



Sustainable Design and Construction & Energy Statement

Project: Knowles Quarry, Barnsley Road, Cudworth S72 8UU

Client: **Consensus Support**
3 The Courtyards, Phoenix Square, Wyncolls Road, Colchester, Essex, CO4 9PE

Local Authority: **Barnsley Metropolitan Borough Council**
1 Westgate, Barnsley, S70 2DR

Architect: **Consult Construct Ltd**
Bysing Wood Road, Gunpowder Works, Faversham, Kent, ME13 7UD

Prepared by: **Consult Sustainability Ltd**
Elm Mews, 55 Elmcroft Road, Orpington BR6 0HZ

Report Authors: **Stuart Searle MRICS OCDEA/ Andrew Pook BREEAM Assessor**
T: 01689 497 852
E: stuart.searle@consultsustainability.co.uk

Reference: 22.2668-SS-02

Date: April 2023

Disclaimer: This report has been prepared for the above-named Client for the purpose agreed in the terms of engagement. Whilst every effort has been made to ensure the accuracy of the information contained within this report, the results and recommendations should not be used as the basis of design or implementation. Consult Sustainability do not warrant the use of the information contained within this report by parties other than above named Client.



Consult Sustainability Limited

Elm Mews 55 Elmcroft Road, Orpington, Kent, BR6 0HZ
Registered in England at this address : Company No. 13524795

info@consultsustainability.co.uk 01689 497852
www.consultconstruct.co.uk



Contents

	Page
1.0 Executive Summary	3
2.0 Introduction	5
3.0 Site Specifics	6
4.0 Planning Requirements	7
5.0 Key Principles of Sustainable Construction & Design	9
6.0 Energy Principles	10
7.0 Energy Proposals	12
8.0 Materials	17
9.0 Water Conservation	18
10.0 Waste Management	19
11.0 Environmental Management	20
12.0 Land Use & Ecology	21
13.0 Pollution, Health & Wellbeing	21

Appendix 1 – Draft SAP/BRUKL Worksheets

Appendix 2 – Renewables Layout



1.0 Executive Summary

Scope:	Consult Sustainability Limited has been appointed to prepare a planning stage sustainability and energy statement for the proposed development known as Knowles Quarry, Barnsley Road, Cudworth S72 8UU for the scheme detailed below.
Description:	New build residential development comprising nine residential units, Use Class C3(b), with communal areas and staff office for adults with autism and learning difficulties, where each individual will benefit from their own flat and 1:1 support to help them develop independent living skills as far as possible, on a personal need's basis.
Purpose:	To outline the sustainability and energy measures incorporated into the proposed development in support of planning application.
Authors:	Mr S Searle MRICS (0854781) OCDEA (Elmhurst EES/022737) & Andrew Pook, BREEAM Registered Assessor (BREEAM 87).
Methodology:	The methodology followed in this report follows general sustainability measures outlined within Barnsley Metropolitan Borough Council's Local Plan. Energy modelling has been prepared using approved software, against current Approved Document L of the 2021 Building Regulations.
Planning:	This statement has been provided to meet the requirements of the Barnsley Local Plan-SPD Sustainable Construction and Climate Change Adaptation:

Policy SD1 Presumption in favour of Sustainable Development

When considering development proposals, we will take a positive approach that reflects the presumption in favour of sustainable development contained in the National Planning Policy Framework. We will work proactively with applicants jointly to find solutions which mean that proposals can be approved wherever possible, and to secure development that improves the economic, social, and environmental conditions in the area.

Policy CC1 Climate Change

We will seek to reduce the causes of and adapt to the future impacts of climate change by:

- Giving preference to development of previously developed land in sustainable locations.
- Promoting the reduction of greenhouse gas emissions through sustainable design and construction techniques.
- Locating and designing development to reduce the risk of flooding.
- Promoting the use of Sustainable Drainage Systems (SuDS).
- Promoting and supporting the delivery of renewable and low carbon energy; and
- Promoting investment in Green Infrastructure to promote and encourage biodiversity gain.

Policy CC2 Sustainable Design and Construction

Development will be expected to minimise resource and energy consumption through the inclusion of sustainable design and construction features, where this is technically feasible and viable.



Scheme Proposal:	Sustainable design measures will be implemented as outlined within this report.
	The basis of this Sustainable Design and Construction & Energy Statement addresses the following key requirements:
	• Significant reduction in CO₂ emissions, (65% reduction in baseline emissions). • incorporating improved fabric standards, communal ASHP's and solar PV. • Consideration of sustainable material choices. • Installation of water saving measures. • Internal air quality. • Natural light. • Accessibility. • Secure design. • Safe routes to public transport. • Safe and securer parking. • Flood resistant design. • Waste and recycling. • Considerate construction. • Apply waste hierarchy in construction and demolition. • Encourage sustainable forms of transport and locally sourced labour. • Green roof/walls where feasible.



2.0 Introduction

This statement aims to help developers and other interested parties to assess how sustainable, designs are for new homes and mixed-use developments at the design and planning application stages of a development. The statement complies with the local authority's verification requirement for sustainable development.

This statement focuses on the sustainability issues pertinent to spatial planning, while addressing construction and "in-use" issues that can be anticipated or influenced at the design phase.

The aims of this checklist are set out as follows:

- It gives advice to the development team as to the sustainability of different site types.
- It guides the design team in illustrating the issues that they need to address, so that these can be considered at the right stage of the design process rather than having to be incorporated (and the design expensively reworked) at a later stage.
- It sets out minimum, good, and best practice standards for each of the issues covered, so that the developer/planning applicant can see where they are performing well, and which areas need further work.
- It provides recognition where the developer/planning applicant has gone above the minimum level of performance.
- It provides a common framework for pre-application discussions.
- It enables the developer/planning applicant to assess the sustainability of their planning application before it is submitted to the local planning authority.
- It provides a level playing field for developers/planning applicants, as issues and standards are clearly laid out.
- It does not constrain the design team – it sets out standards to be achieved rather than defining the methods to achieve them.
- It builds on well-known industry standards such as BREEAM, Urban Design Compendium, and National Standards Framework.

The Checklist is designed specifically for use in planning applications at the development level, rather than at the level of the individual building. The performance of the individual has been considered in all statements allowing for any issues to be considered.

This statement outlines the proposed development's sustainability, energy efficiency and sustainability strategies developed with the aim to meet the targets of Barnsley Metropolitan Borough Council.

To benchmark this process, BREEAM methodology has been used where at all practical, as BREEAM provides best practice solutions in a quantifiable assessment. This considers the broad environmental concerns of climate change, pollution, impact on occupants and the wider community. It balances these with the need for a high quality, safe and healthy internal environment.

BREEAM standards typically go beyond the requirements of the Building Regulations. Some of the proposed sustainable measures for further consideration are:



- The assessment of overheating through Building Regulations Part O.
- Thermal insulation and air tightness levels.
- High efficiency heating & hot water systems with time and temperature zone controls.
- Energy-efficient external lighting & designed to minimise light pollution.
- Acoustic insulation in separating floors and walls, improving on the minimum requirements of Building.
- Regulations Part E
- Internal and external facilities for recyclable waste storage.
- Materials specified to have 'A' ratings from the BRE Green Guide to Specification where possible.
- The construction site has been managed in an environmentally sound manner in terms of resources, waste management, and pollution.
- Multi-residential schemes of this nature should always consider whole life and in-use performance as a fundamental sustainability principle. 90% of the global warming gas emissions of any new building come during the operational lifetime of that building.

3.0 Site Specifics

Description

The development comprises a single, two storey, building incorporating nine independent residential units, Use Class C3(b), plus communal areas and staff office, for adults with autism and learning difficulties, where each individual will benefit from their own flat and 1:1 support to help them develop independent living skills as far as possible, on a personal need's basis.



PROPOSED FRONT ELEVATION- 1:100 (A1)



PROPOSED REAR ELEVATION- 1:100 (A1)

Unit Areas

Area	GIFA (m ²)	No. Units	Total GIFA (m ²)
Flats	46	9	414
Communal	408	1	408
Total			822



4.0 Planning Requirements

National Policy At national level, National Planning Policy Framework (2021) sets out the Government's planning policies for England, identifying how the planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. The NPPF should help to shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure.

Local planning authorities must take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures in line with the objectives and provisions of the Climate Change Act 2008.

New development should be planned for in ways that:

- a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and
- b) can help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards.

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.
- 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.

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.

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.

When determining planning applications for renewable and low carbon development, local planning authorities should:



- a) not require applicants to demonstrate the overall need for renewable or low carbon energy, and recognise that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions; and
- b) approve the application if its impacts are (or can be made) acceptable. Once suitable areas for renewable and low carbon energy have been identified in plans, local planning authorities should expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas.

Local Policy

This statement has been provided to meet the requirements of the Barnsley Local Plan-SPD Sustainable Construction and Climate Change Adaptation:

Policy SD1 Presumption in favour of Sustainable Development

When considering development proposals, we will take a positive approach that reflects the presumption in favour of sustainable development contained in the National Planning Policy Framework. We will work proactively with applicants jointly to find solutions which mean that proposals can be approved wherever possible, and to secure development that improves the economic, social, and environmental conditions in the area.

Policy CC1 Climate Change

We will seek to reduce the causes of and adapt to the future impacts of climate change by:

- Giving preference to development of previously developed land in sustainable locations.
- Promoting the reduction of greenhouse gas emissions through sustainable design and construction techniques.
- Locating and designing development to reduce the risk of flooding.
- Promoting the use of Sustainable Drainage Systems (SuDS).
- Promoting and supporting the delivery of renewable and low carbon energy; and
- Promoting investment in Green Infrastructure to promote and encourage biodiversity gain.

Policy CC2 Sustainable Design and Construction

Development will be expected to minimise resource and energy consumption through the inclusion of sustainable design and construction features, where this is technically feasible and viable.

The basis of this Sustainable Design and Construction Statement addresses the following key requirements:

- Reduction in CO₂ emissions against regulation standards.
- Consider sustainable material choices.
- Installation of water saving.
- Internal air quality.
- Natural light.
- Accessibility.
- Secure design.
- Safe routes to public transport.
- Safe and securer parking.
- Flood resistant design.
- Waste and recycling.
- Considerate construction.
- Apply waste hierarchy in construction and demolition.
- Encourage sustainable forms of transport and locally sourced labour.
- Green Roof/Walls where applicable.



5.0 Key Principles of Sustainable Construction and Design.

This Checklist aims to help developers and other interested parties to assess how sustainable designs are for new homes and mixed-use developments (including conversions) at the design and planning application stages of a development.

It focuses on the sustainability issues pertinent to spatial planning, while addressing construction and “in-use” issues that can be anticipated or influenced at the design phase.

The aims of this checklist are set out as follows:

<i>CfSH/HQM Certification</i>	✗
<i>BREEAM New Construction 2018 version 6</i>	✗
<i>Protect and enhance biodiversity</i>	✓
<i>Minimise noise impact</i>	✓
<i>Minimise air pollution</i>	✓
<i>Minimise light pollution</i>	✓
<i>Apply flood risk assessment</i>	✓
<i>Consider sustainable material choices</i>	✓
<i>Installation of water saving devices</i>	✓
<i>Internal Air Quality</i>	✓
<i>Natural Light</i>	✓
<i>Accessibility</i>	✓
<i>Waste and recycling</i>	✓
<i>Apply waste hierarchy in construction and demolition</i>	✓
<i>Encourage sustainable forms of transport and locally sourced labour</i>	✓
<i>Partially future adapted</i>	✓

The functionality of the dwellings is to take precedence over the individual key elements listed above. As such, the sections that follow, identify the design approach adopted and an indication of the elements considered for this specific project.



6.0 Energy Principles

Lean

Fabric First: Energy Efficiency Standards

Demand reduction (Be Lean) measures specific to the scheme are encouraged at the earliest design stage of a development and aim to reduce to demand of energy.

Measures typically include passive design: both architectural and building fabric measures, and active design: energy efficient services. It is possible to exceed Building Regulations requirements through demand reduction (Be Lean) measures alone.

Improving the envelope performance beyond the minimum Building Regulations standards can help to reduce the annual CO₂ emissions associated with the dwellings' heating demand, by limiting the heat loss through the buildings' fabric.

After assessing the contribution of the passive elements to the overall energy balance, the aim is to further reduce CO₂ emissions by selecting efficient mechanical and electrical systems and efficient controls to manage the energy used during operation.

The proposal is to construct the development to a high thermal performance standard with u-values exceeding the minimum fabric targets of both the current Building Regulations. In addition, enhanced mechanical and electric services will also be implemented to further reduce energy demand as outlined under section 7.0 of this report.

Clean

Supply Energy Efficiently

A 'clean' energy supply refers to the energy efficiency of heating, cooling, and power systems.

Planning applications should demonstrate how the heating, cooling and power systems have been selected to minimise CO₂ emissions.

Finalised heating and hot water systems are yet to be confirmed. It is anticipated however that future heating and hot water will be provided by a communal air source heat pump connected to underfloor heating. Efficiency of electrical heating and hot water appliance has moved on significantly in recent years, and in combination with a very high specification of insulation and air tightness performance can offer a very viable alternative to natural gas.

The future adaptability of heating and hot water production has moved significantly up the agenda, and so it should be considered at a point when most of our energy production is renewable then electric appliances will be able to take advantage of these benefits. It is very possible for future residents to select an energy supplier now, that offers 100% renewable electricity as part of their tariff plans.

Green

Low Carbon/ Renewable Technologies

Use of renewable energy in developments is encouraged at the 'Be Green' third stage. Each renewable energy technology technically feasible and each should be considered in the Energy Assessment. At this stage it is anticipated that ASHP's and 4.0kWp of photovoltaic panels will be installed as outlined under section 7.0 of this report.

Other Design Considerations

The thermal mass of a building is the measure of its capacity to store and release internal heat. Buildings with a high thermal mass take a long time to heat up but also take a long time to cool down.



As a result, they can have a steadier internal temperature. Buildings with a low thermal mass are very responsive to changes in internal temperature- they heat up very quickly, but they also cool down quickly. They can be subject to a wide variation in internal temperature.

Everything inside a building contributes to its thermal mass according to its capacity to absorb and store heat, known as its 'thermal capacity'.

The best materials for storing heat are generally those that are very dense, absorb energy slowly, and then give out that energy gradually. Brick, concrete, and stone have a high thermal capacity, with most of the storage capacity in the first 20mm (approx.) of the exposed surface area of the element and hence for example plastered surfaces negate the benefits of high-density block work walls.

Preliminary assessments indicate that where additional construction fabric is created the proposed dwelling, with a 'medium' thermal mass construction and operable windows during the summer, will minimise the risk of overheating to a degree.

Other Efficiency Measures

Eco-Labelled Goods: Domestic appliances where/and if installed will be energy-efficient with A/A+ ratings being targeted under the EU Energy labelling scheme.

Energy metering: Metering of the energy uses within the development separately, will help the building users identify areas of increased consumption and highlight potential energy-saving measures for the future, hence reducing the associated annual CO₂ emissions from these systems.

This will also help the building users to identify where problems or faults are causing excess energy consumption to occur. For the proposed development all, electrical supplies have been metered using smart units to enable residents to identify their own consumption and hence CO₂ emissions.

To assist residents to control future cost, the smart meters will have the option to pre-programme their individual tariff rate within the display device.

A detailed information pack (Home User Guide) will be provided to allow new residents to fully understand appliances use and energy saving measures.

Fuel source: New energy contracts will be procured seeking to minimise fossil fuel use. As a minimum a supplier company 'green' energy plan will be instructed, however, it is recommended to consider companies who provide a 100% renewable tariff for electricity. As the homes will be fully electric this in principle meets a significant part of the zero-carbon agenda.



7.0 Energy Proposals

7.1 Energy Efficiency Standards

Energy efficiency measures for the building are proposed to be incorporated to reduce the energy demand and CO₂ emission of the development.

The contractor will adopt a fabric first approach.

Table 1 outlines the proposed fabric standards against the Approved Document L limiting U-values for new or replacement elements in new and existing buildings and air permeability in new buildings, together with the percentage improvement against each of the measures.

Building Fabric Measures

Table 1. Approved Document L1 2021			
	A	B	C
Residential Element	Limiting U-Values (W/m ² K)	Proposed U-Values (W/m ² K)	Improvement (%)
Roof - Flat	0.18	0.10	44%
Roof – Pitched	0.16	0.10	38%
Walls	0.26	0.18	31%
Floor	0.18	0.10	44%
Windows	1.60	1.20	25%
Doors	1.60	1.40	13%
Air tightness	8.0m ³ /hr/m ²	4.0m ³ /hr/m ²	50%

Thermal Bridging

In addition to the enhanced building fabric standards, the building will be designed to minimise transmission of heat through thermal bridging and will target an overall PSi value of 0.06W/mK. This will be achieved through good detailing and demonstrated through thermal modelling at detailed design stage.

Air Tightness

Good site quality standards will be adhered to achieve a high-performance building with a low air permeability rate. The building will not exceed 4.00m³/hr/m² at 50 Pascal's or less, against AD L1 target 8.00m³/hr/m².

Low air permeability will be achieved through ensuring attention to detail during construction and making sure all punctures through the building envelope are adequately sealed.

Windows

The quantities of solar radiation entering the building has been balanced against the aim to achieve good daylight levels, by selecting glass with high light transmission (min. 70%) but limited solar transmission (50%).

The contractor shall seek to install windows with a BFRC or BSI certification to ensure robustness of data entry. A glazing g-value of 0.5 will be achieved to mitigate the potential risk of overheating.



Lighting Installing efficient low energy light fittings internally and externally can significantly reduce a building's overall lighting load hence lowering its annual CO₂ emissions. To reduce the energy consumption associated with artificial lighting, dedicated energy-efficient fittings will be specified for 100% of internal and external lighting.

Dedicated fittings comprise the lamp, base, control gear, and an appropriate housing, reflector, shade or diffuser.

Lighting will achieve a minimum 75lm/W and be provided with auto on/off to circulation & communal/staff spaces and manual control elsewhere.

7.2 Supply Energy Efficiently

In addition to the building fabric measures, the contractor shall seek to supply energy efficiently.

Consideration has been given to connection to local existing or planned heat network to provide an efficient means of supplying heating and hot water. None have been identified to currently exist or are planned within proximity of the proposed development site.

Consideration has also been given to the exploitation of local energy opportunities to maximise the use of locally available energy sources whilst minimising primary energy demand and carbon emissions.

Secondary heat sources should be used before renewable energy sources but can also be used in conjunction with them to minimise the carbon intensity of the heat network; these include environmental sources: air, water and ground; and waste sources: such as heat from the sewerage system, sewage treatment plants, the tube network, data centres and chiller systems.

No opportunities exist for the exploitation of local energy opportunities.

The use of low-emission combined heat and power has also been considered however, at this scale it is generally not economic to install CHP in domestic led developments, (and where CHP is installed it tends to have lower electrical efficiencies and therefore higher carbon emissions). There are also growing concerns about the air quality impacts of gas-engine CHP at this scale.

In addition, due to the small landlord electricity demand, CHP installed to meet the base heat load would require the export of electricity to the grid. The administrative burden of managing CHP electricity sales at this small scale where energy service companies (ESCOs) are generally not active, and the low unit price available for small volumes of exported CHP electricity, means it is generally uneconomic for developers to pursue; this can lead to CHP being installed but not operated.

The use of site wide community heating is considered feasible and has been included in the energy modelling.

The dwellings are designed to be naturally ventilated in hot weather, with air being introduced into the occupied spaces via external window openings; hence, saving energy and associated annual CO₂ emissions from cooling which may otherwise have been required. The building will incorporate decentralised mechanical ventilation to flats, (Titon Ultimate dMEV or equal fans), with MVHR to communal areas.



Heating/HW Current guidance suggests that a heating strategy led by ultra-low NOx gas boilers should only be considered when it has been clearly demonstrated that all options have been investigated and ruled out or in cases where they represent interim heating solutions until a site is able to connect to an expanding or new heat network.

With the Governments current drive to move away from fossil fuels and with the increasing decarbonisation of grid electricity, it is proposed that communal electric heat pumps are used to supply heating and hot water as outlined below.

Controls Smart controls will be incorporated to operate heating and hot water, including programmers, thermostats, and zoning where feasible.

The use of underfloor heat emitters will also be included within the design.

7.3 Low Carbon/ Renewable Technology Consideration

Feasible Renewable Energy Technologies A reduction in carbon emissions through the use of on-site renewable energy may be achieved through several technologies to generate heat or power. In determining the most suitable technology/ies consideration has been given to:

- CO₂ reduction effectiveness.
- Cost feasibility.
- Practicality.
- Planning restrictions.
- Site related constraints.
- Operating noise.
- Ongoing maintenance.

GSHPs

Ground Source Heat Pumps (GSHPs)	
CO₂ reduction effectiveness:	Estimated potential 60-70% reduction in CO ₂ emissions.
Cost feasibility:	High – Estimated £200,000-300,000 dependent on results of thermogeological assessment and detailed design.
Practicality:	Practical for new buildings with high fabric efficiency standards and low energy demand.
Planning restrictions:	No abnormal planning restrictions.
Site related constraints:	Limited external space available for boreholes. Depth and feasibility would be subject to detailed design, heat loss calculations and thermogeological assessment.
Operating noise:	Low.
Ongoing maintenance:	Medium - None to boreholes, annual maintenance requirement for heat pumps.
Feasibility:	Not considered feasible for this development.



ASHPs

Air Source Heat Pumps (ASHPs)	
CO₂ reduction effectiveness:	Estimated potential 50-60% reduction in CO ₂ emissions.
Cost feasibility:	Medium - £75,000, dependant on detailed design.
Practicality:	Practical for new buildings with high fabric efficiency standards and low energy demand.
Planning restrictions:	Consideration of externally mounted plant and operating noise. Heat pumps would need to be located externally, in close proximity to the dwellings, either disguised or discreetly hidden, to reduce their impact.
Site related constraints:	Limited external space for locating plant.
Operating noise:	Low - consideration will be required to the siting of the heat pumps to ensure disturbance is not caused to the occupiers or neighbouring properties.
Ongoing maintenance:	Medium - Annual maintenance requirement for heat pumps.
Feasibility:	ASHPs are considered appropriate for the building, (subject to discreet location of heat pumps externally).

PV

Photovoltaics (PV)	
CO₂ reduction effectiveness:	Significant % reductions available, limited only by available roof area.
Cost feasibility:	Low – Circa £1,500/kWp.
Practicality:	PV easy to install and can be fed to building providing a reduction in the energy demand, fuel bills and CO ₂ emissions.
Planning restrictions:	Consideration of externally mounted panels.
Site related constraints:	Limited areas of roof space available in south orientation due to roof layouts. Substantial trees on West boundary of site which may cause shading and reduced efficiency.
Operating noise:	None.
Ongoing maintenance:	Low – Occasional cleaning of panels.
Feasibility:	Considered feasible for this development.

Solar Thermal

Solar Thermal	
CO₂ reduction effectiveness:	Reduction in CO ₂ emissions limited by available roof space and demand for hot water. Estimated potential 5-10% reduction in CO ₂ emissions.
Cost feasibility:	Medium – Circa £15,000.
Practicality:	Distribution through existing building more difficult to achieve without heat losses.
Planning restrictions:	Consideration of externally mounted panels.
Site related constraints:	Limited areas of roof space available in south orientation due to roof layouts. Substantial trees on West boundary of site which may cause shading and reduced efficiency.
Operating noise:	Negligible.
Ongoing maintenance:	Medium – Annual maintenance requirements of mechanical plant.
Feasibility:	Not considered feasible for this development.



Wind Turbines

Wind Turbines	
CO₂ reduction effectiveness:	Estimated potential 3-5% reduction in CO ₂ emissions
Cost feasibility:	Medium – Circa £15,000.
Practicality:	The standalone wind turbine would require sufficient open space on the site to locate the turbine and be far enough away from buildings to be able to work effectively. Building mounted wind turbines have not been shown to be highly effective.
Planning restrictions:	Consideration of higher impact externally mounted plant and effect on neighbouring properties.
Site related constraints:	Limitations on available roof space, extensive site wide trees disrupting air flow.
Operating noise:	High
Ongoing maintenance:	High – Annual maintenance of motors.
Feasibility:	Not considered feasible for this development.

Energy
Summary

In consideration of the above, and in addition to the enhanced fabric standards outlined earlier within this report, it is proposed to provide a combined system of communal ASHP's and PV to achieve a substantial reduction in energy demand and CO₂ emissions as outlined in Table 2 below.

Proposed heat pumps are proposed to be located to the rear flat roofs of the building with internal plant located within the adjacent ground floor plant room.

It is estimated that a minimum of 4.00kWp of PV panels can be located to the rear flat roofs with output directed to the building's electricity supply to power heat pumps and reduce the overall energy demand of the building.

See appendix 2 for renewables layouts.

7.4 Carbon Reduction Summary

Table 2: Regulated CO₂ Emissions Summary

	Total CO ₂ Emissions (t/annum)	CO ₂ Reduction (Tonnes CO ₂ /year)	Percentage Savings (%)
Part L 2021 Baseline	9.3	-	-
Be Lean Stage	8.7	0.6	7%
Be Clean Stage	8.7	0.0	0%
Be Green Stage	3.3	5.4	58%
Total Savings	-	6.0	65%



8.0 Materials

Building and construction activities worldwide consume 3 billion tons of raw materials each year, which account for approximately 50% of total global consumption.

Using green/sustainable building materials and products promotes conservation of dwindling non-renewable resources. In addition, integrating sustainable building materials into building projects can help reduce the environmental impacts associated with the extraction, transport, processing, fabrication, installation, reuse, recycling, and disposal of these source materials.

Where feasible the overall environmental impact will be minimised through the specification of sustainable materials and components.

Environmental Impact of Materials	Materials with low overall environmental impact have been selected for the key building elements in the proposed scheme, targeting A/A+ ratings where possible, from the BRE 'Green Guide to Specification'.
---	--

The Green Guide rates the environmental impact of different materials and components over their lifecycle, considering factors like toxicity, ozone depletion, extraction, ease of recycling, waste disposal etc.

Recycled / Reused Materials	Recycled materials have been specified where possible. Specifying materials with a high-recycled content is a method of saving processing or manufacturing energy. The recycled content of a material can be described as either post-consumer or post- industrial to indicate at what point in the life cycle a material is reclaimed.
-----------------------------------	---

Some typical building materials that can contain a high percentage of recycled material include reinforcing and framing steel, concrete masonry units, gypsum wallboard, acoustic ceiling panels and their suspension system.

Opportunities for reusing materials that may be available from the demolition of existing buildings on the site have been identified.

Lifecycle cost	Consideration will always be given to the future lifecycle cost, by focusing on re-usable/recyclable products where feasible. Re-use of intrinsic materials reduces the whole carbon cost for the scheme. The developer will consider in-use reductions, by selecting products with longer life anticipation.
----------------	---



9.0 Water Use and Attenuation

Water consumption in the UK has risen by 70% over the last 30 years. Trying to meet the increasing demand by creating new sources of water supply is both expensive and damaging to the environment.

The efforts should be focused into reducing the demand for water & managing the existing resources. Good water management can contribute to reducing the overall level of water consumption maintaining a vital resource and having environmental as well as cost benefits in the life cycle of the building.

Demand Reduction and Water Efficiency

The aim has been to minimise internal and external potable water use within the development by specifying water-efficient sanitary fittings and controls.

Water saving measures have been incorporated for all dwellings in the scheme by following the requirements of BREEAM. Because the building follows a definition of multi-residential, it should be possible to use standard water use calculation methods, as these mirror residential use.

Water use will be limited to is limited to <110/person/day.

Compliance has been assessed using the 'Water Efficiency Calculator for new dwellings', which sets out the Government's national calculation methodology for assessing water efficiency in new dwellings and is used to assess performance against BREEAM requirements as well as Part G of the Building Regulations.

Additional measures which can offer water savings and management include:

Water meters: The specification of water meters, if possible, on all mains supplies is a simple and effective way of being able to monitor water usage for the dwellings, which can assist in identifying areas of high consumption and in setting future reduction targets.

Water reuse: Additional measures have been considered to reduce the overall mains water, these include water butts, grey water re-use and rainwater harvesting.

Sustainable Drainage: The site is likely to at least match the existing attenuation and flow rates from the existing use. But the developer should commit to at least meeting the surface water hierarchy introduced by the Building Research Establishment in conjunction with water suppliers. The BRE hierarchy concerning surface water control has been applied to this project.

Flood Risk: Initial investigations outline there is low potential risk, the site lies within a zone 1 flood risk area with an anticipated 1 in 1000 risk of flooding due to a rise in sea or river levels.

However, it is noted that the flood risk maps available outline that there may be a high risk of potential flood due to surface or ground water run-off in the site area.

The local authority would therefore require a full flood risk assessment to be submitted with the application, the NPPF guidance would further require within this a sequential risk assessment outlining the potential risk and the remediation measures required to alleviate/reduce the future risk to an acceptable level.



10.0 Waste Management

Buildings and building sites produce a significant amount of waste per year. Most of the waste produced in the UK is disposed in landfill sites and only a small percentage of it is recycled or reused.

Waste Targets

Under new legislation the UK will have to ensure that less than a third of its waste is sent for burial in landfill sites by 2023 and the figure at present is about 80%. To achieve this target several measures are implemented, including landfill tax, aiming to discourage disposal of waste to landfill.

Good waste management is a key component of sustainable development. Reducing waste is an important means of:

- Reducing unnecessary expenditure.
- Reducing the number of natural resources used for production of new materials.
- Reducing energy for waste disposal.
- Reducing levels of contamination and pollution arising from waste disposal.

The proposed development will minimise the impact of waste in the environment. All waste carriers will provide recorded data of waste transfers, minimum requirement has been set that at least 85% of all site waste has been diverted from landfill.

Demolition & Construction

During the construction phase, a large amount of waste material has been generated through construction, demolition. In building construction, the primary waste products in descending percentages are wood, asphalt /concrete /masonry, drywall, roofing, metals, and paper products.

Prior to commencement on site, the Contractor will finalise a Site Waste Management Plan (SWMP) that complies with the requirements of current legislation.

As a minimum contains:

- Target benchmark for resource efficiency e.g., m³ of waste per 100m² or tonnes of waste per 100m² of building floor area.
- Procedures and commitments for minimising non-hazardous waste in relation to at least 3 waste groups.
- Procedures for minimising hazardous waste.
- Procedures for monitoring, measuring, and reporting hazardous and non-hazardous site waste.

The SWMP also includes procedures and commitments to sort and divert waste from landfill through either:

- Reuse on site or on other sites.
- Salvage/reclaim for reuse.
- Return to the supplier via a 'take-back' scheme.
- Recycling through an approved waste management contractor.
- Compost.



	Site restrictions will play a significant part with this project. Reliance has been placed on the offsite waste operative.
Household Waste in Operation	The scheme has been designed so that adequate internal and external space is provided for the storage of recyclable and non-recyclable household waste. As a minimum, the maximum requirements of BREEAM have been met. The space meets the requirements for inclusive access and usability. Based on the Council's strategy for recyclable waste, and predicted frequency of collection from the proposed site, adequate external storage has been provided, and internal storage for recyclable waste in a dedicated position e.g., kitchen cupboard etc. Three bins of at least 30 litres total capacity (and no bin less than 7 litres) have been provided in the communal facility of this project. As the client group occupying the multi-residential units are not known at this stage, no assumption that this allocation can be introduced for all kitchens, is assumed. If the Council collects all recyclables combined for post-collection sorting, then only one internal bin of 30 litre capacity has been provided. Finalisation of waste collection service from the local authority is pending, but the developer has agreed to meet the required specification.

11.0 Environmental Management

Construction sites are responsible for significant impacts, especially at a local level. These arise from noise, potential sources of pollution and waste and other disturbances. Impacts such as increased energy and water use are also significant. Therefore, attention is being given to site-related parameters with the aim to protect and enhance the existing site & its ecology.

The aim is to have a construction site managed in an environmentally sound manner in terms of resource use, storage, waste management, pollution, and good neighbourliness.

Other areas that have been taken into consideration to minimise the impact of the construction site on its surroundings and the global environment include:

- Monitor, report and set targets for CO₂ or energy use arising from site activities.
- Monitor, report and set targets for CO₂ or energy use arising from transport to and from site.
- Monitor, report and set targets for water use arising from site activities.
- Adopt best practice policies in respect of air water pollution arising from site activities.
- Adopt best practice policies in respect of water pollution arising from site activities.
- Use sustainably sourced temporary site timber.

There has been a requirement for the Contractor to achieve a minimum four of the above items, to ensure that maximum credits BREEAM are targeted.



12.0 Land Use and Ecology

The planning requirements ask that the scheme incorporates those measures outlined under the proposed legislation introducing enhancements to biodiversity.

Government issued guidance on 21 February as new housing, commercial and infrastructure developments are set to become “nature positive” backed by £16 million of funding for Local Planning Authorities to support the new approach.

An initial Ecology scoping report will be completed prior to disturbance. The design includes facility to protect existing significant ecological elements.

The site design will provide enhancements to the existing ecology and maintains existing and increases biodiversity through enhancement initiatives recommended by a suitably qualified ecologist. Again, the developer has used the methodology prescribed by the BRE to address and capture legislation relating to protection of species and increase in biodiversity.

Landscaping will be used to reduce thermal impacts providing shading where appropriate and exclusion of flora where increased thermal protection would be helpful to the building.

13.0 Pollution, Health & Wellbeing

Global concern for environmental pollution has risen in recent years, and concentrations of harmful pollutants in the atmosphere are increasing. Buildings have the potential for major pollution both from their construction and operation, largely through pollution to the air (dust emissions, NOx emissions, ozone depletion & global warming) but also through pollution to watercourses and ground water. The proposed development will aim to minimise the above impacts, both at the design stage and onsite.

Ozone Depletion and Global Warming

CFCs and HCFCs, compounds commonly used in insulation materials and refrigerants, can cause long-term damage to the earth’s stratospheric ozone layer, exposing living organisms to harmful radiation from the sun. They also significantly increase global warming if they leak into the atmosphere.

Following the Montreal Protocol, production and use of CFCs is no longer permitted, and EC regulations will require phasing out of HCFCs. However, products that replace these gases are often still potent global warming contributors.

There is no cooling to be provided in the proposed scheme therefore the use of refrigerants is minimised. Where refrigerants may be used, they are CFC and HCFC-free.

All insulation materials have been specified to have zero Ozone Depleting Potential and low Global Warming Potential, (GWP<5) in either manufacture or composition in line with the BREEAM requirements. This will include insulation for building elements (roofs, walls, floors, doors) as well as insulation for water storage tanks, pipework, and ductwork.

Internal pollutants

Volatile organic compounds (VOCs) are emitted as gases (commonly referred to as off-gassing) from certain solids or liquids. VOCs include a variety of chemicals, some of which are known to have short-term and long-term adverse health effects. Concentrations of many VOCs are consistently higher indoors (up to ten times higher) than outdoors.

VOCs are emitted by a wide array of building products. Examples include paints and lacquers, wall coverings, floor finishes, suspended ceilings, furnishings, glues and adhesives.



	'No' or 'low' VOC paints are available from most standard mainstream paint manufacturers. Their 'eco-friendly' paints are made from organic plant sources and powdered milk-based products. Internal finishes and fittings for the proposed dwellings have been selected to be low or no VOCs where possible. As a minimum the European best practice levels have been met.
NOx emissions from heating/hot water systems	Nitrous oxides (NOx) are emitted from the burning of fossil fuels and contribute to both acid rain and to global warming in the upper atmosphere. At ground level, they react to form ozone, a serious pollutant and irritant at low level. Burners in heating systems are a significant source of low-level NOx, while power stations (and therefore electric heating) are a significant source of NOx in the upper atmosphere. Consideration has been given to NOx levels in the selection of systems. It should be noted that electric appliances have an intrinsically high rated level assumed.
Light Pollution from External Lighting	External lighting encompasses vehicle and pedestrian access lighting, security lighting and general feature lighting. External lighting to the proposed site has been designed in line with the ILE Guidelines for minimising light pollution both to the night sky and to adjacent properties. The objective has been to provide a balance between adequate external lighting for safe and secure operation of the site without unnecessary illumination or power consumption. The use of external lighting with an upward component has been minimised, and luminaires have been mounted in a way that light spill to adjacent properties is taken into consideration; the external lighting design has taken into consideration the following guidance: CIBSE Lighting Guide 6 for the Outdoor Environment Institute of Lighting Engineers Guidance Notes for the Reduction of Obtrusive Light.
Green Transport	The transport of people between buildings is the second largest source of CO₂ emissions in the UK after energy use in buildings and remains the main source of many local pollutants. Energy use and emissions from transport are growing at 4% per year, and at the same time, the effects of climate change are becoming more severe; there has been greater pressure to control CO₂ emissions from transport. In addition to energy use and CO₂ emissions, in areas of high transport usage there is likely to be an increase in congestion, noise and airborne pollution, which have an adverse impact on the health and quality of life of the local inhabitants.
Public transport accessibility	The site has good access to public transport which is anticipated to reduce private car use. This is a supported housing project and so reduction in private transport use, should always be a consideration, however it is accepted that the requirements of the residents will always be a priority.
Cycling facilities	Adequate provision for cycle space has been incorporated into the scheme. In this project this may only be applicable for staff and visitors to the project.
Future adaptability	The scheme will take on, some aspects of Lifetime Homes and has been designed with reference to practice within Approved Document M.

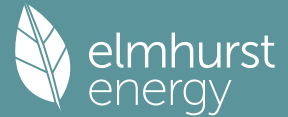


Secured by Design	The scheme will achieve Secured by Design certification covering at least section 2 those elements associated with the physical aspects of the building and individual units.
Considerate Construction	The developer will apply for and meet the minimum requirements for accreditation under the Considerate Constructor Scheme.
Green Roofs/Walls	The local authority highlights extensively within the Local Plan, the need to consider green roof or wall systems. This is an item that will be considered when assessing the biodiversity of the site. The developer recognises the benefits of these systems, but also is aware that protection and enhancement of the site ecology is a better way of supporting biodiversity protection. It is further acknowledged that green roofs can support water attenuation on site, and again this will be considered within the drainage strategy.



Appendix 1 – Draft SAP/BRUKL Worksheets

Full SAP Calculation Printout



Property Reference	22-2668-00-P01				Issued on Date	17/04/2023
Assessment Reference	GREEN	Prop Type Ref		PLANNING		
Property	S72 8UU					
SAP Rating	79 C	DER	5.35	TER	14.15	
Environmental	96 A	% DER < TER				62.19
CO ₂ Emissions (t/year)	0.24	DFEE	30.02	TFEE	35.78	
Compliance Check	See BREL	% DFEE < TFEE				16.11
% DPER < TPER	23.90	DPER	56.67	TPER	74.47	
Assessor Details	Mr. Liam Quinn				Assessor ID	Z699-0001
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	46.0800 (1b)	x 2.4000 (2b)	= 110.5920 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	46.0800		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 110.5920 (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)

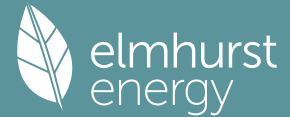
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	4.0000 (17)
Number of sides sheltered	0.2000 (18)
	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												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)												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
FED			2.1000	1.4000	2.9400		(26)
WINDOWS / GLAZED DOORS (U _w = 1.20)			7.7200	1.1450	8.8397		(27)
Heatloss Floor 1			46.0800	0.1000	4.6080		(28a)
External Wall 1	57.8640	9.8200	48.0440	0.1800	8.6479		(29a)

Full SAP Calculation Printout



Total net area of external elements Aum(A, m2)	103.9440	(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) = 25.0356	(33)
Party Wall 1	14.8800	(32)
Party Ceiling 1	46.0800	(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (User defined value 0.060 * total exposed area)	6.2366	(36)
Point Thermal bridges	0.0000	(36a) =
Total fabric heat loss	(33) + (36) + (36a) = 31.2723	(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	(38)
Heat transfer coeff	18.2477	18.2477	18.2477	18.2477	18.2477	18.2477	18.2477	18.2477	18.2477	18.2477	18.2477	18.2477	
Average = Sum(39)m / 12 =	49.5199	49.5199	49.5199	49.5199	49.5199	49.5199	49.5199	49.5199	49.5199	49.5199	49.5199	49.5199	(39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0747	1.0747	1.0747	1.0747	1.0747	1.0747	1.0747	1.0747	1.0747	1.0747	1.0747	1.0747	(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													1.5757 (42)
Hot water usage for mixer showers	50.6379	49.8770	48.7680	46.6463	45.0806	43.3345	42.3420	43.4425	44.6488	46.5237	48.6909	50.4439 (42a)	
Hot water usage for baths	21.8992	21.5740	21.1160	20.2715	19.6392	18.9380	18.5593	19.0141	19.5093	20.2595	21.1214	21.8252 (42b)	
Hot water usage for other uses	30.7662	29.6475	28.5287	27.4099	26.2912	25.1724	25.1724	26.2912	27.4099	28.5287	29.6475	30.7662 (42c)	
Average daily hot water use (litres/day)													94.9598 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy content (annual)	103.3034	101.0984	98.4127	94.3278	91.0109	87.4449	86.0736	88.7477	91.5681	95.3119	99.4598	103.0353 (44)	
Distribution loss (46)m = 0.15 x (45)m	163.6073	143.9628	151.2567	129.1300	122.5182	107.5237	104.0986	109.8882	112.9126	129.3373	141.6987	161.3284 (45)	
Water storage loss:													Total = Sum(45)m = 1577.2625
Store volume	24.5411	21.5944	22.6885	19.3695	18.3777	16.1285	15.6148	16.4832	16.9369	19.4006	21.2548	24.1993 (46)	
b) If manufacturer declared loss factor is not known :												110.0000 (47)	
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													
WWHRS	218.8841	193.8902	206.5335	182.6237	177.7950	161.0173	159.3754	165.1650	166.4063	184.6141	195.1924	216.6052 (62)	
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 (63a)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)	
Output from w/h	218.8841	193.8902	206.5335	182.6237	177.7950	161.0173	159.3754	165.1650	166.4063	184.6141	195.1924	216.6052 (64)	
Total per year (kWh/year)												2228.1023 (64)	
Electric shower(s)													2228 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)	
Heat gains from water heating, kWh/month													
	98.6209	87.8096	94.5143	85.7307	84.9587	78.5466	78.8342	80.7593	80.3384	87.2261	89.9098	97.8631 (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	
78.7826	78.7826	78.7826	78.7826	78.7826	78.7826	78.7826	78.7826	78.7826	78.7826	78.7826	78.7826	78.7826	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
71.4947	79.1549	71.4947	73.8779	71.4947	73.8779	71.4947	71.4947	73.8779	71.4947	73.8779	71.4947	71.4947	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
137.0686	138.4909	134.9067	127.2762	117.6441	108.5913	102.5435	101.1211	104.7054	112.3359	121.9679	131.0208	131.0208	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
30.8783	30.8783	30.8783	30.8783	30.8783	30.8783	30.8783	30.8783	30.8783	30.8783	30.8783	30.8783	30.8783	(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)													
-63.0260	-63.0260	-63.0260	-63.0260	-63.0260	-63.0260	-63.0260	-63.0260	-63.0260	-63.0260	-63.0260	-63.0260	-63.0260	(71)
Water heating gains (Table 5)													
132.5549	130.6690	127.0353	119.0704	114.1918	109.0924	105.9600	108.5474	111.5811	117.2394	124.8747	131.5365	131.5365	(72)
Total internal gains	387.7530	394.9496	380.0715	366.8592	349.9654	338.1964	326.6330	327.7980	336.7991	347.7047	367.3553	380.6867	(73)

Full SAP Calculation Printout



6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W			
North			1.0400	10.6334	0.5000		0.0000	0.7700	4.2576 (74)			
South			6.6800	46.7521	0.5000		0.0000	0.7700	120.2370 (78)			
Solar gains	124.4946	205.0537	264.6635	305.7088	325.3416	316.3329	307.6855	293.4900	278.6527	222.0791	147.7741	107.4452 (83)
Total gains	512.2476	600.0032	644.7349	672.5681	675.3071	654.5293	634.3185	621.2880	615.4518	569.7838	515.1294	488.1319 (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	64.6204	64.6204	64.6204	64.6204	64.6204	64.6204	64.6204	64.6204	64.6204	64.6204	64.6204	64.6204
alpha	5.3080	5.3080	5.3080	5.3080	5.3080	5.3080	5.3080	5.3080	5.3080	5.3080	5.3080	5.3080
util living area	0.9685	0.9344	0.8831	0.7892	0.6507	0.4788	0.3427	0.3655	0.5440	0.7961	0.9356	0.9747 (86)
MIT	20.2196	20.4418	20.6493	20.8386	20.9503	20.9917	20.9988	20.9983	20.9838	20.8551	20.5133	20.1600 (87)
Th 2	20.0216	20.0216	20.0216	20.0216	20.0216	20.0216	20.0216	20.0216	20.0216	20.0216	20.0216	20.0216 (88)
util rest of house	0.9601	0.9186	0.8569	0.7472	0.5921	0.4080	0.2669	0.2884	0.4715	0.7472	0.9173	0.9678 (89)
MIT 2	19.3453	19.5553	19.7454	19.9079	19.9928	20.0183	20.0213	20.0212	20.0144	19.9253	19.6268	19.2878 (90)
Living area fraction	19.6969	19.9118	20.1089	20.2822	20.3778	20.4097	20.4144	20.4141	fLA = Living area / (4) =	20.2992	19.9833	0.4021 (91)
MIT	19.6969	19.9118	20.1089	20.2822	20.3778	20.4097	20.4144	20.4141	20.4043	20.2992	19.9833	19.6386 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6969	19.9118	20.1089	20.2822	20.3778	20.4097	20.4144	20.4141	20.4043	20.2992	19.9833	19.6386 (93)

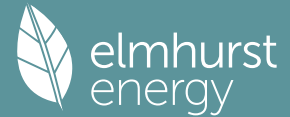
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9567	0.9166	0.8595	0.7590	0.6140	0.4364	0.2974	0.3194	0.5003	0.7619	0.9165	0.9645 (94)
Useful gains	490.0887	549.9377	554.1410	510.4600	414.6688	285.6317	188.6753	198.4597	307.9366	434.1273	472.0904	470.8015 (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	762.4516	743.3832	673.9114	563.6440	429.7245	287.6970	188.8892	198.7790	312.1866	480.3041	637.9798	764.5165 (97)
Space heating kWh	202.6380	129.9954	89.1092	38.2925	11.2015	0.0000	0.0000	0.0000	0.0000	34.3555	119.4404	218.5240 (98a)
Space heating requirement - total per year (kWh/year)												843.5564
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	202.6380	129.9954	89.1092	38.2925	11.2015	0.0000	0.0000	0.0000	0.0000	34.3555	119.4404	218.5240 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												843.5564
Space heating per m2										(98c) / (4) =		18.3063 (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												1.0500 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system												1.5000 (306)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating:												
Space heating requirement	202.6380	129.9954	89.1092	38.2925	11.2015	0.0000	0.0000	0.0000	0.0000	34.3555	119.4404	218.5240 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.50	319.1548	204.7427	140.3469	60.3107	17.6423	0.0000	0.0000	0.0000	0.0000	54.1100	188.1186	344.1753
Space heating requirement	319.1548	204.7427	140.3469	60.3107	17.6423	0.0000	0.0000	0.0000	0.0000	54.1100	188.1186	344.1753 (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												
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.50	328.3262	290.8353	309.8002	273.9355	266.6925	241.5260	239.0631	247.7475	249.6094	276.9212	292.7886	324.9079
Water heating fuel	328.3262	290.8353	309.8002	273.9355	266.6925	241.5260	239.0631	247.7475	249.6094	276.9212	292.7886	324.9079 (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)

Full SAP Calculation Printout



Pumps and Fa	2.0861	1.8842	2.0861	2.0188	2.0861	2.0188	2.0861	2.0861	2.0188	2.0861	2.0188	2.0861 (331)
Lighting	20.2273	16.2271	14.6107	10.7044	8.2684	6.7554	7.5427	9.8043	12.7348	16.7088	18.8725	20.7895 (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												1328.6013 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												3342.1534 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												13.2860 (313)
Space cooling fuel												0.0000 (321)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 3.8230, total flow = 21.0000, SFP = 0.1820)												
mechanical ventilation fans (SFP = 0.1820)												24.5623 (330a)
Total electricity for the above, kWh/year												24.5623 (331)
Electricity for lighting (calculated in Appendix L)												163.2460 (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)
Total delivered energy for all uses												4858.5630 (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			319.0000 (367)
Space and Water heating from Heat pump	1464.1864	0.1574	65.5401 (367)
Electrical energy for heat distribution (space & water)	13.2860	0.0000	6.7945 (372)
Overall CO2 factor for heat network			0.0471 (386)
Total CO2 associated with community systems			219.7885 (373)
Space and water heating			219.7885 (376)
Pumps, fans and electric keep-hot	24.5623	0.1387	3.4071 (378)
Energy for lighting	163.2460	0.1443	23.5614 (379)
Total CO2, kg/year			246.7570 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.3500 (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			319.0000 (467a)
Space and Water heating from Heat pump	1464.1864	1.5825	659.1041 (467)
Electrical energy for heat distribution (space & water)	13.2860	0.0000	71.8396 (472)
Overall CO2 factor for heat network			0.4975 (486)
Total CO2 associated with community systems			2323.8635 (473)
Space and water heating			2323.8635 (476)
Pumps, fans and electric keep-hot	24.5623	1.5128	37.1578 (478)
Energy for lighting	163.2460	1.5338	250.3922 (479)
Total Primary energy kWh/year			2611.4136 (483)
Dwelling Primary energy Rate (DPER)			56.6700 (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	46.0800 (1b)	x 2.4000 (2b)	= 110.5920 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	46.0800		

$$(3a)+(3b)+(3c)+(3d)+(3e)\dots(3n) = 110.5920 \quad (5)$$

		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) =	0.1808 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.4308 (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) =	0.3662 (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												
	0.4669	0.4578	0.4486	0.4028	0.3937	0.3479	0.3479	0.3388	0.3662	0.3937	0.4120	0.4303 (22b)
Effective ac	0.6090	0.6048	0.6006	0.5811	0.5775	0.5605	0.5605	0.5574	0.5671	0.5775	0.5849	0.5926 (25)

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.1000	1.0000	2.1000		(26)
TER Opening Type (Uw = 1.20)			7.7200	1.1450	8.8397		(27)
Heatloss Floor 1			46.0800	0.1300	5.9904		(28a)
External Wall 1	57.8640	9.8200	48.0440	0.1800	8.6479		(29a)
Total net area of external elements Aum(A, m2)			103.9440				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.5780		(33)
Party Wall 1			14.8800	0.0000	0.0000		(32)

250.0000 (35)

	Length	Psi-value	Total
K1 Element	12.0000	0.0900	1.0800
E16 Corner (normal)	18.4900	0.0700	1.2943
E7 Party floor between dwellings (in blocks of flats)	4.8000	-0.0900	-0.4320
E17 Corner (inverted - internal area greater than external area)	6.2000	0.0800	0.4960
P1 Party wall - Ground floor	6.2000	0.0000	0.0000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	1.0000	0.0200	0.0200
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	4.6200	0.0200	0.0924
E9 Balcony between dwellings, wall insulation continuous	5.1000	0.0500	0.2550
E2 Other lintels (including other steel lintels)	4.1000	0.0500	0.2050
E3 Sill	17.1200	0.0500	0.8560
E4 Jamb	24.1100	0.1600	3.8576
E5 Ground floor (normal)	4.8000	0.0600	0.2880
E18 Party wall between dwellings			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			8.0123 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	33.5903 (37)

[illegible]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2113	1.2079	1.2047	1.1892	1.1863	1.1729	1.1729	1.1704	1.1781	1.1863	1.1922	1.1983 (40)
HLP (average)												1.1892
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

Assumed occupancy													1.5757 (42)
Hot water usage for mixer showers	50.6379	49.8770	48.7680	46.6463	45.0806	43.3345	42.3420	43.4425	44.6488	46.5237	48.6909	50.4439 (42a)	

Full SAP Calculation Printout



Hot water usage for baths	21.8992	21.5740	21.1160	20.2715	19.6392	18.9380	18.5593	19.0141	19.5093	20.2595	21.1214	21.8252 (42b)
Hot water usage for other uses	30.7662	29.6475	28.5287	27.4099	26.2912	25.1724	25.1724	26.2912	27.4099	28.5287	29.6475	30.7662 (42c)
Average daily hot water use (litres/day)												94.9598 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	103.3034	101.0984	98.4127	94.3278	91.0109	87.4449	86.0736	88.7477	91.5681	95.3119	99.4598	103.0353 (44)
Energy content (annual)	163.6073	143.9628	151.2567	129.1300	122.5182	107.5237	104.0986	109.8882	112.9126	129.3373	141.6987	161.3284 (45)
Distribution loss (46)m = 0.15 x (45)m	24.5411	21.5944	22.6885	19.3695	18.3777	16.1285	15.6148	16.4832	16.9369	19.4006	21.2548	24.1993 (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	210.2022	186.0485	197.8516	174.2218	169.1131	152.6155	150.6935	156.4831	158.0044	175.9322	186.7906	207.9233 (62)
WWHRS	-23.1496	-20.4737	-21.4388	-17.7522	-16.5444	-14.1572	-13.2701	-14.1114	-14.6476	-17.2679	-19.5624	-22.7209 (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	187.0527	165.5748	176.4127	156.4696	152.5687	138.4583	137.4234	142.3717	143.3569	158.6644	167.2282	185.2025 (64)
12Total per year (kWh/year)												1910.7839 (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	91.6754	81.5362	87.5688	79.0092	78.0132	71.8251	71.8887	73.8138	73.6169	80.2806	83.1883	90.9176 (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	78.7826	78.7826	78.7826	78.7826	78.7826	78.7826	78.7826	78.7826	78.7826	78.7826	78.7826	78.7826 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	71.4947	79.1549	71.4947	73.8779	71.4947	73.8779	71.4947	71.4947	73.8779	71.4947	73.8779	71.4947 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	137.0686	138.4909	134.9067	127.2762	117.6441	108.5913	102.5435	101.1211	104.7054	112.3359	121.9679	131.0208 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.8783	30.8783	30.8783	30.8783	30.8783	30.8783	30.8783	30.8783	30.8783	30.8783	30.8783	30.8783 (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)	-63.0260	-63.0260	-63.0260	-63.0260	-63.0260	-63.0260	-63.0260	-63.0260	-63.0260	-63.0260	-63.0260	-63.0260 (71)
Water heating gains (Table 5)	123.2196	121.3336	117.7000	109.7350	104.8565	99.7571	96.6246	99.2120	102.2457	107.9040	115.5393	122.2011 (72)
Total internal gains	381.4176	388.6142	373.7361	360.5238	343.6301	328.8610	317.2976	318.4627	327.4637	341.3694	361.0199	374.3513 (73)

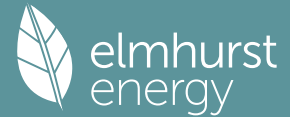
6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W		
North				1.0400	10.6334	0.6300	0.7000	0.7700	3.3797 (74)			
South				6.6800	46.7521	0.6300	0.7000	0.7700	95.4441 (78)			
Solar gains	98.8238	162.7716	210.0898	242.6717	258.2562	251.1051	244.2408	232.9724	221.1945	176.2864	117.3031	85.2900 (83)
Total gains	480.2414	551.3858	583.8259	603.1955	601.8862	579.9661	561.5384	551.4350	548.6582	517.6557	478.3230	459.6413 (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	57.3308	57.4899	57.6468	58.3950	58.5371	59.2081	59.2081	59.3340	58.9478	58.5371	58.2503	57.9534
alpha	4.8221	4.8327	4.8431	4.8930	4.9025	4.9472	4.9472	4.9556	4.9299	4.9025	4.8834	4.8636
util living area	0.9798	0.9609	0.9315	0.8671	0.7538	0.5768	0.4200	0.4451	0.6459	0.8670	0.9594	0.9831 (86)
MIT	19.9380	20.1567	20.3987	20.6765	20.8735	20.9737	20.9954	20.9939	20.9532	20.7233	20.2965	19.9029 (87)
Th 2	19.9110	19.9137	19.9163	19.9286	19.9310	19.9418	19.9418	19.9438	19.9376	19.9310	19.9263	19.9214 (88)
util rest of house												

Full SAP Calculation Printout



MIT 2	0.9738	0.9500	0.9124	0.8311	0.6923	0.4897	0.3208	0.3454	0.5606	0.8244	0.9460	0.9781 (89)
Living area fraction	18.7192	18.9924	19.2895	19.6232	19.8323	19.9279	19.9404	19.9418	19.9100	19.6838	19.1794	18.6830 (90)
MIT	19.2093	19.4606	19.7355	20.0468	20.2510	20.3484	20.3647	20.3649	20.3295	20.1018	19.6287	0.4021 (91)
Temperature adjustment												19.1736 (92)
adjusted MIT	19.2093	19.4606	19.7355	20.0468	20.2510	20.3484	20.3647	20.3649	20.3295	20.1018	19.6287	0.0000 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9689	0.9444	0.9087	0.8355	0.7118	0.5241	0.3608	0.3856	0.5933	0.8320	0.9415	0.9736 (94)
Useful gains	465.2978	520.7456	530.5328	503.9629	428.4390	303.9418	202.6111	212.6325	325.5128	430.6880	450.3566	447.5105 (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	832.1852	810.4690	734.7117	610.8343	467.4519	310.6832	203.4681	213.8339	338.1697	519.4296	688.2661	826.7916 (97)
Space heating kWh	272.9642	194.6941	151.9091	76.9474	29.0256	0.0000	0.0000	0.0000	0.0000	66.0237	171.2948	282.1851 (98a)
Space heating requirement - total per year (kWh/year)												1245.0440
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	272.9642	194.6941	151.9091	76.9474	29.0256	0.0000	0.0000	0.0000	0.0000	66.0237	171.2948	282.1851 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1245.0440
Space heating per m2											(98c) / (4) =	27.0192 (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	272.9642	194.6941	151.9091	76.9474	29.0256	0.0000	0.0000	0.0000	0.0000	66.0237	171.2948	282.1851	(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)	295.7359	210.9362	164.5819	83.3666	31.4470	0.0000	0.0000	0.0000	0.0000	71.5317	185.5848	305.7260	(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	187.0527	165.5748	176.4127	156.4696	152.5687	138.4583	137.4234	142.3717	143.3569	158.6644	167.2282	185.2025	(64)
Efficiency of water heater (217)m	84.9062	84.4240	83.7262	82.5584	81.1140	79.8000	79.8000	79.8000	79.8000	82.2495	84.1137	79.8000	(216)
Fuel for water heating, kWh/month	220.3050	196.1228	210.7019	189.5261	188.0916	173.5067	172.2098	178.4107	179.6452	192.9061	198.8120	217.8819	(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	14.8552	11.9174	10.7303	7.8615	6.0724	4.9612	5.5395	7.2004	9.3526	12.2711	13.8602	15.2681	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-22.0580	-31.3597	-45.4755	-51.6378	-56.1681	-52.6663	-52.0769	-48.9563	-43.4737	-36.1493	-24.3663	-19.0448	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-11.6771	-24.6516	-49.1357	-73.9770	-97.9544	-98.4146	-97.1967	-82.1824	-60.1277	-35.2442	-15.5932	-9.2225	(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												1348.9101	(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												2318.1198	(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)												119.8899	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													

Full SAP Calculation Printout



PV generation	-1138.8097 (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	2734.1101 (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	1348.9101	0.2100	283.2711 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2318.1198	0.2100	486.8052 (264)
Space and water heating			770.0763 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	119.8899	0.1443	17.3038 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-483.4327	0.1344	-64.9565
PV Unit electricity exported	-655.3770	0.1258	-82.4727
Total			-147.4292 (269)
Total CO2, kg/year			651.8802 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.1500 (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	1348.9101	1.1300	1524.2684 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2318.1198	1.1300	2619.4754 (278)
Space and water heating			4143.7438 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	119.8899	1.5338	183.8911 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-483.4327	1.4966	-723.4946
PV Unit electricity exported	-655.3770	0.4619	-302.7308
Total			-1026.2254 (283)
Total Primary energy kWh/year			3431.5104 (286)
Target Primary Energy Rate (TPER)			74.4700 (287)

Full SAP Calculation Printout



Property Reference	22-2668-00-P02				Issued on Date	17/04/2023
Assessment Reference	GREEN		Prop Type Ref	PLANNING		
Property	S72 8UU					
SAP Rating	80 C	DER	5.05	TER	13.08	
Environmental	97 A	% DER < TER				61.39
CO ₂ Emissions (t/year)	0.23	DFEE	25.48	TFEE	30.82	
Compliance Check	See BREL	% DFEE < TFEE				17.35
% DPER < TPER	22.03	DPER	53.59	TPER	68.73	
Assessor Details	Mr. Liam Quinn				Assessor ID	Z699-0001
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	46.1700 (1b)	x 2.4000 (2b)	= 110.8080 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	46.1700		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 110.8080 (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)

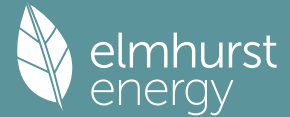
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	4.0000 (17)
Number of sides sheltered	0.2000 (18)
	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1550 (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	0.1976	0.1938	0.1899	0.1705	0.1666	0.1473	0.1473	0.1434	0.1550	0.1666	0.1744	0.1821 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
FED			2.1000	1.4000	2.9400		(26)
WINDOWS / GLAZED DOORS (U _w = 1.20)			7.7200	1.1450	8.8397		(27)
Heatloss Floor 1			46.1700	0.1000	4.6170		(28a)
External Wall 1	43.0080	9.8200	33.1880	0.1800	5.9738		(29a)

Full SAP Calculation Printout



Total net area of external elements Aum(A, m2)	89.1780		(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	22.3705	(33)
Party Wall 1	29.7600	0.0000	(32)
Party Ceiling 1	46.1700		(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (User defined value 0.060 * total exposed area)		5.3507	(36)
Point Thermal bridges		0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	27.7212	(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	(38)
Heat transfer coeff	18.2833	18.2833	18.2833	18.2833	18.2833	18.2833	18.2833	18.2833	18.2833	18.2833	18.2833	18.2833	
Average = Sum(39)m / 12 =	46.0045	46.0045	46.0045	46.0045	46.0045	46.0045	46.0045	46.0045	46.0045	46.0045	46.0045	46.0045	(39)
													(40)
HLP	0.9964	0.9964	0.9964	0.9964	0.9964	0.9964	0.9964	0.9964	0.9964	0.9964	0.9964	0.9964	
HLP (average)													
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

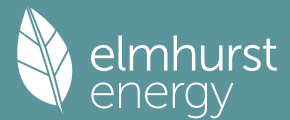
4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.5782	(42)
Hot water usage for mixer showers														
50.6815	49.9198	48.8100	46.6864	45.1193	43.3717	42.3784	43.4798	44.6872	46.5637	48.7328	50.4873			(42a)
Hot water usage for baths														
21.9179	21.5924	21.1340	20.2888	19.6560	18.9542	18.5752	19.0304	19.5260	20.2769	21.1395	21.8438			(42b)
Hot water usage for other uses														
30.7928	29.6731	28.5534	27.4336	26.3139	25.1941	25.1941	26.3139	27.4336	28.5534	29.6731	30.7928			(42c)
Average daily hot water use (litres/day)													95.0415	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	103.3922	101.1853	98.4974	94.4089	91.0892	87.5201	86.1477	88.8241	91.6468	95.3939	99.5453	103.1240		(44)
Energy conte	163.7480	144.0866	151.3868	129.2411	122.6236	107.6161	104.1881	109.9827	113.0097	129.4486	141.8206	161.4672		(45)
Energy content (annual)														
Distribution loss (46)m = 0.15 x (45)m													1578.6191	
24.5622	21.6130	22.7080	19.3862	18.3935	16.1424	15.6282	16.4974	16.9515	19.4173	21.2731	24.2201			(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			(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			(61)
Total heat required for water heating calculated for each month														
219.0248	194.0140	206.6636	182.7347	177.9004	161.1098	159.4649	165.2595	166.5034	184.7254	195.3143	216.7440			(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			(63d)
Output from w/h	219.0248	194.0140	206.6636	182.7347	177.9004	161.1098	159.4649	165.2595	166.5034	184.7254	195.3143	216.7440		(64)
													2229.4589	(64)
12Total per year (kWh/year)													2229	(64)
Electric shower(s)														
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			(64a)
													0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =														
Heat gains from water heating, kWh/month														
98.6677	87.8507	94.5575	85.7676	84.9938	78.5773	78.8640	80.7907	80.3707	87.2631	89.9503	97.9093			(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	78.9124	78.9124	78.9124	78.9124	78.9124	78.9124	78.9124	78.9124	78.9124	78.9124	78.9124	78.9124		(66)
71.6420	79.3179	71.6420	74.0301	71.6420	74.0301	71.6420	71.6420	74.0301	71.6420	74.0301	71.6420			(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	137.3013	138.7260	135.1357	127.4923	117.8438	108.7756	102.7176	101.2928	104.8831	112.5266	122.1750	131.2432		(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.8912	30.8912	30.8912	30.8912	30.8912	30.8912	30.8912	30.8912	30.8912	30.8912	30.8912	30.8912		(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)	-63.1299	-63.1299	-63.1299	-63.1299	-63.1299	-63.1299	-63.1299	-63.1299	-63.1299	-63.1299	-63.1299	-63.1299		(71)
Water heating gains (Table 5)	132.6178	130.7303	127.0935	119.1217	114.2389	109.1352	106.0000	108.5897	111.6259	117.2891	124.9310	131.5985		(72)
Total internal gains	388.2348	395.4479	380.5449	367.3177	350.3985	338.6146	327.0333	328.1982	337.2129	348.1314	367.8097	381.1574		(73)

Full SAP Calculation Printout



6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF		Access factor Table 6d	Gains W	
North				0.5200	10.6334	0.5000		0.0000		0.7700	2.1288 (74)	
South				6.6800	46.7521	0.5000		0.0000		0.7700	120.2370 (78)	
West				0.5200	19.6403	0.5000		0.0000		0.7700	3.9320 (80)	
Solar gains	126.2977	208.6772	270.4178	313.0793	333.0247	323.4971	314.8010	300.5830	285.0736	226.3633	150.0507	108.9039 (83)
Total gains	514.5326	604.1251	650.9626	680.3970	683.4232	662.1117	641.8342	628.7811	622.2865	574.4947	517.8604	490.0613 (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	69.6942	69.6942	69.6942	69.6942	69.6942	69.6942	69.6942	69.6942	69.6942	69.6942	69.6942	69.6942	
alpha	5.6463	5.6463	5.6463	5.6463	5.6463	5.6463	5.6463	5.6463	5.6463	5.6463	5.6463	5.6463	
util living area	0.9631	0.9214	0.8597	0.7531	0.6086	0.4421	0.3151	0.3361	0.5045	0.7624	0.9233	0.9706 (86)	
MIT	20.3485	20.5604	20.7434	20.8943	20.9716	20.9960	20.9995	20.9993	20.9916	20.9033	20.6147	20.2901 (87)	
Th 2	20.0863	20.0863	20.0863	20.0863	20.0863	20.0863	20.0863	20.0863	20.0863	20.0863	20.0863	20.0863 (88)	
util rest of house	0.9537	0.9039	0.8317	0.7112	0.5546	0.3802	0.2498	0.2696	0.4401	0.7136	0.9031	0.9629 (89)	
MIT 2	19.5237	19.7219	19.8866	20.0130	20.0701	20.0847	20.0862	20.0861	20.0826	20.0231	19.7764	19.4678 (90)	
Living area fraction									fLA = Living area / (4) =				0.4026 (91)
MIT	19.8558	20.0595	20.2316	20.3678	20.4331	20.4516	20.4539	20.4538	20.4486	20.3775	20.1139	19.7989 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.8558	20.0595	20.2316	20.3678	20.4331	20.4516	20.4539	20.4538	20.4486	20.3775	20.1139	19.7989 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9509	0.9033	0.8365	0.7246	0.5754	0.4051	0.2761	0.2964	0.4658	0.7298	0.9038	0.9600 (94)
Useful gains	489.2663	545.7107	544.5311	493.0243	393.2645	268.2063	177.2089	186.3563	289.8861	419.2805	468.0321	470.4709 (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	715.6375	697.4046	631.7165	527.5722	401.7599	269.2009	177.2988	186.4936	292.0653	449.8098	598.6999	717.6187 (97)
Space heating kWh	168.4201	101.9383	64.8659	24.8745	6.3206	0.0000	0.0000	0.0000	0.0000	22.7138	94.0808	183.8780 (98a)
Space heating requirement - total per year (kWh/year)												667.0921
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	168.4201	101.9383	64.8659	24.8745	6.3206	0.0000	0.0000	0.0000	0.0000	22.7138	94.0808	183.8780 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												667.0921
Space heating per m2										(98c) / (4) =		14.4486 (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												1.0500 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system												1.5000 (306)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating:												
Space heating requirement	168.4201	101.9383	64.8659	24.8745	6.3206	0.0000	0.0000	0.0000	0.0000	22.7138	94.0808	183.8780 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.50												
307a	265.2617	160.5528	102.1638	39.1773	9.9549	0.0000	0.0000	0.0000	0.0000	35.7742	148.1773	289.6078
Space heating requirement	265.2617	160.5528	102.1638	39.1773	9.9549	0.0000	0.0000	0.0000	0.0000	35.7742	148.1773	289.6078 (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												
	219.0248	194.0140	206.6636	182.7347	177.9004	161.1098	159.4649	165.2595	166.5034	184.7254	195.3143	216.7440 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.50												
310a	328.5373	291.0210	309.9954	274.1021	266.8505	241.6647	239.1974	247.8893	249.7551	277.0881	292.9714	325.1160
Water heating fuel	328.5373	291.0210	309.9954	274.1021	266.8505	241.6647	239.1974	247.8893	249.7551	277.0881	292.9714	325.1160 (310)
Cooling System Energy Efficiency Ratio												0.0000 (314)

Full SAP Calculation Printout



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	2.2389	2.0222	2.2389	2.1667	2.2389	2.1667	2.2389	2.1667	2.2389	2.1667	2.2389	2.1667	(331)
Lighting	20.2718	16.2628	14.6428	10.7280	8.2866	6.7702	7.5593	9.8259	12.7628	16.7455	18.9140	20.8352	(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												1050.6700	(307)
Space heating fuel - secondary												0.0000	(309)
Water heating fuel - community heating												3344.1884	(310)
Efficiency of water heater												0.0000	(311)
Electricity used for heat distribution												10.5067	(313)
Space cooling fuel												0.0000	(321)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 4.0950, total flow = 21.0000, SFP = 0.1950)													
mechanical ventilation fans (SFP = 0.1950)												26.3612	(330a)
Total electricity for the above, kWh/year												26.3612	(331)
Electricity for lighting (calculated in Appendix L)												163.6050	(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)
Total delivered energy for all uses												4584.8245	(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			319.0000	(367)
Space and Water heating from Heat pump	1377.6985	0.1579	52.0125	(367)
Electrical energy for heat distribution (space & water)	10.5067	0.0000	6.3659	(372)
Overall CO2 factor for heat network			0.0469	(386)
Total CO2 associated with community systems			205.9225	(373)
Space and water heating			205.9225	(376)
Pumps, fans and electric keep-hot	26.3612	0.1387	3.6566	(378)
Energy for lighting	163.6050	0.1443	23.6133	(379)
Total CO2, kg/year			233.1924	(383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.0500	(384)

13b. Primary energy - Community heating scheme

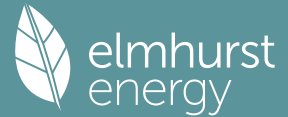
	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Heat pump			319.0000	(467a)
Space and Water heating from Heat pump	1377.6985	1.5846	521.8943	(467)
Electrical energy for heat distribution (space & water)	10.5067	0.0000	67.4936	(472)
Overall CO2 factor for heat network			0.4968	(486)
Total CO2 associated with community systems			2183.2797	(473)
Space and water heating			2183.2797	(476)
Pumps, fans and electric keep-hot	26.3612	1.5128	39.8793	(478)
Energy for lighting	163.6050	1.5338	250.9427	(479)
Total Primary energy kWh/year			2474.1016	(483)
Dwelling Primary energy Rate (DPER)			53.5900	(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	46.1700 (1b)	x 2.4000 (2b)	= 110.8080 (1b)	-

Full SAP Calculation Printout



Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 46.1700 (4)
 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 110.8080 (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) = 0.1805 (8)
 Pressure test Yes
 Pressure Test Method Blower Door
 Measured/design AP50 5.0000 (17)
 Infiltration rate 0.4305 (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) = 0.3336 (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	0.4254	0.4170	0.4087	0.3670	0.3587	0.3170	0.3170	0.3086	0.3336	0.3587	0.3753	0.3920	(22b)
Effective ac	0.5905	0.5870	0.5835	0.5673	0.5643	0.5502	0.5502	0.5476	0.5557	0.5643	0.5704	0.5768	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1000	1.0000	2.1000			(26)
TER Opening Type (Uw = 1.20)			7.7200	1.1450	8.8397			(27)
Heatloss Floor 1			46.1700	0.1300	6.0021			(28a)
External Wall 1	43.0080	9.8200	33.1880	0.1800	5.9738			(29a)
Total net area of external elements Aum(A, m2)			89.1780					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	22.9156			(33)
Party Wall 1			29.7600	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
List of Thermal Bridges								
K1 Element				Length	Psi-value		Total	
E7 Party floor between dwellings (in blocks of flats)				12.2900	0.0700		0.8603	
E23 Balcony within or between dwellings, balcony support penetrates wall insulation				1.0000	0.0200		0.0200	
E9 Balcony between dwellings, wall insulation continuous				4.6300	0.0200		0.0926	
P1 Party wall - Ground floor				12.4000	0.0800		0.9920	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)				12.4000	0.0800		0.0000	
E16 Corner (normal)				9.6000	0.0900		0.8640	
E17 Corner (inverted - internal area greater than external area)				4.8000	-0.0900		-0.4320	
E2 Other lintels (including other steel lintels)				5.1000	0.0500		0.2550	
E3 Sill				4.1000	0.0500		0.2050	
E4 Jamb				17.1200	0.0500		0.8560	
E5 Ground floor (normal)				17.9200	0.1600		2.8672	
E18 Party wall between dwellings				9.6000	0.0600		0.5760	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1561	(36)
Point Thermal bridges							(36a) =	0.0000
Total fabric heat loss							(33) + (36) + (36a) =	30.0717 (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	21.5917	21.4632	21.3373	20.7458	20.6352	20.1200	20.1200	20.0246	20.3184	20.6352	20.8590	21.0931	(38)
Heat transfer coeff	51.6634	51.5349	51.4090	50.8175	50.7069	50.1917	50.1917	50.0964	50.3902	50.7069	50.9307	51.1648	(39)
Average = Sum(39)m / 12 =												50.8170	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1190	1.1162	1.1135	1.1007	1.0983	1.0871	1.0871	1.0850	1.0914	1.0983	1.1031	1.1082	(40)
HLP (average)												1.1007	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.5782 (42)
 Hot water usage for mixer showers

Full SAP Calculation Printout



Hot water usage for baths	50.6815	49.9198	48.8100	46.6864	45.1193	43.3717	42.3784	43.4798	44.6872	46.5637	48.7328	50.4873 (42a)
Hot water usage for other uses	21.9179	21.5924	21.1340	20.2888	19.6560	18.9542	18.5752	19.0304	19.5260	20.2769	21.1395	21.8438 (42b)
Average daily hot water use (litres/day)	30.7928	29.6731	28.5534	27.4336	26.3139	25.1941	25.1941	26.3139	27.4336	28.5534	29.6731	30.7928 (42c)
												95.0415 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	103.3922	101.1853	98.4974	94.4089	91.0892	87.5201	86.1477	88.8241	91.6468	95.3939	99.5453	103.1240 (44)
Distribution loss (46)m = 0.15 x (45)m	163.7480	144.0866	151.3868	129.2411	122.6236	107.6161	104.1881	109.9827	113.0097	129.4486	141.8206	161.4672 (45)
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												
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 (56)
Primary 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 (57)
Combi 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)
Total heat required for water heating calculated for each month	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)
WWHRS	210.3429	186.1723	197.9817	174.3329	169.2185	152.7080	150.7830	156.5776	158.1015	176.0435	186.9124	208.0621 (62)
PV diverter	-23.1695	-20.4913	-21.4573	-17.7675	-16.5586	-14.1693	-13.2815	-14.1235	-14.6601	-17.2827	-19.5792	-22.7404 (63a)
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
12Total per year (kWh/year)	187.1735	165.6810	176.5244	156.5654	152.6598	138.5386	137.5015	142.4541	143.4414	158.7608	167.3332	185.3217 (64)
Electric shower(s)												
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64b)
	91.7221	81.5774	87.6120	79.0461	78.0483	71.8558	71.9185	73.8452	73.6492	80.3176	83.2288	90.9638 (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	78.9124	78.9124	78.9124	78.9124	78.9124	78.9124	78.9124	78.9124	78.9124	78.9124	78.9124	78.9124 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	71.6420	79.3179	71.6420	74.0301	71.6420	74.0301	71.6420	71.6420	74.0301	71.6420	74.0301	71.6420 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	137.3013	138.7260	135.1357	127.4923	117.8438	108.7756	102.7176	101.2928	104.8831	112.5266	122.1750	131.2432 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.8912	30.8912	30.8912	30.8912	30.8912	30.8912	30.8912	30.8912	30.8912	30.8912	30.8912	30.8912 (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)	-63.1299	-63.1299	-63.1299	-63.1299	-63.1299	-63.1299	-63.1299	-63.1299	-63.1299	-63.1299	-63.1299	-63.1299 (71)
Water heating gains (Table 5)	123.2825	121.3949	117.7581	109.7863	104.9036	99.7998	96.6646	99.2543	102.2906	107.9537	115.5956	122.2631 (72)
Total internal gains	381.8994	389.1125	374.2095	360.9823	344.0631	329.2792	317.6979	318.8628	327.8775	341.7960	361.4744	374.8220 (73)

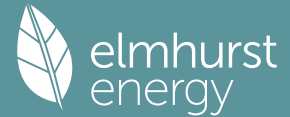
6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
North			0.5200	10.6334	0.6300	0.7000	0.7700	1.6898 (74)				
South			6.6800	46.7521	0.6300	0.7000	0.7700	95.4441 (78)				
West			0.5200	19.6403	0.6300	0.7000	0.7700	3.1212 (80)				
Solar gains	100.2552	165.6480	214.6576	248.5224	264.3550	256.7920	249.8890	238.6028	226.2914	179.6872	119.1102	86.4480 (83)
Total gains	482.1546	554.7605	588.8671	609.5047	608.4181	586.0712	567.5869	557.4656	554.1689	521.4832	480.5846	461.2700 (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	62.0604	62.2151	62.3675	63.0934	63.2311	63.8800	63.8800	64.0017	63.6285	63.2311	62.9531	62.6652
alpha	5.1374	5.1477	5.1578	5.2062	5.2154	5.2587	5.2587	5.2668	5.2419	5.2154	5.1969	5.1777
util living area	0.9772	0.9544	0.9187	0.8425	0.7170	0.5374	0.3874	0.4111	0.6059	0.8438	0.9528	0.9811 (86)
MIT	20.0855	20.2986	20.5222	20.7625	20.9172	20.9852	20.9978	20.9970	20.9721	20.7953	20.4145	20.0478 (87)

Full SAP Calculation Printout



Th 2	19.9854	19.9876	19.9898	20.0003	20.0023	20.0114	20.0114	20.0131	20.0079	20.0023	19.9983	19.9942 (88)
util rest of house	0.9707	0.9424	0.8977	0.8047	0.6572	0.4590	0.3013	0.3241	0.5274	0.7993	0.9382	0.9757 (89)
MIT 2	18.9596	19.2239	19.4954	19.7790	19.9387	20.0036	20.0107	20.0121	19.9916	19.8219	19.3792	18.9193 (90)
Living area fraction									flA = Living area / (4) =			0.4026 (91)
MIT	19.4130	19.6567	19.9088	20.1750	20.3326	20.3989	20.4081	20.4086	20.3864	20.2138	19.7960	19.3736 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4130	19.6567	19.9088	20.1750	20.3326	20.3989	20.4081	20.4086	20.3864	20.2138	19.7960	19.3736 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9661	0.9377	0.8958	0.8119	0.6778	0.4902	0.3360	0.3592	0.5582	0.8095	0.9347	0.9715	(94)
Useful gains	465.8071	520.1991	527.5317	494.8367	412.4113	287.3149	190.7229	200.2235	309.3097	422.1659	449.1975	448.1057	(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	780.7867	760.4831	689.3352	572.9686	437.7348	291.0546	191.1377	200.8180	316.7703	487.4881	646.6184	776.3563	(97)
Space heating kWh	234.3448	161.4709	120.3818	56.2550	18.8407	0.0000	0.0000	0.0000	0.0000	48.5997	142.1430	244.2184	(98a)
Space heating requirement - total per year (kWh/year)												1026.2543	
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	234.3448	161.4709	120.3818	56.2550	18.8407	0.0000	0.0000	0.0000	0.0000	48.5997	142.1430	244.2184	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1026.2543	
Space heating per m2										(98c) / (4) =		22.2277	(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)

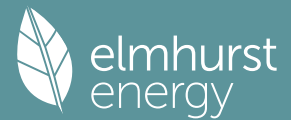
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	234.3448	161.4709	120.3818	56.2550	18.8407	0.0000	0.0000	0.0000	0.0000	48.5997	142.1430	244.2184	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	253.8947	174.9414	130.4245	60.9480	20.4125	0.0000	0.0000	0.0000	0.0000	52.6541	154.0011	264.5920	(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	187.1735	165.6810	176.5244	156.5654	152.6598	138.5386	137.5015	142.4541	143.4414	158.7608	167.3332	185.3217	(64)
Efficiency of water heater	84.5650	84.0021	83.2198	81.9967	80.6985	79.8000	79.8000	79.8000	79.8000	81.7417	83.6961	84.6796	(216)
Fuel for water heating, kWh/month	221.3369	197.2345	212.1183	190.9411	189.1730	173.6073	172.3077	178.5139	179.7511	194.2225	199.9295	218.8505	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
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	14.8858	11.9419	10.7524	7.8777	6.0849	4.9714	5.5509	7.2152	9.3719	12.2964	13.8888	15.2995	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-22.0992	-31.4172	-45.5573	-51.7286	-56.2649	-52.7561	-52.1654	-49.0404	-43.5499	-36.2145	-24.4114	-19.0805	(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)	-11.7018	-24.7035	-49.2387	-74.1315	-98.1586	-98.6199	-97.3997	-82.3543	-60.2538	-35.3185	-15.6262	-9.2420	(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												1111.8682	(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												2327.9865	(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)		120.1369 (232)

Full SAP Calculation Printout



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

PV generation	-1141.0340 (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	2504.9576 (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	1111.8682	0.2100	233.4923 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2327.9865	0.2100	488.8772 (264)
Space and water heating			722.3695 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	120.1369	0.1443	17.3395 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-484.2854	0.1344	-65.0715
PV Unit electricity exported	-656.7486	0.1258	-82.6454
Total			-147.7168 (269)
Total CO2, kg/year			603.9214 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.0800 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1111.8682	1.1300	1256.4111 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2327.9865	1.1300	2630.6247 (278)
Space and water heating			3887.0358 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	120.1369	1.5338	184.2699 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-484.2854	1.4966	-724.7723
PV Unit electricity exported	-656.7486	0.4619	-303.3647
Total			-1028.1370 (283)
Total Primary energy kWh/year			3173.2695 (286)
Target Primary Energy Rate (TPER)			68.7300 (287)

Full SAP Calculation Printout



Property Reference	22-2668-00-P06				Issued on Date	17/04/2023
Assessment Reference	GREEN	Prop Type Ref	PLANNING			
Property	S72 8UU					
SAP Rating	79 C	DER	5.35	TER	13.39	
Environmental	96 A	% DER < TER				60.04
CO ₂ Emissions (t/year)	0.24	DFEE	30.02	TFEE	32.21	
Compliance Check	See BREL	% DFEE < TFEE				6.79
% DPER < TPER	19.48	DPER	56.67	TPER	70.38	
Assessor Details	Mr. Liam Quinn				Assessor ID	Z699-0001
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	46.0800 (1b)	x 2.4000 (2b)	= 110.5920 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	46.0800		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 110.5920 (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)

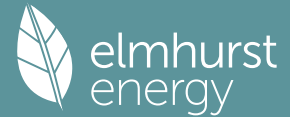
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	4.0000 (17)
Number of sides sheltered	0.2000 (18)
	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
FED			2.1000	1.4000	2.9400		(26)
WINDOWS / GLAZED DOORS (Uw = 1.20)			7.7200	1.1450	8.8397		(27)
External Wall 1	57.8640	9.8200	48.0440	0.1800	8.6479		(29a)
RT1	46.0800		46.0800	0.1000	4.6080		(30)

Full SAP Calculation Printout



Total net area of external elements Aum(A, m2)	103.9440	(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) = 25.0356	(33)
Party Wall 1	14.8800	(32)
Party Floor 1	46.0800	(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (User defined value 0.060 * total exposed area)	6.2366	(36)
Point Thermal bridges	0.0000	(36a) =
Total fabric heat loss	(33) + (36) + (36a) = 31.2723	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)		
(38)m	Jan 18.2477	Feb 18.2477
Heat transfer coeff	49.5199	49.5199
Average = Sum(39)m / 12 =	49.5199	49.5199

HLP	Jan 1.0747	Feb 1.0747	Mar 1.0747	Apr 1.0747	May 1.0747	Jun 1.0747	Jul 1.0747	Aug 1.0747	Sep 1.0747	Oct 1.0747	Nov 1.0747	Dec 1.0747	(40)
HLP (average)													1.0747
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.5757 (42)
Hot water usage for mixer showers	50.6379	49.8770	48.7680	46.6463	45.0806	43.3345	42.3420	43.4425	44.6488	46.5237	48.6909	50.4439 (42a)	
Hot water usage for baths	21.8992	21.5740	21.1160	20.2715	19.6392	18.9380	18.5593	19.0141	19.5093	20.2595	21.1214	21.8252 (42b)	
Hot water usage for other uses	30.7662	29.6475	28.5287	27.4099	26.2912	25.1724	25.1724	26.2912	27.4099	28.5287	29.6475	30.7662 (42c)	
Average daily hot water use (litres/day)												94.9598 (43)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	103.3034	101.0984	98.4127	94.3278	91.0109	87.4449	86.0736	88.7477	91.5681	95.3119	99.4598	103.0353	(44)
Energy conte	163.6073	143.9628	151.2567	129.1300	122.5182	107.5237	104.0986	109.8882	112.9126	129.3373	141.6987	161.3284	(45)
Energy content (annual)										Total =	Sum(45)m =	1577.2625	
Distribution loss (46)m = 0.15 x (45)m	24.5411	21.5944	22.6885	19.3695	18.3777	16.1285	15.6148	16.4832	16.9369	19.4006	21.2548	24.1993	(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													

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													
	218.8841	193.8902	206.5335	182.6237	177.7950	161.0173	159.3754	165.1650	166.4063	184.6141	195.1924	216.6052	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	218.8841	193.8902	206.5335	182.6237	177.7950	161.0173	159.3754	165.1650	166.4063	184.6141	195.1924	216.6052	(64)

Heat gains from water heating, kWh/month	98.6209	87.8096	94.5143	85.7307	84.9587	78.5466	78.8342	80.7593	80.3384	87.2261	89.9098	97.8631	(65)
--	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	------

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

Metabolic gains (Table 5), Watts													
(66)m	Jan 78.7826	Feb 78.7826	Mar 78.7826	Apr 78.7826	May 78.7826	Jun 78.7826	Jul 78.7826	Aug 78.7826	Sep 78.7826	Oct 78.7826	Nov 78.7826	Dec 78.7826	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	71.4947	79.1549	71.4947	73.8779	71.4947	73.8779	71.4947	71.4947	73.8779	71.4947	73.8779	71.4947	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	137.0686	138.4909	134.9067	127.2762	117.6441	108.5913	102.5435	101.1211	104.7054	112.3359	121.9679	131.0208	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.8783	30.8783	30.8783	30.8783	30.8783	30.8783	30.8783	30.8783	30.8783	30.8783	30.8783	30.8783	(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)	-63.0260	-63.0260	-63.0260	-63.0260	-63.0260	-63.0260	-63.0260	-63.0260	-63.0260	-63.0260	-63.0260	-63.0260	(71)
Water heating gains (Table 5)	132.5549	130.6690	127.0353	119.0704	114.1918	109.0924	105.9600	108.5474	111.5811	117.2394	124.8747	131.5365	(72)
Total internal gains	387.7530	394.9496	380.0715	366.8592	349.9654	338.1964	326.6330	327.7980	336.7991	347.7047	367.3553	380.6867	(73)

Full SAP Calculation Printout



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				1.0400	10.6334		0.5000		0.0000		0.7700		4.2576 (74)
South				6.6800	46.7521		0.5000		0.0000		0.7700		120.2370 (78)
Solar gains	124.4946	205.0537	264.6635	305.7088	325.3416	316.3329	307.6855	293.4900	278.6527	222.0791	147.7741	107.4452	(83)
Total gains	512.2476	600.0032	644.7349	672.5681	675.3071	654.5293	634.3185	621.2880	615.4518	569.7838	515.1294	488.1319	(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	64.6204	64.6204	64.6204	64.6204	64.6204	64.6204	64.6204	64.6204	64.6204	64.6204	64.6204	64.6204	
alpha	5.3080	5.3080	5.3080	5.3080	5.3080	5.3080	5.3080	5.3080	5.3080	5.3080	5.3080	5.3080	
util living area	0.9685	0.9344	0.8831	0.7892	0.6507	0.4788	0.3427	0.3655	0.5440	0.7961	0.9356	0.9747	(86)
MIT	20.2196	20.4418	20.6493	20.8386	20.9503	20.9917	20.9988	20.9983	20.9838	20.8551	20.5133	20.1600	(87)
Th 2	20.0216	20.0216	20.0216	20.0216	20.0216	20.0216	20.0216	20.0216	20.0216	20.0216	20.0216	20.0216	(88)
util rest of house	0.9601	0.9186	0.8569	0.7472	0.5921	0.4080	0.2669	0.2884	0.4715	0.7472	0.9173	0.9678	(89)
MIT 2	19.3453	19.5553	19.7454	19.9079	19.9928	20.0183	20.0213	20.0212	20.0144	19.9253	19.6268	19.2878	(90)
Living area fraction	19.6969	19.9118	20.1089	20.2822	20.3778	20.4097	20.4144	20.4141	fLA = Living area / (4) =	20.2992	19.9833	19.6386	(91)
MIT	19.6969	19.9118	20.1089	20.2822	20.3778	20.4097	20.4144	20.4141	20.4043	20.2992	19.9833	19.6386	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6969	19.9118	20.1089	20.2822	20.3778	20.4097	20.4144	20.4141	20.4043	20.2992	19.9833	19.6386	(93)

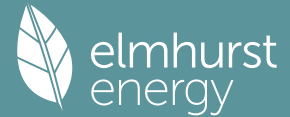
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9567	0.9166	0.8595	0.7590	0.6140	0.4364	0.2974	0.3194	0.5003	0.7619	0.9165	0.9645	(94)
Useful gains	490.0887	549.9377	554.1410	510.4600	414.6688	285.6317	188.6753	198.4597	307.9366	434.1273	472.0904	470.8015	(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	762.4516	743.3832	673.9114	563.6440	429.7245	287.6970	188.8892	198.7790	312.1866	480.3041	637.9798	764.5165	(97)
Space heating kWh	202.6380	129.9954	89.1092	38.2925	11.2015	0.0000	0.0000	0.0000	0.0000	34.3555	119.4404	218.5240	(98a)
Space heating requirement - total per year (kWh/year)												843.5564	
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	202.6380	129.9954	89.1092	38.2925	11.2015	0.0000	0.0000	0.0000	0.0000	34.3555	119.4404	218.5240	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												843.5564	
Space heating per m2										(98c) / (4) =		18.3063	(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													1.0500 (305)
Factor for charging method (Table 4c(3)) for water heating													1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system													1.5000 (306)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating:													
Space heating requirement	202.6380	129.9954	89.1092	38.2925	11.2015	0.0000	0.0000	0.0000	0.0000	34.3555	119.4404	218.5240	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.50	319.1548	204.7427	140.3469	60.3107	17.6423	0.0000	0.0000	0.0000	0.0000	54.1100	188.1186	344.1753	
Space heating requirement	319.1548	204.7427	140.3469	60.3107	17.6423	0.0000	0.0000	0.0000	0.0000	54.1100	188.1186	344.1753	(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													
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.50	328.3262	290.8353	309.8002	273.9355	266.6925	241.5260	239.0631	247.7475	249.6094	276.9212	292.7886	324.9079	
Water heating fuel	328.3262	290.8353	309.8002	273.9355	266.6925	241.5260	239.0631	247.7475	249.6094	276.9212	292.7886	324.9079	(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)

Full SAP Calculation Printout



Pumps and Fa	2.0861	1.8842	2.0861	2.0188	2.0861	2.0188	2.0861	2.0861	2.0188	2.0861	2.0188	2.0861 (331)
Lighting	20.2273	16.2271	14.6107	10.7044	8.2684	6.7554	7.5427	9.8043	12.7348	16.7088	18.8725	20.7895 (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												1328.6013 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												3342.1534 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												13.2860 (313)
Space cooling fuel												0.0000 (321)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 3.8230, total flow = 21.0000, SFP = 0.1820)												
mechanical ventilation fans (SFP = 0.1820)												24.5623 (330a)
Total electricity for the above, kWh/year												24.5623 (331)
Electricity for lighting (calculated in Appendix L)												163.2460 (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)
Total delivered energy for all uses												4858.5630 (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			319.0000 (367)
Space and Water heating from Heat pump	1464.1864	0.1574	65.5401 (367)
Electrical energy for heat distribution (space & water)	13.2860	0.0000	6.7945 (372)
Overall CO2 factor for heat network			0.0471 (386)
Total CO2 associated with community systems			219.7885 (373)
Space and water heating			219.7885 (376)
Pumps, fans and electric keep-hot	24.5623	0.1387	3.4071 (378)
Energy for lighting	163.2460	0.1443	23.5614 (379)
Total CO2, kg/year			246.7570 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.3500 (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			319.0000 (467a)
Space and Water heating from Heat pump	1464.1864	1.5825	659.1041 (467)
Electrical energy for heat distribution (space & water)	13.2860	0.0000	71.8396 (472)
Overall CO2 factor for heat network			0.4975 (486)
Total CO2 associated with community systems			2323.8635 (473)
Space and water heating			2323.8635 (476)
Pumps, fans and electric keep-hot	24.5623	1.5128	37.1578 (478)
Energy for lighting	163.2460	1.5338	250.3922 (479)
Total Primary energy kWh/year			2611.4136 (483)
Dwelling Primary energy Rate (DPER)			56.6700 (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	46.0800 (1b)	x 2.4000 (2b)	= 110.5920 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	46.0800		

Full SAP Calculation Printout



Dwelling volume

(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 110.5920 (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) =	0.1808 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.4308	(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) =	0.3662 (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													
	0.4669	0.4578	0.4486	0.4028	0.3937	0.3479	0.3479	0.3388	0.3662	0.3937	0.4120	0.4303	(22b)
Effective ac	0.6090	0.6048	0.6006	0.5811	0.5775	0.5605	0.5605	0.5574	0.5671	0.5775	0.5849	0.5926	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.1000	1.0000	2.1000		(26)
TER Opening Type (Uw = 1.20)			7.7200	1.1450	8.8397		(27)
External Wall 1	57.8640	9.8200	48.0440	0.1800	8.6479		(29a)
RT1	46.0800		46.0800	0.1100	5.0688		(30)
Total net area of external elements Aum(A, m2)			103.9440				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	24.6564		(33)
Party Wall 1			14.8800	0.0000	0.0000		(32)

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

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	12.0000	0.0900	1.0800
E7 Party floor between dwellings (in blocks of flats)	18.4900	0.0700	1.2943
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	6.2000	0.0000	0.0000
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	1.0000	0.0200	0.0200
E9 Balcony between dwellings, wall insulation continuous	4.6200	0.0200	0.0924
E2 Other lintels (including other steel lintels)	5.1000	0.0500	0.2550
E3 Sill	4.1000	0.0500	0.2050
E4 Jamb	17.1200	0.0500	0.8560
E18 Party wall between dwellings	4.8000	0.0600	0.2880
E10 Eaves (insulation at ceiling level)	13.1100	0.0600	0.7866
E12 Gable (insulation at ceiling level)	10.9900	0.0600	0.6594
P4 Party wall - Roof (insulation at ceiling level)	6.2000	0.1200	0.7440

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.8487 (36)

Point Thermal bridges

(33a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 30.5051 (37)

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

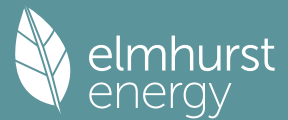
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	22.2261	22.0716	21.9202	21.2089	21.0758	20.4564	20.4564	20.3417	20.6950	21.0758	21.3450	21.6265	(38)
Heat transfer coeff	52.7312	52.5767	52.4253	51.7140	51.5810	50.9615	50.9615	50.8468	51.2001	51.5810	51.8502	52.1316	(39)
Average = Sum(39)m / 12 =												51.7134	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	1.1443	1.1410	1.1377	1.1223	1.1194	1.1059	1.1059	1.1034	1.1111	1.1194	1.1252	1.1313	(40)
HLP (average)												1.1223	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.5757 (42)
Hot water usage for mixer showers	

Full SAP Calculation Printout



Hot water usage for baths	50.6379	49.8770	48.7680	46.6463	45.0806	43.3345	42.3420	43.4425	44.6488	46.5237	48.6909	50.4439 (42a)
Hot water usage for other uses	21.8992	21.5740	21.1160	20.2715	19.6392	18.9380	18.5593	19.0141	19.5093	20.2595	21.1214	21.8252 (42b)
Average daily hot water use (litres/day)	30.7662	29.6475	28.5287	27.4099	26.2912	25.1724	25.1724	26.2912	27.4099	28.5287	29.6475	30.7662 (42c)
												94.9598 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	103.3034	101.0984	98.4127	94.3278	91.0109	87.4449	86.0736	88.7477	91.5681	95.3119	99.4598	103.0353 (44)
Distribution loss (46)m = 0.15 x (45)m	163.6073	143.9628	151.2567	129.1300	122.5182	107.5237	104.0986	109.8882	112.9126	129.3373	141.6987	161.3284 (45)
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												
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 (56)
Primary 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 (57)
Combi 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)
Total heat required for water heating calculated for each month	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)
WWHRS	210.2022	186.0485	197.8516	174.2218	169.1131	152.6155	150.6935	156.4831	158.0044	175.9322	186.7906	207.9233 (62)
PV diverter	-23.1496	-20.4737	-21.4388	-17.7522	-16.5444	-14.1572	-13.2701	-14.1114	-14.6476	-17.2679	-19.5624	-22.7209 (63a)
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
12Total per year (kWh/year)	187.0527	165.5748	176.4127	156.4696	152.5687	138.4583	137.4234	142.3717	143.3569	158.6644	167.2282	185.2025 (64)
Electric shower(s)												
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	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)
	91.6754	81.5362	87.5688	79.0092	78.0132	71.8251	71.8887	73.8138	73.6169	80.2806	83.1883	90.9176 (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	78.7826	78.7826	78.7826	78.7826	78.7826	78.7826	78.7826	78.7826	78.7826	78.7826	78.7826	78.7826 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	71.4947	79.1549	71.4947	73.8779	71.4947	73.8779	71.4947	71.4947	73.8779	71.4947	73.8779	71.4947 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	137.0686	138.4909	134.9067	127.2762	117.6441	108.5913	102.5435	101.1211	104.7054	112.3359	121.9679	131.0208 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.8783	30.8783	30.8783	30.8783	30.8783	30.8783	30.8783	30.8783	30.8783	30.8783	30.8783	30.8783 (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)	-63.0260	-63.0260	-63.0260	-63.0260	-63.0260	-63.0260	-63.0260	-63.0260	-63.0260	-63.0260	-63.0260	-63.0260 (71)
Water heating gains (Table 5)	123.2196	121.3336	117.7000	109.7350	104.8565	99.7571	96.6246	99.2120	102.2457	107.9040	115.5393	122.2011 (72)
Total internal gains	381.4176	388.6142	373.7361	360.5238	343.6301	328.8610	317.2976	318.4627	327.4637	341.3694	361.0199	374.3513 (73)

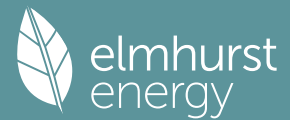
6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North					1.0400	10.6334		0.6300	0.7000		0.7700		3.3797 (74)	
South					6.6800	46.7521		0.6300	0.7000		0.7700		95.4441 (78)	
Solar gains	98.8238	162.7716	210.0898	242.6717	258.2562	251.1051	244.2408	232.9724	221.1945	176.2864	117.3031	85.2900	(83)	
Total gains	480.2414	551.3858	583.8259	603.1955	601.8862	579.9661	561.5384	551.4350	548.6582	517.6557	478.3230	459.6413	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{li,m} (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	60.6851	60.8635	61.0393	61.8788	62.0384	62.7925	62.7925	62.9342	62.4999	62.0384	61.7163	61.3831
alpha	5.0457	5.0576	5.0693	5.1253	5.1359	5.1862	5.1862	5.1956	5.1667	5.1359	5.1144	5.0922
util living area	0.9781	0.9569	0.9238	0.8517	0.7299	0.5496	0.3973	0.4213	0.6186	0.8516	0.9550	0.9818 (86)
MIT	20.0432	20.2570	20.4851	20.7381	20.9055	20.9826	20.9973	20.9963	20.9675	20.7763	20.3833	20.0090 (87)
Th 2	19.9648	19.9675	19.9702	19.9827	19.9850	19.9960	19.9960	19.9980	19.9918	19.9850	19.9803	19.9753 (88)

Full SAP Calculation Printout



util rest of house												
MIT 2	0.9718	0.9453	0.9036	0.8146	0.6696	0.4689	0.3077	0.3310	0.5383	0.8077	0.9408	0.9765 (89)
Living area fraction	18.8911	19.1572	19.4357	19.7374	19.9120	19.9868	19.9952	19.9968	19.9727	19.7870	19.3271	18.8565 (90)
MIT	19.3544	19.5995	19.8577	20.1398	20.3115	20.3872	20.3982	20.3987	20.3728	20.1848	19.7518	19.3199 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3544	19.5995	19.8577	20.1398	20.3115	20.3872	20.3982	20.3987	20.3728	20.1848	19.7518	19.3199 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9671	0.9403	0.9010	0.8209	0.6899	0.5009	0.3438	0.3674	0.5695	0.8172	0.9370	0.9722	(94)
Useful gains	464.4618	518.4875	526.0553	495.1366	415.2589	290.5134	193.0528	202.6022	312.4754	423.0242	448.2035	446.8705	(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	793.8344	772.8506	700.2798	581.2567	444.1907	294.9268	193.5597	203.3234	321.1661	494.3953	655.9991	788.2268	(97)
Space heating kWh	245.0532	170.9320	129.6231	62.0065	21.5252	0.0000	0.0000	0.0000	0.0000	53.1001	149.6129	253.9690	(98a)
Space heating requirement - total per year (kWh/year)												1085.8219	
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	245.0532	170.9320	129.6231	62.0065	21.5252	0.0000	0.0000	0.0000	0.0000	53.1001	149.6129	253.9690	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1085.8219	
Space heating per m2										(98c) / (4) =		23.5638	(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	245.0532	170.9320	129.6231	62.0065	21.5252	0.0000	0.0000	0.0000	0.0000	53.1001	149.6129	253.9690	(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)	265.4964	185.1918	140.4367	67.1793	23.3210	0.0000	0.0000	0.0000	0.0000	57.5299	162.0941	275.1560	(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	187.0527	165.5748	176.4127	156.4696	152.5687	138.4583	137.4234	142.3717	143.3569	158.6644	167.2282	185.2025	(64)
Efficiency of water heater (217)m	84.6664	84.1313	83.3793	82.1634	80.8127	79.8000	79.8000	79.8000	79.8000	81.8809	83.8111	79.8000	(216)
Fuel for water heating, kWh/month	220.9289	196.8053	211.5786	190.4371	188.7930	173.5067	172.2098	178.4107	179.6452	193.7746	199.5300	218.4808	(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	14.8552	11.9174	10.7303	7.8615	6.0724	4.9612	5.5395	7.2004	9.3526	12.2711	13.8602	15.2681	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-22.0580	-31.3597	-45.4755	-51.6378	-56.1681	-52.6663	-52.0769	-48.9563	-43.4737	-36.1493	-24.3663	-19.0448	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-11.6771	-24.6516	-49.1357	-73.9770	-97.9544	-98.4146	-97.1967	-82.1824	-60.1277	-35.2442	-15.5932	-9.2225	(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												1176.4051	(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												2324.1006	(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)	119.8899	(232)

Full SAP Calculation Printout



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

PV generation	-1138.8097 (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	2567.5859 (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	1176.4051	0.2100	247.0451 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2324.1006	0.2100	488.0611 (264)
Space and water heating			735.1062 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	119.8899	0.1443	17.3038 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-483.4327	0.1344	-64.9565
PV Unit electricity exported	-655.3770	0.1258	-82.4727
Total			-147.4292 (269)
Total CO2, kg/year			616.9101 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.3900 (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	1176.4051	1.1300	1329.3378 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2324.1006	1.1300	2626.2337 (278)
Space and water heating			3955.5715 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	119.8899	1.5338	183.8911 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-483.4327	1.4966	-723.4946
PV Unit electricity exported	-655.3770	0.4619	-302.7308
Total			-1026.2254 (283)
Total Primary energy kWh/year			3243.3380 (286)
Target Primary Energy Rate (TPER)			70.3800 (287)

Full SAP Calculation Printout



Property Reference	22-2668-00-P07				Issued on Date	17/04/2023
Assessment Reference	GREEN	Prop Type Ref	PLANNING			
Property	S72 8UU					
SAP Rating	80 C	DER	5.05	TER	12.72	
Environmental	97 A	% DER < TER				60.30
CO ₂ Emissions (t/year)	0.23	DFEE	25.48	TFEE	29.11	
Compliance Check	See BREL	% DFEE < TFEE				12.46
% DPER < TPER	19.77	DPER	53.59	TPER	66.79	
Assessor Details	Mr. Liam Quinn				Assessor ID	Z699-0001
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	46.1700 (1b)	x 2.4000 (2b)	= 110.8080 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	46.1700		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 110.8080 (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)

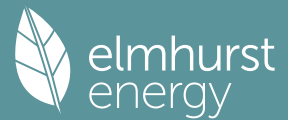
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	4.0000 (17)
Number of sides sheltered	0.2000 (18)
	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1550 (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	0.1976	0.1938	0.1899	0.1705	0.1666	0.1473	0.1473	0.1434	0.1550	0.1666	0.1744	0.1821 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
FED			2.1000	1.4000	2.9400		(26)
WINDOWS / GLAZED DOORS (U _w = 1.20)			7.7200	1.1450	8.8397		(27)
External Wall 1	43.0080	9.8200	33.1880	0.1800	5.9738		(29a)
External Roof 1	42.5600		42.5600	0.1000	4.2560		(30)

Full SAP Calculation Printout



External Roof 2	3.6200	3.6200	0.1000	0.3620	(30)
Total net area of external elements Aum(A, m2)		89.1880			(31)
Fabric heat loss, W/K = Sum (A x U)		(26)...	(30) + (32) =	22.3715	(33)
Party Wall 1		29.7600	0.0000	0.0000	(32)
Party Floor 1		46.1700			(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K					250.0000 (35)
Thermal bridges (User defined value 0.060 * total exposed area)					5.3513 (36)
Point Thermal bridges				(36a) =	0.0000
Total fabric heat loss				(33) + (36) + (36a) =	27.7228 (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	(38)
Heat transfer coeff	18.2833	18.2833	18.2833	18.2833	18.2833	18.2833	18.2833	18.2833	18.2833	18.2833	18.2833	18.2833	
Average = Sum(39)m / 12 =	46.0061	46.0061	46.0061	46.0061	46.0061	46.0061	46.0061	46.0061	46.0061	46.0061	46.0061	46.0061	(39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9965	0.9965	0.9965	0.9965	0.9965	0.9965	0.9965	0.9965	0.9965	0.9965	0.9965	0.9965	(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													1.5782 (42)
Hot water usage for mixer showers													
Hot water usage for baths	50.6815	49.9198	48.8100	46.6864	45.1193	43.3717	42.3784	43.4798	44.6872	46.5637	48.7328	50.4873	(42a)
Hot water usage for other uses	21.9179	21.5924	21.1340	20.2888	19.6560	18.9542	18.5752	19.0304	19.5260	20.2769	21.1395	21.8438	(42b)
Average daily hot water use (litres/day)	30.7928	29.6731	28.5534	27.4336	26.3139	25.1941	25.1941	26.3139	27.4336	28.5534	29.6731	30.7928	(42c)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	103.3922	101.1853	98.4974	94.4089	91.0892	87.5201	86.1477	88.8241	91.6468	95.3939	99.5453	103.1240	(44)
Energy content (annual)	163.7480	144.0866	151.3868	129.2411	122.6236	107.6161	104.1881	109.9827	113.0097	129.4486	141.8206	161.4672	(45)
Distribution loss (46)m = 0.15 x (45)m	24.5622	21.6130	22.7080	19.3862	18.3935	16.1424	15.6282	16.4974	16.9515	19.4173	21.2731	24.2201	(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	219.0248	194.0140	206.6636	182.7347	177.9004	161.1098	159.4649	165.2595	166.5034	184.7254	195.3143	216.7440	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h	219.0248	194.0140	206.6636	182.7347	177.9004	161.1098	159.4649	165.2595	166.5034	184.7254	195.3143	216.7440	(64)
12Total per year (kWh/year)													2229.4589 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Heat gains from water heating, kWh/month	98.6677	87.8507	94.5575	85.7676	84.9938	78.5773	78.8640	80.7907	80.3707	87.2631	89.9503	97.9093	(65)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	78.9124	78.9124	78.9124	78.9124	78.9124	78.9124	78.9124	78.9124	78.9124	78.9124	78.9124	78.9124	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	71.6420	79.3179	71.6420	74.0301	71.6420	74.0301	71.6420	71.6420	74.0301	71.6420	74.0301	71.6420	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	137.3013	138.7260	135.1357	127.4923	117.8438	108.7756	102.7176	101.2928	104.8831	112.5266	122.1750	131.2432	(68)
Pumps, fans	30.8912	30.8912	30.8912	30.8912	30.8912	30.8912	30.8912	30.8912	30.8912	30.8912	30.8912	30.8912	(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)	-63.1299	-63.1299	-63.1299	-63.1299	-63.1299	-63.1299	-63.1299	-63.1299	-63.1299	-63.1299	-63.1299	-63.1299	(71)
Total internal gains	132.6178	130.7303	127.0935	119.1217	114.2389	109.1352	106.0000	108.5897	111.6259	117.2891	124.9310	131.5985	(72)
	388.2348	395.4479	380.5449	367.3177	350.3985	338.6146	327.0333	328.1982	337.2129	348.1314	367.8097	381.1574	(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				
North			0.5200	10.6334	0.5000	0.0000	0.7700	2.1288 (74)				
South			6.6800	46.7521	0.5000	0.0000	0.7700	120.2370 (78)				
West			0.5200	19.6403	0.5000	0.0000	0.7700	3.9320 (80)				
Solar gains	126.2977	208.6772	270.4178	313.0793	333.0247	323.4971	314.8010	300.5830	285.0736	226.3633	150.0507	108.9039 (83)
Total gains	514.5326	604.1251	650.9626	680.3970	683.4232	662.1117	641.8342	628.7811	622.2865	574.4947	517.8604	490.0613 (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	69.6918	69.6918	69.6918	69.6918	69.6918	69.6918	69.6918	69.6918	69.6918	69.6918	69.6918	69.6918
alpha	5.6461	5.6461	5.6461	5.6461	5.6461	5.6461	5.6461	5.6461	5.6461	5.6461	5.6461	5.6461
util living area	0.9631	0.9214	0.8597	0.7531	0.6086	0.4421	0.3151	0.3361	0.5045	0.7624	0.9233	0.9706 (86)
MIT	20.3485	20.5603	20.7434	20.8943	20.9716	20.9960	20.9995	20.9993	20.9916	20.9033	20.6147	20.2900 (87)
Th 2	20.0863	20.0863	20.0863	20.0863	20.0863	20.0863	20.0863	20.0863	20.0863	20.0863	20.0863	20.0863 (88)
util rest of house	0.9537	0.9039	0.8318	0.7112	0.5546	0.3802	0.2498	0.2696	0.4401	0.7136	0.9031	0.9629 (89)
MIT 2	19.5236	19.7218	19.8866	20.0129	20.0700	20.0847	20.0862	20.0861	20.0826	20.0230	19.7763	19.4677 (90)
Living area fraction									fLA = Living area / (4) =			0.4026 (91)
MIT	19.8557	20.0594	20.2316	20.3678	20.4330	20.4516	20.4539	20.4538	20.4486	20.3775	20.1139	19.7988 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8557	20.0594	20.2316	20.3678	20.4330	20.4516	20.4539	20.4538	20.4486	20.3775	20.1139	19.7988 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9509	0.9033	0.8365	0.7246	0.5754	0.4051	0.2761	0.2964	0.4659	0.7298	0.9038	0.9600 (94)
Useful gains	489.2678	545.7145	544.5377	493.0341	393.2752	268.2145	177.2142	186.3620	289.8947	419.2887	468.0353	470.4720 (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	715.6592	697.4260	631.7361	527.5890	401.7729	269.2094	177.3041	186.4993	292.0746	449.8240	598.7182	717.6404 (97)
Space heating kWh	168.4352	101.9501	64.8756	24.8795	6.3223	0.0000	0.0000	0.0000	0.0000	22.7183	94.0917	183.8933 (98a)
Space heating requirement - total per year (kWh/year)												667.1659
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	168.4352	101.9501	64.8756	24.8795	6.3223	0.0000	0.0000	0.0000	0.0000	22.7183	94.0917	183.8933 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												667.1659
Space heating per m2										(98c) / (4) =		14.4502 (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												1.0500 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system												1.5000 (306)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating:												
Space heating requirement	168.4352	101.9501	64.8756	24.8795	6.3223	0.0000	0.0000	0.0000	0.0000	22.7183	94.0917	183.8933 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.50												
307a	265.2854	160.5714	102.1791	39.1852	9.9576	0.0000	0.0000	0.0000	0.0000	35.7812	148.1944	289.6320
Space heating requirement	265.2854	160.5714	102.1791	39.1852	9.9576	0.0000	0.0000	0.0000	0.0000	35.7812	148.1944	289.6320 (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	219.0248	194.0140	206.6636	182.7347	177.9004	161.1098	159.4649	165.2595	166.5034	184.7254	195.3143	216.7440 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.50												
310a	328.5373	291.0210	309.9954	274.1021	266.8505	241.6647	239.1974	247.8893	249.7551	277.0881	292.9714	325.1160
Water heating fuel	328.5373	291.0210	309.9954	274.1021	266.8505	241.6647	239.1974	247.8893	249.7551	277.0881	292.9714	325.1160 (310)

Full SAP Calculation Printout



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	2.2389	2.0222	2.2389	2.1667	2.2389	2.1667	2.2389	2.2389	2.1667	2.2389	2.1667	2.2389 (331)
Lighting	20.2718	16.2628	14.6428	10.7280	8.2866	6.7702	7.5593	9.8259	12.7628	16.7455	18.9140	20.8352 (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												1050.7862 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												3344.1884 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												10.5079 (313)
Space cooling fuel												0.0000 (321)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 4.0950, total flow = 21.0000, SFP = 0.1950)												
mechanical ventilation fans (SFP = 0.1950)												26.3612 (330a)
Total electricity for the above, kWh/year												26.3612 (331)
Electricity for lighting (calculated in Appendix L)												163.6050 (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)
Total delivered energy for all uses												4584.9408 (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			319.0000 (367)
Space and Water heating from Heat pump	1377.7350	0.1579	52.0181 (367)
Electrical energy for heat distribution (space & water)	10.5079	0.0000	6.3660 (372)
Overall CO2 factor for heat network			0.0469 (386)
Total CO2 associated with community systems			205.9284 (373)
Space and water heating			205.9284 (376)
Pumps, fans and electric keep-hot	26.3612	0.1387	3.6566 (378)
Energy for lighting	163.6050	0.1443	23.6133 (379)
Total CO2, kg/year			233.1983 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.0500 (384)

13b. Primary energy - Community heating scheme

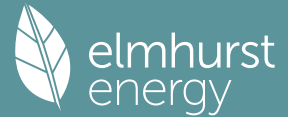
	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			319.0000 (467a)
Space and Water heating from Heat pump	1377.7350	1.5846	521.9517 (467)
Electrical energy for heat distribution (space & water)	10.5079	0.0000	67.4954 (472)
Overall CO2 factor for heat network			0.4968 (486)
Total CO2 associated with community systems			2183.3389 (473)
Space and water heating			2183.3389 (476)
Pumps, fans and electric keep-hot	26.3612	1.5128	39.8793 (478)
Energy for lighting	163.6050	1.5338	250.9427 (479)
Total Primary energy kWh/year			2474.1609 (483)
Dwelling Primary energy Rate (DPER)			53.5900 (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)
--	--------------	----------------------	----------------

Full SAP Calculation Printout



Ground floor
 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 46.1700
 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 110.8080 (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 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) = 0.1805 (8)
 Pressure test Yes
 Pressure Test Method Blower Door
 Measured/design AP50 5.0000 (17)
 Infiltration rate 0.4305 (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) = 0.3336 (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	0.4254	0.4170	0.4087	0.3670	0.3587	0.3170	0.3170	0.3086	0.3336	0.3587	0.3753	0.3920 (22b)
Effective ac	0.5905	0.5870	0.5835	0.5673	0.5643	0.5502	0.5502	0.5476	0.5557	0.5643	0.5704	0.5768 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.1000	1.0000	2.1000		(26)
TER Opening Type (Uw = 1.20)			7.7200	1.1450	8.8397		(27)
External Wall 1	43.0080	9.8200	33.1880	0.1800	5.9738		(29a)
External Roof 1	42.5600		42.5600	0.1100	4.6816		(30)
External Roof 2	3.6200		3.6200	0.1100	0.3982		(30)
Total net area of external elements Aum(A, m2)			89.1880				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	21.9933		(33)
Party Wall 1			29.7600	0.0000	0.0000		(32)

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

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E7 Party floor between dwellings (in blocks of flats)	12.2900	0.0700	0.8603
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	1.0000	0.0200	0.0200
E9 Balcony between dwellings, wall insulation continuous	4.6300	0.0200	0.0926
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	12.4000	0.0000	0.0000
E16 Corner (normal)	9.6000	0.0900	0.8640
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320
E2 Other lintels (including other steel lintels)	5.1000	0.0500	0.2550
E3 Sill	4.1000	0.0500	0.2050
E4 Jamb	17.1200	0.0500	0.8560
E18 Party wall between dwellings	9.6000	0.0600	0.5760
E24 Eaves (insulation at ceiling level - inverted)	2.5200	0.2400	0.6048
E14 Flat roof	5.3800	0.0800	0.4304
E10 Eaves (insulation at ceiling level)	9.1800	0.0600	0.5508
E12 Gable (insulation at ceiling level)	3.3600	0.0600	0.2016
P4 Party wall - Roof (insulation at ceiling level)	12.4000	0.1200	1.4880

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.5725 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 28.5658 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)
 (38)m Jan 21.5917 Feb 21.4632 Mar 21.3373 Apr 20.7458 May 20.6352 Jun 20.1200 Jul 20.1200 Aug 20.0246 Sep 20.3184 Oct 20.6352 Nov 20.8590 Dec 21.0931 (38)
 Heat transfer coeff 50.1575 50.0290 49.9031 49.3116 49.2010 48.6858 48.6858 48.5905 48.8843 49.2010 49.4248 49.6589 (39)
 Average = Sum(39)m / 12 = 49.3111

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0864	1.0836	1.0809	1.0680	1.0656	1.0545	1.0545	1.0524	1.0588	1.0656	1.0705	1.0756 (40)
HLP (average)												1.0680
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

Full SAP Calculation Printout



4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.5782 (42)
Hot water usage for mixer showers	50.6815	49.9198	48.8100	46.6864	45.1193	43.3717	42.3784	43.4798	44.6872	46.5637	48.7328	50.4873 (42a)
Hot water usage for baths	21.9179	21.5924	21.1340	20.2888	19.6560	18.9542	18.5752	19.0304	19.5260	20.2769	21.1395	21.8438 (42b)
Hot water usage for other uses	30.7928	29.6731	28.5534	27.4336	26.3139	25.1941	25.1941	26.3139	27.4336	28.5534	29.6731	30.7928 (42c)
Average daily hot water use (litres/day)												95.0415 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	103.3922	101.1853	98.4974	94.4089	91.0892	87.5201	86.1477	88.8241	91.6468	95.3939	99.5453	103.1240 (44)
Energy content (annual)	163.7480	144.0866	151.3868	129.2411	122.6236	107.6161	104.1881	109.9827	113.0097	129.4486	141.8206	161.4672 (45)
Distribution loss (46)m = 0.15 x (45)m	24.5622	21.6130	22.7080	19.3862	18.3935	16.1424	15.6282	16.4974	16.9515	19.4173	21.2731	24.2201 (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	210.3429	186.1723	197.9817	174.3329	169.2185	152.7080	150.7830	156.5776	158.1015	176.0435	186.9124	208.0621 (62)
WWHRS	-23.1695	-20.4913	-21.4573	-17.7675	-16.5586	-14.1693	-13.2815	-14.1235	-14.6601	-17.2827	-19.5792	-22.7404 (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	187.1735	165.6810	176.5244	156.5654	152.6598	138.5386	137.5015	142.4541	143.4414	158.7608	167.3332	185.3217 (64)
Total per year (kWh/year)												1911.9556 (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	91.7221	81.5774	87.6120	79.0461	78.0483	71.8558	71.9185	73.8452	73.6492	80.3176	83.2288	90.9638 (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	78.9124	78.9124	78.9124	78.9124	78.9124	78.9124	78.9124	78.9124	78.9124	78.9124	78.9124	78.9124 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	71.6420	79.3179	71.6420	74.0301	71.6420	74.0301	71.6420	71.6420	74.0301	71.6420	74.0301	71.6420 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	137.3013	138.7260	135.1357	127.4923	117.8438	108.7756	102.7176	101.2928	104.8831	112.5266	122.1750	131.2432 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.8912	30.8912	30.8912	30.8912	30.8912	30.8912	30.8912	30.8912	30.8912	30.8912	30.8912	30.8912 (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)	-63.1299	-63.1299	-63.1299	-63.1299	-63.1299	-63.1299	-63.1299	-63.1299	-63.1299	-63.1299	-63.1299	-63.1299 (71)
Water heating gains (Table 5)	123.2825	121.3949	117.7581	109.7863	104.9036	99.7998	96.6646	99.2543	102.2906	107.9537	115.5956	122.2631 (72)
Total internal gains	381.8994	389.1125	374.2095	360.9823	344.0631	329.2792	317.6979	318.8628	327.8775	341.7960	361.4744	374.8220 (73)

6. Solar gains

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

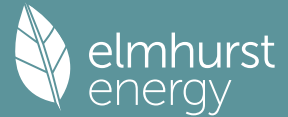
North				0.5200	10.6334	0.6300	0.7000	0.7700	1.6898 (74)			
South				6.6800	46.7521	0.6300	0.7000	0.7700	95.4441 (78)			
West				0.5200	19.6403	0.6300	0.7000	0.7700	3.1212 (80)			

Solar gains	100.2552	165.6480	214.6576	248.5224	264.3550	256.7920	249.8890	238.6028	226.2914	179.6872	119.1102	86.4480 (83)
Total gains	482.1546	554.7605	588.8671	609.5047	608.4181	586.0712	567.5869	557.4656	554.1689	521.4832	480.5846	461.2700 (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	63.9237	64.0878	64.2495	65.0201	65.1664	65.8559	65.8559	65.9852	65.5886	65.1664	64.8712	64.5655

Full SAP Calculation Printout



alpha	5.2616	5.2725	5.2833	5.3347	5.3444	5.3904	5.3904	5.3990	5.3726	5.3444	5.3247	5.3044
util living area	0.9760	0.9518	0.9136	0.8330	0.7034	0.5232	0.3762	0.3992	0.5914	0.8343	0.9500	0.9802 (86)
MIT	20.1378	20.3479	20.5636	20.7904	20.9302	20.9883	20.9983	20.9977	20.9774	20.8193	20.4570	20.1006 (87)
Th 2	20.0120	20.0143	20.0165	20.0270	20.0290	20.0382	20.0382	20.0399	20.0346	20.0290	20.0250	20.0208 (88)
util rest of house	0.9693	0.9393	0.8920	0.7948	0.6446	0.4483	0.2946	0.3168	0.5157	0.7893	0.9348	0.9746 (89)
MIT 2	19.0453	19.3053	19.5663	19.8326	19.9757	20.0321	20.0377	20.0391	20.0215	19.8707	19.4519	19.0058 (90)
Living area fraction	19.4852	19.7251	19.9678	20.2183	20.3600	20.4171	20.4245	20.4251	fLA = Living area / (4) =			0.4026 (91)
MIT	19.4852	19.7251	19.9678	20.2183	20.3600	20.4171	20.4245	20.4251	20.4064	20.2527	19.8566	19.4466 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4852	19.7251	19.9678	20.2183	20.3600	20.4171	20.4245	20.4251	20.4064	20.2527	19.8566	19.4466 (93)

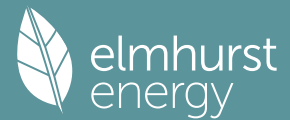
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9649	0.9350	0.8908	0.8028	0.6654	0.4782	0.3275	0.3500	0.5455	0.8005	0.9317	0.9705 (94)
Useful gains	465.2287	518.6810	524.5863	489.3349	404.8394	280.2792	185.8903	195.1364	302.2826	417.4438	447.7728	447.6611 (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	761.6514	741.6851	672.0869	558.1220	426.0809	283.2106	186.1982	195.5813	308.2826	474.9200	630.4948	757.1299 (97)
Space heating kWh	220.5384	149.8587	109.7404	49.5268	15.8037	0.0000	0.0000	0.0000	0.0000	42.7623	131.5598	230.2448 (98a)
Space heating requirement - total per year (kWh/year)												950.0350
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	220.5384	149.8587	109.7404	49.5268	15.8037	0.0000	0.0000	0.0000	0.0000	42.7623	131.5598	230.2448 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												950.0350
Space heating per m2										(98c) / (4) =		20.5769 (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	220.5384	149.8587	109.7404	49.5268	15.8037	0.0000	0.0000	0.0000	0.0000	42.7623	131.5598	230.2448 (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)	238.9366	162.3605	118.8953	53.6585	17.1221	0.0000	0.0000	0.0000	0.0000	46.3297	142.5350	249.4527 (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	187.1735	165.6810	176.5244	156.5654	152.6598	138.5386	137.5015	142.4541	143.4414	158.7608	167.3332	185.3217 (64)
Efficiency of water heater	84.4286	83.8354	83.0258	81.7921	80.5660	79.8000	79.8000	79.8000	79.8000	81.5539	83.5261	79.8000 (216)
Fuel for water heating, kWh/month	221.6944	197.6266	212.6138	191.4187	189.4841	173.6073	172.3077	178.5139	179.7511	194.6697	200.3364	219.1920 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
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	14.8858	11.9419	10.7524	7.8777	6.0849	4.9714	5.5509	7.2152	9.3719	12.2964	13.8888	15.2995 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-22.0992	-31.4172	-45.5573	-51.7286	-56.2649	-52.7561	-52.1654	-49.0404	-43.5499	-36.2145	-24.4114	-19.0805 (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)	-11.7018	-24.7035	-49.2387	-74.1315	-98.1586	-98.6199	-97.3997	-82.3543	-60.2538	-35.3185	-15.6262	-9.2420 (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												1029.2903 (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												2331.2158 (219)

Full SAP Calculation Printout



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)	120.1369 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1141.0340 (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	2425.6091 (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	1029.2903	0.2100	216.1510 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2331.2158	0.2100	489.5553 (264)
Space and water heating			705.7063 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	120.1369	0.1443	17.3395 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-484.2854	0.1344	-65.0715
PV Unit electricity exported	-656.7486	0.1258	-82.6454
Total			-147.7168 (269)
Total CO2, kg/year			587.2582 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.7200 (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	1029.2903	1.1300	1163.0981 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2331.2158	1.1300	2634.2739 (278)
Space and water heating			3797.3720 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	120.1369	1.5338	184.2699 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-484.2854	1.4966	-724.7723
PV Unit electricity exported	-656.7486	0.4619	-303.3647
Total			-1028.1370 (283)
Total Primary energy kWh/year			3083.6057 (286)
Target Primary Energy Rate (TPER)			66.7900 (287)

Project name

Knowles Quarry - Be Green**As designed****Date:** Fri Apr 14 08:55:03 2023**Administrative information****Building Details****Address:** Knowles Quarry, Barnsley Road, Cudworth, S72 8UU**Certifier details****Name:****Telephone number:****Address:** , ,**Certification tool****Calculation engine:** TAS**Calculation engine version:** "v9.5.4"**Interface to calculation engine:** TAS**Interface to calculation engine version:** v9.5.4**BRUKL compliance check version:** v6.1.b.0**Foundation area [m²]:** 134.27**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	4.09
Building CO ₂ emission rate (BER), kgCO ₂ /m ² annum	3.07
Target primary energy rate (TPER), kWh/m ² annum	43.15
Building primary energy rate (BPER), kWh/m ² annum	31.79
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	0.18	0.18	External Wall
Floors	0.18	0.1	0.1	Ground Floor
Pitched roofs	0.16	0.1	0.1	Roof
Flat roofs	0.18	0.1	0.1	Flat Roof
Windows** and roof windows	1.6	1.2	1.2	W04
Rooflights***	2.2	-	-	No rooflights in project
Personnel doors^	1.6	1.4	1.4	D01
Vehicle access & similar large doors	1.3	-	-	No vehicle access or similar large doors in project
High usage entrance doors	3	-	-	No high usage entrance doors in project
U _a -Limit = Limiting area-weighted average U-values [W/(m²K)] U _a -Calc = Calculated area-weighted average U-values [W/(m²K)] U _i -Calc = Calculated maximum individual element 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 N.B.: 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
m³/(h.m²) at 50 Pa	8	5

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	0.9 to 0.95

1- Heated

	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- Extract (3 Zones)

	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.					

1- New HWS Circuit

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	3	0
Standard value	0.91	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	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			
GF_Toilet	-	-	0.5	-	-	-	-	-	-	-	-	N/A
1F_Toilet	-	-	0.5	-	-	-	-	-	-	-	-	N/A
1F_Staff WC	-	-	0.5	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value		95	80	0.3
GF_Plant		100	-	-

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
GF_Lobby		-	-	-
GF_Circ 1		-	-	-
GF_Circ 2		-	-	-
GF_Cpd		100	-	-
GF_Stair 1		-	-	-
GF_Reception		-	100	-
GF_Toilet		-	-	-
GF_Communal Area		-	-	-
GF_Circ 3		-	-	-
GF_Stair 2		-	-	-
1F_Toilet		-	-	-
1F_Services		100	-	-
1F_Circ 1		-	-	-
1F_Stair 1		-	-	-
1F_Cpd		100	-	-
1F_Circ 2		-	-	-
1F_Store		100	-	-
1F_Communal Area		-	-	-
1F_Staff Office		100	-	-
1F_Staff Bed		-	-	-
1F_Staff WC		-	-	-
1F_Circ 3		-	-	-
1F_Cleaners Cpd		100	-	-
1F_Stairs 2		-	-	-

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?
GF_Reception	YES (+2%)	NO
1F_Staff Office	YES (+97%)	NO
1F_Staff Bed	YES (+2%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m ²]	361	361
External area [m ²]	701	701
Weather	LEE	LEE
Infiltration [m ³ /hm ² @ 50Pa]	5	3
Average conductance [W/K]	188	226
Average U-value [W/m ² K]	0.27	0.32
Alpha value* [%]	26.7	11.7

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

Building Use

% Area Building Type

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

100 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
 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	10.89	13.02
Cooling	0	0
Auxiliary	1.89	3.87
Lighting	11.21	9.96
Hot water	1.54	1.89
Equipment*	40.62	40.62
TOTAL **	25.53	28.74

* 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	4.86	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
<i>Displaced electricity</i>	<i>4.86</i>	<i>0</i>

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	123.8	130.25
Primary energy [kWh/m ²]	31.79	43.15
Total emissions [kg/m ²]	3.07	4.09

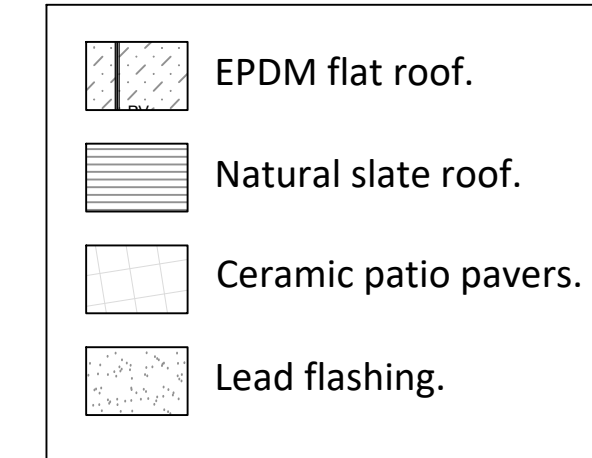
HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Central heating using water: floor heating, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	173.3	0	16.1	0	2.1	3	0	3	0
	Notional	181.4	0	19.1	0	2.1	2.64	0	----	----
[ST] Central heating using water: floor heating, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	8.9	0	0.8	0	14.7	3	0	3	0
	Notional	29.5	0	3.1	0	12.2	2.64	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



Appendix 2 – Renewables Layout



This architectural drawing shows a detailed roof plan for a building, illustrating the layout of solar panels and other roof features. The plan includes the following elements:

- ASHP (Air Source Heat Pump):** Three units are shown on the left side of the roof, each with a label and a small icon.
- PV (Photovoltaic) Panels:** A large array of solar panels is shown in the center, arranged in a grid pattern. Each panel is labeled 'PV'.
- Roof area (m²):** A label indicating the total area of the roof.
- FALL (Slope):** Arrows labeled 'FALL' indicate the direction of the roof slope in various sections.
- Blue Line A:** A vertical blue line labeled 'A' at both ends, indicating a cross-section line through the roof.
- Other Features:** The plan also shows various roof structures, including gables and a chimney, with dashed lines indicating internal divisions or boundaries.

Revisions



project no :	drawing no	rev :	scale :	date :
22.2668	03	-	1:100 A1	31.03.2023