00_Equipment Storage	NO
00_General Storage	NO
01_Kitchen	NO
01_Core	NO
01_M&E Equipment	NO
01_Lift Lobby	NO
01_Core	NO
00_store	NO
00_Public W/C	NO
00_Circulation	NO
00_Public W/C	NO
01_Public W/C	NO
01_Public W/C	NO
01_Circulation	NO
00_Circulation	NO
00_Circulation	NO
00_Circulation	NO
00_Circulation	NO
00_First Aid	NO
00_Changing Room	NO
00_Officials Room M	NO
00_Physiotherapy Room	NO
00_Officials Room W	NO
00_Changing Room	NO
00_Club Office	NO
00_Reception	NO
00_Commercial 95sqm	NO
00_Welling United FC Club Bar	NO

Shell and core configuration

Zone	Assumed shell?
00_Welling United FC Shop & Tickets	NO
00_Commercial 109.3sqm	NO
00_Officials Room	NO
01_Club Office	NO
01_Hospitality/ Classroom	NO
01_Club/ VIP	NO
01_Hospitality/ Classroom	NO
01_Hospitality/ Classroom	NO
00_Changing Room	NO
00_Changing Room	NO
00_Club Office	NO
00_Public W/C	NO
00_Public W/C	NO
00_Changing Room	NO
00_W/C	NO
00_Public W/C	NO
00_Public W/C	NO
00_Public W/C	NO
00_W/C	NO
00_W/C	NO
00_W/C	NO
00_Circulation	NO
00_Circulation	NO

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m ²]
	Standard value	95	80	0.3
00_Unallocated		120	-	-
00_General Storage		120	-	-
00_General Storage		120	-	-
00_Core		120	-	-
00_Officials Room Lobby		120	-	-
00_Plant Room		120	-	-
00_Circulation		120	-	-
00_Core		120	-	-
00_Club Refuse		120	-	-
00_Equipment Storage		120	-	-
00_General Storage		120	-	-
01_Kitchen		120	-	-
01_Core		120	-	-
01_M&E Equipment		120	-	-
01_Lift Lobby		120	-	-
01_Core		120	-	-
00_store		120	-	-
00_Public W/C		120	-	-

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m ²]
	Standard value	95	80	0.3
00_Circulation		120	-	-
00_Public W/C		120	-	-
01_Public W/C		120	-	-
01_Public W/C		120	-	-
01_Circulation		120	-	-
00_Circulation		120	-	-
00_Circulation		120	-	-
00_Circulation		120	-	-
00_First Aid		120	-	-
00_Changing Room		120	-	-
00_Officials Room M		120	-	-
00_Physiotherapy Room		120	-	-
00_Officials Room W		120	-	-
00_Changing Room		120	-	-
00_Club Office		120	-	-
00_Reception		120	120	1.125
00_Commercial 95sqm		120	120	1.25
00_Welling United FC Club Bar		120	-	-
00_Welling United FC Shop & Tickets		120	120	1.25
00_Commercial 109.3sqm		120	120	1.25
00_Officials Room		120	-	-
01_Club Office		120	-	-
01_Hospitality/ Classroom		120	-	-
01_Club/ VIP		120	-	-
01_Hospitality/ Classroom		120	-	-
01_Hospitality/ Classroom		120	-	-
00_Changing Room		120	-	-
00_Changing Room		120	-	-
00_Club Office		120	-	-
00_Public W/C		120	-	-
00_Public W/C		120	-	-
00_Changing Room		120	-	-
00_W/C		120	-	-
00_Public W/C		120	-	-
00_Public W/C		120	-	-
00_Public W/C		120	-	-
00_W/C		120	-	-
00_W/C		120	-	-
00_W/C		120	-	-
00_Circulation		120	-	-
00_Circulation		120	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
00_First Aid	N/A	N/A
00_Changing Room	N/A	N/A
00_Officials Room M	N/A	N/A
00_Physiotherapy Room	N/A	N/A
00_Officials Room W	N/A	N/A
00_Changing Room	N/A	N/A
00_Club Office	N/A	N/A
00_Reception	YES (+25.7%)	NO
00_Commercial 95sqm	YES (+30.6%)	NO
00_Welling United FC Club Bar	NO (-70.1%)	NO
00_Welling United FC Shop & Tickets	NO (-32.7%)	NO
00_Commercial 109.3sqm	NO (-69.7%)	NO
00_Officials Room	N/A	N/A
01_Club Office	NO (-54%)	NO
01_Hospitality/ Classroom	YES (+45.1%)	NO
01_Club/ VIP	YES (+47.2%)	NO
01_Hospitality/ Classroom	YES (+44.6%)	NO
01_Hospitality/ Classroom	YES (+44.6%)	NO
00_Changing Room	N/A	N/A
00_Changing Room	N/A	N/A
00_Club Office	N/A	N/A

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m ²]	1613.6	1613.6
External area [m ²]	5366.6	5366.6
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	3	3
Average conductance [W/K]	958.57	1706.25
Average U-value [W/m ² K]	0.18	0.32
Alpha value* [%]	37.4	20.41

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
14	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
86	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Terminals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	12.15	14.76
Cooling	3.5	4.01
Auxiliary	5.45	3.36
Lighting	10.76	10.89
Hot water	131.92	127.62
Equipment*	31.74	31.74
TOTAL**	163.79	160.63

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	7.32
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
<i>Displaced electricity</i>	<i>0</i>	<i>7.32</i>

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	235.71	312.62
Primary energy [kWh _{PE} /m ²]	242.14	226.9
Total emissions [kg/m ²]	22.3	20.98

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] No Heating or Cooling									
Actual	279.3	113	0	0	0.8	0	0	0	0
Notional	336.2	197.7	0	0	0.6	0	0	----	----
[ST] Central heating using water: floor heating, [HS] ASHP, [HFT] Electricity, [CFT] Electricity									
Actual	205.3	25.4	23	0	3.9	2.48	0	2.64	0
Notional	304.8	138.2	32.1	0	2.3	2.64	0	----	----
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity									
Actual	44.2	129.9	4.7	6.4	5.9	2.59	5.68	2.64	7.6
Notional	57.4	115.2	6	7.3	3.6	2.64	4.4	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity									
Actual	264	38.8	65	0	3.3	1.13	0	1.34	0
Notional	324.1	111.9	67.2	0	4.4	1.34	0	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity									
Actual	408.2	16.9	100.5	0	0	1.13	0	1.34	0
Notional	485.5	151.7	100.6	0	0	1.34	0	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Project name

Shell and Core

Welling United FC Commercial and Football Facilities BE GREEN

As designed

Date: Thu Nov 30 16:07:04 2023

Administrative information

Building Details

Address: Park View Road, Welling, London, DA16 1SY

Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.e.0

Interface to calculation engine: Virtual Environment

Interface to calculation engine version: v7.0.23

BRUKL compliance module version: v6.1.e.1

Certifier details

Name: MWL

Telephone number: 02084 469696

Address: Lymehouse Studios, 30-31 Lyme Street, London, NW1 0EE

Foundation area [m²]: 671.41

The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m ² annum	20.98
Building CO ₂ emission rate (BER), kgCO ₂ /m ² annum	13.26
Target primary energy rate (TPER), kWh _{PE} /m ² annum	226.9
Building primary energy rate (BPER), kWh _{PE} /m ² annum	138.54
Do the building's emission and primary energy rates exceed the targets?	BER =< TER BPER =< TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	U _{a-Limit}	U _{a-Calc}	U _{i-Calc}	First surface with maximum value
Walls*	0.26	0.16	0.16	00000006_W1
Floors	0.18	0.08	0.1	0100001B_F_A4
Pitched roofs	0.16	-	-	No heat loss pitched roofs
Flat roofs	0.18	0.1	0.1	00000006_C
Windows** and roof windows	1.6	1.2	1.2	0000004A_W1_O0
Rooflights***	2.2	-	-	No external rooflights
Personnel doors [^]	1.6	1.2	1.2	00000007_W1_O0
Vehicle access & similar large doors	1.3	-	-	No external vehicle access doors
High usage entrance doors	3	-	-	No external high usage entrance doors

U_{a-Limit} = Limiting area-weighted average U-values [W/(m²K)]U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]U_{a-Calc} = Calculated area-weighted average U-values [W/(m²K)]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.

[^] For fire doors, limiting U-value is 1.8 W/m²K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
m ³ /(h.m ²) at 50 Pa	8	3

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- 00. UFH via ASHP_E

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3	-	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

2- 01. VRV_MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.3	7.6	-	-	-
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

3- 03. ElePanels_Extract

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	-	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

4- 02. ElePanels_NatVent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	-	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

5- 00. DHW - ASHP 3.5

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	-	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

1- SYST0009-DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0.015
Standard value	N/A	N/A

2- SYST0005-DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

ID	System type in the Approved Documents
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter

NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

Zone name	ID of system type	SFP [W/(l/s)]									HR efficiency	
		A	B	C	D	E	F	G	H	I	Zone	Standard
	Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1		
01_Kitchen		-	-	-	-	-	-	-	-	0.8	-	N/A
00_Public W/C		0.3	-	-	-	-	-	-	-	-	-	N/A
00_Public W/C		0.3	-	-	-	-	-	-	-	-	-	N/A
01_Public W/C		0.3	-	-	-	-	-	-	-	-	-	N/A
01_Public W/C		0.3	-	-	-	-	-	-	-	-	-	N/A
00_First Aid		-	-	-	-	1	-	-	-	-	0.85	N/A
00_Changing Room		-	-	-	-	1	-	-	-	-	0.85	N/A
00_Officials Room M		-	-	-	-	1	-	-	-	-	0.85	N/A
00_Physiotherapy Room		-	-	-	-	1	-	-	-	-	0.85	N/A
00_Officials Room W		-	-	-	-	1	-	-	-	-	0.85	N/A
00_Changing Room		-	-	-	-	1	-	-	-	-	0.85	N/A
00_Club Office		-	-	-	-	1	-	-	-	-	0.85	N/A
00_Reception		-	-	-	-	1	-	-	-	-	0.85	N/A
00_Commercial 95sqm		-	-	-	-	1	-	-	-	-	0.85	N/A
00_Welling United FC Club Bar		-	-	-	-	1	-	-	-	-	0.85	N/A
00_Welling United FC Shop & Tickets		-	-	-	-	1	-	-	-	-	0.85	N/A
00_Commercial 109.3sqm		-	-	-	-	1	-	-	-	-	0.85	N/A
00_Officials Room		-	-	-	-	1	-	-	-	-	0.85	N/A
01_Club Office		-	-	-	-	1	-	-	-	-	0.85	N/A
01_Hospitality/ Classroom		-	-	-	-	1	-	-	-	-	0.85	N/A
01_Club/ VIP		-	-	-	-	1	-	-	-	-	0.85	N/A
01_Hospitality/ Classroom		-	-	-	-	1	-	-	-	-	0.85	N/A
01_Hospitality/ Classroom		-	-	-	-	1	-	-	-	-	0.85	N/A
00_Changing Room		-	-	-	-	1	-	-	-	-	0.85	N/A
00_Changing Room		-	-	-	-	1	-	-	-	-	0.85	N/A
00_Club Office		-	-	-	-	1	-	-	-	-	0.85	N/A
00_Public W/C		0.3	-	-	-	-	-	-	-	-	-	N/A
00_Public W/C		0.3	-	-	-	-	-	-	-	-	-	N/A
00_Changing Room		0.3	-	-	-	-	-	-	-	-	-	N/A
00_W/C		0.3	-	-	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency		
	ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1			
00_Public W/C	0.3	-	-	-	-	-	-	-	-	-	-	N/A
00_Public W/C	0.3	-	-	-	-	-	-	-	-	-	-	N/A
00_Public W/C	0.3	-	-	-	-	-	-	-	-	-	-	N/A
00_W/C	0.3	-	-	-	-	-	-	-	-	-	-	N/A
00_W/C	0.3	-	-	-	-	-	-	-	-	-	-	N/A
00_W/C	0.3	-	-	-	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
00_Unallocated	NO
00_General Storage	NO
00_General Storage	NO
00_Core	NO
00_Officials Room Lobby	NO
00_Plant Room	NO
00_Circulation	NO
00_Core	NO
00_Club Refuse	NO
00_Equipment Storage	NO
00_General Storage	NO
01_Kitchen	NO
01_Core	NO
01_M&E Equipment	NO
01_Lift Lobby	NO
01_Core	NO
00_store	NO
00_Public W/C	NO
00_Circulation	NO
00_Public W/C	NO
01_Public W/C	NO
01_Public W/C	NO
01_Circulation	NO
00_Circulation	NO
00_Circulation	NO
00_Circulation	NO
00_Circulation	NO
00_First Aid	NO
00_Changing Room	NO
00_Officials Room M	NO
00_Physiotherapy Room	NO
00_Officials Room W	NO
00_Changing Room	NO
00_Club Office	NO
00_Reception	NO
00_Commercial 95sqm	NO
00_Welling United FC Club Bar	NO

Shell and core configuration

Zone	Assumed shell?
00_Welling United FC Shop & Tickets	NO
00_Commercial 109.3sqm	NO
00_Officials Room	NO
01_Club Office	NO
01_Hospitality/ Classroom	NO
01_Club/ VIP	NO
01_Hospitality/ Classroom	NO
01_Hospitality/ Classroom	NO
00_Changing Room	NO
00_Changing Room	NO
00_Club Office	NO
00_Public W/C	NO
00_Public W/C	NO
00_Changing Room	NO
00_W/C	NO
00_Public W/C	NO
00_Public W/C	NO
00_Public W/C	NO
00_W/C	NO
00_W/C	NO
00_W/C	NO
00_Circulation	NO
00_Circulation	NO

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m ²]
	Standard value	95	80	0.3
00_Unallocated		120	-	-
00_General Storage		120	-	-
00_General Storage		120	-	-
00_Core		120	-	-
00_Officials Room Lobby		120	-	-
00_Plant Room		120	-	-
00_Circulation		120	-	-
00_Core		120	-	-
00_Club Refuse		120	-	-
00_Equipment Storage		120	-	-
00_General Storage		120	-	-
01_Kitchen		120	-	-
01_Core		120	-	-
01_M&E Equipment		120	-	-
01_Lift Lobby		120	-	-
01_Core		120	-	-
00_store		120	-	-
00_Public W/C		120	-	-

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m ²]
	Standard value	95	80	0.3
00_Circulation		120	-	-
00_Public W/C		120	-	-
01_Public W/C		120	-	-
01_Public W/C		120	-	-
01_Circulation		120	-	-
00_Circulation		120	-	-
00_Circulation		120	-	-
00_Circulation		120	-	-
00_First Aid		120	-	-
00_Changing Room		120	-	-
00_Officials Room M		120	-	-
00_Physiotherapy Room		120	-	-
00_Officials Room W		120	-	-
00_Changing Room		120	-	-
00_Club Office		120	-	-
00_Reception		120	120	1.125
00_Commercial 95sqm		120	120	1.25
00_Welling United FC Club Bar		120	-	-
00_Welling United FC Shop & Tickets		120	120	1.25
00_Commercial 109.3sqm		120	120	1.25
00_Officials Room		120	-	-
01_Club Office		120	-	-
01_Hospitality/ Classroom		120	-	-
01_Club/ VIP		120	-	-
01_Hospitality/ Classroom		120	-	-
01_Hospitality/ Classroom		120	-	-
00_Changing Room		120	-	-
00_Changing Room		120	-	-
00_Club Office		120	-	-
00_Public W/C		120	-	-
00_Public W/C		120	-	-
00_Changing Room		120	-	-
00_W/C		120	-	-
00_Public W/C		120	-	-
00_Public W/C		120	-	-
00_Public W/C		120	-	-
00_W/C		120	-	-
00_W/C		120	-	-
00_W/C		120	-	-
00_Circulation		120	-	-
00_Circulation		120	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
00_First Aid	N/A	N/A
00_Changing Room	N/A	N/A
00_Officials Room M	N/A	N/A
00_Physiotherapy Room	N/A	N/A
00_Officials Room W	N/A	N/A
00_Changing Room	N/A	N/A
00_Club Office	N/A	N/A
00_Reception	YES (+25.7%)	NO
00_Commercial 95sqm	YES (+30.6%)	NO
00_Welling United FC Club Bar	NO (-70.1%)	NO
00_Welling United FC Shop & Tickets	NO (-32.7%)	NO
00_Commercial 109.3sqm	NO (-69.7%)	NO
00_Officials Room	N/A	N/A
01_Club Office	NO (-54%)	NO
01_Hospitality/ Classroom	YES (+45.1%)	NO
01_Club/ VIP	YES (+47.2%)	NO
01_Hospitality/ Classroom	YES (+44.6%)	NO
01_Hospitality/ Classroom	YES (+44.6%)	NO
00_Changing Room	N/A	N/A
00_Changing Room	N/A	N/A
00_Club Office	N/A	N/A

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m ²]	1613.6	1613.6
External area [m ²]	5366.6	5366.6
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	3	3
Average conductance [W/K]	958.57	1706.25
Average U-value [W/m ² K]	0.18	0.32
Alpha value* [%]	37.4	20.41

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
14	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
86	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Terminals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	12.32	14.76
Cooling	3.5	4.01
Auxiliary	5.45	3.36
Lighting	10.76	10.89
Hot water	124.18	127.62
Equipment*	31.74	31.74
TOTAL**	156.22	160.63

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	63.01	7.32
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
<i>Displaced electricity</i>	<i>63.01</i>	<i>7.32</i>

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	235.71	312.62
Primary energy [kWh _{PE} /m ²]	138.54	226.9
Total emissions [kg/m ²]	13.26	20.98

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] No Heating or Cooling									
Actual	279.3	113	0	0	0.8	0	0	0	0
Notional	336.2	197.7	0	0	0.6	0	0	----	----
[ST] Central heating using water: floor heating, [HS] ASHP, [HFT] Electricity, [CFT] Electricity									
Actual	205.3	25.4	20.2	0	3.9	2.82	0	3	0
Notional	304.8	138.2	32.1	0	2.3	2.64	0	----	----
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity									
Actual	44.2	129.9	2.9	6.4	5.9	4.22	5.68	4.3	7.6
Notional	57.4	115.2	6	7.3	3.6	2.64	4.4	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity									
Actual	264	38.8	87.1	0	3.3	0.84	0	1	0
Notional	324.1	111.9	67.2	0	4.4	1.34	0	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity									
Actual	408.2	16.9	134.7	0	0	0.84	0	1	0
Notional	485.5	151.7	100.6	0	0	1.34	0	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type