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Energy Statement

Chase New Homes

The Barn Hotel

Draft

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We are able to advise at all stages of projects from planning applications to handover.

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Executive Summary

The proposed development comprises the demolition of existing Barn Hotel buildings and the new construction of two residential blocks, providing 87 flats, 7 terraced houses and refurbishment of two Grade II listed buildings to provide additional two houses. The development is located in Ruislip, in the London Borough of Hillingdon.

The Energy Strategy for the development has been formulated following the London Plan Energy Hierarchy: *Be Lean*, *Be Clean* and *Be Green*. The overriding objective in the formulation of the strategy is to maximise the reductions in CO_2 emissions through the application of this hierarchy with a cost-effective and technically appropriate approach and to minimise the emission of other pollutants.

A range of *Be Lean* energy efficiency measures are proposed for the new dwellings which enable the proposed development to significantly reduce regulated CO_2 emissions by 16% over the baseline through energy efficiency measures alone. These include very well insulated building fabric, efficient mechanical ventilation systems and low energy lighting throughout.

The refurbished buildings will be thermally upgraded as far as technically feasible, preserving their Grade II listed character. The external walls will be internally insulated, roof insulation will be upgraded, where space allows for it, and all windows will be fitted with secondary glazing panels. The proposed improvements will result in approximately 19% CO_2 emissions reduction over the baseline scenario.

Be Clean: The opportunity for the proposed development to link into an existing or planned decentralised energy network has been considered. The proposal is located approximately 4km away from the nearest planned district heat network and is not included in a Heat Network Priority Area. As the development is relatively small, the heat network serving only the development would not benefit from the economy of scale and therefore the system's running costs would be higher when compared to individual heating systems. A connection to district heating is concluded to be impractical and unfeasible.

Be Green: A feasibility study has been undertaken to establish suitability of the new extension for integration of renewable technology on site. It has been concluded that the most feasible technologies for the development will be:

> Individual Exhaust air source heat pumps (EAHP) fitted in new dwellings,

> Air source heat pumps (ASHP) fitted to the refurbished Grade II listed buildings,

> Photovoltaic panels (PV) mounted on roofs of the new buildings.

A highly optimised energy strategy based on passive design, building fabric performance and building services systems and controls, and suitable Low and Zero Carbon systems will allow the scheme to achieve

an improvement on total regulated carbon dioxide emissions over the existing scenario of over 70%, exceeding the Building Regulations Part L 2021 targets for compliance and London Plan carbon emissions reduction target of 35%.

Zero Carbon: The on-site 'zero carbon' target for the development will be met through payment towards Hillingdon Council's carbon offsetting fund. The funds secured by the council will be ring-fenced to deliver carbon emissions savings off site through a variety of projects and will be secured through Section 106 legal agreements.

Be Seen: The Client will commit to carrying out energy monitoring and reporting at each stage of the planning, construction and in-use processes to enable the GLA to record the estimated and actual energy uses in new developments, helping to achieve net zero-carbon buildings and providing a number of environmental and socio-economic benefits.

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1. INTRODUCTION

1.1 This document has been prepared by Hodkinson Consultancy, a specialist energy and environmental consultancy for planning and development in support of the planning application for the residential development at The Barn Hotel in Ruislip, the London Borough (LB) of Hillingdon.

1.2 The energy strategy for the development has been formulated following The London Plan Energy Hierarchy*: Be Lean, Be Clean* and *Be Green*. The overriding objective in the formulation of the strategy is to maximise the reductions in CO_2 emissions through the application of this hierarchy with a cost-effective and technically appropriate approach and to minimise the emission of other pollutants.

Objectives

1.3 The objectives of this report are to:

> Demonstrate how the proposed development has been assessed against the policy requirements of the Hillingdon Local Plan, Policy DMEI 2 and New London Plan, Policy SI 2.

> Identify the most suitable passive and energy efficient design approach for the scheme, the feasibility of Low and Zero Carbon technologies and operational Best Practice.

> Identify the drivers relating to an energy efficient design over and above minimum compliance with current Building Regulations and energy targets.

> Identify the most cost-effective heating solutions to ensure the operational costs for residents are minimised.

2. DEVELOPMENT OVERIEW

Site Location & Proposed Development

2.1 The proposed development is located off West End Road in Ruislip, in the London Borough of Hillingdon. The site is located to the south of overground rail line (Metropolitan and Piccadilly) and Ruislip train station and to the east of West End Road (A4180). Please refer to Figure 1 for site location plan.

Figure 1: Site location (source: Google maps, Map data 2023)

2.2 The proposed development comprises a redevelopment of the site to provide 96 dwellings spread across two apartment blocks, terraced houses and two refurbished Garade II listed buildings. Please refer to the Figure 2 below for the proposed site plan, for context.

Figure 2: Proposed Block Plan (source: Chase New Homes, March 2023)

3. PLANNING POLICIES & GUIDANCE

3.1 The following planning policies and material considerations have informed the sustainable design of the proposed development.

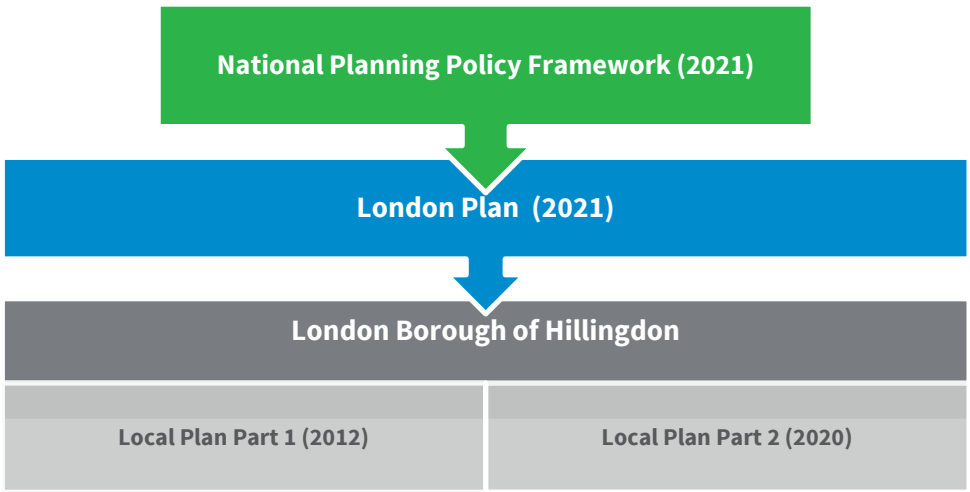

Figure 3: Relevant Planning Policy and Guidance Documents

National Policy: National Planning Policy Framework

3.2 The revised National Planning Policy Framework (NPPF) was published on the 20th July 2021 and sets out the Government's planning policies for England.

3.3 The NPPF provides a framework for achieving sustainable development, which has been summarised as "*meeting the needs of the present without compromising the ability of future generations to meet their own needs*" (Resolution 42/187 of the United National General Assembly). At the heart of the framework is a **presumption in favour of sustainable development**.

3.4 The document states that the planning system has three overarching objectives which are interdependent and need to be pursued in mutually supportive ways:

a) **An economic objective** – to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure;

b) A social objective – to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering a well-designed and safe built environment, with accessible services and open spaces that reflect current and future needs and support communities' health, social and cultural well-being; and

c) An environmental objective – to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.

Regional Policy: The London Plan

The London Plan (2021)

3.5 The following policies in the London Plan are considered relevant to the proposed development and this Statement.

3.6 Policy SI2 Minimising Greenhouse Gas Emissions, states:

'Major development should be net zero-carbon. This means reducing greenhouse gas emissions in operation, and minimising both annual and peak energy demand in accordance with the following energy hierarchy:

1) Be Lean: Use less energy and manage demand during operation;

2) Be Clean: Exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly;

3) Be Green: Maximise opportunities for renewable energy by producing, storing and using renewable energy on-site.

4) Be Seen: Monitoring and reporting of the actual operational energy performance of major developments for at least five years.

A minimum on-site reduction of at least 35 per cent beyond Building Regulations is required for major development. Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent through energy efficiency measures.'

3.7 Policy SI3 Energy Infrastructure, states:

'Major development proposals within Heat Network Priority Areas should have a communal low-temperature heating system. The heat source for the communal heating system should be selected in accordance with the following heating hierarchy:

a) Connect to local existing or planned heat networks;

b) Use zero-emission or local secondary heat sources (in conjunction with heat pump, if required);

c) Use low-emission combined heat and power (CHP) (only where there is a case for CHP to enable the delivery of an area-wide heat network);

d) Use ultra-low NOx gas boilers.'

3.8 Policy SI4 Managing Heat Risk seeks for energy strategies to demonstrate how they intend to reduce the risk of internal overheating, in line with the cooling hierarchy.

GLA Energy Assessment Guidance (2022)

3.9 The GLA Energy Assessment Guidance published June 2022 provides advice on how the energy statement can demonstrate compliance with the London Plan Policy SI2. It further clarifies the reporting format and confirms the targets for major development. The following key points, relevant to the development at The Barn Hotel, have been taken from the document:

> The requirements for the reduction in regulated CO_2 emissions of 10% for residential development to be achieved at the *Be Lean* stage is applicable to major development, defined as that exceeding 10 dwellings.

> There is a requirement to report energy use intensity (EUI), energy demands and improvements in carbon emissions.

> A guidance is given on how to model baseline emissions for major refurbishments, however the requirements for minor refurbishments should be determined on local level and assessed by each borough based on the specifics of the site.

'Be Seen' Energy Monitoring Guidance Consultation Draft (September 2021)

3.10 Major developments are required to monitor and report on energy performance to the Mayor for at least five years via an online portal to enable the GLA to identify good practice and report on the operational performance of new development in London.

3.11 The document is aimed at those involved in the planning, design, construction, delivery and operation of development. It includes a reporting template which applicants will be expected to use.

It applies to major developments and sets out what each responsible party needs to do to comply with the policy from the inception stage of a development to full occupancy.

3.12 The 'Be Seen' policy is designed help verify the London Plan policies and to ensure compliance with London's net zero-carbon standard is achieved.

Local Policy: London Borough of Hillingdon

3.13 LB of Hillingdon's Local Plan was issued in two parts. Part 1: Strategic Policies was adopted in 2012 and Part 2: Development Management Policies was adopted in 2020. The key policies from these documents pertinent to this Energy Statement are:

> Policy EM1 Climate Change requires that climate change mitigation is addressed at every stage of the development process by encouraging sustainable transport, promoting the use of decentralised energy, encouraging renewable energy, managing flood risk and surface water drainage, and promoting the use of living walls and roofs.

> Policy DMEI 2: Reducing Carbon Emissions requires all major development proposed to minimise carbon dioxide emissions and be accompanied by an energy assessment.

> Policy DMEI 3 Decentralised Energy requires all major developments to be able to connect to a Decentralised Energy Network.

Summary of Requirements

3.14 The majority of the development will be assessed as new build under Part L of the Building Regulations (2021). The two Grade II listed buildings, which are proposed to be upgraded and converted to houses, will be assessed against the requirements of Part L (2021) relating to retained upgraded elements. These buildings are not required to meet the TER target.

3.15 The 10% carbon emissions reduction target from the Be Lean measures will be applied to the new part of the development. The refurbished buildings will be improved as far as practically possible, taking into account their listed status.

3.16 The site-wide 35% carbon emissions reduction target will include the refurbished buildings, however the results for both parts of the development (new and refurbished) will also be reported separately as per the Energy Assessment Guidance requirement.

4. BUILDING REGULATIONS BASELINE

Methodology

4.1 This statement first establishes a baseline assessment of the energy demands and associated CO_2 emissions for the development.

4.2 The report will then follow the London Plan Energy Hierarchy approach of *Be Lean*, *Be Clean* and *Be Green* to enable the maximum feasible reductions in Regulated CO_2 emissions over the baseline.

Standard Assessment Procedure (SAP)

4.3 The Standard Assessment Procedure (SAP), which forms the basis for demonstrating dwelling's compliance with Part L of the Building Regulations 2021 for new build residential buildings, has been used for the development to estimate the savings achieved through the energy efficiency features proposed and to predict the annual building regulated energy consumption and CO_2 emissions of the dwellings. An accredited Design SAP 10 software has been used to support the calculations.

4.4 The energy consumption and CO_2 emissions of the unregulated elements (cooking and appliances) have been estimated based on the methodology developed in Appendix L of SAP 2021.

Baseline Scenario

4.5 The GLA guidance on preparing energy assessments clarifies the calculation methodology for new developments to ensure the consistency of the calculations across all boroughs.

4.6 The energy assessment must first establish the regulated CO_2 emissions assuming the development complies with Part L 2021 of the Building Regulations. When determining this baseline, it should be assumed that the heating would be provided by gas boilers and that any active cooling would be provided by electrically powered equipment. The boilers should be assumed to have an efficiency of 89.5% for individual heating systems. All controls should align with the Part L notional building assumptions. This is to demonstrate the CO_2 emissions savings achieved through incorporation of passive design and efficient building fabric. This is to demonstrate the CO_2 emissions savings achieved through incorporation of passive design and efficient building fabric.

4.7 Very limited information has been provided for the Grade II listed buildings. It has been confirmed that some improvements had already been made to the fabric to make the buildings suitable for hotel use. A more intrusive survey of the building elements will be carried out post-planning. We have assumed that the Part L threshold U-values for retained elements are applicable to the existing walls and roof.

4.8 The retained and refurbished Grade II listed buildings will be assessed using SAP 10 software, however their compliance with Part L of the Building Regulations will not be determined by the same compliance criteria as applicable for new dwellings. A baseline scenario will use the current status of the buildings and, where the survey data is incomplete, the threshold U-values of thermal elements, taken from the Approved Document (AD) Part L, will be used (please refer to AD Part L, Table 4.3).

4.9 Any improvements to the building fabric will inform the Be Lean scenario for the refurbished buildings. The GLA baseline fabric requirements for refurbishments will not be used as they have been deemed too onerous to meet and improve on in listed buildings. The GLA suggested values are applicable to referrable developments. The guidance states that for smaller refurbishments, local boroughs should establish suitable approach to establish CO_2 improvements in existing building stock.

Unit Selection

4.10 A representative sample of eight units across the development has been selected and assessed for energy calculations purposes. This accounts for various unit types, floor levels, occupancies and exposed façade directions.

4.11 The selected dwellings have been modelled based on the latest set of architectural drawings from Chase New Homes, dated March 2023.

Baseline Results

4.12 Table 1 below shows the estimated baseline regulated and unregulated CO_2 emissions for the proposed development.

Table 1: Regulated and Unregulated Baseline CO_2 Emissions for the New Dewllings

New dwellings	Regulated CO_2 (tonnes/year)	Unregulated CO_2 (tonnes/year)
Baseline emissions	83.1	40.2

Table 2: Regulated and Unregulated Baseline CO_2 Emissions for the Refurbished Buildings

Refurbished dwellings	Regulated CO2 (tonnes/year)	Unregulated CO_2 (tonnes/year)
Baseline emissions	11.7	1.45

Table 3: Regulated and Unregulated Baseline CO_2 Emissions for the Whole Development

Whole development	Regulated CO2 (tonnes/year)	Unregulated CO_2 (tonnes/year)
Baseline emissions	94.8	41.6

5. *BE LEAN*: ENERGY EFFICIENCY MEASURES

5.1 The first stage of the London Plan energy hierarchy is demand reduction through energy efficiency measures. A number of measures are proposed in order to reduce energy demands across the development.

5.2 This section outlines the currently proposed strategies for achieving these targets. These measures, or alternatives, can be provided to achieve the policy requirements.

Building Envelope

5.3 A fabric strategy has been developed to ensure the building complies with the requirements of Part L 2021 and helps reduce the space heating demand of the spaces. This has been set out below.

Table 4: Proposed Specification

Element	New Buildings	Refurbished dwellings
External Wall	0.16 W/m^{2}K	0.30W/m^{2}K if possible
Walls to unheated spaces	0.15 W/m^{2}K	n/a
Ground Floor	0.10 W/m^{2}K	0.70 W/m^{2}K should strive to improve to 0.25W/m^{2}K if possible.
Roof	0.09 W/m^{2}K	0.35W/m^{2}K
Windows/Glazed doors	1.1 W/m^{2}K	1.7W/m^{2}K; Draught-stripping and secondary glazing
Air Permeability (m^3/hm^2)	3.0 (flats) 4.0 (houses)	No target given in Part L1; it is assumed that internal linings will improve the building AP to 12 m^3/hm^2 (to be tested post construction)

Thermal Bridging

5.4 In well insulated buildings significant heat loss can occur through thermal bridges at the building junctions. This occurs when highly conductive elements in the construction enable a low resistance escape route for heat.

5.5 Chase New Homes are committed to developing building fabric where linear thermal transmission through thermal bridges is minimised as far as practicable.

5.6 Psi-values listed below were used for the assessment of new dwellings, and those or similar will be required to achieve the performance outlined:

> Lintels (E2) – 0.06 W/mK,

> Sills (E3) – 0.04 W/mK,

> Jambs (E4) – 0.05 W/mK,

- Ground Floor (E5) – 0.160 W/mK,
- Party Floor (E7) – 0.140 W/mK,
- Balcony (E23) – 0.125 W/mK,
- Corner – normal (E16) – 0.09 W/mK,
- Corner – inverted (E17) – -0.09 W/mK,
- Party wall (E18) – 0.120 W/mK,
- Party wall, ground floor (P1) – 0.160 W/mK,
- Party wall, intermediate floor (P3) – 0.000 W/mK,

Air Tightness and Ventilation

5.7 Mechanical ventilation units with heat recovery (MVHR, System 4) will be installed to all flats and new houses. The proposed units are expected to achieve a specific fan power of less than 0.6W/l/s and heat recovery efficiency of more than 90% with a function of a summer bypass.

5.8 The refurbished listed buildings will utilise natural ventilation with extract fans in all wet rooms (system 1).

Space Heating & Cooling

5.9 The space heating requirements will be reduced by the fabric and air tightness measures detailed above.

5.10 All dwellings are proposed to be connected to individual heat pumps providing space and water heating. Heat pumps are a renewable technology, and rationale for selection of this system is covered within Section 6 and Section 7.

5.11 For the purpose of this energy statement, the baseline strategy involves the use of boilers, as required by the GLA guidance and described in Section 4 of this report.

Limiting the Risk of Summer Overheating

5.12 Minimising the risk of summer overheating is important to ensure that homes are adapted to climate change and remain comfortable to occupy in the future. It is important to ensure that the energy strategy presented does not cause an unacceptable risk of summer overheating within the dwellings.

5.13 Homes should utilise openable windows where possible, with any proposed mechanical ventilation system to assist in overheating mitigation.

5.14 Natural ventilation through openable windows and cross-ventilation will be maximised as far as possible with external noise, air pollution and security in mind to reduce the build-up of heat within homes.

5.15 All south and west facing glazing will have low solar thermal transmittance (g-value) of 0.35-0.4.

5.16 An Overheating Assessment has been completed by Hodkinson Consultancy (March 2023) which outlines a mitigation strategy for demonstrating compliance with both CIBSE TM59 and Approved Document O (AD-O) criteria.

Lighting & Systems' Controls and Metering

5.17 Energy efficient LED light fittings will be installed. All lights will be energy efficient and will exceed efficacy of 80 lamp lumens per circuit-watt.

5.18 Appropriate demand reducing light controls will be installed in communal areas. This will be achieved through the use of Passive Infrared sensors (PIRs) for occupancy sensing fitted in all communal corridors and staircases.

5.19 All external lighting will meet or exceed the requirements of Part L of the building regulations relating to fixed external lighting.

5.20 Every dwelling will be fitted with a smart metering device helping the tenants to control their energy use and associated cost. The meters fitted will help with energy use data collection to inform the Be Seen stage of energy hierarchy. Please refer to Section 8 for more details.

CO_2 Emissions Following *Be Lean* Measures

5.21 Table 7 shows the new build part of the development achieves a 16% reduction in CO_2 emissions site-wide through the application of energy efficiency measures. The refurbished dwellings will exhibit over an 18% energy efficiency improvement over the baseline scenario.

Table 5: Reduction in Regulated CO_2 Emissions following Be Lean Measures – New Dwellings

New dwellings	Regulated CO_2 (tonnes/year)	Reduction in Regulated CO_2
Baseline	83.1	-
After *Be Lean* Measures	69.5	**16%**

Table 6: Reduction in Regulated CO_2 Emissions following Be Lean Measures – Refurbished dwellings

Refurbished dwellings	Regulated CO_2 (tonnes/year)	Reduction in Regulated CO_2
Baseline	11.7	-
After *Be Lean* Measures	9.5	**18.5%**

Table 7: Reduction in Regulated CO_2 Emissions following Be Lean Measures – Whole development

Whole development	Regulated CO_2 (kg/year)	Reduction in Regulated CO_2
Baseline	94.8	-
After *Be Lean* Measures	79	**16.5%**

5.22 The Be Lean DER Worksheets can be seen in Appendix A.

6. *BE CLEAN*: DECENTRALISED ENERGY

6.1 In line with the London Plan Policy SI3 Energy Infrastructure, the heating hierarchy has been considered:

> connect to local existing or planned heat networks;

> use zero-emission or local secondary heat sources (in conjunction with heat pump, if required);

> use low-emission combined heat and power (CHP) (only where there is a case for CHP to enable the delivery of an area-wide heat network, meet the development's electricity demand and provide demand response to the local electricity network);

> use ultra-low NOx gas boilers.

6.2 Connection to a decentralised energy network is a recognised method of generating energy more efficiently. The London Plan Policy SI3 requires major development proposals to explore the opportunities to link into an existing or planned decentralised energy network. Where an existing decentralised energy network is not present, major developments should undertake a detailed investigation into the feasibility of establishing a District Heating Network with the proposed development as an anchor heat load or contribute towards such feasibility work.

6.3 The proposal is located over 4km from the nearest proposed district heat network in Uxbridge and Brunnel University and is outside of a Heat Network Priority Area. As such, if a communal heating system was to be specified, it would have to be financially feasible on the basis of the system serving just the proposed development. The heat costs for the residents would have to be reasonable at the time of completion and prior to any connection to a larger heat network. As the development is relatively small, the development's heat network would not benefit from the economy of scale and therefore the system's running costs would be higher when compared to individual heating systems.

6.4 Therefore, without certainty on the provision of an external heat source via district heat network, the scheme is not able to proceed with a communal heating strategy, as it would run the risk of never being connected to any large network. This would result in high heat costs for residents in perpetuity.

6.5 Individual dwelling heating options therefore represent a more appropriate alternative that provides certainty in relation to heating costs and carbon reductions.

7. *BE GREEN*: RENEWABLE ENERGY

7.1 The third step in the London Plan energy hierarchy requires that the clean generation of energy by renewable energy technologies be examined.

7.2 In line with the energy hierarchy an assessment of the feasibility of renewable energy technologies has been undertaken and presented in this section.

7.3 A feasibility study has been undertaken to establish the most technically and economically feasible renewable technology which provides the highest overall reduction in carbon dioxide emissions for the proposed development to help achieve the planning policy target.

Heat Pumps

7.4 Air Source Heat Pumps (ASHP) extract energy from air and therefore need external areas for condensers. This will be problematic for flats, as the blocks are located on a constrained site with limited external areas. The condensers could be located on flat roofs; this would, however, raise the buildings' height and necessitate large acoustic enclosures.

7.5 ASHP will be suitable for houses and will be fitted to the refurbished buildings. This system will be suitable for the retained buildings provided their thermal envelope is upgraded as discussed in Section 5. Heat will be distributed via low temperature radiators. Mitsubishi Ecodan 5kW system has been used in the modelling of the listed buildings.

7.6 Exhaust air heat pump (EAHP) systems are the preferred strategy for the new dwellings within the development as they minimise the amount of external plant required and are therefore suitable for blocks of flats or houses with limited external areas. These systems will also benefit from the extra efficiency of not having heat losses associated with communal heating systems.

7.7 For the purpose of the modelling, Joule Modul-Air All-E EAHPs have been selected. This selection has been made to inform the carbon emissions reduction achieved for the site and should not limit the system specification at detailed design stage.

7.8 EAHPs provide mechanical ventilation to dwellings and when fitted with additional heat recovery unit, act as standard, stand-alone MVHR system.

Photovoltaics (PV) Panels

7.9 PV panels generate electricity from solar radiation. The generating potential of PV panels is not dependent on development demand, but only on available roof space for installation and ensuring that they are not over shaded.

7.10 PV panels are suitable for this development. Flat roofs of the apartment blocks as well as sloping roofs of the houses are suitable for installation of PV panels. For maximum efficiency, they should be facing south, east or west. North orientation should be avoided.

7.11 The roof areas on blocks, identified as suitable, are shown on the sketches below (Figures 4 and 5). As a 'rule of thumb', the area suitable for installation of PV panels is typically 75% of the available roof area. This is to account for spacing, safe access and minor roof obstructions. The spatial requirement for 1kWp of horizontally mounted PV system is approximately 12m^2.

7.12 The terraced houses have suitable sloping roofs facing south, east and west. These will be fully utilised for PVs. One panel's measurement is approximately 1m x 1.6m and requires very little spacing when mounted on sloping roofs.

7.13 Based on these assumptions, the total size of PV system that could be fitted on the identified roofs is as estimated below:

> North Block – 40kWp

> South Block – 23kWp

> Houses – 14kWp total (2kWp per house)

> Refurbished, Grade II listed buildings – no PVs

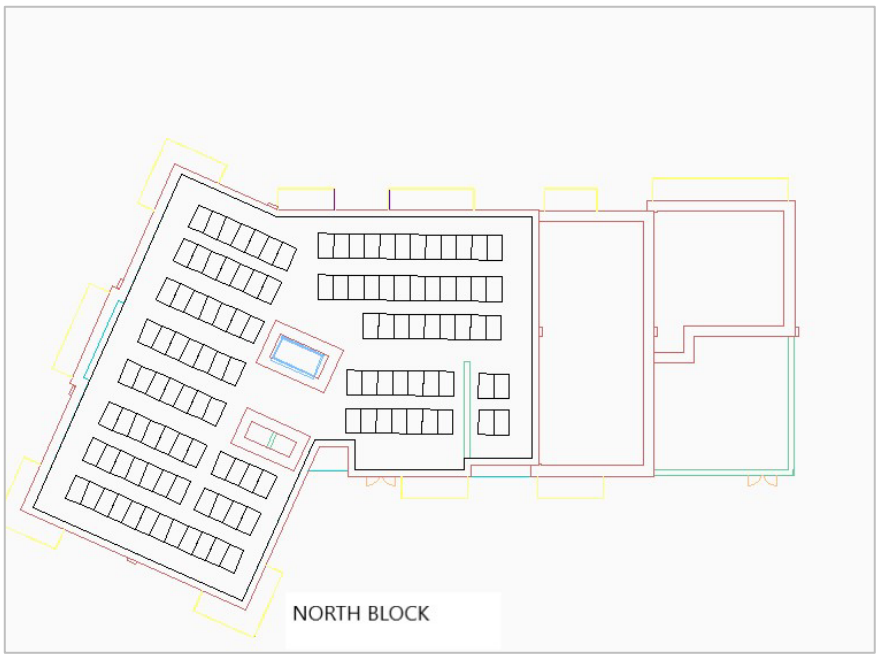

Figure 4: Indicative location of the proposed PV system on north block (source: Architect's plan)

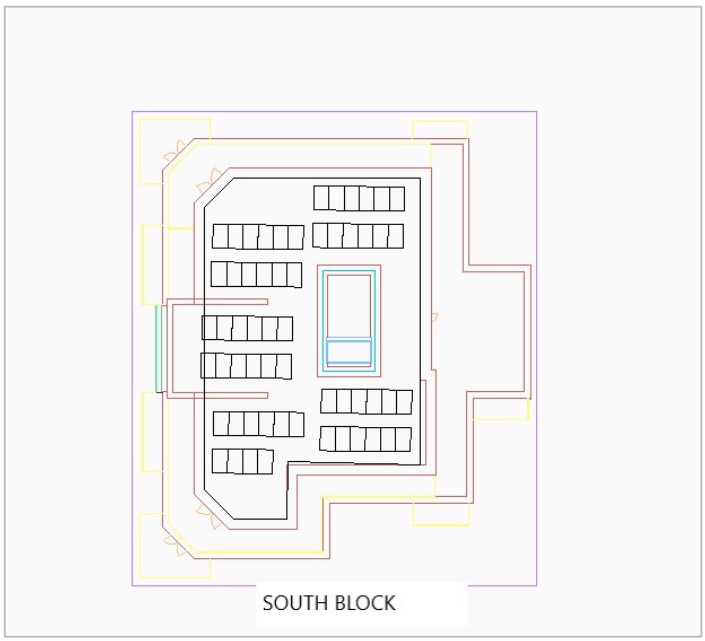

Figure 5: Indicative location of the proposed PV system on south block (source: Architect's plan)

CO_2 Emissions Following Be Green Measures

7.14 The estimated total carbon emissions reduction from the development after incorporation of PV panels and ASHP is over 70%, as shown in the Table 10 below. Please refer to Appendix B for DER Worksheets and Appendix C for the GLA carbon emissions calculations spreadsheet. This exceeds the requirements of Part L of the Building Regulations and the minimum local planning policy.

7.15 These results provide a robust case for supporting the proposed heating strategy incorporating heat pumps for the development. This aligns with the London Plan policy strategy supporting clean, low emission fuels.

Table 8: Reduction in Regulated CO_2 Emissions following Be Green Measures – New Dwellings

New dwellings	Regulated CO_2 (tonnes/year)	Reduction in Regulated CO_2
Baseline	83.1	-
After *Be Lean* Measures	69.5	**16%**
After *Be Green* Measures (ASHP + PVs)	24.6	**70%**

Table 9: Reduction in Regulated CO_2 Emissions following Be Green Measures – Refurbished dwellings

Refurbished dwellings	Regulated CO_2 (tonnes/year)	Reduction in Regulated CO_2
Baseline	11.7	-
After *Be Lean* Measures	9.5	**19%**
After *Be Green* Measures (ASHP)	3.2	**73%**

Table 10: Reduction in Regulated CO_2 Emissions following Be Green Measures – Whole development

Whole development	Regulated CO_2 (tonnes/year)	Reduction in Regulated CO_2
Baseline	94.8	-
After *Be Lean* Measures	79	**16.5%**
After *Be Green* Measures (ASHP + PVs)	27.8	**70.6%**

Other Technologies – Not Feasible

Solar Thermal

7.16 Solar thermal panels use the sun's energy to generate hot water. Solar thermal panels are generally installed on the roofs, with panels facing as close to south as possible to maximise their efficiency.

7.17 The benefits of solar thermal panels are constrained by the seasonal variation in solar radiation. This means that solar thermal panels can only deliver a maximum of 60% of the annual hot water demand. This would still require all of the proposed conventional fuel heating infrastructure to be in place to meet times when Domestic Hot Water (DHW) generation is not possible using this technology.

7.18 This technology would be in direct competition for roof space with photovoltaics which are better suited to this development.

Ground Source Heat Pump

7.19 Ground Source Heat Pump (GSHP) can provide reductions in energy. However, they are generally limited to sites with large amount of space. The proposed development is located on a brownfield site. This increases the complexity and subsequent costs for applying the technology. GSHP is therefore not considered as appropriate.

Wind Turbines

7.20 Urban rooftop wind turbines do not generally perform sufficiently to well to warrant their installation, due to the low and turbulent wind conditions present. The rooftop for this application is considered to meet these parameters and as a result remain technically unfeasible.

7.21 It has therefore been concluded that wind turbines are not a suitable technology for this site.

'Zero Carbon' Offset Payment

7.22 The on-site 'zero carbon' target shortfall for the development will be met through the payment towards Hillingdon Council's carbon offsetting fund. The funds secured by the council will be ring-fenced to deliver carbon emissions savings off site through a variety of projects and will be secured through Section 106 legal agreements.

7.23 The council's carbon offset cost is £95 for every tonne of CO_2 emitted per year over a period of 30 years (or £2,850 per tonne of annual residual CO_2 emissions).

7.24 The estimated offset payment will be in the region of £79,000, if the listed buildings are included in the calculation. Please refer to Table 11 for detailed calculations of the carbon shortfall and the 'zero carbon' offset payment.

Table 11: 'Zero carbon' offset payment calculations

Energy hierarchy	Regulated carbon dioxide (tonnes/year)
Baseline emissions	94.8
Savings from 'Be Lean' measures - energy demand reduction	15.8
Savings from 'Be Clean'	0.0
Savings from 'Be Green'	51.2
Cumulative savings	67
Shortfall to 'zero carbon'	27.8
'Zero carbon' offset payment	27.8 x 30 years = 834 834 x £95 = **£79,230**

8. *BE SEEN*: ENERGY MONITORING

8.1 To comply with London Plan Policy SI 2 an estimate of energy use and carbon emissions predicted for the development will be reported by the Client via the GLA web portal and will be further updated at each stage of the planning, design, as-built and in-use process.

8.2 The 'Be Seen' Energy Monitoring Guidance sets out processes and responsibilities at each reporting stage to ensure the 'Be Seen' stage of the energy hierarchy is well understood and correctly applied to all major developments. The figure 6 below, extracted from the GLA guidance, summarises the tasks involved in energy and carbon reporting and shows the party most likely responsible for each task.

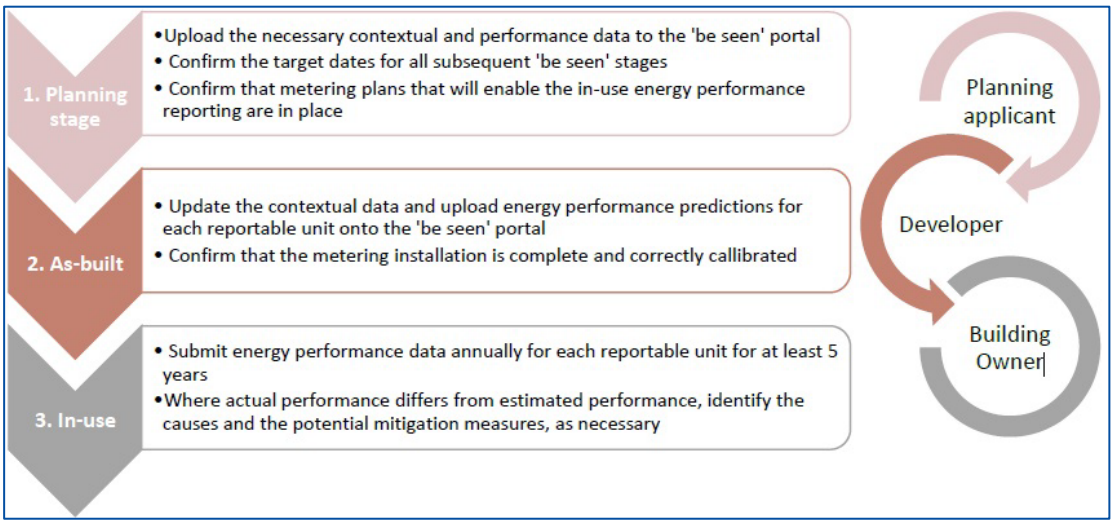

Figure 6: 'Be Seen' reporting stages, processes and responsibilities (source: 'Be Seen' Energy Reporting Guidance)

8.3 The Client will ensure that all involved parties are aware of their reporting responsibilities at subsequent monitoring stages and will provide estimates of each of the performance indicators listed in Table 12 below which will be reported to the GLA using the 'be seen' spreadsheet.

Table 12: 'Be Seen' reporting requirements at planning stage.

Planning stage Performance indicator group	Description
Contextual data	> Location Unique Property Reference Number (UPRN) or Address (if no UPRN available) > Site plan > Typology / Planning Use Class (all included) > GIA (m2) for each Typology / Use Class > Anticipated target dates for each 'be seen' reporting stage (i.e. 'as-built' and 'in-use')
Building energy use	> Grid electricity consumption (kWh) > Gas consumption (kWh) > Other fuels consumption (kWh) > District heating/cooling consumption(kWh) (if applicable)
Renewable energy	> Energy generation (kWh)
Carbon emissions	> Carbon emissions estimates (tonnes CO_2/m2) for residential and non-residential uses separately as well as the whole development > Carbon shortfall for the entire development (tonnes CO_2) > Estimated carbon offset amount (£)

9. SUMMARY

9.1 The proposed development comprises the demolition of existing Barn Hotel buildings and the new construction of two residential blocks, providing 87 flats, 7 terraced houses and refurbishment of 2 Grade II listed buildings to provide additional 2 houses. The development is located in Ruislip, in the London Borough of Hillingdon.

9.2 The Energy Strategy for the development has been formulated following the London Plan Energy Hierarchy: Be Lean, Be Clean and Be Green. The overriding objective in the formulation of the strategy is to maximise the reductions in CO_2 emissions through the application of this hierarchy with a cost-effective and technically appropriate approach and to minimise the emission of other pollutants.

9.3 A range of Be Lean energy efficiency measures are proposed which enable the proposed development to significantly reduce regulated CO_2 emissions by 16% over the baseline through energy efficiency measures alone. These include very well insulated building fabric, efficient mechanical ventilation systems and low energy lighting throughout.

9.4 The refurbished buildings will be thermally upgraded as far as technically feasible, preserving their Grade II listed character. The external walls will be internally insulated, roof insulation will be upgraded, where space allows for it, and all windows will be fitted with secondary glazing panels.

9.5 The opportunity for the proposed development to link into an existing or planned decentralised energy network has been considered. The proposal is located approximately 4km away from the nearest planned district heat network and is not included in the Heat Network Priority Area. As the development is relatively small, a heat network serving only this development would not benefit from the economy of scale and therefore the system's running costs would be higher when compared to individual heating systems. The connection to district heating is concluded to be impractical and unfeasible.

9.6 A feasibility study has been undertaken to establish suitability of the new extension for integration of renewable technology on site. It has been concluded that the most feasible technologies for the development will be:

> Individual Exhaust air source heat pumps (EAHP) fitted in new dwellings,

> Air source heat pumps (ASHP) fitted to the refurbished Grade II listed buildings,

> Photovoltaic panels (PV) mounted on roofs of the new buildings.

9.7 A highly optimised energy strategy based on passive design, building fabric performance and building services systems and controls, and suitable Low and Zero Carbon systems will allow the scheme to achieve an improvement on total carbon dioxide emissions over the existing scenario of

over 70%, exceeding the Building Regulations Part L 2021 targets for compliance and London Plan carbon emissions reduction target of 35%.

9.8 The on-site 'zero carbon' target for the development will be met through payment towards Hillingdon Council's carbon offsetting fund. The funds secured by the council will be ring-fenced to deliver carbon emissions savings off site through a variety of projects and will be secured through Section 106 legal agreements.

9.9 The Client will commit to carrying out energy monitoring and reporting at each stage of the planning, construction and in-use processes to enable the GLA to record the estimated and actual energy uses in new developments, helping to achieve net zero-carbon buildings and providing a number of environmental and socio-economic benefits.

10. APPENDICES

Appendix A
DER Worksheets Baseline and Be Lean (TER & BER)

Appendix B
DER Worksheets Be Green (BER)

Appendix C
GLA carbon emissions reporting spreadsheet

HODKINSON

Appendix A

DER Worksheets – Baseline & Be Lean

Full SAP Calculation Printout

Property Reference	B1_00_2B_0.4g_Copy	Issued on Date	04/04/2023
Assessment Reference	B1_00_2B_Copy_Copy	Prop Type Ref	
Property			

SAP Rating	83 B	DER	14.29	TER	15.25
Environmental	89 B	% DER < TER			6.30
CO_2 Emissions (t/year)	0.82	DFEE	38.72	TFEE	39.77
Compliance Check	See BREL	% DFEE < TFEE			2.63
% DPER < TPER	-1.53	DPER	83.09	TPER	81.84

Assessor Details	Miss Eleanor Ballinger	Assessor ID	M976-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	62.5700 (1b)	x	3.1500 (2b)	=	197.0955	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.5700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	197.0955	(5)

---
2. Ventilation rate
---

		m3 per hour	
Number of open chimneys	0 * 80	=	0.0000 (6a)
Number of open flues	0 * 20	=	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10	=	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20	=	0.0000 (6d)
Number of flues attached to other heater	0 * 35	=	0.0000 (6e)
Number of blocked chimneys	0 * 20	=	0.0000 (6f)
Number of intermittent extract fans	0 * 10	=	0.0000 (7a)
Number of passive vents	0 * 10	=	0.0000 (7b)
Number of flueless gas fires	0 * 40	=	0.0000 (7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5)	=	0.0000 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			3.0000 (17)
Infiltration rate			0.1500 (18)
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.1275 (21)

	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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.9000 (23c)

Effective ac	0.2531	0.2499	0.2467	0.2307	0.2276	0.2116	0.2116	0.2084	0.2180	0.2276	0.2339	0.2403	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.10)			17.2800	1.0536	18.2069			(27)
Door			1.9500	1.0000	1.9500			(26)
Heatloss Floor 1			62.5700	0.1000	6.2570			(28a)

External Wall 1	50.1200	17.2800	32.8400	0.1600	5.2544	(29a)
Corrido Wall	5.0000	1.9500	3.0500	0.1500	0.4575	(29a)
Total net area of external elements Aum(A, m2)			117.6900			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.1258	(33)
Party Wall 1			44.8200	0.0000	0.0000	(32)
Party Ceiling 1			62.5700			(32b)

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

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	15.9100	0.0600	0.9546
E7 Party floor between dwellings (in blocks of flats)	10.3600	0.0700	0.7252
E5 Ground floor (normal)	1.5900	0.2600	0.4134
E7 Party floor between dwellings (in blocks of flats)	1.5900	0.1100	0.1749
E16 Corner (normal)	3.1500	0.0900	0.2835
E18 Party wall between dwellings	3.1500	0.0600	0.1890
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	5.5500	0.0630	0.3497
P1 Party wall - Ground floor	14.2300	0.0800	1.1384
E2 Other lintels (including other steel lintels)	9.1900	0.0600	0.5514
E3 Sill	8.2500	0.0400	0.3300
E4 Jamb	25.0600	0.0500	1.2530
E25 Staggered party wall between dwellings	9.4500	0.2400	2.2680

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.6311 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 40.7568 (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	16.4596	16.2522	16.0449	15.0083	14.8010	13.7644	13.7644	13.5571	14.1791	14.8010	15.2156	15.6303	(38)
Heat transfer coeff	57.2164	57.0091	56.8018	55.7652	55.5579	54.5213	54.5213	54.3139	54.9359	55.5579	55.9725	56.3871	(39)

Average = Sum(39)m / 12 = 55.7133

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9144	0.9111	0.9078	0.8912	0.8879	0.8714	0.8714	0.8681	0.8780	0.8879	0.8946	0.9012	(40)
HLP (average)												0.8904	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0533 (42)

Hot water usage for mixer showers												
	58.6465	57.7651	56.4808	54.0236	52.2102	50.1879	49.0385	50.3130	51.7102	53.8815	56.3915	58.4218 (42a)
Hot water usage for baths												
	25.3431	24.9667	24.4367	23.4595	22.7277	21.9163	21.4780	22.0043	22.5774	23.4456	24.4430	25.2575 (42b)
Hot water usage for other uses												
	35.6577	34.3611	33.0644	31.7678	30.4711	29.1745	29.1745	30.4711	31.7678	33.0644	34.3611	35.6577 (42c)

Average daily hot water use (litres/day) 109.9833 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	119.6473	117.0930	113.9820	109.2508	105.4090	101.2787	99.6909	102.7885	106.0553	110.3915	115.1956	119.3370	(44)
Energy conte	189.4921	166.7388	175.1861	149.5589	141.9008	124.5340	120.5676	127.2736	130.7768	149.8003	164.1173	186.8528	(45)
Energy content (annual)										Total = Sum(45)m =		1826.7991	
Distribution loss (46)m = 0.15 x (45)m													
	28.4238	25.0108	26.2779	22.4338	21.2851	18.6801	18.0851	19.0910	19.6165	22.4700	24.6176	28.0279	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2960	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.6998	(55)
Total storage loss													
	21.6950	19.5955	21.6950	20.9952	21.6950	20.9952	21.6950	21.6950	20.9952	21.6950	20.9952	21.6950	(56)
If cylinder contains dedicated solar storage													
	21.6950	19.5955	21.6950	20.9952	21.6950	20.9952	21.6950	21.6950	20.9952	21.6950	20.9952	21.6950	(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													
	234.4496	207.3455	220.1435	193.0661	186.8583	168.0412	165.5250	172.2310	174.2840	194.7577	207.6245	231.8103	(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													
	234.4496	207.3455	220.1435	193.0661	186.8583	168.0412	165.5250	172.2310	174.2840	194.7577	207.6245	231.8103	(64)
										Total per year (kWh/year) = Sum(64)m =		2356.1367	(64)
12Total per year (kWh/year)												2356	(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													
	98.9721	87.9260	94.2153	84.5341	83.1480	76.2133	76.0547	78.2844	78.2891	85.7745	89.3748	98.0945	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	102.6644	102.6644	102.6644	102.6644	102.6644	102.6644	102.6644	102.6644	102.6644	102.6644	102.6644	102.6644	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
90.4760 100.1699 90.4760 93.4919 90.4760 93.4919 90.4760 90.4760 93.4919 90.4760 93.4919 90.4760 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
179.3789 181.2403 176.5496 166.5638 153.9585 142.1113 134.1966 132.3352 137.0258 147.0117 159.6170 171.4642 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
33.2664 33.2664 33.2664 33.2664 33.2664 33.2664 33.2664 33.2664 33.2664 33.2664 33.2664 33.2664 (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)
-82.1315 -82.1315 -82.1315 -82.1315 -82.1315 -82.1315 -82.1315 -82.1315 -82.1315 -82.1315 -82.1315 -82.1315 (71)
Water heating gains (Table 5)
133.0270 130.8423 126.6335 117.4085 111.7580 105.8518 102.2240 105.2210 108.7348 115.2884 124.1316 131.8475 (72)
Total internal gains
459.6812 469.0518 450.4585 434.2635 412.9919 395.2543 380.6960 381.8316 393.0519 409.5754 434.0398 450.5870 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
South	6.7600	46.7521	0.4000	0.8000	0.7700	70.0859	(78)
West	10.5200	19.6403	0.4000	0.8000	0.7700	45.8191	(80)

Solar gains 115.9050 204.4145 293.8236 380.5338 436.0387 435.8047 419.0502 378.1179 324.4140 230.1596 140.2067 98.2400 (83)
Total gains 575.5862 673.4663 744.2821 814.7973 849.0305 831.0590 799.7462 759.9494 717.4659 639.7350 574.2465 548.8271 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	75.9422	76.2183	76.4965	77.9185	78.2093	79.6962	79.6962	80.0004	79.0947	78.2093	77.6299	77.0590	
alpha	6.0628	6.0812	6.0998	6.1946	6.2140	6.3131	6.3131	6.3334	6.2730	6.2140	6.1753	6.1373	
util living area	0.9811	0.9544	0.8987	0.7685	0.5974	0.4189	0.2999	0.3286	0.5237	0.8139	0.9547	0.9849	(86)
MIT	20.3004	20.5073	20.7227	20.9127	20.9829	20.9985	20.9998	20.9997	20.9941	20.8973	20.5871	20.2701	(87)
Th 2	20.1552	20.1581	20.1609	20.1749	20.1778	20.1919	20.1919	20.1947	20.1862	20.1778	20.1721	20.1665	(88)
util rest of house	0.9759	0.9431	0.8764	0.7298	0.5483	0.3664	0.2448	0.2712	0.4639	0.7712	0.9415	0.9807	(89)
MIT 2	19.3617	19.6186	19.8764	20.0963	20.1652	20.1911	20.1919	20.1947	20.1828	20.0883	19.7317	19.3328	(90)
Living area fraction										fLA = Living area / (4) =		0.4680	(91)
MIT	19.8010	20.0344	20.2725	20.4783	20.5478	20.5689	20.5700	20.5714	20.5624	20.4668	20.1320	19.7714	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.6510	19.8844	20.1225	20.3283	20.3978	20.4189	20.4200	20.4214	20.4124	20.3168	19.9820	19.6214	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9720	0.9388	0.8753	0.7373	0.5616	0.3812	0.2604	0.2873	0.4807	0.7789	0.9380	0.9773	(94)
Useful gains	559.4706	632.2484	651.4578	600.7593	476.8495	316.8054	208.2377	218.3599	344.8964	498.2816	538.6260	536.3469	(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	878.3268	854.2492	773.7800	637.3019	483.2324	317.2549	208.2692	218.4178	346.7791	539.8472	721.0388	869.5673	(97)
Space heating kWh	237.2290	149.1845	91.0078	26.3107	4.7488	0.0000	0.0000	0.0000	0.0000	30.9248	131.3373	247.9160	(98a)

Space heating requirement - total per year (kWh/year) 918.6589

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	237.2290	149.1845	91.0078	26.3107	4.7488	0.0000	0.0000	0.0000	0.0000	30.9248	131.3373	247.9160	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 918.6589
Space heating per m2 (98c) / (4) = 14.6821 (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 %) 88.8000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	237.2290	149.1845	91.0078	26.3107	4.7488	0.0000	0.0000	0.0000	0.0000	30.9248	131.3373	247.9160	(98)
Space heating efficiency (main heating system 1)	88.8000	88.8000	88.8000	88.8000	88.8000	0.0000	0.0000	0.0000	0.0000	88.8000	88.8000	88.8000	(210)
Space heating fuel (main heating system)	267.1497	168.0006	102.4862	29.6291	5.3478	0.0000	0.0000	0.0000	0.0000	34.8252	147.9023	279.1847	(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

234.4496	207.3455	220.1435	193.0661	186.8583	168.0412	165.5250	172.2310	174.2840	194.7577	207.6245	231.8103 (64)

Efficiency of water heater

											79.8000 (216)
(217)m	84.0862	83.3341	82.2379	80.7819	80.0010	79.8000	79.8000	79.8000	80.9239	83.0619	84.2107 (217)

Fuel for water heating, kWh/month

278.8204	248.8123	267.6912	238.9967	233.5700	210.5779	207.4248	215.8284	218.4011	240.6678	249.9636	275.2741 (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 (221)
Pumps and Fa	29.7687	26.8878	29.7687	28.8084	29.7687	28.8084	29.7687	29.7687	28.8084	29.7687	28.8084 29.7687 (231)
Lighting	19.2846	15.4708	13.9297	10.2055	7.8830	6.4405	7.1912	9.3474	12.1413	15.9300	17.9929 19.8206 (232)

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

(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000 (233a)

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

(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000 (234a)

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

(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000 (235a)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000 (235c)

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

(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000 (233b)

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

(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000 (234b)

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

(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000 (235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000 (235d)

Annual totals kWh/year

Space heating fuel - main system 1	1034.5258 (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	2886.0283 (219)
Space cooling fuel	0.0000 (221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.1000)

mechanical ventilation fans (SFP = 1.1000)	264.5022 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	350.5022 (231)
Electricity for lighting (calculated in Appendix L)	155.6376 (232)

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

PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4426.6938 (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	1034.5258	0.2100	217.2504	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2886.0283	0.2100	606.0659	(264)
Space and water heating			823.3164	(265)
Pumps, fans and electric keep-hot	350.5022	0.1387	48.6190	(267)
Energy for lighting	155.6376	0.1443	22.4633	(268)
Total CO2, kg/year			894.3986	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			14.2900	(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	1034.5258	1.1300	1169.0141	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2886.0283	1.1300	3261.2120	(278)
Space and water heating			4430.2261	(279)
Pumps, fans and electric keep-hot	350.5022	1.5128	530.2397	(281)
Energy for lighting	155.6376	1.5338	238.7221	(282)
Total Primary energy kWh/year			5199.1879	(286)
Dwelling Primary energy Rate (DPER)			83.0900	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	62.5700 (1b)	x	3.1500 (2b)	=	197.0955 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.5700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	197.0955	(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) =	0.1015	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3515	(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) =	0.2988	(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	0.3809	0.3734	0.3660	0.3286	0.3212	0.2838	0.2838	0.2763	0.2988	0.3212	0.3361	0.3510	(22b)
Effective ac	0.5725	0.5697	0.5670	0.5540	0.5516	0.5403	0.5403	0.5382	0.5446	0.5516	0.5565	0.5616	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.9500	1.0000	1.9500			(26)
TER Opening Type (Uw = 1.20)			13.6900	1.1450	15.6756			(27)
Heatloss Floor 1			62.5700	0.1300	8.1341			(28a)
External Wall 1	50.1200	13.6900	36.4300	0.1800	6.5574			(29a)
Corrido Wall	5.0000	1.9500	3.0500	0.1800	0.5490			(29a)
Total net area of external elements Aum(A, m2)			117.6900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.8661			(33)
Party Wall 1			44.8200	0.0000	0.0000			(32)

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

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E5 Ground floor (normal)	15.9100	0.1600	2.5456
E7 Party floor between dwellings (in blocks of flats)	10.3600	0.0700	0.7252
E5 Ground floor (normal)	1.5900	0.1600	0.2544
E7 Party floor between dwellings (in blocks of flats)	1.5900	0.0700	0.1113
E16 Corner (normal)	3.1500	0.0900	0.2835
E18 Party wall between dwellings	3.1500	0.0600	0.1890
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	5.5500	0.0200	0.1110
P1 Party wall - Ground floor	14.2300	0.0800	1.1384
E2 Other lintels (including other steel lintels)	9.1900	0.0500	0.4595
E3 Sill	8.2500	0.0500	0.4125
E4 Jamb	25.0600	0.0500	1.2530
E25 Staggered party wall between dwellings	9.4500	0.0600	0.5670

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.0504	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	40.9165	(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	37.2393	37.0560	36.8764	36.0329	35.8751	35.1403	35.1403	35.0043	35.4233	35.8751	36.1943	36.5281	(38)
Heat transfer coeff													
	78.1557	77.9725	77.7929	76.9494	76.7915	76.0568	76.0568	75.9207	76.3398	76.7915	77.1108	77.4446	(39)
Average = Sum(39)m / 12 =												76.9486	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2491	1.2462	1.2433	1.2298	1.2273	1.2155	1.2155	1.2134	1.2201	1.2273	1.2324	1.2377	(40)
HLP (average)												1.2298	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0533	(42)
Hot water usage for mixer showers													
	58.6465	57.7651	56.4808	54.0236	52.2102	50.1879	49.0385	50.3130	51.7102	53.8815	56.3915	58.4218	(42a)
Hot water usage for baths													
	25.3431	24.9667	24.4367	23.4595	22.7277	21.9163	21.4780	22.0043	22.5774	23.4456	24.4430	25.2575	(42b)
Hot water usage for other uses													
	35.6577	34.3611	33.0644	31.7678	30.4711	29.1745	29.1745	30.4711	31.7678	33.0644	34.3611	35.6577	(42c)
Average daily hot water use (litres/day)												109.9833	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	119.6473	117.0930	113.9820	109.2508	105.4090	101.2787	99.6909	102.7885	106.0553	110.3915	115.1956	119.3370	(44)
Energy conte	189.4921	166.7388	175.1861	149.5589	141.9008	124.5340	120.5676	127.2736	130.7768	149.8003	164.1173	186.8528	(45)
Energy content (annual)										Total = Sum(45)m =		1826.7991	
Distribution loss (46)m = 0.15 x (45)m													
	28.4238	25.0108	26.2779	22.4338	21.2851	18.6801	18.0851	19.0910	19.6165	22.4700	24.6176	28.0279	(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													
	236.0870	208.8245	221.7810	194.6508	188.4957	169.6258	167.1625	173.8685	175.8687	196.3952	209.2091	233.4477	(62)
WWHRS	-26.8107	-23.7116	-24.8294	-20.5598	-19.1610	-16.3962	-15.3688	-16.3432	-16.9641	-19.9988	-22.6562	-26.3142	(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													
	209.2763	185.1129	196.9516	174.0910	169.3348	153.2296	151.7937	157.5253	158.9046	176.3964	186.5529	207.1335	(64)
										Total per year (kWh/year) = Sum(64)m =		2126.3025	(64)
12Total per year (kWh/year)												2126	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
							Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =					0.0000	(64a)
Heat gains from water heating, kWh/month													
	100.2821	89.1092	95.5253	85.8018	84.4579	77.4810	77.3646	79.5944	79.5568	87.0845	90.6425	99.4045	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	102.6644	102.6644	102.6644	102.6644	102.6644	102.6644	102.6644	102.6644	102.6644	102.6644	102.6644	102.6644	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	90.5242	100.2233	90.5242	93.5417	90.5242	93.5417	90.5242	90.5242	93.5417	90.5242	93.5417	90.5242	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	179.3789	181.2403	176.5496	166.5638	153.9585	142.1113	134.1966	132.3352	137.0258	147.0117	159.6170	171.4642	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.2664	33.2664	33.2664	33.2664	33.2664	33.2664	33.2664	33.2664	33.2664	33.2664	33.2664	33.2664	(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)													
	-82.1315	-82.1315	-82.1315	-82.1315	-82.1315	-82.1315	-82.1315	-82.1315	-82.1315	-82.1315	-82.1315	-82.1315	(71)
Water heating gains (Table 5)													
	134.7877	132.6030	128.3942	119.1692	113.5187	107.6125	103.9847	106.9817	110.4955	117.0491	125.8923	133.6082	(72)
Total internal gains													
	461.4901	470.8659	452.2674	436.0740	414.8008	397.0648	382.5049	383.6405	394.8624	411.3843	435.8503	452.3959	(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	
South	5.3600	46.7521	0.6300	0.7000	0.7700	76.5839	(78)
West	8.3300	19.6403	0.6300	0.7000	0.7700	49.9993	(80)

Solar gains	126.5832	223.2340	320.8468	415.4960	476.0751	475.8102	457.5216	412.8479	354.2377	251.3412	153.1213	107.2925	(83)
Total gains	588.0734	694.0998	773.1142	851.5700	890.8759	872.8751	840.0264	796.4883	749.1001	662.7255	588.9716	559.6885	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.5959	55.7265	55.8552	56.4675	56.5836	57.1302	57.1302	57.2326	56.9184	56.5836	56.3493	56.1064	
alpha	4.7064	4.7151	4.7237	4.7645	4.7722	4.8087	4.8087	4.8155	4.7946	4.7722	4.7566	4.7404	
util living area	0.9870	0.9717	0.9403	0.8612	0.7248	0.5423	0.3955	0.4338	0.6588	0.8940	0.9730	0.9895	(86)
MIT	19.7803	20.0219	20.3244	20.6662	20.8844	20.9773	20.9959	20.9937	20.9438	20.6517	20.1582	19.7399	(87)
Th 2	19.8809	19.8832	19.8855	19.8962	19.8982	19.9076	19.9076	19.9093	19.9040	19.8982	19.8942	19.8899	(88)
util rest of house	0.9829	0.9633	0.9229	0.8239	0.6610	0.4563	0.2988	0.3334	0.5710	0.8561	0.9635	0.9862	(89)
MIT 2	18.4995	18.8037	19.1769	19.5830	19.8100	19.8959	19.9064	19.9073	19.8707	19.5802	18.9864	18.4550	(90)
Living area fraction										fLA = Living area / (4) =		0.4680	(91)
MIT	19.0989	19.3738	19.7139	20.0899	20.3128	20.4019	20.4162	20.4157	20.3729	20.0817	19.5347	19.0563	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0989	19.3738	19.7139	20.0899	20.3128	20.4019	20.4162	20.4157	20.3729	20.0817	19.5347	19.0563	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9792	0.9585	0.9197	0.8311	0.6862	0.4960	0.3442	0.3804	0.6101	0.8632	0.9596	0.9829	(94)
Useful gains	575.8352	665.3023	711.0675	707.7135	611.2908	432.9071	289.1028	303.0219	457.0180	572.0856	565.1638	550.0949	(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	1156.6155	1128.5550	1027.9482	861.0531	661.3877	441.2755	290.2517	304.8748	478.8701	728.1105	958.8532	1150.5369	(97)
Space heating kWh	432.1005	311.3058	235.7593	110.4045	37.2721	0.0000	0.0000	0.0000	0.0000	116.0825	283.4564	446.7288	(98a)
Space heating requirement - total per year (kWh/year)												1973.1099	
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	432.1005	311.3058	235.7593	110.4045	37.2721	0.0000	0.0000	0.0000	0.0000	116.0825	283.4564	446.7288	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1973.1099	
Space heating per m2										(98c) / (4) =		31.5344	(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	432.1005	311.3058	235.7593	110.4045	37.2721	0.0000	0.0000	0.0000	0.0000	116.0825	283.4564	446.7288	(98)
Space heating efficiency (main heating system 1)	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)	468.1479	337.2760	255.4272	119.6148	40.3815	0.0000	0.0000	0.0000	0.0000	125.7665	307.1034	483.9965	(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	209.2763	185.1129	196.9516	174.0910	169.3348	153.2296	151.7937	157.5253	158.9046	176.3964	186.5529	207.1335	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.6482	85.2161	84.4642	83.0672	81.2862	79.8000	79.8000	79.8000	79.8000	83.1445	84.9952	85.7368	(217)
Fuel for water heating, kWh/month	244.3442	217.2275	233.1777	209.5786	208.3191	192.0171	190.2176	197.4002	199.1285	212.1563	219.4863	241.5922	(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	18.8091	15.0894	13.5863	9.9539	7.6887	6.2817	7.0139	9.1169	11.8420	15.5373	17.5494	19.3319	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.8876	-18.0136	-27.8088	-33.6604	-38.4466	-36.6884	-36.2485	-33.1423	-28.0646	-21.6189	-13.5083	-10.1370	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.3816	-7.3382	-15.0140	-23.1952	-31.3121	-31.6936	-31.3155	-26.2135	-18.8273	-10.6951	-4.5782	-2.6573	(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	(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	(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	(235d)

Annual totals kWh/year	
Space heating fuel - main system 1	2137.7139 (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	2564.6454 (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)	151.8006 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-515.4465 (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	4424.7134 (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	2137.7139	0.2100	448.9199	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2564.6454	0.2100	538.5755	(264)
Space and water heating			987.4955	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	151.8006	0.1443	21.9095	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-309.2250	0.1331	-41.1572	
PV Unit electricity exported	-206.2215	0.1251	-25.7951	
Total			-66.9524	(269)
Total CO2, kg/year			954.3818	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.2500	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2137.7139	1.1300	2415.6167	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2564.6454	1.1300	2898.0493	(278)
Space and water heating			5313.6661	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	151.8006	1.5338	232.8368	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-309.2250	1.4918	-461.3088	
PV Unit electricity exported	-206.2215	0.4591	-94.6779	
Total			-555.9867	(283)
Total Primary energy kWh/year			5120.6170	(286)
Target Primary Energy Rate (TPER)			81.8400	(287)

Full SAP Calculation Printout

Property Reference	B1_02_2B_0.4g_Copy	Issued on Date	04/04/2023
Assessment Reference	B1_02_2B_Copy_Copy	Prop Type Ref	
Property			

SAP Rating	84 B	DER	12.07	TER	13.53
Environmental	90 B	% DER < TER			10.79
CO_2 Emissions (t/year)	0.79	DFEE	32.71	TFEE	33.98
Compliance Check	See BREL	% DFEE < TFEE			3.73
% DPER < TPER	2.00	DPER	71.12	TPER	72.57

Assessor Details	Miss Eleanor Ballinger	Assessor ID	M976-0001
Client			

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

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		71.0300 (1b)	x	3.1500 (2b)	=	223.7445	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.0300						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	223.7445	(5)

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2. Ventilation rate

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			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		0 * 10 =	0.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		0.0000 / (5) =	0.0000	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			3.0000	(17)
Infiltration rate			0.1500	(18)
Number of sides sheltered			3	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.9000 (23c)

Effective ac	0.2387	0.2358	0.2329	0.2184	0.2155	0.2009	0.2009	0.1980	0.2067	0.2155	0.2213	0.2271	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.10)			10.3800	1.0536	10.9368			(27)
Door			2.0900	1.0000	2.0900			(26)
External Wall 1	31.9700	10.3800	21.5900	0.1600	3.4544			(29a)

Corridor Wall	37.9800	2.0900	35.8900	0.1500	5.3835	(29a)
Total net area of external elements Aum(A, m2)			69.9500			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.8647	(33)
Party Wall 1			46.5600	0.0000	0.0000	(32)
Party Floor 1			71.0300			(32d)
Party Ceiling 1			71.0300			(32b)

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)	9.0800	0.0700	0.6356
E7 Party floor between dwellings (in blocks of flats)	24.1200	0.1100	2.6532
E16 Corner (normal)	6.3000	0.0900	0.5670
E18 Party wall between dwellings	12.6000	0.0600	0.7560
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	11.2200	0.0630	0.7069
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	29.5600	0.0000	0.0000
E17 Corner (inverted – internal area greater than external area)	6.3000	-0.0900	-0.5670
E2 Other lintels (including other steel lintels)	6.0000	0.0600	0.3600
E3 Sill	4.9900	0.0400	0.1996
E4 Jamb	16.6200	0.0500	0.8310

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.1423 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 28.0069 (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	17.6260	17.4114	17.1968	16.1239	15.9093	14.8364	14.8364	14.6218	15.2655	15.9093	16.3385	16.7676	(38)
Heat transfer coeff	45.6329	45.4183	45.2037	44.1308	43.9162	42.8433	42.8433	42.6287	43.2725	43.9162	44.3454	44.7746	(39)

Average = Sum(39)m / 12 = 44.0772

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6424	0.6394	0.6364	0.6213	0.6183	0.6032	0.6032	0.6002	0.6092	0.6183	0.6243	0.6304	(40)
HLP (average)												0.6205	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2709 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	62.2947	61.3585	59.9943	57.3842	55.4580	53.3099	52.0890	53.4428	54.9269	57.2333	59.8994	62.0560	(42a)
Hot water usage for baths	26.9120	26.5123	25.9495	24.9117	24.1346	23.2730	22.8076	23.3665	23.9750	24.8970	25.9561	26.8210	(42b)
Hot water usage for other uses	37.8860	36.5083	35.1306	33.7530	32.3753	30.9976	30.9976	32.3753	33.7530	35.1306	36.5083	37.8860	(42c)

Average daily hot water use (litres/day) 116.8270 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	127.0926	124.3791	121.0744	116.0488	111.9679	107.5805	105.8941	109.1846	112.6548	117.2609	122.3639	126.7629	(44)
Energy conte	201.2836	177.1141	186.0868	158.8651	150.7303	132.2828	128.0698	135.1933	138.9147	159.1219	174.3298	198.4801	(45)
Energy content (annual)										Total = Sum(45)m =		1940.4723	
Distribution loss (46)m = 0.15 x (45)m	30.1925	26.5671	27.9130	23.8298	22.6095	19.8424	19.2105	20.2790	20.8372	23.8683	26.1495	29.7720	(46)

Water storage loss:

Store volume 150.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.2960 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.6998 (55)

Total storage loss	21.6950	19.5955	21.6950	20.9952	21.6950	20.9952	21.6950	21.6950	20.9952	21.6950	20.9952	21.6950	(56)
If cylinder contains dedicated solar storage	21.6950	19.5955	21.6950	20.9952	21.6950	20.9952	21.6950	21.6950	20.9952	21.6950	20.9952	21.6950	(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	246.2410	217.7209	231.0443	202.3723	195.6878	175.7900	173.0272	180.1507	182.4219	204.0794	217.8370	243.4376	(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	246.2410	217.7209	231.0443	202.3723	195.6878	175.7900	173.0272	180.1507	182.4219	204.0794	217.8370	243.4376	(64)
										Total per year (kWh/year) = Sum(64)m =		2469.8099	(64)
12Total per year (kWh/year)												2470	(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	102.8928	91.3758	97.8398	87.6284	86.0838	78.7898	78.5492	80.9177	80.9949	88.8740	92.7704	101.9606	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	113.5434	113.5434	113.5434	113.5434	113.5434	113.5434	113.5434	113.5434	113.5434	113.5434	113.5434	113.5434	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	104.2178	115.3840	104.2178	107.6918	104.2178	107.6918	104.2178	104.2178	107.6918	104.2178	107.6918	104.2178	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
199.6890 201.7611 196.5394 185.4229 171.3904 158.2017 149.3909 147.3188 152.5405 163.6570 177.6895 190.8782 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
34.3543 34.3543 34.3543 34.3543 34.3543 34.3543 34.3543 34.3543 34.3543 34.3543 34.3543 34.3543 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 0.0000 0.0000 0.0000 0.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-90.8348 -90.8348 -90.8348 -90.8348 -90.8348 -90.8348 -90.8348 -90.8348 -90.8348 -90.8348 -90.8348 -90.8348 (71)
Water heating gains (Table 5)
138.2967 135.9759 131.5051 121.7061 115.7040 109.4303 105.5768 108.7604 112.4929 119.4543 128.8478 137.0438 (72)
Total internal gains
502.2666 513.1841 492.3254 474.8838 451.3752 432.3868 416.2486 417.3600 429.7882 447.3922 474.2921 492.2029 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	10.3800	10.6334	0.4000	0.8000	0.7700	24.4767	(74)

Solar gains 24.4767 46.7762 79.4842 127.6719 171.9858 184.1159 171.8957 136.3773 95.5657 55.6809 30.1951 20.4050 (83)
Total gains 526.7432 559.9603 571.8095 602.5558 623.3610 616.5027 588.1443 553.7374 525.3540 503.0731 504.4873 512.6078 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	108.0939	108.6046	109.1202	111.7731	112.3193	115.1321	115.1321	115.7116	113.9902	112.3193	111.2323	110.1661	
alpha	8.2063	8.2403	8.2747	8.4515	8.4880	8.6755	8.6755	8.7141	8.5993	8.4880	8.4155	8.3444	
util living area	0.9846	0.9716	0.9426	0.8328	0.6488	0.4445	0.3205	0.3541	0.5664	0.8465	0.9604	0.9866	(86)
MIT	20.5952	20.6886	20.8061	20.9463	20.9934	20.9998	21.0000	21.0000	20.9983	20.9484	20.7798	20.5892	(87)
Th 2	20.3919	20.3946	20.3973	20.4109	20.4136	20.4271	20.4271	20.4299	20.4217	20.4136	20.4082	20.4028	(88)
util rest of house	0.9806	0.9646	0.9292	0.8040	0.6101	0.4049	0.2788	0.3102	0.5198	0.8138	0.9497	0.9832	(89)
MIT 2	19.9272	20.0454	20.1903	20.3605	20.4085	20.4270	20.4271	20.4299	20.4207	20.3673	20.1704	19.9290	(90)
Living area fraction									fLA = Living area / (4) =			0.2992	(91)
MIT	20.1270	20.2378	20.3745	20.5357	20.5835	20.5984	20.5985	20.6004	20.5935	20.5411	20.3527	20.1265	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.9770	20.0878	20.2245	20.3857	20.4335	20.4484	20.4485	20.4504	20.4435	20.3911	20.2027	19.9765	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9773	0.9605	0.9248	0.8027	0.6114	0.4063	0.2803	0.3118	0.5216	0.8124	0.9455	0.9801	(94)
Useful gains	514.7626	537.8360	528.8342	483.6850	381.1259	250.5032	164.8814	172.6595	274.0042	408.7093	476.9691	502.4149	(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	715.3883	689.8048	620.4007	506.8748	383.5412	250.5635	164.8833	172.6641	274.4986	429.9900	581.0453	706.3856	(97)
Space heating kWh	149.2655	102.1230	68.1255	16.6966	1.7970	0.0000	0.0000	0.0000	0.0000	15.8328	74.9349	151.7541	(98a)
Space heating requirement - total per year (kWh/year)												580.5295	
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	149.2655	102.1230	68.1255	16.6966	1.7970	0.0000	0.0000	0.0000	0.0000	15.8328	74.9349	151.7541	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												580.5295	
Space heating per m2											(98c) / (4) =	8.1730	(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 %) 88.8000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	149.2655	102.1230	68.1255	16.6966	1.7970	0.0000	0.0000	0.0000	0.0000	15.8328	74.9349	151.7541	(98)
Space heating efficiency (main heating system 1)	88.8000	88.8000	88.8000	88.8000	88.8000	0.0000	0.0000	0.0000	0.0000	88.8000	88.8000	88.8000	(210)
Space heating fuel (main heating system)	168.0918	115.0034	76.7179	18.8025	2.0236	0.0000	0.0000	0.0000	0.0000	17.8298	84.3861	170.8943	(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

246.2410	217.7209	231.0443	202.3723	195.6878	175.7900	173.0272	180.1507	182.4219	204.0794	217.8370	243.4376 (64)
Efficiency of water heater											79.8000 (216)
(217)m 82.9738	82.4687	81.6852	80.4212	79.8737	79.8000	79.8000	79.8000	79.8000	80.3866	81.9252	83.0315 (217)
Fuel for water heating, kWh/month											
296.7697	264.0041	282.8470	251.6404	244.9966	220.2882	216.8261	225.7528	228.5989	253.8724	265.8973	293.1870 (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 32.8061	29.6313	32.8061	31.7478	32.8061	31.7478	32.8061	32.8061	31.7478	32.8061	31.7478	32.8061 (231)
Lighting 23.2634	18.6628	16.8037	12.3111	9.5095	7.7693	8.6749	11.2759	14.6463	19.2167	21.7053	23.9100 (232)
Electricity generated by PVs (Appendix M) (negative quantity)											
(233a)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)											
(234a)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)											
(235a)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)											
(235c)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)											
(233b)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)											
(234b)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)											
(235b)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)											
(235d)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	653.7494 (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	3044.6806 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.1000)	
mechanical ventilation fans (SFP = 1.1000)	300.2651 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	386.2651 (231)
Electricity for lighting (calculated in Appendix L)	187.7489 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4272.4440 (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	653.7494	0.2100	137.2874	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3044.6806	0.2100	639.3829	(264)
Space and water heating			776.6703	(265)
Pumps, fans and electric keep-hot	386.2651	0.1387	53.5797	(267)
Energy for lighting	187.7489	0.1443	27.0980	(268)
Total CO2, kg/year			857.3480	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			12.0700	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	653.7494	1.1300	738.7368	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3044.6806	1.1300	3440.4891	(278)
Space and water heating			4179.2259	(279)
Pumps, fans and electric keep-hot	386.2651	1.5128	584.3419	(281)
Energy for lighting	187.7489	1.5338	287.9755	(282)
Total Primary energy kWh/year			5051.5433	(286)
Dwelling Primary energy Rate (DPER)			71.1200	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	71.0300	(1b)	x 3.1500	(2b) =	223.7445	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.0300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		223.7445	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1341 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3841 (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) =	0.2977 (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	0.3795	0.3721	0.3646	0.3274	0.3200	0.2828	0.2828	0.2753	0.2977	0.3200	0.3349	0.3498	(22b)
Effective ac	0.5720	0.5692	0.5665	0.5536	0.5512	0.5400	0.5400	0.5379	0.5443	0.5512	0.5561	0.5612	(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			2.0900	1.0000	2.0900			(26)
TER Opening Type (Uw = 1.20)			10.3800	1.1450	11.8855			(27)
External Wall 1	31.9700	10.3800	21.5900	0.1800	3.8862			(29a)
Corridor Wall	37.9800	2.0900	35.8900	0.1800	6.4602			(29a)
Total net area of external elements Aum(A, m2)			69.9500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.3219			(33)
Party Wall 1			46.5600	0.0000	0.0000			(32)

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

List of Thermal Bridges

	Length	Psi-value	Total
E7 Party floor between dwellings (in blocks of flats)	9.0800	0.0700	0.6356
E7 Party floor between dwellings (in blocks of flats)	24.1200	0.0700	1.6884
E16 Corner (normal)	6.3000	0.0900	0.5670
E18 Party wall between dwellings	12.6000	0.0600	0.7560
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	11.2200	0.0200	0.2244
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	29.5600	0.0000	0.0000
E17 Corner (inverted – internal area greater than external area)	6.3000	-0.0900	-0.5670
E2 Other lintels (including other steel lintels)	6.0000	0.0500	0.3000
E3 Sill	4.9900	0.0500	0.2495
E4 Jamb	16.6200	0.0500	0.8310

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.6849 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 29.0068 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.2353	42.0289	41.8265	40.8758	40.6979	39.8700	39.8700	39.7166	40.1889	40.6979	41.0578	41.4339	(38)
Heat transfer coeff	71.2421	71.0356	70.8333	69.8826	69.7047	68.8768	68.8768	68.7234	69.1957	69.7047	70.0646	70.4407	(39)

Average = Sum(39)m / 12 = 69.8818

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

HLP	1.0030	1.0001	0.9972	0.9838	0.9813	0.9697	0.9697	0.9675	0.9742	0.9813	0.9864	0.9917 (40)
HLP (average)												0.9838
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2709 (42)

Hot water usage for mixer showers

62.2947	61.3585	59.9943	57.3842	55.4580	53.3099	52.0890	53.4428	54.9269	57.2333	59.8994	62.0560 (42a)

Hot water usage for baths

26.9120	26.5123	25.9495	24.9117	24.1346	23.2730	22.8076	23.3665	23.9750	24.8970	25.9561	26.8210 (42b)

Hot water usage for other uses

37.8860	36.5083	35.1306	33.7530	32.3753	30.9976	30.9976	32.3753	33.7530	35.1306	36.5083	37.8860 (42c)

Average daily hot water use (litres/day) 116.8270 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	127.0926	124.3791	121.0744	116.0488	111.9679	107.5805	105.8941	109.1846	112.6548	117.2609	122.3639	126.7629	(44)
Energy conte	201.2836	177.1141	186.0868	158.8651	150.7303	132.2828	128.0698	135.1933	138.9147	159.1219	174.3298	198.4801	(45)
Energy content (annual)										Total = Sum(45)m =		1940.4723	
Distribution loss (46)m = 0.15 x (45)m													
	30.1925	26.5671	27.9130	23.8298	22.6095	19.8424	19.2105	20.2790	20.8372	23.8683	26.1495	29.7720	(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													
	247.8785	219.1999	232.6817	203.9569	197.3252	177.3746	174.6647	181.7882	184.0065	205.7168	219.4216	245.0750	(62)
WWHRS	-28.4785	-25.1866	-26.3740	-21.8387	-20.3529	-17.4161	-16.3248	-17.3598	-18.0194	-21.2429	-24.0656	-27.9511	(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													
	219.4000	194.0132	206.3077	182.1182	176.9723	159.9585	158.3398	164.4284	165.9871	184.4739	195.3560	217.1239	(64)
										Total per year (kWh/year) = Sum(64)m =		2224.4792	(64)
12Total per year (kWh/year)												2224	(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													
	104.2027	92.5590	99.1498	88.8961	87.3938	80.0575	79.8591	82.2277	82.2626	90.1840	94.0381	103.2706	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	113.5434	113.5434	113.5434	113.5434	113.5434	113.5434	113.5434	113.5434	113.5434	113.5434	113.5434	113.5434	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	107.0601	118.5308	107.0601	110.6287	107.0601	110.6287	107.0601	107.0601	110.6287	107.0601	110.6287	107.0601	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	199.6890	201.7611	196.5394	185.4229	171.3904	158.2017	149.3909	147.3188	152.5405	163.6570	177.6895	190.8782	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.3543	34.3543	34.3543	34.3543	34.3543	34.3543	34.3543	34.3543	34.3543	34.3543	34.3543	34.3543	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-90.8348	-90.8348	-90.8348	-90.8348	-90.8348	-90.8348	-90.8348	-90.8348	-90.8348	-90.8348	-90.8348	-90.8348	(71)
Water heating gains (Table 5)													
	140.0574	137.7366	133.2658	123.4668	117.4647	111.1910	107.3375	110.5211	114.2536	121.2150	130.6085	138.8045	(72)
Total internal gains													
	506.8695	518.0916	496.9283	479.5815	455.9782	437.0845	420.8516	421.9630	434.4859	451.9951	478.9898	496.8058	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	10.3800	10.6334	0.6300	0.7000	0.7700	33.7319	(74)

Solar gains	33.7319	64.4634	109.5391	175.9479	237.0179	253.7347	236.8938	187.9450	131.7015	76.7353	41.6127	28.1206	(83)
Total gains	540.6014	582.5550	606.4674	655.5294	692.9961	690.8192	657.7453	609.9079	566.1874	528.7304	520.6025	524.9264	(84)

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7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
tau	69.2377	69.4389	69.6373	70.5846	70.7648	71.6154	71.6154	71.7752	71.2854	70.7648	70.4013	70.0254	
alpha	5.6158	5.6293	5.6425	5.7056	5.7177	5.7744	5.7744	5.7850	5.7524	5.7177	5.6934	5.6684	
util living area	0.9935	0.9889	0.9784	0.9358	0.8213	0.6200	0.4579	0.5127	0.7708	0.9494	0.9866	0.9944	(86)
MIT	19.9879	20.1193	20.3267	20.6387	20.8769	20.9805	20.9971	20.9946	20.9360	20.6528	20.2841	19.9722	(87)
Th 2	20.0808	20.0833	20.0856	20.0968	20.0989	20.1087	20.1087	20.1105	20.1049	20.0989	20.0947	20.0903	(88)
util rest of house	0.9914	0.9854	0.9713	0.9150	0.7711	0.5413	0.3667	0.4165	0.6963	0.9286	0.9818	0.9927	(89)
MIT 2	18.9102	19.0788	19.3422	19.7320	19.9968	20.0977	20.1077	20.1086	20.0623	19.7570	19.2976	18.8973	(90)
Living area fraction										fLA = Living area / (4) =		0.2992	(91)
MIT	19.2326	19.3901	19.6367	20.0033	20.2601	20.3618	20.3738	20.3736	20.3237	20.0250	19.5927	19.2189	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2326	19.3901	19.6367	20.0033	20.2601	20.3618	20.3738	20.3736	20.3237	20.0250	19.5927	19.2189	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9889	0.9820	0.9670	0.9124	0.7808	0.5643	0.3941	0.4454	0.7158	0.9265	0.9783	0.9904	(94)
Useful gains	534.5950	572.0514	586.4360	598.1349	541.0891	389.8119	259.1870	271.6321	405.2938	489.8786	509.3016	519.9005	(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	1063.8330	1029.3157	930.5163	775.9246	596.6796	396.8551	259.9267	273.0826	430.6532	656.9661	875.2963	1057.9428	(97)
Space heating kWh	393.7531	307.2816	255.9957	128.0086	41.3593	0.0000	0.0000	0.0000	0.0000	124.3132	263.5162	400.3034	(98a)
Space heating requirement - total per year (kWh/year)												1914.5311	
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	393.7531	307.2816	255.9957	128.0086	41.3593	0.0000	0.0000	0.0000	0.0000	124.3132	263.5162	400.3034	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1914.5311	
Space heating per m2											(98c) / (4) =	26.9538	(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	393.7531	307.2816	255.9957	128.0086	41.3593	0.0000	0.0000	0.0000	0.0000	124.3132	263.5162	400.3034	(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)	426.6014	332.9161	277.3518	138.6875	44.8097	0.0000	0.0000	0.0000	0.0000	134.6838	285.4996	433.6982	(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	219.4000	194.0132	206.3077	182.1182	176.9723	159.9585	158.3398	164.4284	165.9871	184.4739	195.3560	217.1239	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.3554	85.0860	84.5448	83.2841	81.3621	79.8000	79.8000	79.8000	79.8000	83.1946	84.7316	85.4125	(217)
Fuel for water heating, kWh/month	257.0429	228.0200	244.0217	218.6710	217.5120	200.4493	198.4209	206.0506	208.0039	221.7380	230.5585	254.2063	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	22.2450	17.8457	16.0681	11.7722	9.0932	7.4292	8.2951	10.7823	14.0051	18.3755	20.7551	22.8632	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-13.4552	-20.3653	-31.3986	-37.9485	-43.2862	-41.2785	-40.7808	-37.3161	-31.6414	-24.4181	-15.2810	-11.4762	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.8784	-8.4142	-17.2142	-26.5945	-35.9045	-36.3494	-35.9184	-30.0651	-21.5907	-12.2651	-5.2508	-3.0480	(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	2074.2482 (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	2684.6951 (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)	179.5296 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-585.1393 (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	4439.3337 (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	2074.2482	0.2100	435.5921	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2684.6951	0.2100	563.7860	(264)
Space and water heating			999.3781	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	179.5296	0.1443	25.9117	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-348.6460	0.1331	-46.4147	
PV Unit electricity exported	-236.4933	0.1251	-29.5810	
Total			-75.9957	(269)
Total CO2, kg/year			961.2233	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.5300	(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	2074.2482	1.1300	2343.9005	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2684.6951	1.1300	3033.7055	(278)
Space and water heating			5377.6060	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	179.5296	1.5338	275.3685	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-348.6460	1.4919	-520.1578	
PV Unit electricity exported	-236.4933	0.4591	-108.5732	
Total			-628.7310	(283)
Total Primary energy kWh/year			5154.3443	(286)
Target Primary Energy Rate (TPER)			72.5700	(287)

Full SAP Calculation Printout

Property Reference	B1_03_2B_0.4g_Copy	Issued on Date	04/04/2023
Assessment Reference	B1_03_2B_Copy_Copy	Prop Type Ref	
Property			

SAP Rating	83 B	DER	13.96	TER	14.50
Environmental	90 B	% DER < TER			3.72
CO_2 Emissions (t/year)	0.79	DFEE	36.81	TFEE	36.12
Compliance Check	See BREL	% DFEE < TFEE			-1.90
% DPER < TPER	-4.48	DPER	81.29	TPER	77.80

Assessor Details	Miss Eleanor Ballinger	Assessor ID	M976-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	61.9000 (1b)	x	3.1500 (2b)	=	194.9850 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	194.9850	(5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys	0 * 80	= 0.0000	(6a)
Number of open flues	0 * 20	= 0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10	= 0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20	= 0.0000	(6d)
Number of flues attached to other heater	0 * 35	= 0.0000	(6e)
Number of blocked chimneys	0 * 20	= 0.0000	(6f)
Number of intermittent extract fans	0 * 10	= 0.0000	(7a)
Number of passive vents	0 * 10	= 0.0000	(7b)
Number of flueless gas fires	0 * 40	= 0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5)	= 0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	= 0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	= 0.1275	(21)

	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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.9000 (23c)

Effective ac	0.2531	0.2499	0.2467	0.2307	0.2276	0.2116	0.2116	0.2084	0.2180	0.2276	0.2339	0.2403	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.10)			16.2500	1.0536	17.1216			(27)
Door			2.0700	1.0000	2.0700			(26)
External Wall 1	52.6100	16.2500	36.3600	0.1600	5.8176			(29a)

Corridor Wall	16.0700	2.0700	14.0000	0.1500	2.1000	(29a)
Wall to Unheated	14.8100		14.8100	0.1500	2.2215	(29a)
Total net area of external elements Aum(A, m2)			83.4900			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.3307	(33)
Party Wall 1			21.1100	0.0000	0.0000	(32)
Party Floor 1			61.9000			(32d)
Party Ceiling 1			61.9000			(32b)

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)	21.2000	0.0700	1.4840
	E7 Party floor between dwellings (in blocks of flats)	10.2000	0.1100	1.1220
	E16 Corner (normal)	9.4500	0.0900	0.8505
	E18 Party wall between dwellings	3.1500	0.0600	0.1890
	E23 Balcony within or between dwellings, balcony support penetrates wall insulation	12.2000	0.0630	0.7686
	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	13.4000	0.0000	0.0000
	E17 Corner (inverted – internal area greater than external area)	3.1500	-0.0900	-0.2835
	E7 Party floor between dwellings (in blocks of flats)	9.4000	0.1100	1.0340
	E25 Staggered party wall between dwellings	3.1500	0.2400	0.7560
	E2 Other lintels (including other steel lintels)	9.3200	0.0600	0.5592
	E3 Sill	8.3200	0.0400	0.3328
	E4 Jamb	23.1400	0.0500	1.1570

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.9696 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 37.3003 (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	16.2833	16.0782	15.8731	14.8476	14.6425	13.6170	13.6170	13.4119	14.0272	14.6425	15.0527	15.4629	(38)
Heat transfer coeff	53.5837	53.3786	53.1735	52.1480	51.9429	50.9174	50.9174	50.7123	51.3276	51.9429	52.3531	52.7633	(39)

Average = Sum(39)m / 12 = 52.0967

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8656	0.8623	0.8590	0.8425	0.8391	0.8226	0.8226	0.8193	0.8292	0.8391	0.8458	0.8524	(40)
HLP (average)												0.8416	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0348 (42)

Hot water usage for mixer showers

58.3367	57.4600	56.1825	53.7383	51.9344	49.9228	48.7794	50.0473	51.4371	53.5969	56.0937	58.1132	(42a)

Hot water usage for baths

25.2099	24.8355	24.3083	23.3362	22.6082	21.8011	21.3651	21.8887	22.4587	23.3224	24.3145	25.1247	(42b)

Hot water usage for other uses

35.4685	34.1788	32.8890	31.5992	30.3095	29.0197	29.0197	30.3095	31.5992	32.8890	34.1788	35.4685	(42c)

Average daily hot water use (litres/day) 109.4022 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	119.0152	116.4743	113.3798	108.6736	104.8521	100.7436	99.1643	102.2454	105.4950	109.8083	114.5870	118.7064	(44)
Energy conte	188.4909	165.8579	174.2605	148.7688	141.1511	123.8760	119.9306	126.6012	130.0859	149.0088	163.2502	185.8656	(45)

Energy content (annual) Total = Sum(45)m = 1817.1475

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

28.2736	24.8787	26.1391	22.3153	21.1727	18.5814	17.9896	18.9902	19.5129	22.3513	24.4875	27.8798	(46)

Water storage loss:

Store volume 150.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.2960 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.6998 (55)

Total storage loss

21.6950	19.5955	21.6950	20.9952	21.6950	20.9952	21.6950	21.6950	20.9952	21.6950	20.9952	21.6950	(56)

If cylinder contains dedicated solar storage

21.6950	19.5955	21.6950	20.9952	21.6950	20.9952	21.6950	21.6950	20.9952	21.6950	20.9952	21.6950	(57)
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)
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)

Primary loss / Combi loss

Total heat required for water heating calculated for each month

233.4484	206.4646	219.2180	192.2760	186.1086	167.3832	164.8880	171.5586	173.5931	193.9663	206.7574	230.8230	(62)
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)
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)
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)
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)

WWHRS / PV diverter / Solar input / FGHRS

Output from w/h

233.4484	206.4646	219.2180	192.2760	186.1086	167.3832	164.8880	171.5586	173.5931	193.9663	206.7574	230.8230	(64)

Total per year (kWh/year) = Sum(64)m = 2346.4851 (64)

12Total per year (kWh/year) 2346 (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

98.6392	87.6331	93.9076	84.2714	82.8987	75.9945	75.8429	78.0608	78.0593	85.5114	89.0864	97.7663	(65)

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

Metabolic gains (Table 5), Watts

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

(66)m	101.7407	101.7407	101.7407	101.7407	101.7407	101.7407	101.7407	101.7407	101.7407	101.7407	101.7407	101.7407	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	89.6353	99.2391	89.6353	92.6232	89.6353	92.6232	89.6353	89.6353	92.6232	89.6353	92.6232	89.6353	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	177.7121	179.5562	174.9091	165.0161	152.5279	140.7907	132.9496	131.1055	135.7526	145.6456	158.1338	169.8710	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.1741	33.1741	33.1741	33.1741	33.1741	33.1741	33.1741	33.1741	33.1741	33.1741	33.1741	33.1741	(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)													
	-81.3925	-81.3925	-81.3925	-81.3925	-81.3925	-81.3925	-81.3925	-81.3925	-81.3925	-81.3925	-81.3925	-81.3925	(71)
Water heating gains (Table 5)													
	132.5796	130.4064	126.2199	117.0436	111.4230	105.5480	101.9393	104.9205	108.4157	114.9347	123.7312	131.4063	(72)
Total internal gains													
	456.4492	465.7239	447.2865	431.2050	410.1084	392.4841	378.0465	379.1836	390.3137	406.7378	431.0104	447.4348	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.6500	19.6403	0.4000	0.8000	0.7700	46.3853	(76)
South	5.6000	46.7521	0.4000	0.8000	0.7700	58.0593	(78)

Solar gains	104.4446	185.8257	270.5579	354.8372	409.7494	410.7047	394.4425	353.8640	300.3263	210.2294	126.6571	88.3136	(83)
Total gains	560.8938	651.5496	717.8444	786.0422	819.8578	803.1888	772.4890	733.0476	690.6400	616.9672	557.6675	535.7484	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	80.2224	80.5307	80.8413	82.4310	82.7565	84.4233	84.4233	84.7647	83.7486	82.7565	82.1081	81.4698	
alpha	6.3482	6.3687	6.3894	6.4954	6.5171	6.6282	6.6282	6.6510	6.5832	6.5171	6.4739	6.4313	
util living area													
	0.9801	0.9523	0.8935	0.7557	0.5814	0.4051	0.2900	0.3181	0.5097	0.8030	0.9517	0.9841	(86)
MIT	20.3697	20.5634	20.7630	20.9321	20.9882	20.9991	20.9999	20.9999	20.9961	20.9178	20.6388	20.3423	(87)
Th 2	20.1968	20.1996	20.2025	20.2167	20.2195	20.2338	20.2338	20.2367	20.2281	20.2195	20.2138	20.2082	(88)
util rest of house													
	0.9748	0.9408	0.8710	0.7179	0.5353	0.3569	0.2395	0.2654	0.4540	0.7609	0.9380	0.9797	(89)
MIT 2	19.4818	19.7220	19.9600	20.1558	20.2108	20.2333	20.2338	20.2366	20.2258	20.1483	19.8294	19.4569	(90)
Living area fraction										fLA = Living area / (4) =		0.4701	(91)
MIT	19.8992	20.1176	20.3375	20.5208	20.5763	20.5933	20.5940	20.5954	20.5879	20.5101	20.2099	19.8731	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.7492	19.9676	20.1875	20.3708	20.4263	20.4433	20.4440	20.4454	20.4379	20.3601	20.0599	19.7231	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9711	0.9370	0.8706	0.7256	0.5476	0.3701	0.2533	0.2798	0.4693	0.7689	0.9349	0.9764	(94)
Useful gains	544.6857	610.4938	624.9249	570.3281	448.9577	297.2675	195.7078	205.1218	324.0944	474.3837	521.3898	523.1237	(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													
	827.8270	804.2843	727.8099	598.1765	453.2677	297.5270	195.7241	205.1528	325.3099	506.9666	678.4907	819.0515	(97)
Space heating kWh													
	210.6571	130.2272	76.5464	20.0508	3.2066	0.0000	0.0000	0.0000	0.0000	24.2417	113.1126	220.1703	(98a)
Space heating requirement - total per year (kWh/year)												798.2128	
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													
	210.6571	130.2272	76.5464	20.0508	3.2066	0.0000	0.0000	0.0000	0.0000	24.2417	113.1126	220.1703	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												798.2128	
Space heating per m2											(98c) / (4) =	12.8952	(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 %)												88.8000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	210.6571	130.2272	76.5464	20.0508	3.2066	0.0000	0.0000	0.0000	0.0000	24.2417	113.1126	220.1703	(98)
Space heating efficiency (main heating system 1)													
	88.8000	88.8000	88.8000	88.8000	88.8000	0.0000	0.0000	0.0000	0.0000	88.8000	88.8000	88.8000	(210)
Space heating fuel (main heating system)													

	237.2264	146.6523	86.2009	22.5798	3.6111	0.0000	0.0000	0.0000	0.0000	27.2992	127.3791	247.9395 (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												
	233.4484	206.4646	219.2180	192.2760	186.1086	167.3832	164.8880	171.5586	173.5931	193.9663	206.7574	230.8230 (64)
Efficiency of water heater												79.8000 (216)
(217)m	83.8301	83.0559	81.9496	80.5711	79.9372	79.8000	79.8000	79.8000	79.8000	80.7087	82.7663	83.9539 (217)
Fuel for water heating, kWh/month												
	278.4779	248.5851	267.5035	238.6412	232.8184	209.7534	206.6266	214.9857	217.5352	240.3287	249.8085	274.9401 (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	29.5281	26.6706	29.5281	28.5756	29.5281	28.5756	29.5281	29.5281	28.5756	29.5281	28.5756	29.5281 (231)
Lighting	19.0233	15.2612	13.7410	10.0673	7.7763	6.3533	7.0938	9.2207	11.9768	15.7142	17.7492	19.5520 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	898.8883 (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	2880.0043 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.1000)	
mechanical ventilation fans (SFP = 1.1000)	261.6699 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	347.6699 (231)
Electricity for lighting (calculated in Appendix L)	153.5292 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4280.0917 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	898.8883	0.2100	188.7665	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2880.0043	0.2100	604.8009	(264)
Space and water heating			793.5675	(265)
Pumps, fans and electric keep-hot	347.6699	0.1387	48.2261	(267)
Energy for lighting	153.5292	0.1443	22.1590	(268)
Total CO2, kg/year			863.9526	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			13.9600	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	898.8883	1.1300	1015.7438	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2880.0043	1.1300	3254.4049	(278)
Space and water heating			4270.1487	(279)
Pumps, fans and electric keep-hot	347.6699	1.5128	525.9550	(281)
Energy for lighting	153.5292	1.5338	235.4881	(282)
Total Primary energy kWh/year			5031.5918	(286)
Dwelling Primary energy Rate (DPER)			81.2900	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	61.9000 (1b)	x	3.1500 (2b)	=	194.9850 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 61.9000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	194.9850	(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) =	0.1026 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3526 (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) =	0.2997 (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	0.3821	0.3746	0.3671	0.3297	0.3222	0.2847	0.2847	0.2772	0.2997	0.3222	0.3371	0.3521	(22b)
Effective ac	0.5730	0.5702	0.5674	0.5543	0.5519	0.5405	0.5405	0.5384	0.5449	0.5519	0.5568	0.5620	(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			2.0700	1.0000	2.0700			(26)
TER Opening Type (Uw = 1.20)			13.4000	1.1450	15.3435			(27)
External Wall 1	52.6100	13.4000	39.2100	0.1800	7.0578			(29a)
Corridor Wall	16.0700	2.0700	14.0000	0.1800	2.5200			(29a)
Wall to Unheated	14.8100		14.8100	0.1800	2.6658			(29a)
Total net area of external elements Aum(A, m2)			83.4900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.6571			(33)
Party Wall 1			21.1100	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)	21.2000	0.0700	1.4840
E7 Party floor between dwellings (in blocks of flats)	10.2000	0.0700	0.7140
E16 Corner (normal)	9.4500	0.0900	0.8505
E18 Party wall between dwellings	3.1500	0.0600	0.1890
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	12.2000	0.0200	0.2440
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	13.4000	0.0000	0.0000
E17 Corner (inverted – internal area greater than external area)	3.1500	-0.0900	-0.2835
E7 Party floor between dwellings (in blocks of flats)	9.4000	0.0700	0.6580
E25 Staggered party wall between dwellings	3.1500	0.0600	0.1890
E2 Other lintels (including other steel lintels)	9.3200	0.0500	0.4660
E3 Sill	8.3200	0.0500	0.4160
E4 Jamb	23.1400	0.0500	1.1570

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.0840 (36)

Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	35.7411 (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	36.8697	36.6873	36.5085	35.6688	35.5117	34.7803	34.7803	34.6448	35.0620	35.5117	35.8295	36.1618	(38)
Heat transfer coeff													
	72.6108	72.4284	72.2497	71.4099	71.2528	70.5214	70.5214	70.3859	70.8031	71.2528	71.5706	71.9029	(39)
Average = Sum(39)m / 12 =												71.4091	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1730	1.1701	1.1672	1.1536	1.1511	1.1393	1.1393	1.1371	1.1438	1.1511	1.1562	1.1616	(40)
HLP (average)												1.1536	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0348	(42)
Hot water usage for mixer showers													
	58.3367	57.4600	56.1825	53.7383	51.9344	49.9228	48.7794	50.0473	51.4371	53.5969	56.0937	58.1132	(42a)
Hot water usage for baths													
	25.2099	24.8355	24.3083	23.3362	22.6082	21.8011	21.3651	21.8887	22.4587	23.3224	24.3145	25.1247	(42b)
Hot water usage for other uses													
	35.4685	34.1788	32.8890	31.5992	30.3095	29.0197	29.0197	30.3095	31.5992	32.8890	34.1788	35.4685	(42c)
Average daily hot water use (litres/day)												109.4022	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	119.0152	116.4743	113.3798	108.6736	104.8521	100.7436	99.1643	102.2454	105.4950	109.8083	114.5870	118.7064	(44)
Energy conte	188.4909	165.8579	174.2605	148.7688	141.1511	123.8760	119.9306	126.6012	130.0859	149.0088	163.2502	185.8656	(45)
Energy content (annual)										Total = Sum(45)m =		1817.1475	
Distribution loss (46)m = 0.15 x (45)m													
	28.2736	24.8787	26.1391	22.3153	21.1727	18.5814	17.9896	18.9902	19.5129	22.3513	24.4875	27.8798	(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													
	235.0858	207.9436	220.8554	193.8606	187.7460	168.9679	166.5255	173.1961	175.1777	195.6037	208.3420	232.4605	(62)
WWHRS	-26.6691	-23.5864	-24.6983	-20.4512	-19.0598	-16.3096	-15.2876	-16.2568	-16.8745	-19.8932	-22.5366	-26.1752	(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													
	208.4167	184.3572	196.1571	173.4094	168.6863	152.6583	151.2379	156.9392	158.3032	175.7105	185.8054	206.2852	(64)
										Total per year (kWh/year) = Sum(64)m =		2117.9667	(64)
12Total per year (kWh/year)												2118	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	99.9492	88.8163	95.2176	85.5391	84.2087	77.2623	77.1528	79.3708	79.3270	86.8214	90.3542	99.0762	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	101.7407	101.7407	101.7407	101.7407	101.7407	101.7407	101.7407	101.7407	101.7407	101.7407	101.7407	101.7407	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	89.7225	99.3356	89.7225	92.7132	89.7225	92.7132	89.7225	89.7225	92.7132	89.7225	92.7132	89.7225	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	177.7121	179.5562	174.9091	165.0161	152.5279	140.7907	132.9496	131.1055	135.7526	145.6456	158.1338	169.8710	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.1741	33.1741	33.1741	33.1741	33.1741	33.1741	33.1741	33.1741	33.1741	33.1741	33.1741	33.1741	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-81.3925	-81.3925	-81.3925	-81.3925	-81.3925	-81.3925	-81.3925	-81.3925	-81.3925	-81.3925	-81.3925	-81.3925	(71)
Water heating gains (Table 5)													
	134.3403	132.1671	127.9806	118.8043	113.1837	107.3087	103.7000	106.6812	110.1764	116.6954	125.4919	133.1670	(72)
Total internal gains													
	458.2970	467.5811	449.1344	433.0558	411.9563	394.3349	379.8943	381.0314	392.1644	408.5857	432.8611	449.2826	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	8.7800	19.6403	0.6300	0.7000	0.7700	52.7004	(76)
South	4.6200	46.7521	0.6300	0.7000	0.7700	66.0107	(78)

Solar gains	118.7111	211.2017	307.4908	403.2570	465.6498	466.7309	448.2521	402.1460	341.3163	238.9339	143.9564	100.3776	(83)
Total gains	577.0081	678.7828	756.6252	836.3128	877.6061	861.0658	828.1465	783.1773	733.4808	647.5196	576.8175	549.6602	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.2007	59.3498	59.4966	60.1963	60.3290	60.9547	60.9547	61.0720	60.7122	60.3290	60.0611	59.7835	
alpha	4.9467	4.9567	4.9664	5.0131	5.0219	5.0636	5.0636	5.0715	5.0475	5.0219	5.0041	4.9856	
util living area	0.9865	0.9702	0.9356	0.8470	0.6998	0.5145	0.3731	0.4107	0.6348	0.8848	0.9714	0.9892	(86)
MIT	19.8905	20.1243	20.4135	20.7305	20.9160	20.9856	20.9977	20.9962	20.9602	20.7089	20.2484	19.8521	(87)
Th 2	19.9416	19.9440	19.9463	19.9573	19.9593	19.9689	19.9689	19.9707	19.9652	19.9593	19.9552	19.9508	(88)
util rest of house	0.9824	0.9616	0.9175	0.8089	0.6379	0.4358	0.2865	0.3202	0.5518	0.8460	0.9616	0.9858	(89)
MIT 2	18.6827	18.9767	19.3321	19.7060	19.8957	19.9615	19.9682	19.9695	19.9418	19.6947	19.1442	18.6410	(90)
Living area fraction									fLA = Living area / (4) =			0.4701	(91)
MIT	19.2505	19.5162	19.8405	20.1876	20.3753	20.4429	20.4522	20.4522	20.4205	20.1715	19.6633	19.2103	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2505	19.5162	19.8405	20.1876	20.3753	20.4429	20.4522	20.4522	20.4205	20.1715	19.6633	19.2103	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9790	0.9573	0.9154	0.8180	0.6636	0.4725	0.3273	0.3628	0.5894	0.8548	0.9582	0.9827	(94)
Useful gains	564.8641	649.8220	692.6423	684.0727	582.3685	406.8454	271.0134	284.1325	432.3409	553.4971	552.7155	540.1615	(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	1085.5699	1058.6272	963.8447	806.0499	618.1424	412.0498	271.6600	285.2156	447.5145	681.9961	899.1619	1079.2875	(97)
Space heating kWh	387.4051	274.7170	201.7746	87.8236	26.6158	0.0000	0.0000	0.0000	0.0000	95.6032	249.4415	401.1097	(98a)
Space heating requirement - total per year (kWh/year)												1724.4906	
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	387.4051	274.7170	201.7746	87.8236	26.6158	0.0000	0.0000	0.0000	0.0000	95.6032	249.4415	401.1097	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1724.4906	
Space heating per m2										(98c) / (4) =		27.8593	(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	387.4051	274.7170	201.7746	87.8236	26.6158	0.0000	0.0000	0.0000	0.0000	95.6032	249.4415	401.1097	(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)	419.7239	297.6349	218.6074	95.1502	28.8362	0.0000	0.0000	0.0000	0.0000	103.5788	270.2508	434.5718	(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	208.4167	184.3572	196.1571	173.4094	168.6863	152.6583	151.2379	156.9392	158.3032	175.7105	185.8054	206.2852	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.4297	84.9524	84.1232	82.6150	80.9176	79.8000	79.8000	79.8000	79.8000	82.7555	84.7210	85.5241	(217)
Fuel for water heating, kWh/month	243.9628	217.0124	233.1785	209.9008	208.4666	191.3011	189.5211	196.6657	198.3750	212.3250	219.3145	241.2012	(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	18.6426	14.9558	13.4660	9.8658	7.6206	6.2261	6.9518	9.0362	11.7371	15.3997	17.3939	19.1607	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.7636	-17.8275	-27.5246	-33.3202	-38.0620	-36.3233	-35.8883	-32.8114	-27.7816	-21.3978	-13.3682	-10.0311	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233b)m	-3.3420	-7.2527	-14.8397	-22.9266	-30.9498	-31.3265	-30.9523	-25.9088	-18.6081	-10.5702	-4.5246	-2.6262 (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	1868.3539 (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	2561.2247 (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)	150.4561 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-509.9271 (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	4156.1075 (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	1868.3539	0.2100	392.3543	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2561.2247	0.2100	537.8572	(264)
Space and water heating			930.2115	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	150.4561	0.1443	21.7155	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-306.0994	0.1331	-40.7405	
PV Unit electricity exported	-203.8277	0.1251	-25.4956	
Total			-66.2361	(269)
Total CO2, kg/year			897.6201	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.5000	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1868.3539	1.1300	2111.2399	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2561.2247	1.1300	2894.1839	(278)
Space and water heating			5005.4237	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	150.4561	1.5338	230.7746	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-306.0994	1.4918	-456.6432	
PV Unit electricity exported	-203.8277	0.4591	-93.5786	
Total			-550.2218	(283)
Total Primary energy kWh/year			4816.0774	(286)
Target Primary Energy Rate (TPER)			77.8000	(287)

Full SAP Calculation Printout

Property Reference	B2_04_2B_0.4g_Copy	Issued on Date	04/04/2023
Assessment Reference	00001_Copy_Copy	Prop Type Ref	
Property			

SAP Rating	83 B	DER	14.65	TER	16.39
Environmental	89 B	% DER < TER			10.62
CO_2 Emissions (t/year)	0.83	DFEE	39.90	TFEE	45.03
Compliance Check	See BREL	% DFEE < TFEE			11.39
% DPER < TPER	3.39	DPER	84.99	TPER	87.97

Assessor Details	Miss Eleanor Ballinger	Assessor ID	M976-0001
Client			

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

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		62.4700 (1b)	x	3.1500 (2b)	=	196.7805	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.4700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	196.7805	(5)

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2. Ventilation rate
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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1388 (21)

	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	0.1769	0.1734	0.1700	0.1526	0.1492	0.1318	0.1318	0.1283	0.1388	0.1492	0.1561	0.1630	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.9000 (23c)

Effective ac	0.2674	0.2639	0.2605	0.2431	0.2397	0.2223	0.2223	0.2188	0.2292	0.2397	0.2466	0.2535	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.10)			15.5700	1.0536	16.4052			(27)
External Wall 1	57.4600	15.5700	41.8900	0.1600	6.7024			(29a)
Corridor wall	10.4300		10.4300	0.1500	1.5645			(29a)

External Roof	33.1000	33.1000	0.0900	2.9790	(30)
Total net area of external elements Aum(A, m2)		100.9900			(31)
Fabric heat loss, W/K = Sum (A x U)		(26)...(30) + (32) =		27.6511	(33)
Party Wall 1		44.5100	0.0000	0.0000	(32)
Party Floor 1		62.4700			(32d)
Party Ceiling 1		29.3700			(32b)

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)	18.2400	0.0700	1.2768
E15 Flat roof with parapet	18.2400	0.3000	5.4720
E7 Party floor between dwellings (in blocks of flats)	6.6200	0.1100	0.7282
E16 Corner (normal)	9.4500	0.0900	0.8505
E18 Party wall between dwellings	3.1500	-0.0900	-0.2835
E25 Staggered party wall between dwellings	9.4500	0.2400	2.2680
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	24.1900	0.0000	0.0000
E2 Other lintels (including other steel lintels)	8.4200	0.0600	0.5052
E3 Sill	8.4200	0.0400	0.3368
E4 Jamb	21.6000	0.0500	1.0800
E24 Eaves (insulation at ceiling level - inverted)	14.4900	0.1500	2.1735

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 14.4075 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 42.0586 (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	17.3647	17.1395	16.9142	15.7879	15.5627	14.4364	14.4364	14.2112	14.8869	15.5627	16.0132	16.4637	(38)
Heat transfer coeff	59.4233	59.1980	58.9728	57.8465	57.6213	56.4950	56.4950	56.2698	56.9455	57.6213	58.0718	58.5223	(39)

Average = Sum(39)m / 12 = 57.7902

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9512	0.9476	0.9440	0.9260	0.9224	0.9044	0.9044	0.9007	0.9116	0.9224	0.9296	0.9368	(40)
HLP (average)												0.9251	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0505 (42)

Hot water usage for mixer showers	58.6004	57.7198	56.4365	53.9812	52.1692	50.1485	48.9999	50.2735	51.6696	53.8392	56.3472	58.3759 (42a)
Hot water usage for baths	25.3233	24.9472	24.4176	23.4411	22.7099	21.8991	21.4612	21.9871	22.5597	23.4273	24.4239	25.2377 (42b)
Hot water usage for other uses	35.6296	34.3340	33.0383	31.7427	30.4471	29.1515	29.1515	30.4471	31.7427	33.0383	34.3340	35.6296 (42c)

Average daily hot water use (litres/day) 109.8969 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	119.5533	117.0010	113.8924	109.1650	105.3262	101.1991	99.6126	102.7077	105.9720	110.3048	115.1051	119.2432	(44)
Energy conte	189.3432	166.6078	175.0484	149.4414	141.7893	124.4361	120.4728	127.1736	130.6741	149.6826	163.9883	186.7060	(45)

Energy content (annual) Total = Sum(45)m = 1825.3637

Distribution loss (46)m = 0.15 x (45)m	28.4015	24.9912	26.2573	22.4162	21.2684	18.6654	18.0709	19.0760	19.6011	22.4524	24.5982	28.0059 (46)

Water storage loss:

Store volume 150.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.2960 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.6998 (55)

Total storage loss

	21.6950	19.5955	21.6950	20.9952	21.6950	20.9952	21.6950	21.6950	20.9952	21.6950	20.9952	21.6950 (56)

If cylinder contains dedicated solar storage

	21.6950	19.5955	21.6950	20.9952	21.6950	20.9952	21.6950	21.6950	20.9952	21.6950	20.9952	21.6950 (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

	234.3007	207.2145	220.0059	192.9486	186.7468	167.9433	165.4303	172.1310	174.1813	194.6400	207.4955	231.6634 (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

	234.3007	207.2145	220.0059	192.9486	186.7468	167.9433	165.4303	172.1310	174.1813	194.6400	207.4955	231.6634 (64)

Total per year (kWh/year) = Sum(64)m = 2354.7013 (64)

12Total per year (kWh/year) 2355 (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

	98.9226	87.8825	94.1696	84.4950	83.1109	76.1808	76.0232	78.2512	78.2549	85.7354	89.3319	98.0457 (65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	102.5270	102.5270	102.5270	102.5270	102.5270	102.5270	102.5270	102.5270	102.5270	102.5270	102.5270	102.5270	(66)

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

	90.3508	100.0313	90.3508	93.3625	90.3508	93.3625	90.3508	90.3508	93.3625	90.3508	93.3625	90.3508 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	179.1306	180.9894	176.3052	166.3332	153.7454	141.9145	134.0108	132.1520	136.8362	146.8082	159.3960	171.2269 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	33.2527	33.2527	33.2527	33.2527	33.2527	33.2527	33.2527	33.2527	33.2527	33.2527	33.2527	33.2527 (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)												
	-82.0216	-82.0216	-82.0216	-82.0216	-82.0216	-82.0216	-82.0216	-82.0216	-82.0216	-82.0216	-82.0216	-82.0216 (71)
Water heating gains (Table 5)												
	132.9604	130.7775	126.5720	117.3542	111.7082	105.8066	102.1817	105.1763	108.6874	115.2358	124.0720	131.7819 (72)
Total internal gains												
	459.1999	468.5562	449.9861	433.8080	412.5625	394.8418	380.3014	381.4372	392.6441	409.1528	433.5887	450.1176 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	3.0700	19.6403	0.4000	0.8000	0.7700	13.3712 (76)
South	7.1900	46.7521	0.4000	0.8000	0.7700	74.5440 (78)
Southwest	3.7800	36.7938	0.4000	0.8000	0.7700	30.8425 (79)
West	1.5300	19.6403	0.4000	0.8000	0.7700	6.6638 (80)

Solar gains	125.4215	213.8128	291.9403	358.9640	398.2832	393.4001	380.1380	351.3336	315.3535	236.2481	150.2836	107.2835 (83)
Total gains	584.6215	682.3690	741.9264	792.7721	810.8457	788.2419	760.4395	732.7708	707.9976	645.4009	583.8723	557.4011 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	73.0050	73.2827	73.5627	74.9949	75.2881	76.7890	76.7890	77.0964	76.1815	75.2881	74.7040	74.1289	
alpha	5.8670	5.8855	5.9042	5.9997	6.0192	6.1193	6.1193	6.1398	6.0788	6.0192	5.9803	5.9419	
util living area													
	0.9811	0.9558	0.9084	0.7987	0.6413	0.4566	0.3267	0.3529	0.5480	0.8239	0.9555	0.9848	(86)
MIT	20.2543	20.4640	20.6770	20.8806	20.9716	20.9970	20.9997	20.9995	20.9911	20.8791	20.5543	20.2248	(87)
Th 2	20.1242	20.1272	20.1302	20.1455	20.1485	20.1638	20.1638	20.1669	20.1577	20.1485	20.1424	20.1363	(88)
util rest of house													
	0.9758	0.9447	0.8871	0.7606	0.5889	0.3979	0.2647	0.2892	0.4841	0.7811	0.9423	0.9806	(89)
MIT 2	19.2792	19.5401	19.7970	20.0363	20.1272	20.1622	20.1637	20.1667	20.1525	20.0426	19.6670	19.2519	(90)
Living area fraction										fLA = Living area / (4) =		0.4865	(91)
MIT	19.7536	19.9895	20.2251	20.4471	20.5380	20.5683	20.5704	20.5718	20.5605	20.4495	20.0987	19.7252	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.6036	19.8395	20.0751	20.2971	20.3880	20.4183	20.4204	20.4218	20.4105	20.2995	19.9487	19.5752	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9719	0.9403	0.8856	0.7677	0.6040	0.4159	0.2837	0.3087	0.5035	0.7892	0.9388	0.9771	(94)
Useful gains	568.2008	641.6652	657.0368	608.6215	489.7324	327.7966	215.7629	226.1921	356.4606	509.3520	548.1219	544.6160	(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													
	909.3888	884.3904	800.5621	659.2797	500.6109	328.7063	215.8325	226.3073	359.3525	558.9002	746.1444	899.7907	(97)
Space heating kWh													
	253.8438	163.1114	106.7828	36.4739	8.0936	0.0000	0.0000	0.0000	0.0000	36.8638	142.5762	264.2500	(98a)
Space heating requirement - total per year (kWh/year)												1011.9955	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	253.8438	163.1114	106.7828	36.4739	8.0936	0.0000	0.0000	0.0000	0.0000	36.8638	142.5762	264.2500	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1011.9955	
Space heating per m2											(98c) / (4) =	16.1997	(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 %)	88.8000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	253.8438	163.1114	106.7828	36.4739	8.0936	0.0000	0.0000	0.0000	0.0000	36.8638	142.5762	264.2500	(98)
Space heating efficiency (main heating system 1)													
	88.8000	88.8000	88.8000	88.8000	88.8000	0.0000	0.0000	0.0000	0.0000	88.8000	88.8000	88.8000	(210)
Space heating fuel (main heating system)													

	285.8602	183.6840	120.2509	41.0742	9.1145	0.0000	0.0000	0.0000	0.0000	41.5133	160.5588	297.5788 (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

234.3007	207.2145	220.0059	192.9486	186.7468	167.9433	165.4303	172.1310	174.1813	194.6400	207.4955	231.6634 (64)
Efficiency of water heater											79.8000 (216)
(217)m 84.2398	83.5288	82.5333	81.1069	80.1374	79.8000	79.8000	79.8000	79.8000	81.1090	83.2358	84.3557 (217)
Fuel for water heating, kWh/month											
278.1353	248.0756	266.5661	237.8943	233.0333	210.4553	207.3061	215.7031	218.2723	239.9734	249.2863	274.6270 (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 29.7328	26.8554	29.7328	28.7737	29.7328	28.7737	29.7328	29.7328	28.7737	29.7328	28.7737	29.7328 (231)
Lighting 19.2456	15.4396	13.9016	10.1849	7.8671	6.4275	7.1767	9.3285	12.1168	15.8979	17.9566	19.7805 (232)
Electricity generated by PVs (Appendix M) (negative quantity)											
(233a)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)											
(234a)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)											
(235a)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)											
(235c)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)											
(233b)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)											
(234b)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)											
(235b)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)											
(235d)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	1139.6346 (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	2879.3280 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.1000)	
mechanical ventilation fans (SFP = 1.1000)	264.0794 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	350.0794 (231)
Electricity for lighting (calculated in Appendix L)	155.3234 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4524.3654 (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	1139.6346	0.2100	239.3233	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2879.3280	0.2100	604.6589	(264)
Space and water heating			843.9821	(265)
Pumps, fans and electric keep-hot	350.0794	0.1387	48.5603	(267)
Energy for lighting	155.3234	0.1443	22.4180	(268)
Total CO2, kg/year			914.9604	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			14.6500	(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	1139.6346	1.1300	1287.7871	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2879.3280	1.1300	3253.6406	(278)
Space and water heating			4541.4277	(279)
Pumps, fans and electric keep-hot	350.0794	1.5128	529.6002	(281)
Energy for lighting	155.3234	1.5338	238.2402	(282)
Total Primary energy kWh/year			5309.2681	(286)
Dwelling Primary energy Rate (DPER)			84.9900	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	62.4700 (1b)	x	3.1500 (2b)	=	196.7805 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 62.4700						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	196.7805 (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) =	0.1016 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3516 (18)
Number of sides sheltered		1 (19)
Shelter factor (20) = 1 - [0.075 x (19)]	=	0.9250 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20)	=	0.3253 (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	0.4147	0.4066	0.3984	0.3578	0.3497	0.3090	0.3090	0.3009	0.3253	0.3497	0.3659	0.3822	(22b)
Effective ac	0.5860	0.5827	0.5794	0.5640	0.5611	0.5477	0.5477	0.5453	0.5529	0.5611	0.5669	0.5730	(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 Opening Type (Uw = 1.20)			15.5700	1.1450	17.8282			(27)
External Wall 1	57.4600	15.5700	41.8900	0.1800	7.5402			(29a)
Corridor wall	10.4300		10.4300	0.1800	1.8774			(29a)
External Roof	33.1000		33.1000	0.1100	3.6410			(30)
Total net area of external elements Aum(A, m2)			100.9900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.8868			(33)
Party Wall 1			44.5100	0.0000	0.0000			(32)

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

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E7 Party floor between dwellings (in blocks of flats)	18.2400	0.0700	1.2768
E15 Flat roof with parapet	18.2400	0.5600	10.2144
E7 Party floor between dwellings (in blocks of flats)	6.6200	0.0700	0.4634
E16 Corner (normal)	9.4500	0.0900	0.8505
E18 Party wall between dwellings	3.1500	0.0600	0.1890
E25 Staggered party wall between dwellings	9.4500	0.0600	0.5670
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	24.1900	0.0000	0.0000
E2 Other lintels (including other steel lintels)	8.4200	0.0500	0.4210
E3 Sill	8.4200	0.0500	0.4210
E4 Jamb	21.6000	0.0500	1.0800
E24 Eaves (insulation at ceiling level - inverted)	14.4900	0.2400	3.4776

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.9607 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 49.8475 (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	38.0529	37.8361	37.6235	36.6252	36.4384	35.5689	35.5689	35.4079	35.9039	36.4384	36.8163	37.2113	(38)

Heat transfer coeff

	87.9005	87.6836	87.4711	86.4728	86.2860	85.4165	85.4165	85.2555	85.7514	86.2860	86.6638	87.0589 (39)
Average = Sum(39)m / 12 =												86.4719

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4071	1.4036	1.4002	1.3842	1.3812	1.3673	1.3673	1.3647	1.3727	1.3812	1.3873	1.3936	(40)
HLP (average)												1.3842	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0505	(42)
Hot water usage for mixer showers													
	58.6004	57.7198	56.4365	53.9812	52.1692	50.1485	48.9999	50.2735	51.6696	53.8392	56.3472	58.3759	(42a)
Hot water usage for baths													
	25.3233	24.9472	24.4176	23.4411	22.7099	21.8991	21.4612	21.9871	22.5597	23.4273	24.4239	25.2377	(42b)
Hot water usage for other uses													
	35.6296	34.3340	33.0383	31.7427	30.4471	29.1515	29.1515	30.4471	31.7427	33.0383	34.3340	35.6296	(42c)
Average daily hot water use (litres/day)												109.8969	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	119.5533	117.0010	113.8924	109.1650	105.3262	101.1991	99.6126	102.7077	105.9720	110.3048	115.1051	119.2432	(44)
Energy conte	189.3432	166.6078	175.0484	149.4414	141.7893	124.4361	120.4728	127.1736	130.6741	149.6826	163.9883	186.7060	(45)
Energy content (annual)										Total = Sum(45)m =		1825.3637	
Distribution loss (46)m = 0.15 x (45)m													
	28.4015	24.9912	26.2573	22.4162	21.2684	18.6654	18.0709	19.0760	19.6011	22.4524	24.5982	28.0059	(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													
	235.9381	208.6935	221.6433	194.5333	188.3842	169.5280	167.0677	173.7685	175.7659	196.2775	209.0802	233.3009	(62)
WWHRS	-26.7897	-23.6930	-24.8099	-20.5436	-19.1459	-16.3833	-15.3567	-16.3303	-16.9508	-19.9831	-22.6384	-26.2936	(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													
	209.1485	185.0005	196.8334	173.9897	169.2383	153.1447	151.7110	157.4382	158.8151	176.2944	186.4417	207.0073	(64)
										Total per year (kWh/year) = Sum(64)m =		2125.0628	(64)
12Total per year (kWh/year)												2125	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	100.2325	89.0657	95.4795	85.7627	84.4209	77.4485	77.3331	79.5611	79.5226	87.0454	90.5996	99.3557	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	102.5270	102.5270	102.5270	102.5270	102.5270	102.5270	102.5270	102.5270	102.5270	102.5270	102.5270	102.5270	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	90.3508	100.0313	90.3508	93.3625	90.3508	93.3625	90.3508	90.3508	93.3625	90.3508	93.3625	90.3508	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	179.1306	180.9894	176.3052	166.3332	153.7454	141.9145	134.0108	132.1520	136.8362	146.8082	159.3960	171.2269	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.2527	33.2527	33.2527	33.2527	33.2527	33.2527	33.2527	33.2527	33.2527	33.2527	33.2527	33.2527	(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)													
	-82.0216	-82.0216	-82.0216	-82.0216	-82.0216	-82.0216	-82.0216	-82.0216	-82.0216	-82.0216	-82.0216	-82.0216	(71)
Water heating gains (Table 5)													
	134.7212	132.5382	128.3327	119.1149	113.4689	107.5673	103.9424	106.9370	110.4481	116.9965	125.8328	133.5426	(72)
Total internal gains													
	460.9607	470.3169	451.7469	435.5688	414.3232	396.6025	382.0621	383.1979	394.4048	410.9136	435.3494	451.8783	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.0700	19.6403	0.6300	0.7000	0.7700	18.4271	(76)
South	7.1900	46.7521	0.6300	0.7000	0.7700	102.7310	(78)
Southwest	3.7800	36.7938	0.6300	0.7000	0.7700	42.5049	(79)
West	1.5300	19.6403	0.6300	0.7000	0.7700	9.1835	(80)

Solar gains	172.8465	294.6607	402.3302	494.6973	548.8840	542.1545	523.8777	484.1816	434.5965	325.5793	207.1096	147.8500	(83)
Total gains	633.8072	764.9777	854.0771	930.2661	963.2072	938.7570	905.9399	867.3796	829.0014	736.4929	642.4590	599.7284	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.3535	49.4755	49.5958	50.1683	50.2769	50.7887	50.7887	50.8847	50.5904	50.2769	50.0577	49.8306	
alpha	4.2902	4.2984	4.3064	4.3446	4.3518	4.3859	4.3859	4.3923	4.3727	4.3518	4.3372	4.3220	
util living area	0.9843	0.9658	0.9322	0.8573	0.7324	0.5583	0.4097	0.4444	0.6578	0.8837	0.9684	0.9874	(86)
MIT	19.6164	19.8963	20.2251	20.5906	20.8403	20.9628	20.9923	20.9890	20.9236	20.5941	20.0419	19.5698	(87)
Th 2	19.7579	19.7606	19.7632	19.7754	19.7777	19.7885	19.7885	19.7905	19.7843	19.7777	19.7731	19.7682	(88)
util rest of house	0.9794	0.9555	0.9122	0.8173	0.6642	0.4627	0.2995	0.3315	0.5628	0.8414	0.9570	0.9833	(89)
MIT 2	18.2056	18.5565	18.9606	19.3950	19.6567	19.7697	19.7864	19.7872	19.7401	19.4138	18.7526	18.1540	(90)
Living area fraction										fLA = Living area / (4) =		0.4865	(91)
MIT	18.8919	19.2083	19.5757	19.9766	20.2325	20.3501	20.3730	20.3718	20.3158	19.9880	19.3798	18.8428	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8919	19.2083	19.5757	19.9766	20.2325	20.3501	20.3730	20.3718	20.3158	19.9880	19.3798	18.8428	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9748	0.9498	0.9086	0.8246	0.6910	0.5082	0.3533	0.3865	0.6063	0.8497	0.9524	0.9793	(94)
Useful gains	617.8446	726.5842	776.0002	767.0639	665.5879	477.0587	320.0387	335.2841	502.5945	625.7836	611.8639	587.3007	(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	1282.6346	1254.6007	1143.7497	957.8272	736.2332	491.1554	322.2787	338.6202	533.0176	810.0528	1064.2145	1274.7839	(97)
Space heating kWh	494.6037	354.8271	273.6056	137.3496	52.5601	0.0000	0.0000	0.0000	0.0000	137.0963	325.6925	511.4875	(98a)
Space heating requirement - total per year (kWh/year)												2287.2224	
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	494.6037	354.8271	273.6056	137.3496	52.5601	0.0000	0.0000	0.0000	0.0000	137.0963	325.6925	511.4875	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2287.2224	
Space heating per m2										(98c) / (4) =		36.6131	(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	494.6037	354.8271	273.6056	137.3496	52.5601	0.0000	0.0000	0.0000	0.0000	137.0963	325.6925	511.4875	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	535.8653	384.4280	296.4308	148.8078	56.9449	0.0000	0.0000	0.0000	0.0000	148.5333	352.8629	554.1577	(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	209.1485	185.0005	196.8334	173.9897	169.2383	153.1447	151.7110	157.4382	158.8151	176.2944	186.4417	207.0073	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.9202	85.4955	84.7985	83.5350	81.7638	79.8000	79.8000	79.8000	79.8000	83.5023	85.2978	86.0054	(217)
Fuel for water heating, kWh/month	243.4219	216.3862	232.1190	208.2835	206.9845	191.9106	190.1140	197.2909	199.0165	211.1253	218.5773	240.6912	(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	18.7731	15.0605	13.5603	9.9349	7.6740	6.2697	7.0005	9.0995	11.8193	15.5075	17.5157	19.2949	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.8690	-17.9857	-27.7662	-33.6094	-38.3890	-36.6337	-36.1945	-33.0927	-28.0221	-21.5857	-13.4873	-10.1211	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233b)m	-3.3757	-7.3255	-14.9882	-23.1554	-31.2582	-31.6390	-31.2615	-26.1683	-18.7949	-10.6766	-4.5703	-2.6528 (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	2478.0308 (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	2555.9210 (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)	151.5098 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-514.6227 (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	4756.8389 (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	2478.0308	0.2100	520.3865	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2555.9210	0.2100	536.7434	(264)
Space and water heating			1057.1299	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	151.5098	0.1443	21.8675	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-308.7563	0.1331	-41.0948	
PV Unit electricity exported	-205.8664	0.1251	-25.7507	
Total			-66.8455	(269)
Total CO2, kg/year			1024.0812	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			16.3900	(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	2478.0308	1.1300	2800.1748	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2555.9210	1.1300	2888.1907	(278)
Space and water heating			5688.3656	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	151.5098	1.5338	232.3908	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-308.7563	1.4918	-460.6092	
PV Unit electricity exported	-205.8664	0.4591	-94.5149	
Total			-555.1241	(283)
Total Primary energy kWh/year			5495.7330	(286)
Target Primary Energy Rate (TPER)			87.9700	(287)

Full SAP Calculation Printout

Property Reference	B2_05_2B_0.4g_Copy	Issued on Date	04/04/2023
Assessment Reference	B2_05_2B_Copy_Copy	Prop Type Ref	
Property			

SAP Rating	83 B	DER	14.06	TER	16.10
Environmental	89 B	% DER < TER			12.67
CO_2 Emissions (t/year)	0.96	DFEE	43.28	TFEE	48.07
Compliance Check	See BREL	% DFEE < TFEE			9.97
% DPER < TPER	5.34	DPER	81.59	TPER	86.19

Assessor Details	Miss Eleanor Ballinger	Assessor ID	M976-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.0600 (1b)	x	3.0200 (2b)	=	229.7012	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	229.7012	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.9000 (23c)

Effective ac	0.2387	0.2358	0.2329	0.2184	0.2155	0.2009	0.2009	0.1980	0.2067	0.2155	0.2213	0.2271	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.10)			17.2600	1.0536	18.1858			(27)
Door			1.6800	1.0000	1.6800			(26)
External Wall 1	54.7800	17.2600	37.5200	0.1600	6.0032			(29a)

Corridor Wall	32.1000	1.6800	30.4200	0.1500	4.5630	(29a)
External Roof 1	76.0600		76.0600	0.0900	6.8454	(30)
Total net area of external elements Aum(A, m2)			162.9400			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.2774	(33)
Party Wall 1			38.9900	0.0000	0.0000	(32)
Party Floor 1			76.0600			(32d)

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)	5.8600	0.0700	0.4102
E7 Party floor between dwellings (in blocks of flats)	10.6300	0.1100	1.1693
E16 Corner (normal)	6.0400	0.0900	0.5436
E18 Party wall between dwellings	6.0400	0.0600	0.3624
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	12.2800	0.0630	0.7736
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	12.9100	0.0000	0.0000
E17 Corner (inverted – internal area greater than external area)	6.0400	-0.0900	-0.5436
E25 Staggered party wall between dwellings	6.0400	0.2400	1.4496
P4 Party wall - Roof (insulation at ceiling level)	12.9100	0.0150	0.1936
E14 Flat roof	10.6300	0.1600	1.7008
E15 Flat roof with parapet	18.1400	0.3000	5.4420
E2 Other lintels (including other steel lintels)	9.1100	0.0600	0.5466
E3 Sill	8.3000	0.0400	0.3320
E4 Jamb	20.7800	0.0500	1.0390

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.4192 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 50.6966 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	18.0952	17.8749	17.6546	16.5531	16.3328	15.2313	15.2313	15.0110	15.6719	16.3328	16.7734	17.2140	(38)
Heat transfer coeff	68.7918	68.5715	68.3512	67.2497	67.0294	65.9280	65.9280	65.7077	66.3686	67.0294	67.4700	67.9106	(39)

Average = Sum(39)m / 12 = 67.1947

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9044	0.9015	0.8986	0.8842	0.8813	0.8668	0.8668	0.8639	0.8726	0.8813	0.8871	0.8929	(40)
HLP (average)												0.8834	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3839 (42)

Hot water usage for mixer showers

64.1891	63.2245	61.8188	59.1293	57.1445	54.9311	53.6730	55.0681	56.5973	58.9738	61.7210	63.9432	(42a)

Hot water usage for baths

27.7266	27.3149	26.7350	25.6658	24.8652	23.9775	23.4980	24.0738	24.7008	25.6507	26.7419	27.6329	(42b)

Hot water usage for other uses

39.0431	37.6233	36.2036	34.7838	33.3641	31.9443	31.9443	33.3641	34.7838	36.2036	37.6233	39.0431	(42c)

Average daily hot water use (litres/day) 120.3809 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	130.9588	128.1626	124.7573	119.5789	115.3738	110.8529	109.1153	112.5059	116.0819	120.8280	126.0862	130.6191	(44)
Energy conte	207.4067	182.5019	191.7474	163.6976	155.3153	136.3066	131.9656	139.3058	143.1405	163.9625	179.6329	204.5180	(45)
Energy content (annual)										Total = Sum(45)m =		1999.5009	
Distribution loss (46)m = 0.15 x (45)m	31.1110	27.3753	28.7621	24.5546	23.2973	20.4460	19.7948	20.8959	21.4711	24.5944	26.9449	30.6777	(46)

Water storage loss:

Store volume 150.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.2960 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.6998 (55)

Total storage loss

21.6950	19.5955	21.6950	20.9952	21.6950	20.9952	21.6950	21.6950	20.9952	21.6950	20.9952	21.6950	(56)

If cylinder contains dedicated solar storage

21.6950	19.5955	21.6950	20.9952	21.6950	20.9952	21.6950	21.6950	20.9952	21.6950	20.9952	21.6950	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

252.3642	223.1086	236.7048	207.2048	200.2728	179.8138	176.9230	184.2633	186.6477	208.9199	223.1401	249.4754	(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

252.3642	223.1086	236.7048	207.2048	200.2728	179.8138	176.9230	184.2633	186.6477	208.9199	223.1401	249.4754	(64)

Total per year (kWh/year) = Sum(64)m = 2528.8385 (64)

12Total per year (kWh/year) 2529 (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

104.9287	93.1673	99.7220	89.2352	87.6083	80.1277	79.8445	82.2851	82.4000	90.4835	94.5337	103.9682	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.1928	119.1928	119.1928	119.1928	119.1928	119.1928	119.1928	119.1928	119.1928	119.1928	119.1928	119.1928	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	106.4301	117.8334	106.4301	109.9778	106.4301	109.9778	106.4301	106.4301	109.9778	106.4301	109.9778	106.4301	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	211.0096	213.1993	207.6815	195.9348	181.1067	167.1704	157.8601	155.6705	161.1883	172.9350	187.7630	201.6993	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.9193	34.9193	34.9193	34.9193	34.9193	34.9193	34.9193	34.9193	34.9193	34.9193	34.9193	34.9193	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.3542	-95.3542	-95.3542	-95.3542	-95.3542	-95.3542	-95.3542	-95.3542	-95.3542	-95.3542	-95.3542	-95.3542	(71)
Water heating gains (Table 5)													
	141.0332	138.6417	134.0349	123.9378	117.7531	111.2885	107.3179	110.5983	114.4444	121.6176	131.2968	139.7422	(72)
Total internal gains													
	520.2308	531.4322	509.9043	491.6082	467.0478	447.1946	430.3660	431.4568	444.3683	462.7405	490.7955	509.6295	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
West	17.2600	19.6403	0.4000	0.8000	0.7700	75.1746	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	75.1746	147.0575	242.1828	353.2092	432.8711	443.1206	421.8689	362.3791	281.6686	174.4962	93.7339	61.8200	(83)
Total gains	595.4054	678.4897	752.0872	844.8174	899.9189	890.3152	852.2349	793.8359	726.0370	637.2366	584.5294	571.4494	(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, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.7816	77.0282	77.2765	78.5422	78.8004	80.1169	80.1169	80.3855	79.5850	78.8004	78.2858	77.7779	
alpha	6.1188	6.1352	6.1518	6.2361	6.2534	6.3411	6.3411	6.3590	6.3057	6.2534	6.2191	6.1852	
util living area													
	0.9913	0.9799	0.9487	0.8451	0.6697	0.4717	0.3401	0.3802	0.6175	0.8977	0.9794	0.9930	(86)
MIT	20.1759	20.3518	20.5900	20.8523	20.9693	20.9971	20.9997	20.9994	20.9858	20.8146	20.4592	20.1521	(87)
Th 2	20.1637	20.1662	20.1686	20.1810	20.1834	20.1958	20.1958	20.1983	20.1909	20.1834	20.1785	20.1736	(88)
util rest of house													
	0.9887	0.9742	0.9348	0.8114	0.6182	0.4135	0.2781	0.3143	0.5505	0.8656	0.9725	0.9909	(89)
MIT 2	19.2122	19.4354	19.7305	20.0420	20.1601	20.1943	20.1957	20.1981	20.1822	20.0108	19.5822	19.1898	(90)
Living area fraction										fLA = Living area / (4) =		0.4449	(91)
MIT	19.6409	19.8431	20.1129	20.4025	20.5201	20.5515	20.5534	20.5546	20.5397	20.3684	19.9724	19.6179	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.4909	19.6931	19.9629	20.2525	20.3701	20.4015	20.4034	20.4046	20.3897	20.2184	19.8224	19.4679	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9860	0.9702	0.9309	0.8146	0.6303	0.4284	0.2941	0.3313	0.5674	0.8671	0.9688	0.9886	(94)
Useful gains	587.0562	658.2906	700.0812	688.1773	567.2018	381.4481	250.6760	262.9761	411.9327	552.5558	566.2972	564.9214	(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													
	1045.0119	1014.3845	920.2062	763.4521	581.1514	382.4782	250.7517	263.1331	417.4416	644.7181	858.3802	1036.8545	(97)
Space heating kWh													
	340.7191	239.2951	163.7730	54.1978	10.3785	0.0000	0.0000	0.0000	0.0000	68.5687	210.2998	351.1182	(98a)
Space heating requirement - total per year (kWh/year)												1438.3502	
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													
	340.7191	239.2951	163.7730	54.1978	10.3785	0.0000	0.0000	0.0000	0.0000	68.5687	210.2998	351.1182	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1438.3502	
Space heating per m2											(98c) / (4) =	18.9107	(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 %)												88.8000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	340.7191	239.2951	163.7730	54.1978	10.3785	0.0000	0.0000	0.0000	0.0000	68.5687	210.2998	351.1182	(98)
Space heating efficiency (main heating system 1)													
	88.8000	88.8000	88.8000	88.8000	88.8000	0.0000	0.0000	0.0000	0.0000	88.8000	88.8000	88.8000	(210)
Space heating fuel (main heating system)													

	383.6927	269.4765	184.4290	61.0336	11.6875	0.0000	0.0000	0.0000	0.0000	77.2170	236.8241	395.4034 (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

	252.3642	223.1086	236.7048	207.2048	200.2728	179.8138	176.9230	184.2633	186.6477	208.9199	223.1401	249.4754 (64)
Efficiency of water heater												79.8000 (216)
(217)m	84.7336	84.2172	83.2505	81.5129	80.2005	79.8000	79.8000	79.8000	79.8000	81.8499	83.9271	84.8261 (217)
Fuel for water heating, kWh/month												
	297.8324	264.9206	284.3285	254.1988	249.7152	225.3306	221.7080	230.9064	233.8944	255.2477	265.8739	294.1022 (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	33.4850	30.2445	33.4850	32.4049	33.4850	32.4049	33.4850	33.4850	32.4049	33.4850	32.4049	33.4850 (231)
Lighting	24.2816	19.4796	17.5392	12.8500	9.9257	8.1094	9.0545	11.7694	15.2873	20.0578	22.6553	24.9564 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	1619.7637 (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	3078.0586 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.1000)	
mechanical ventilation fans (SFP = 1.1000)	308.2590 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	394.2590 (231)
Electricity for lighting (calculated in Appendix L)	195.9663 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	5288.0477 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1619.7637	0.2100	340.1504	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3078.0586	0.2100	646.3923	(264)
Space and water heating			986.5427	(265)
Pumps, fans and electric keep-hot	394.2590	0.1387	54.6886	(267)
Energy for lighting	195.9663	0.1443	28.2840	(268)
Total CO2, kg/year			1069.5153	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			14.0600	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1619.7637	1.1300	1830.3330	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3078.0586	1.1300	3478.2063	(278)
Space and water heating			5308.5392	(279)
Pumps, fans and electric keep-hot	394.2590	1.5128	596.4350	(281)
Energy for lighting	195.9663	1.5338	300.5797	(282)
Total Primary energy kWh/year			6205.5539	(286)
Dwelling Primary energy Rate (DPER)			81.5900	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.0600	(1b)	x 3.0200	(2b) =	229.7012	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		229.7012	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1306 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3806 (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) =	0.2950 (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	0.3761	0.3687	0.3613	0.3245	0.3171	0.2802	0.2802	0.2728	0.2950	0.3171	0.3318	0.3466	(22b)
Effective ac	0.5707	0.5680	0.5653	0.5526	0.5503	0.5393	0.5393	0.5372	0.5435	0.5503	0.5551	0.5601	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.6800	1.0000	1.6800			(26)
TER Opening Type (Uw = 1.20)			17.2600	1.1450	19.7634			(27)
External Wall 1	54.7800	17.2600	37.5200	0.1800	6.7536			(29a)
Corridor Wall	32.1000	1.6800	30.4200	0.1800	5.4756			(29a)
External Roof 1	76.0600		76.0600	0.1100	8.3666			(30)
Total net area of external elements Aum(A, m2)			162.9400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.0392			(33)
Party Wall 1			38.9900	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)	5.8600	0.0700	0.4102
E7 Party floor between dwellings (in blocks of flats)	10.6300	0.0700	0.7441
E16 Corner (normal)	6.0400	0.0900	0.5436
E18 Party wall between dwellings	6.0400	0.0600	0.3624
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	12.2800	0.0200	0.2456
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	12.9100	0.0000	0.0000
E17 Corner (inverted – internal area greater than external area)	6.0400	-0.0900	-0.5436
E25 Staggered party wall between dwellings	6.0400	0.0600	0.3624
P4 Party wall - Roof (insulation at ceiling level)	12.9100	0.1200	1.5492
E14 Flat roof	10.6300	0.0800	0.8504
E15 Flat roof with parapet	18.1400	0.5600	10.1584
E2 Other lintels (including other steel lintels)	9.1100	0.0500	0.4555
E3 Sill	8.3000	0.0500	0.4150
E4 Jamb	20.7800	0.0500	1.0390

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.5922 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 58.6314 (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	43.2614	43.0532	42.8492	41.8908	41.7115	40.8768	40.8768	40.7222	41.1983	41.7115	42.0742	42.4535	(38)
Heat transfer coeff	101.8927	101.6846	101.4805	100.5222	100.3428	99.5081	99.5081	99.3536	99.8297	100.3428	100.7056	101.0848	(39)
Average = Sum(39)m / 12 =												100.5213	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3396	1.3369	1.3342	1.3216	1.3193	1.3083	1.3083	1.3063	1.3125	1.3193	1.3240	1.3290	(40)
HLP (average)												1.3216	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3839	(42)
Hot water usage for mixer showers	64.1891	63.2245	61.8188	59.1293	57.1445	54.9311	53.6730	55.0681	56.5973	58.9738	61.7210	63.9432	(42a)
Hot water usage for baths	27.7266	27.3149	26.7350	25.6658	24.8652	23.9775	23.4980	24.0738	24.7008	25.6507	26.7419	27.6329	(42b)
Hot water usage for other uses	39.0431	37.6233	36.2036	34.7838	33.3641	31.9443	31.9443	33.3641	34.7838	36.2036	37.6233	39.0431	(42c)
Average daily hot water use (litres/day)												120.3809	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	130.9588	128.1626	124.7573	119.5789	115.3738	110.8529	109.1153	112.5059	116.0819	120.8280	126.0862	130.6191	(44)
Energy conte	207.4067	182.5019	191.7474	163.6976	155.3153	136.3066	131.9656	139.3058	143.1405	163.9625	179.6329	204.5180	(45)
Energy content (annual)										Total = Sum(45)m =		1999.5009	
Distribution loss (46)m = 0.15 x (45)m	31.1110	27.3753	28.7621	24.5546	23.2973	20.4460	19.7948	20.8959	21.4711	24.5944	26.9449	30.6777	(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	254.0016	224.5876	238.3423	208.7894	201.9102	181.3985	178.5605	185.9008	188.2324	210.5574	224.7248	251.1129	(62)
WWHRS	-29.3446	-25.9526	-27.1760	-22.5028	-20.9718	-17.9458	-16.8213	-17.8877	-18.5674	-21.8889	-24.7974	-28.8012	(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	224.6571	198.6350	211.1663	186.2866	180.9384	163.4527	161.7392	168.0130	169.6650	188.6685	199.9273	222.3117	(64)
									Total per year (kWh/year) = Sum(64)m =			2275.4608	(64)
12Total per year (kWh/year)												2275	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	106.2387	94.3505	101.0319	90.5029	88.9183	81.3954	81.1545	83.5951	83.6677	91.7934	95.8014	105.2782	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.1928	119.1928	119.1928	119.1928	119.1928	119.1928	119.1928	119.1928	119.1928	119.1928	119.1928	119.1928	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	106.4087	117.8097	106.4087	109.9557	106.4087	109.9557	106.4087	106.4087	109.9557	106.4087	109.9557	106.4087	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	211.0096	213.1993	207.6815	195.9348	181.1067	167.1704	157.8601	155.6705	161.1883	172.9350	187.7630	201.6993	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.9193	34.9193	34.9193	34.9193	34.9193	34.9193	34.9193	34.9193	34.9193	34.9193	34.9193	34.9193	(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)	-95.3542	-95.3542	-95.3542	-95.3542	-95.3542	-95.3542	-95.3542	-95.3542	-95.3542	-95.3542	-95.3542	-95.3542	(71)
Water heating gains (Table 5)	142.7939	140.4025	135.7956	125.6985	119.5138	113.0492	109.0786	112.3590	116.2051	123.3783	133.0575	141.5029	(72)
Total internal gains	521.9701	533.1692	511.6436	493.3468	468.7871	448.9331	432.1053	433.1961	446.1069	464.4798	492.5341	511.3688	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
West	17.2600	19.6403	0.6300	0.7000	0.7700	103.6000	(80)

Solar gains	103.6000	202.6637	333.7582	486.7664	596.5505	610.6756	581.3881	499.4038	388.1746	240.4775	129.1771	85.1956 (83)
Total gains	625.5701	735.8329	845.4018	980.1132	1065.3376	1059.6087	1013.4933	932.5998	834.2815	704.9573	621.7111	596.5644 (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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.8383	51.9444	52.0488	52.5451	52.6390	53.0805	53.0805	53.1631	52.9096	52.6390	52.4494	52.2526	
alpha	4.4559	4.4630	4.4699	4.5030	4.5093	4.5387	4.5387	4.5442	4.5273	4.5093	4.4966	4.4835	
util living area	0.9926	0.9843	0.9625	0.8944	0.7605	0.5757	0.4265	0.4801	0.7331	0.9375	0.9854	0.9940	(86)
MIT	19.5278	19.7558	20.1030	20.5357	20.8318	20.9633	20.9924	20.9873	20.8943	20.4768	19.9246	19.4915	(87)
Th 2	19.8099	19.8120	19.8141	19.8239	19.8258	19.8343	19.8343	19.8359	19.8310	19.8258	19.8221	19.8182	(88)
util rest of house	0.9902	0.9792	0.9501	0.8615	0.6956	0.4814	0.3164	0.3636	0.6412	0.9102	0.9797	0.9920	(89)
MIT 2	18.1302	18.4202	18.8555	19.3790	19.6954	19.8154	19.8322	19.8320	19.7657	19.3273	18.6439	18.0897	(90)
Living area fraction										fLA = Living area / (4) =		0.4449	(91)
MIT	18.7520	19.0144	19.4105	19.8936	20.2010	20.3261	20.3484	20.3460	20.2678	19.8387	19.2137	18.7134	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7520	19.0144	19.4105	19.8936	20.2010	20.3261	20.3484	20.3460	20.2678	19.8387	19.2137	18.7134	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9872	0.9746	0.9449	0.8637	0.7177	0.5224	0.3655	0.4156	0.6780	0.9105	0.9757	0.9894	(94)
Useful gains	617.5628	717.1630	798.8467	846.5431	764.6433	553.5047	370.4617	387.5816	565.6048	641.8862	606.6252	590.2552	(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	1472.5535	1435.2191	1310.1655	1105.1016	853.0148	569.7966	372.9956	392.0465	615.7298	927.0405	1219.9200	1467.0798	(97)
Space heating kWh	636.1131	482.5337	380.4212	186.1622	65.7483	0.0000	0.0000	0.0000	0.0000	212.1548	441.5722	652.3575	(98a)
Space heating requirement - total per year (kWh/year)												3057.0631	
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	636.1131	482.5337	380.4212	186.1622	65.7483	0.0000	0.0000	0.0000	0.0000	212.1548	441.5722	652.3575	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3057.0631	
Space heating per m2											(98c) / (4) =	40.1928	(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	636.1131	482.5337	380.4212	186.1622	65.7483	0.0000	0.0000	0.0000	0.0000	212.1548	441.5722	652.3575	(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)	689.1800	522.7884	412.1573	201.6925	71.2333	0.0000	0.0000	0.0000	0.0000	229.8535	478.4098	706.7796	(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	224.6571	198.6350	211.1663	186.2866	180.9384	163.4527	161.7392	168.0130	169.6650	188.6685	199.9273	222.3117	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.2609	85.9725	85.3635	84.0583	82.0155	79.8000	79.8000	79.8000	79.8000	84.3235	85.7847	86.3254	(217)
Fuel for water heating, kWh/month	260.4391	231.0448	247.3730	221.6160	220.6150	204.8280	202.6807	210.5426	212.6128	223.7436	233.0570	257.5275	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	22.1096	17.7372	15.9704	11.7006	9.0379	7.3840	8.2446	10.7167	13.9199	18.2637	20.6288	22.7241	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.3666	-21.7239	-33.4633	-40.4076	-46.0586	-43.9074	-43.3706	-39.6944	-33.6787	-26.0224	-16.3064	-12.2553	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)

Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-4.1946	-9.0937	-18.5920	-28.7060	-38.7400	-39.2177	-38.7601	-32.4584	-23.3230	-13.2585	-5.6795	-3.2975 (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	3312.0944 (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	2726.0800 (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)	178.4374 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-626.5760 (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	5676.0358 (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	3312.0944	0.2100	695.5398	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2726.0800	0.2100	572.4768	(264)
Space and water heating			1268.0166	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	178.4374	0.1443	25.7540	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-371.2551	0.1331	-49.4320	
PV Unit electricity exported	-255.3209	0.1251	-31.9393	
Total			-81.3713	(269)
Total CO2, kg/year			1224.3286	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			16.1000	(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	3312.0944	1.1300	3742.6667	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2726.0800	1.1300	3080.4704	(278)
Space and water heating			6823.1371	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	178.4374	1.5338	273.6932	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-371.2551	1.4920	-553.9168	
PV Unit electricity exported	-255.3209	0.4591	-117.2292	
Total			-671.1460	(283)
Total Primary energy kWh/year			6555.7851	(286)
Target Primary Energy Rate (TPER)			86.1900	(287)

Full SAP Calculation Printout

Property Reference	End House_0.35g_S/N	Issued on Date	04/04/2023
Assessment Reference	End House_S/N	Prop Type Ref	
Property			

SAP Rating	84 B	DER	12.13	TER	10.32
Environmental	89 B	% DER < TER			-17.54
CO_2 Emissions (t/year)	1.13	DFEE	37.19	TFEE	38.01
Compliance Check	See BREL	% DFEE < TFEE			2.16
% DPER < TPER	-32.22	DPER	71.16	TPER	53.82

Assessor Details	Miss Eleanor Ballinger	Assessor ID	M976-0001
Client			

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

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		53.4800 (1b)	x	2.5000 (2b)	=	133.7000 (1b)	-
First floor		53.4800 (1c)	x	2.8200 (2c)	=	150.8136 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.9600						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	284.5136	(5)

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2. Ventilation rate
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			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		0 * 10 =	0.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		0.0000 / (5) =	0.0000	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			4.0000	(17)
Infiltration rate			0.2000	(18)
Number of sides sheltered			1	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.1850	(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	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.2000 (23c)

Effective ac	0.3399	0.3353	0.3306	0.3075	0.3029	0.2797	0.2797	0.2751	0.2890	0.3029	0.3121	0.3214	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.10)			10.3900	1.0536	10.9473			(27)
Door			1.9200	1.0000	1.9200			(26)

Window(0.35g) (Uw = 1.10)			7.8900	1.0536	8.3132	(27)
Heatloss Floor 1			53.4800	0.1000	5.3480	(28a)
External Wall 1	110.0700	20.2000	89.8700	0.1600	14.3792	(29a)
External Roof 1	53.4800		53.4800	0.0900	4.8132	(30)
Total net area of external elements Aum(A, m2)			217.0300			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.7209	(33)
Party Wall 1			55.1200	0.0000	0.0000	(32)

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

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E5 Ground floor (normal)	20.6900	0.1600	3.3104
E6 Intermediate floor within a dwelling	20.6900	0.0000	0.0000
E16 Corner (normal)	10.6400	0.0900	0.9576
E18 Party wall between dwellings	10.6400	0.0600	0.6384
P2 Party wall - Intermediate floor within a dwelling	10.3600	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	10.3600	0.0150	0.1554
E10 Eaves (insulation at ceiling level)	20.6900	0.1200	2.4828
P1 Party wall - Ground floor	10.3600	0.1600	1.6576
E2 Other lintels (including other steel lintels)	11.0500	0.0600	0.6630
E3 Sill	10.1400	0.0400	0.4056
E4 Jamb	38.4200	0.0500	1.9210

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.1918 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 57.9127 (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	31.9107	31.4765	31.0422	28.8710	28.4368	26.2656	26.2656	25.8313	27.1341	28.4368	29.3053	30.1737	(38)
Heat transfer coeff	89.8234	89.3892	88.9549	86.7838	86.3495	84.1783	84.1783	83.7441	85.0468	86.3495	87.2180	88.0865	(39)

Average = Sum(39)m / 12 = 86.6752

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8398	0.8357	0.8317	0.8114	0.8073	0.7870	0.7870	0.7829	0.7951	0.8073	0.8154	0.8235	(40)
HLP (average)												0.8104	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7953 (42)

Hot water usage for mixer showers

71.0877	70.0194	68.4626	65.4841	63.2860	60.8347	59.4414	60.9864	62.6799	65.3119	68.3544	70.8153	(42a)

Hot water usage for baths

30.6933	30.2374	29.5955	28.4119	27.5257	26.5430	26.0122	26.6496	27.3436	28.3952	29.6031	30.5895	(42b)

Hot water usage for other uses

43.2566	41.6836	40.1107	38.5377	36.9647	35.3918	35.3918	36.9647	38.5377	40.1107	41.6836	43.2566	(42c)

Average daily hot water use (litres/day) 133.3221 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.0375	141.9404	138.1688	132.4337	127.7764	122.7695	120.8453	124.6007	128.5613	133.8177	139.6411	144.6614	(44)
Energy conte	229.7040	202.1213	212.3603	181.2952	172.0116	150.9594	146.1520	154.2817	158.5289	181.5893	198.9444	226.5048	(45)
Energy content (annual)										Total = Sum(45)m =		2214.4528	
Distribution loss (46)m = 0.15 x (45)m	34.4556	30.3182	31.8540	27.1943	25.8017	22.6439	21.9228	23.1423	23.7793	27.2384	29.8417	33.9757	(46)

Water storage loss:

Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2960	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.6998	(55)
Total storage loss	21.6950	19.5955	21.6950	20.9952	21.6950	20.9952	21.6950	21.6950	20.9952	21.6950	20.9952	21.6950	(56)
If cylinder contains dedicated solar storage	21.6950	19.5955	21.6950	20.9952	21.6950	20.9952	21.6950	21.6950	20.9952	21.6950	20.9952	21.6950	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	274.6614	242.7280	257.3177	224.8024	216.9691	194.4666	191.1094	199.2391	202.0361	226.5468	242.4516	271.4622	(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	274.6614	242.7280	257.3177	224.8024	216.9691	194.4666	191.1094	199.2391	202.0361	226.5468	242.4516	271.4622	(64)
										Total per year (kWh/year) = Sum(64)m =		2743.7904	(64)
12Total per year (kWh/year)												2744	(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	112.3425	99.6907	106.5758	95.0864	93.1598	84.9998	84.5615	87.2646	87.5166	96.3444	100.9548	111.2788	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	(66)

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

	136.0366	150.6119	136.0366	140.5711	136.0366	140.5711	136.0366	136.0366	140.5711	136.0366	140.5711	136.0366 (67)

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

	267.1138	269.8856	262.9007	248.0308	229.2602	211.6184	199.8327	197.0609	204.0457	218.9157	237.6863	255.3280 (68)

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

	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765 (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)

	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117 (71)

Water heating gains (Table 5)

	150.9980	148.3493	143.2470	132.0644	125.2148	118.0552	113.6579	117.2911	121.5509	129.4952	140.2150	149.5683 (72)

Total internal gains

	622.0778	636.7762	610.1137	588.5958	558.4409	535.1742	514.4565	515.3180	531.0971	552.3768	586.4018	608.8623 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	9.0500	10.6334	0.4500	0.8000	0.7700	24.0080 (74)
East	1.3400	19.6403	0.4500	0.8000	0.7700	6.5658 (76)
South	7.8900	46.7521	0.3500	0.8000	0.7700	71.5763 (78)

Solar gains	102.1501	175.9481	248.4366	324.8431	382.3648	388.5390	370.8143	326.0074	274.3214	196.2919	122.6460	87.2621 (83)
Total gains	724.2279	812.7243	858.5503	913.4388	940.8057	923.7131	885.2708	841.3254	805.4185	748.6687	709.0478	696.1244 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	82.6931	83.0948	83.5004	85.5895	86.0199	88.2386	88.2386	88.6962	87.3375	86.0199	85.1634	84.3237	
alpha	6.5129	6.5397	6.5667	6.7060	6.7347	6.8826	6.8826	6.9131	6.8225	6.7347	6.6776	6.6216	
util living area	0.9955	0.9895	0.9758	0.9224	0.7926	0.5772	0.4178	0.4568	0.7037	0.9353	0.9883	0.9964	(86)
MIT	20.1724	20.3250	20.5190	20.7783	20.9387	20.9940	20.9994	20.9990	20.9785	20.7886	20.4540	20.1622	(87)
Th 2	20.2190	20.2225	20.2260	20.2435	20.2470	20.2646	20.2646	20.2681	20.2576	20.2470	20.2400	20.2330	(88)
util rest of house	0.9941	0.9863	0.9684	0.9004	0.7455	0.5136	0.3483	0.3847	0.6377	0.9122	0.9842	0.9953	(89)
MIT 2	19.2513	19.4476	19.6941	20.0215	20.1968	20.2612	20.2644	20.2678	20.2437	20.0412	19.6261	19.2493	(90)
Living area fraction										fLA = Living area / (4) =		0.1537	(91)
MIT	19.3929	19.5825	19.8209	20.1378	20.3108	20.3739	20.3774	20.3802	20.3567	20.1561	19.7534	19.3896	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.2429	19.4325	19.6709	19.9878	20.1608	20.2239	20.2274	20.2302	20.2067	20.0061	19.6034	19.2396	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9916	0.9820	0.9617	0.8917	0.7397	0.5100	0.3448	0.3809	0.6330	0.9033	0.9795	0.9933	(94)
Useful gains	718.1723	798.1335	825.6353	814.5383	695.9608	471.0773	305.2155	320.4998	509.8007	676.2784	694.5160	691.4283	(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	1342.2194	1299.0446	1171.6200	962.2431	730.5875	473.4076	305.3472	320.7526	519.3524	812.2079	1090.5199	1324.7837	(97)
Space heating kWh	464.2911	336.6122	257.4126	106.3475	25.7623	0.0000	0.0000	0.0000	0.0000	101.1316	285.1227	471.2164	(98a)
Space heating requirement - total per year (kWh/year)												2047.8963	
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	464.2911	336.6122	257.4126	106.3475	25.7623	0.0000	0.0000	0.0000	0.0000	101.1316	285.1227	471.2164	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2047.8963	
Space heating per m2											(98c) / (4) =	19.1464	(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 %)	88.8000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	464.2911	336.6122	257.4126	106.3475	25.7623	0.0000	0.0000	0.0000	0.0000	101.1316	285.1227	471.2164	(98)
Space heating efficiency (main heating system 1)	88.8000	88.8000	88.8000	88.8000	88.8000	0.0000	0.0000	0.0000	0.0000	88.8000	88.8000	88.8000	(210)
Space heating fuel (main heating system)													

	522.8503	379.0678	289.8791	119.7607	29.0115	0.0000	0.0000	0.0000	0.0000	113.8869	321.0842	530.6491 (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												
	274.6614	242.7280	257.3177	224.8024	216.9691	194.4666	191.1094	199.2391	202.0361	226.5468	242.4516	271.4622 (64)
Efficiency of water heater												79.8000 (216)
(217)m	85.2273	84.7933	84.0606	82.4848	80.6677	79.8000	79.8000	79.8000	79.8000	82.3768	84.4243	85.2843 (217)
Fuel for water heating, kWh/month												
	322.2694	286.2585	306.1098	272.5380	268.9664	243.6925	239.4855	249.6731	253.1781	275.0130	287.1823	318.3029 (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	46.7340	42.2113	46.7340	45.2264	46.7340	45.2264	46.7340	46.7340	45.2264	46.7340	45.2264	46.7340 (231)
Lighting	33.7704	27.0919	24.3933	17.8715	13.8045	11.2784	12.5929	16.3688	21.2614	27.8961	31.5086	34.7090 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	2306.1895 (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	3322.6693 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.3375)	
mechanical ventilation fans (SFP = 1.3375)	464.2551 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	550.2551 (231)
Electricity for lighting (calculated in Appendix L)	272.5468 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	6451.6607 (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	2306.1895	0.2100	484.2998	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3322.6693	0.2100	697.7605	(264)
Space and water heating			1182.0604	(265)
Pumps, fans and electric keep-hot	550.2551	0.1387	76.3272	(267)
Energy for lighting	272.5468	0.1443	39.3369	(268)
Total CO2, kg/year			1297.7244	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			12.1300	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2306.1895	1.1300	2605.9942	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3322.6693	1.1300	3754.6163	(278)
Space and water heating			6360.6105	(279)
Pumps, fans and electric keep-hot	550.2551	1.5128	832.4259	(281)
Energy for lighting	272.5468	1.5338	418.0414	(282)
Total Primary energy kWh/year			7611.0778	(286)
Dwelling Primary energy Rate (DPER)			71.1600	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	53.4800 (1b)	x	2.5000 (2b)	=	133.7000 (1b)	-
First floor	53.4800 (1c)	x	2.8200 (2c)	=	150.8136 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.9600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	284.5136	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1406	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3906	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3613	(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	0.4607	0.4516	0.4426	0.3974	0.3884	0.3432	0.3432	0.3342	0.3613	0.3884	0.4065	0.4245	(22b)
Effective ac	0.6061	0.6020	0.5979	0.5790	0.5754	0.5589	0.5589	0.5558	0.5653	0.5754	0.5826	0.5901	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.9200	1.0000	1.9200			(26)
TER Opening Type (Uw = 1.20)			18.2800	1.1450	20.9313			(27)
Heatloss Floor 1			53.4800	0.1300	6.9524			(28a)
External Wall 1	110.0700	20.2000	89.8700	0.1800	16.1766			(29a)
External Roof 1	53.4800		53.4800	0.1100	5.8828			(30)
Total net area of external elements Aum(A, m2)			217.0300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.8631			(33)
Party Wall 1			55.1200	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
E5 Ground floor (normal)	20.6900	0.1600	3.3104
E6 Intermediate floor within a dwelling	20.6900	0.0000	0.0000
E16 Corner (normal)	10.6400	0.0900	0.9576
E18 Party wall between dwellings	10.6400	0.0600	0.6384
P2 Party wall - Intermediate floor within a dwelling	10.3600	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	10.3600	0.1200	1.2432
E10 Eaves (insulation at ceiling level)	20.6900	0.0600	1.2414
P1 Party wall - Ground floor	10.3600	0.0800	0.8288
E2 Other lintels (including other steel lintels)	11.0500	0.0500	0.5525
E3 Sill	10.1400	0.0500	0.5070
E4 Jamb	38.4200	0.0500	1.9210

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.2003 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 63.0634 (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	56.9065	56.5197	56.1405	54.3596	54.0263	52.4752	52.4752	52.1880	53.0727	54.0263	54.7004	55.4051	(38)
Heat transfer coeff													
	119.9699	119.5830	119.2039	117.4229	117.0897	115.5386	115.5386	115.2514	116.1361	117.0897	117.7638	118.4685	(39)
Average = Sum(39)m / 12 =												117.4214	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1216	1.1180	1.1145	1.0978	1.0947	1.0802	1.0802	1.0775	1.0858	1.0947	1.1010	1.1076	(40)
HLP (average)												1.0978	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7953	(42)
Hot water usage for mixer showers													
	71.0877	70.0194	68.4626	65.4841	63.2860	60.8347	59.4414	60.9864	62.6799	65.3119	68.3544	70.8153	(42a)
Hot water usage for baths													
	30.6933	30.2374	29.5955	28.4119	27.5257	26.5430	26.0122	26.6496	27.3436	28.3952	29.6031	30.5895	(42b)
Hot water usage for other uses													
	43.2566	41.6836	40.1107	38.5377	36.9647	35.3918	35.3918	36.9647	38.5377	40.1107	41.6836	43.2566	(42c)
Average daily hot water use (litres/day)												133.3221	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	145.0375	141.9404	138.1688	132.4337	127.7764	122.7695	120.8453	124.6007	128.5613	133.8177	139.6411	144.6614	(44)
Energy conte	229.7040	202.1213	212.3603	181.2952	172.0116	150.9594	146.1520	154.2817	158.5289	181.5893	198.9444	226.5048	(45)
Energy content (annual)										Total = Sum(45)m =		2214.4528	
Distribution loss (46)m = 0.15 x (45)m													
	34.4556	30.3182	31.8540	27.1943	25.8017	22.6439	21.9228	23.1423	23.7793	27.2384	29.8417	33.9757	(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													
	276.2989	244.2070	258.9552	226.3870	218.6065	196.0512	192.7469	200.8766	203.6207	228.1842	244.0362	273.0997	(62)
WWHRS	-32.4983	-28.7418	-30.0967	-24.9213	-23.2257	-19.8744	-18.6291	-19.8102	-20.5629	-24.2413	-27.4625	-31.8965	(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													
	243.8006	215.4652	228.8585	201.4657	195.3808	176.1768	174.1178	181.0664	183.0579	203.9429	216.5737	241.2032	(64)
										Total per year (kWh/year) = Sum(64)m =		2461.1094	(64)
12Total per year (kWh/year)												2461	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	113.6525	100.8739	107.8857	96.3541	94.4698	86.2675	85.8715	88.5746	88.7843	97.6544	102.2225	112.5888	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	138.8216	153.6953	138.8216	143.4489	138.8216	143.4489	138.8216	138.8216	143.4489	138.8216	143.4489	138.8216	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	267.1138	269.8856	262.9007	248.0308	229.2602	211.6184	199.8327	197.0609	204.0457	218.9157	237.6863	255.3280	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	(71)
Water heating gains (Table 5)													
	152.7587	150.1100	145.0077	133.8252	126.9755	119.8159	115.4186	119.0519	123.3116	131.2559	141.9757	151.3290	(72)
Total internal gains													
	626.6235	641.6203	614.6594	593.2343	562.9867	539.8127	519.0022	519.8637	535.7356	556.9225	591.0403	613.4080	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.0500	10.6334	0.6300	0.7000	0.7700	29.4098	(74)
East	1.3400	19.6403	0.6300	0.7000	0.7700	8.0431	(76)
South	7.8900	46.7521	0.6300	0.7000	0.7700	112.7326	(78)

Solar gains	150.1855	256.5647	356.5975	457.0009	529.9495	535.1963	512.1247	455.5660	390.6382	284.7104	179.9362	128.5431	(83)
Total gains	776.8090	898.1849	971.2569	1050.2352	1092.9362	1075.0090	1031.1270	975.4296	926.3739	841.6329	770.9765	741.9511	(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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.9137	62.1140	62.3115	63.2566	63.4366	64.2883	64.2883	64.4485	63.9575	63.4366	63.0735	62.6983	
alpha	5.1276	5.1409	5.1541	5.2171	5.2291	5.2859	5.2859	5.2966	5.2638	5.2291	5.2049	5.1799	
util living area	0.9952	0.9893	0.9769	0.9364	0.8379	0.6550	0.4870	0.5335	0.7738	0.9503	0.9894	0.9962	(86)
MIT	19.7605	19.9549	20.2135	20.5574	20.8247	20.9642	20.9937	20.9901	20.9143	20.5769	20.1161	19.7363	(87)
Th 2	19.9832	19.9861	19.9890	20.0026	20.0052	20.0170	20.0170	20.0192	20.0125	20.0052	20.0000	19.9946	(88)
util rest of house	0.9937	0.9859	0.9692	0.9149	0.7867	0.5678	0.3814	0.4249	0.6944	0.9289	0.9854	0.9950	(89)
MIT 2	18.5488	18.7980	19.1261	19.5574	19.8589	19.9968	20.0150	20.0158	19.9560	19.5901	19.0145	18.5263	(90)
Living area fraction										fLA = Living area / (4) =		0.1537	(91)
MIT	18.7350	18.9758	19.2933	19.7111	20.0073	20.1455	20.1655	20.1655	20.1033	19.7418	19.1838	18.7123	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7350	18.9758	19.2933	19.7111	20.0073	20.1455	20.1655	20.1655	20.1033	19.7418	19.1838	18.7123	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9909	0.9811	0.9621	0.9072	0.7869	0.5798	0.3976	0.4415	0.7024	0.9217	0.9807	0.9926	(94)
Useful gains	769.7342	881.2390	934.4940	952.8011	859.9913	623.2556	410.0060	430.6572	650.7248	775.7386	756.1002	736.4933	(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	1731.7696	1683.2246	1525.0058	1269.4747	972.7037	640.7217	411.9489	433.9804	697.1994	1070.4101	1423.0372	1719.2484	(97)
Space heating kWh	715.7543	538.9343	439.3408	228.0049	83.8580	0.0000	0.0000	0.0000	0.0000	219.2356	480.1946	731.1698	(98a)
Space heating requirement - total per year (kWh/year)												3436.4924	
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	715.7543	538.9343	439.3408	228.0049	83.8580	0.0000	0.0000	0.0000	0.0000	219.2356	480.1946	731.1698	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3436.4924	
Space heating per m2											(98c) / (4) =	32.1288	(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	715.7543	538.9343	439.3408	228.0049	83.8580	0.0000	0.0000	0.0000	0.0000	219.2356	480.1946	731.1698	(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)	775.4651	583.8942	475.9922	247.0259	90.8537	0.0000	0.0000	0.0000	0.0000	237.5250	520.2542	792.1666	(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	243.8006	215.4652	228.8585	201.4657	195.3808	176.1768	174.1178	181.0664	183.0579	203.9429	216.5737	241.2032	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.3263	86.0289	85.4974	84.3380	82.3051	79.8000	79.8000	79.8000	79.8000	84.2223	85.7925	86.3833	(217)
Fuel for water heating, kWh/month	282.4175	250.4569	267.6788	238.8789	237.3860	220.7729	218.1927	226.9002	229.3958	242.1485	252.4390	279.2243	(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	28.8444	23.1400	20.8350	15.2646	11.7908	9.6332	10.7560	13.9811	18.1600	23.8269	26.9125	29.6461	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-48.5931	-67.7782	-96.3850	-107.1503	-114.4813	-106.4238	-105.0458	-99.6466	-90.0166	-76.8661	-53.1380	-42.0924	(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	-29.7122	-62.2341	-123.2247	-184.4243	-243.2649	-244.2623	-241.4452	-204.7498	-150.4608	-88.8511	-39.6154	-23.5212 (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	3723.1770 (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	2945.8917 (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)	232.7907 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2643.3830 (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	4344.4764 (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	3723.1770	0.2100	781.8672	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2945.8917	0.2100	618.6372	(264)
Space and water heating			1400.5044	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	232.7907	0.1443	33.5989	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1007.6171	0.1348	-135.8582	
PV Unit electricity exported	-1635.7659	0.1260	-206.0978	
Total			-341.9560	(269)
Total CO2, kg/year			1104.0766	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.3200	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3723.1770	1.1300	4207.1901	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2945.8917	1.1300	3328.8576	(278)
Space and water heating			7536.0476	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	232.7907	1.5338	357.0621	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1007.6171	1.4983	-1509.7398	
PV Unit electricity exported	-1635.7659	0.4625	-756.5272	
Total			-2266.2670	(283)
Total Primary energy kWh/year			5756.9435	(286)
Target Primary Energy Rate (TPER)			53.8200	(287)

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Appendix B

DER Worksheets – Be Green

Full SAP Calculation Printout

Property Reference	B1_00_2B_Copy	Issued on Date	23/03/2023
Assessment Reference	B1_00_2B_Copy	Prop Type Ref	
Property			

SAP Rating	82 B	DER	4.62	TER	15.25
Environmental	96 A	% DER < TER			69.70
CO_2 Emissions (t/year)	0.28	DFEE	40.08	TFEE	39.77
Compliance Check	See BREL	% DFEE < TFEE			-0.79
% DPER < TPER	40.84	DPER	48.42	TPER	81.84

Assessor Details	Miss Nimco Ali	Assessor ID	R572-0001
Client			

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

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		62.5700 (1b)	x	3.1500 (2b)	=	197.0955 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.5700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	197.0955 (5)	

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.9000 (23c)

Effective ac	0.2531	0.2499	0.2467	0.2307	0.2276	0.2116	0.2116	0.2084	0.2180	0.2276	0.2339	0.2403	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			17.2800	1.1450	19.7863			(27)
Door			1.9500	1.0000	1.9500			(26)
Heatloss Floor 1			62.5700	0.1000	6.2570			(28a)

External Wall 1	50.1200	17.2800	32.8400	0.1600	5.2544	(29a)
Corrido Wall	5.0000	1.9500	3.0500	0.1500	0.4575	(29a)
Total net area of external elements Aum(A, m2)			117.6900			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.7052	(33)
Party Wall 1			44.8200	0.0000	0.0000	(32)
Party Ceiling 1			62.5700			(32b)

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

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	15.9100	0.0600	0.9546
E7 Party floor between dwellings (in blocks of flats)	10.3600	0.0700	0.7252
E5 Ground floor (normal)	1.5900	0.2600	0.4134
E7 Party floor between dwellings (in blocks of flats)	1.5900	0.1100	0.1749
E16 Corner (normal)	3.1500	0.0900	0.2835
E18 Party wall between dwellings	3.1500	0.0600	0.1890
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	5.5500	0.0630	0.3497
P1 Party wall - Ground floor	14.2300	0.0800	1.1384
E2 Other lintels (including other steel lintels)	9.1900	0.0600	0.5514
E3 Sill	8.2500	0.0400	0.3300
E4 Jamb	25.0600	0.0500	1.2530
E25 Staggered party wall between dwellings	9.4500	0.2400	2.2680

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.6311 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 42.3362 (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	16.4596	16.2522	16.0449	15.0083	14.8010	13.7644	13.7644	13.5571	14.1791	14.8010	15.2156	15.6303	(38)
Heat transfer coeff	58.7958	58.5885	58.3811	57.3445	57.1372	56.1006	56.1006	55.8933	56.5153	57.1372	57.5519	57.9665	(39)

Average = Sum(39)m / 12 = 57.2927

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9397	0.9364	0.9331	0.9165	0.9132	0.8966	0.8966	0.8933	0.9032	0.9132	0.9198	0.9264	(40)
HLP (average)												0.9157	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0533 (42)

Hot water usage for mixer showers	58.6465	57.7651	56.4808	54.0236	52.2102	50.1879	49.0385	50.3130	51.7102	53.8815	56.3915	58.4218 (42a)
Hot water usage for baths	25.3431	24.9667	24.4367	23.4595	22.7277	21.9163	21.4780	22.0043	22.5774	23.4456	24.4430	25.2575 (42b)
Hot water usage for other uses	35.6577	34.3611	33.0644	31.7678	30.4711	29.1745	29.1745	30.4711	31.7678	33.0644	34.3611	35.6577 (42c)

Average daily hot water use (litres/day) 109.9833 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	119.6473	117.0930	113.9820	109.2508	105.4090	101.2787	99.6909	102.7885	106.0553	110.3915	115.1956	119.3370	(44)
Energy conte	189.4921	166.7388	175.1861	149.5589	141.9008	124.5340	120.5676	127.2736	130.7768	149.8003	164.1173	186.8528	(45)
Energy content (annual)										Total = Sum(45)m =		1826.7991	
Distribution loss (46)m = 0.15 x (45)m	28.4238	25.0108	26.2779	22.4338	21.2851	18.6801	18.0851	19.0910	19.6165	22.4700	24.6176	28.0279	(46)

Water storage loss:

Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2960	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.6998	(55)
Total storage loss	21.6950	19.5955	21.6950	20.9952	21.6950	20.9952	21.6950	21.6950	20.9952	21.6950	20.9952	21.6950	(56)
If cylinder contains dedicated solar storage	21.6950	19.5955	21.6950	20.9952	21.6950	20.9952	21.6950	21.6950	20.9952	21.6950	20.9952	21.6950	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	211.1872	186.3343	196.8811	170.5541	163.5959	145.5292	142.2626	148.9686	151.7720	171.4953	185.1125	208.5479	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	211.1872	186.3343	196.8811	170.5541	163.5959	145.5292	142.2626	148.9686	151.7720	171.4953	185.1125	208.5479	(64)
										Total per year (kWh/year) = Sum(64)m =		2082.2407	(64)
12Total per year (kWh/year)												2082	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	63.0061	55.4407	58.2494	49.7283	47.1820	41.4075	40.0887	42.3185	43.4833	49.8086	54.5690	62.1286	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	102.6644	102.6644	102.6644	102.6644	102.6644	102.6644	102.6644	102.6644	102.6644	102.6644	102.6644	102.6644	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
90.4760 100.1699 90.4760 93.4919 90.4760 93.4919 90.4760 90.4760 93.4919 90.4760 93.4919 90.4760 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
179.3789 181.2403 176.5496 166.5638 153.9585 142.1113 134.1966 132.3352 137.0258 147.0117 159.6170 171.4642 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
33.2664 33.2664 33.2664 33.2664 33.2664 33.2664 33.2664 33.2664 33.2664 33.2664 33.2664 33.2664 (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)
-82.1315 -82.1315 -82.1315 -82.1315 -82.1315 -82.1315 -82.1315 -82.1315 -82.1315 -82.1315 -82.1315 -82.1315 (71)
Water heating gains (Table 5)
84.6857 82.5010 78.2922 69.0671 63.4167 57.5105 53.8827 56.8797 60.3935 66.9470 75.7903 83.5061 (72)
Total internal gains
408.3399 417.7105 399.1172 382.9222 361.6505 346.9130 332.3546 333.4902 344.7106 358.2341 382.6985 399.2457 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
South	6.7600	46.7521	0.4000	0.8000	0.7700	70.0859	(78)
West	10.5200	19.6403	0.4000	0.8000	0.7700	45.8191	(80)

Solar gains 115.9050 204.4145 293.8236 380.5338 436.0387 435.8047 419.0502 378.1179 324.4140 230.1596 140.2067 98.2400 (83)
Total gains 524.2449 622.1250 692.9408 763.4559 797.6892 782.7177 751.4049 711.6081 669.1245 588.3936 522.9052 497.4858 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	73.9022	74.1637	74.4271	75.7725	76.0474	77.4526	77.4526	77.7399	76.8843	76.0474	75.4995	74.9595	
alpha	5.9268	5.9442	5.9618	6.0515	6.0698	6.1635	6.1635	6.1827	6.1256	6.0698	6.0333	5.9973	
util living area	0.9885	0.9696	0.9268	0.8141	0.6461	0.4567	0.3283	0.3609	0.5737	0.8628	0.9720	0.9912	(86)
Living	20.1740	20.3938	20.6356	20.8706	20.9714	20.9971	20.9997	20.9995	20.9891	20.8450	20.4783	20.1414	
Non living	19.3955	19.6116	19.8422	20.0605	20.1396	20.1692	20.1703	20.1731	20.1597	20.0473	19.7080	19.3727	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	15	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	16	28	18	0	0	0	0	0	0	0	0	31	
MIT	20.7585	20.6567	20.7274	20.8706	20.9714	20.9971	20.9997	20.9995	20.9891	20.8450	20.4783	20.5137	(87)
Th 2	20.1339	20.1367	20.1395	20.1535	20.1563	20.1704	20.1704	20.1732	20.1648	20.1563	20.1507	20.1451	(88)
util rest of house	0.9852	0.9614	0.9086	0.7772	0.5940	0.3984	0.2665	0.2963	0.5081	0.8245	0.9629	0.9886	(89)
MIT 2	19.9181	19.8393	19.9171	20.0605	20.1396	20.1692	20.1703	20.1731	20.1597	20.0473	19.7080	19.7076	(90)
Living area fraction										fLA = Living area / (4) =		0.4680	(91)
MIT	20.3114	20.2218	20.2963	20.4396	20.5288	20.5566	20.5584	20.5598	20.5478	20.4206	20.0685	20.0849	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3114	20.2218	20.2963	20.4396	20.5288	20.5566	20.5584	20.5598	20.5478	20.4206	20.0685	20.0849	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9860	0.9623	0.9122	0.7902	0.6174	0.4256	0.2954	0.3265	0.5385	0.8374	0.9619	0.9884	(94)
Useful gains	516.8859	598.6923	632.1347	603.3030	492.4986	333.1597	221.9845	232.3483	360.3363	492.7145	502.9770	491.7101	(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	941.4009	897.6808	805.4408	661.7304	504.4548	334.1711	222.0699	232.5036	364.4008	561.1216	746.3595	920.7899	(97)
Space heating kWh	315.8392	200.9203	128.9397	42.0677	8.8954	0.0000	0.0000	0.0000	0.0000	50.8948	175.2354	319.2354	(98a)
Space heating requirement - total per year (kWh/year)												1242.0279	
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	315.8392	200.9203	128.9397	42.0677	8.8954	0.0000	0.0000	0.0000	0.0000	50.8948	175.2354	319.2354	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1242.0279	
Space heating per m2											(98c) / (4) =	19.8502	(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 %) 253.8364 (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												

	315.8392	200.9203	128.9397	42.0677	8.8954	0.0000	0.0000	0.0000	0.0000	50.8948	175.2354	319.2354 (98)
Space heating efficiency (main heating system 1)												
	253.8364	253.8364	253.8364	253.8364	253.8364	0.0000	0.0000	0.0000	0.0000	253.8364	253.8364	253.8364 (210)
Space heating fuel (main heating system)												
	124.4263	79.1535	50.7964	16.5728	3.5044	0.0000	0.0000	0.0000	0.0000	20.0503	69.0348	125.7643 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating

Water heating requirement

	211.1872	186.3343	196.8811	170.5541	163.5959	145.5292	142.2626	148.9686	151.7720	171.4953	185.1125	208.5479 (64)
Efficiency of water heater												138.8163 (216)
(217)m	138.8163	138.8163	138.8163	138.8163	138.8163	138.8163	138.8163	138.8163	138.8163	138.8163	138.8163	138.8163 (217)
Fuel for water heating, kWh/month												
	152.1343	134.2309	141.8286	122.8632	117.8506	104.8358	102.4827	107.3135	109.3331	123.5412	133.3507	150.2330 (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	16.0715	14.5162	16.0715	15.5531	16.0715	15.5531	16.0715	16.0715	15.5531	16.0715	15.5531	16.0715 (231)
Lighting	19.2846	15.4708	13.9297	10.2055	7.8830	6.4405	7.1912	9.3474	12.1413	15.9300	17.9929	19.8206 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-10.1527	-17.6614	-31.6498	-42.6979	-51.7910	-50.4335	-49.3774	-43.2888	-33.3312	-22.3464	-12.0328	-8.3164 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	489.3026 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	138.8163
Water heating fuel used	1499.9978 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.1000)	
mechanical ventilation fans (SFP = 1.1000)	189.2290 (230a)
Total electricity for the above, kWh/year	189.2290 (231)
Electricity for lighting (calculated in Appendix L)	155.6376 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-373.0792 (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	1961.0878 (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	489.3026	0.1578	77.2010	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1499.9978	0.1412	211.8395	(264)
Space and water heating			289.0406	(265)
Pumps, fans and electric keep-hot	189.2290	0.1387	26.2484	(267)
Energy for lighting	155.6376	0.1443	22.4633	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-373.0792	0.1311	-48.9246	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-48.9246	(269)
Total CO2, kg/year			288.8276	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.6200	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	489.3026	1.5840	775.0762	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1499.9978	1.5222	2283.3278	(278)
Space and water heating			3058.4039	(279)

Pumps, fans and electric keep-hot	189.2290	1.5128	286.2657 (281)
Energy for lighting	155.6376	1.5338	238.7221 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-373.0792	1.4845	-553.8234
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-553.8234 (283)
Total Primary energy kWh/year			3029.5683 (286)
Dwelling Primary energy Rate (DPER)			48.4200 (287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	62.5700 (1b)	x	3.1500 (2b)	=	197.0955 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.5700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	197.0955 (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) =	0.1015	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3515	(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) =	0.2988	(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	0.3809	0.3734	0.3660	0.3286	0.3212	0.2838	0.2838	0.2763	0.2988	0.3212	0.3361	0.3510	(22b)
Effective ac	0.5725	0.5697	0.5670	0.5540	0.5516	0.5403	0.5403	0.5382	0.5446	0.5516	0.5565	0.5616	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.9500	1.0000	1.9500			(26)
TER Opening Type (Uw = 1.20)			13.6900	1.1450	15.6756			(27)
Heatloss Floor 1			62.5700	0.1300	8.1341			(28a)
External Wall 1	50.1200	13.6900	36.4300	0.1800	6.5574			(29a)
Corrido Wall	5.0000	1.9500	3.0500	0.1800	0.5490			(29a)
Total net area of external elements Aum(A, m2)			117.6900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.8661			(33)
Party Wall 1			44.8200	0.0000	0.0000			(32)

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

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E5 Ground floor (normal)	15.9100	0.1600	2.5456
E7 Party floor between dwellings (in blocks of flats)	10.3600	0.0700	0.7252
E5 Ground floor (normal)	1.5900	0.1600	0.2544
E7 Party floor between dwellings (in blocks of flats)	1.5900	0.0700	0.1113
E16 Corner (normal)	3.1500	0.0900	0.2835

E18 Party wall between dwellings	3.1500	0.0600	0.1890	
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	5.5500	0.0200	0.1110	
P1 Party wall - Ground floor	14.2300	0.0800	1.1384	
E2 Other lintels (including other steel lintels)	9.1900	0.0500	0.4595	
E3 Sill	8.2500	0.0500	0.4125	
E4 Jamb	25.0600	0.0500	1.2530	
E25 Staggered party wall between dwellings	9.4500	0.0600	0.5670	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.0504 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 40.9165 (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	37.2393	37.0560	36.8764	36.0329	35.8751	35.1403	35.1403	35.0043	35.4233	35.8751	36.1943	36.5281	(38)
Heat transfer coeff	78.1557	77.9725	77.7929	76.9494	76.7915	76.0568	76.0568	75.9207	76.3398	76.7915	77.1108	77.4446	(39)
Average = Sum(39)m / 12 =												76.9486	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2491	1.2462	1.2433	1.2298	1.2273	1.2155	1.2155	1.2134	1.2201	1.2273	1.2324	1.2377	(40)
HLP (average)												1.2298	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0533 (42)
Hot water usage for mixer showers

58.6465	57.7651	56.4808	54.0236	52.2102	50.1879	49.0385	50.3130	51.7102	53.8815	56.3915	58.4218	(42a)

Hot water usage for baths

25.3431	24.9667	24.4367	23.4595	22.7277	21.9163	21.4780	22.0043	22.5774	23.4456	24.4430	25.2575	(42b)

Hot water usage for other uses

35.6577	34.3611	33.0644	31.7678	30.4711	29.1745	29.1745	30.4711	31.7678	33.0644	34.3611	35.6577	(42c)

Average daily hot water use (litres/day) 109.9833 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	119.6473	117.0930	113.9820	109.2508	105.4090	101.2787	99.6909	102.7885	106.0553	110.3915	115.1956	119.3370	(44)
Energy conte	189.4921	166.7388	175.1861	149.5589	141.9008	124.5340	120.5676	127.2736	130.7768	149.8003	164.1173	186.8528	(45)
Energy content (annual)										Total = Sum(45)m =		1826.7991	
Distribution loss (46)m = 0.15 x (45)m	28.4238	25.0108	26.2779	22.4338	21.2851	18.6801	18.0851	19.0910	19.6165	22.4700	24.6176	28.0279	(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

236.0870	208.8245	221.7810	194.6508	188.4957	169.6258	167.1625	173.8685	175.8687	196.3952	209.2091	233.4477	(62)
WWHRS -26.8107	-23.7116	-24.8294	-20.5598	-19.1610	-16.3962	-15.3688	-16.3432	-16.9641	-19.9988	-22.6562	-26.3142	(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

209.2763	185.1129	196.9516	174.0910	169.3348	153.2296	151.7937	157.5253	158.9046	176.3964	186.5529	207.1335	(64)

Total per year (kWh/year) = Sum(64)m = 2126.3025 (64)
12Total per year (kWh/year) 2126 (64)
Electric shower(s)

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

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month

100.2821	89.1092	95.5253	85.8018	84.4579	77.4810	77.3646	79.5944	79.5568	87.0845	90.6425	99.4045	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	102.6644	102.6644	102.6644	102.6644	102.6644	102.6644	102.6644	102.6644	102.6644	102.6644	102.6644	102.6644	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	90.5242	100.2233	90.5242	93.5417	90.5242	93.5417	90.5242	90.5242	93.5417	90.5242	93.5417	90.5242	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	179.3789	181.2403	176.5496	166.5638	153.9585	142.1113	134.1966	132.3352	137.0258	147.0117	159.6170	171.4642	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.2664	33.2664	33.2664	33.2664	33.2664	33.2664	33.2664	33.2664	33.2664	33.2664	33.2664	33.2664	(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)	-82.1315	-82.1315	-82.1315	-82.1315	-82.1315	-82.1315	-82.1315	-82.1315	-82.1315	-82.1315	-82.1315	-82.1315	(71)
Water heating gains (Table 5)	134.7877	132.6030	128.3942	119.1692	113.5187	107.6125	103.9847	106.9817	110.4955	117.0491	125.8923	133.6082	(72)
Total internal gains	461.4901	470.8659	452.2674	436.0740	414.8008	397.0648	382.5049	383.6405	394.8624	411.3843	435.8503	452.3959	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
South	5.3600	46.7521	0.6300	0.7000	0.7700	76.5839	(78)
West	8.3300	19.6403	0.6300	0.7000	0.7700	49.9993	(80)

Solar gains	126.5832	223.2340	320.8468	415.4960	476.0751	475.8102	457.5216	412.8479	354.2377	251.3412	153.1213	107.2925	(83)
Total gains	588.0734	694.0998	773.1142	851.5700	890.8759	872.8751	840.0264	796.4883	749.1001	662.7255	588.9716	559.6885	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.5959	55.7265	55.8552	56.4675	56.5836	57.1302	57.1302	57.2326	56.9184	56.5836	56.3493	56.1064	
alpha	4.7064	4.7151	4.7237	4.7645	4.7722	4.8087	4.8087	4.8155	4.7946	4.7722	4.7566	4.7404	
util living area	0.9870	0.9717	0.9403	0.8612	0.7248	0.5423	0.3955	0.4338	0.6588	0.8940	0.9730	0.9895	(86)
MIT	19.7803	20.0219	20.3244	20.6662	20.8844	20.9773	20.9959	20.9937	20.9438	20.6517	20.1582	19.7399	(87)
Th 2	19.8809	19.8832	19.8855	19.8962	19.8982	19.9076	19.9076	19.9093	19.9040	19.8982	19.8942	19.8899	(88)
util rest of house	0.9829	0.9633	0.9229	0.8239	0.6610	0.4563	0.2988	0.3334	0.5710	0.8561	0.9635	0.9862	(89)
MIT 2	18.4995	18.8037	19.1769	19.5830	19.8100	19.8959	19.9064	19.9073	19.8707	19.5802	18.9864	18.4550	(90)
Living area fraction									fLA = Living area / (4) =			0.4680	(91)
MIT	19.0989	19.3738	19.7139	20.0899	20.3128	20.4019	20.4162	20.4157	20.3729	20.0817	19.5347	19.0563	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0989	19.3738	19.7139	20.0899	20.3128	20.4019	20.4162	20.4157	20.3729	20.0817	19.5347	19.0563	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9792	0.9585	0.9197	0.8311	0.6862	0.4960	0.3442	0.3804	0.6101	0.8632	0.9596	0.9829	(94)
Useful gains	575.8352	665.3023	711.0675	707.7135	611.2908	432.9071	289.1028	303.0219	457.0180	572.0856	565.1638	550.0949	(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	1156.6155	1128.5550	1027.9482	861.0531	661.3877	441.2755	290.2517	304.8748	478.8701	728.1105	958.8532	1150.5369	(97)
Space heating kWh	432.1005	311.3058	235.7593	110.4045	37.2721	0.0000	0.0000	0.0000	0.0000	116.0825	283.4564	446.7288	(98a)
Space heating requirement - total per year (kWh/year)												1973.1099	
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	432.1005	311.3058	235.7593	110.4045	37.2721	0.0000	0.0000	0.0000	0.0000	116.0825	283.4564	446.7288	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1973.1099	
Space heating per m2										(98c) / (4) =		31.5344	(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	432.1005	311.3058	235.7593	110.4045	37.2721	0.0000	0.0000	0.0000	0.0000	116.0825	283.4564	446.7288	(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)	468.1479	337.2760	255.4272	119.6148	40.3815	0.0000	0.0000	0.0000	0.0000	125.7665	307.1034	483.9965	(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	209.2763	185.1129	196.9516	174.0910	169.3348	153.2296	151.7937	157.5253	158.9046	176.3964	186.5529	207.1335	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.6482	85.2161	84.4642	83.0672	81.2862	79.8000	79.8000	79.8000	79.8000	83.1445	84.9952	85.7368	(217)
Fuel for water heating, kWh/month	244.3442	217.2275	233.1777	209.5786	208.3191	192.0171	190.2176	197.4002	199.1285	212.1563	219.4863	241.5922	(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	18.8091	15.0894	13.5863	9.9539	7.6887	6.2817	7.0139	9.1169	11.8420	15.5373	17.5494	19.3319	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.8876	-18.0136	-27.8088	-33.6604	-38.4466	-36.6884	-36.2485	-33.1423	-28.0646	-21.6189	-13.5083	-10.1370	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.3816	-7.3382	-15.0140	-23.1952	-31.3121	-31.6936	-31.3155	-26.2135	-18.8273	-10.6951	-4.5782	-2.6573	(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	2137.7139 (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	2564.6454 (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)	151.8006 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-515.4465 (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	4424.7134 (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	2137.7139	0.2100	448.9199	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2564.6454	0.2100	538.5755	(264)
Space and water heating			987.4955	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	151.8006	0.1443	21.9095	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-309.2250	0.1331	-41.1572	
PV Unit electricity exported	-206.2215	0.1251	-25.7951	
Total			-66.9524	(269)
Total CO2, kg/year			954.3818	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.2500	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2137.7139	1.1300	2415.6167	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2564.6454	1.1300	2898.0493	(278)
Space and water heating			5313.6661	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	151.8006	1.5338	232.8368	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-309.2250	1.4918	-461.3088	
PV Unit electricity exported	-206.2215	0.4591	-94.6779	
Total			-555.9867	(283)
Total Primary energy kWh/year			5120.6170	(286)
Target Primary Energy Rate (TPER)			81.8400	(287)

Full SAP Calculation Printout

elmhurst energy

Property Reference	B1_02_2B_Copy	Issued on Date	23/03/2023
Assessment Reference	B1_02_2B_Copy	Prop Type Ref	
Property			

SAP Rating	85 B	DER	3.90	TER	13.53
Environmental	97 A	% DER < TER			71.18
CO_2 Emissions (t/year)	0.25	DFEE	33.49	TFEE	33.98
Compliance Check	See BREL	% DFEE < TFEE			1.42
% DPER < TPER	43.45	DPER	41.04	TPER	72.57

Assessor Details	Miss Nimco Ali	Assessor ID	R572-0001
Client			

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

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		71.0300 (1b)	x	3.1500 (2b)	=	223.7445	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.0300						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	223.7445	(5)

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2. Ventilation rate
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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.9000 (23c)

Effective ac	0.2387	0.2358	0.2329	0.2184	0.2155	0.2009	0.2009	0.1980	0.2067	0.2155	0.2213	0.2271	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			10.3800	1.1450	11.8855			(27)
Door			2.0900	1.0000	2.0900			(26)
External Wall 1	31.9700	10.3800	21.5900	0.1600	3.4544			(29a)

Corridor Wall	37.9800	2.0900	35.8900	0.1500	5.3835	(29a)
Total net area of external elements Aum(A, m2)			69.9500			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.8134	(33)
Party Wall 1			46.5600	0.0000	0.0000	(32)
Party Floor 1			71.0300			(32d)
Party Ceiling 1			71.0300			(32b)

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

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E7 Party floor between dwellings (in blocks of flats)	9.0800	0.0700	0.6356
E7 Party floor between dwellings (in blocks of flats)	24.1200	0.1100	2.6532
E16 Corner (normal)	6.3000	0.0900	0.5670
E18 Party wall between dwellings	12.6000	0.0600	0.7560
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	11.2200	0.0630	0.7069
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	29.5600	0.0000	0.0000
E17 Corner (inverted – internal area greater than external area)	6.3000	-0.0900	-0.5670
E2 Other lintels (including other steel lintels)	6.0000	0.0600	0.3600
E3 Sill	4.9900	0.0400	0.1996
E4 Jamb	16.6200	0.0500	0.8310

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.1423 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 28.9557 (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	17.6260	17.4114	17.1968	16.1239	15.9093	14.8364	14.8364	14.6218	15.2655	15.9093	16.3385	16.7676	(38)
Heat transfer coeff	46.5816	46.3670	46.1524	45.0795	44.8649	43.7920	43.7920	43.5774	44.2212	44.8649	45.2941	45.7233	(39)

Average = Sum(39)m / 12 = 45.0259

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6558	0.6528	0.6498	0.6347	0.6316	0.6165	0.6165	0.6135	0.6226	0.6316	0.6377	0.6437	(40)
HLP (average)												0.6339	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2709 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	62.2947	61.3585	59.9943	57.3842	55.4580	53.3099	52.0890	53.4428	54.9269	57.2333	59.8994	62.0560	(42a)
Hot water usage for baths	26.9120	26.5123	25.9495	24.9117	24.1346	23.2730	22.8076	23.3665	23.9750	24.8970	25.9561	26.8210	(42b)
Hot water usage for other uses	37.8860	36.5083	35.1306	33.7530	32.3753	30.9976	30.9976	32.3753	33.7530	35.1306	36.5083	37.8860	(42c)

Average daily hot water use (litres/day) 116.8270 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	127.0926	124.3791	121.0744	116.0488	111.9679	107.5805	105.8941	109.1846	112.6548	117.2609	122.3639	126.7629	(44)
Energy conte	201.2836	177.1141	186.0868	158.8651	150.7303	132.2828	128.0698	135.1933	138.9147	159.1219	174.3298	198.4801	(45)
Energy content (annual)										Total = Sum(45)m =		1940.4723	
Distribution loss (46)m = 0.15 x (45)m	30.1925	26.5671	27.9130	23.8298	22.6095	19.8424	19.2105	20.2790	20.8372	23.8683	26.1495	29.7720	(46)

Water storage loss:

Store volume 150.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.2960 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.6998 (55)

Total storage loss	21.6950	19.5955	21.6950	20.9952	21.6950	20.9952	21.6950	21.6950	20.9952	21.6950	20.9952	21.6950	(56)
If cylinder contains dedicated solar storage	21.6950	19.5955	21.6950	20.9952	21.6950	20.9952	21.6950	21.6950	20.9952	21.6950	20.9952	21.6950	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	222.9786	196.7097	207.7819	179.8603	172.4254	153.2780	149.7648	156.8883	159.9099	180.8170	195.3250	220.1752	(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	222.9786	196.7097	207.7819	179.8603	172.4254	153.2780	149.7648	156.8883	159.9099	180.8170	195.3250	220.1752	(64)
										Total per year (kWh/year) = Sum(64)m =		2195.9139	(64)
12Total per year (kWh/year)												2196	(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	66.9268	58.8905	61.8739	52.8226	50.1178	43.9840	42.5832	44.9518	46.1891	52.9080	57.9646	65.9946	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	113.5434	113.5434	113.5434	113.5434	113.5434	113.5434	113.5434	113.5434	113.5434	113.5434	113.5434	113.5434	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	104.2178	115.3840	104.2178	107.6918	104.2178	107.6918	104.2178	104.2178	107.6918	104.2178	107.6918	104.2178	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	199.6890	201.7611	196.5394	185.4229	171.3904	158.2017	149.3909	147.3188	152.5405	163.6570	177.6895	190.8782 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	34.3543	34.3543	34.3543	34.3543	34.3543	34.3543	34.3543	34.3543	34.3543	34.3543	34.3543	34.3543 (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)												
	-90.8348	-90.8348	-90.8348	-90.8348	-90.8348	-90.8348	-90.8348	-90.8348	-90.8348	-90.8348	-90.8348	-90.8348 (71)
Water heating gains (Table 5)												
	89.9554	87.6346	83.1638	73.3648	67.3627	61.0889	57.2355	60.4190	64.1516	71.1130	80.5065	88.7025 (72)
Total internal gains												
	450.9252	461.8428	440.9841	423.5425	400.0339	384.0455	367.9073	369.0187	381.4469	396.0508	422.9508	440.8615 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	10.3800	10.6334	0.4000	0.8000	0.7700	24.4767	(74)

Solar gains	24.4767	46.7762	79.4842	127.6719	171.9858	184.1159	171.8957	136.3773	95.5657	55.6809	30.1951	20.4050	(83)
Total gains	475.4019	508.6190	520.4682	551.2144	572.0197	568.1614	539.8030	505.3960	477.0126	451.7318	453.1459	461.2665	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	105.8924	106.3825	106.8771	109.4208	109.9442	112.6379	112.6379	113.1925	111.5447	109.9442	108.9024	107.8803	
alpha	8.0595	8.0922	8.1251	8.2947	8.3296	8.5092	8.5092	8.5462	8.4363	8.3296	8.2602	8.1920	
util living area													
	0.9926	0.9853	0.9679	0.8877	0.7144	0.4927	0.3569	0.3965	0.6343	0.9067	0.9805	0.9938	(86)
Living	20.4924	20.5928	20.7253	20.9065	20.9857	20.9994	21.0000	20.9999	20.9957	20.9050	20.6916	20.4851	
Non living	19.9187	20.0196	20.1503	20.3279	20.3928	20.4149	20.4151	20.4178	20.4076	20.3316	20.1288	19.9209	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	4	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	27	0	0	0	0	0	0	0	0	0	0	22	
MIT	20.7496	20.5928	20.7253	20.9065	20.9857	20.9994	21.0000	20.9999	20.9957	20.9050	20.6916	20.6435	(87)
Th 2	20.3800	20.3827	20.3854	20.3989	20.4016	20.4151	20.4151	20.4179	20.4097	20.4016	20.3962	20.3908	(88)
util rest of house													
	0.9905	0.9813	0.9593	0.8630	0.6732	0.4479	0.3095	0.3464	0.5823	0.8804	0.9746	0.9921	(89)
MIT 2	20.1525	20.0196	20.1503	20.3279	20.3928	20.4149	20.4151	20.4178	20.4076	20.3316	20.1288	20.0655	(90)
Living area fraction										fLA = Living area / (4) =		0.2992	(91)
MIT	20.3311	20.1911	20.3223	20.5010	20.5702	20.5898	20.5901	20.5920	20.5836	20.5031	20.2972	20.2384	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3311	20.1911	20.3223	20.5010	20.5702	20.5898	20.5901	20.5920	20.5836	20.5031	20.2972	20.2384	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9903	0.9798	0.9582	0.8675	0.6850	0.4613	0.3237	0.3614	0.5978	0.8853	0.9734	0.9916	(94)
Useful gains	470.7873	498.3389	498.7341	478.1727	391.8556	262.1071	174.7266	182.6562	285.1373	399.9015	441.0928	457.3756	(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													
	746.7557	709.0032	637.9349	522.9663	397.9591	262.3039	174.7346	182.6757	286.7105	444.3026	597.7562	733.3289	(97)
Space heating kWh													
	205.3205	141.5664	103.5654	32.2513	4.5410	0.0000	0.0000	0.0000	0.0000	33.0344	112.7976	205.3093	(98a)
Space heating requirement - total per year (kWh/year)												838.3859	
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													
	205.3205	141.5664	103.5654	32.2513	4.5410	0.0000	0.0000	0.0000	0.0000	33.0344	112.7976	205.3093	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												838.3859	
Space heating per m2											(98c) / (4) =	11.8033	(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 %)	234.2023	(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													
	205.3205	141.5664	103.5654	32.2513	4.5410	0.0000	0.0000	0.0000	0.0000	33.0344	112.7976	205.3093	(98)
Space heating efficiency (main heating system 1)													
	234.2023	234.2023	234.2023	234.2023	234.2023	0.0000	0.0000	0.0000	0.0000	234.2023	234.2023	234.2023	(210)

Space heating fuel (main heating system)

87.6680	60.4462	44.2205	13.7707	1.9389	0.0000	0.0000	0.0000	0.0000	14.1051	48.1625	87.6632 (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

222.9786	196.7097	207.7819	179.8603	172.4254	153.2780	149.7648	156.8883	159.9099	180.8170	195.3250	220.1752 (64)

Efficiency of water heater

											143.3328 (216)
(217)m 143.3328	143.3328	143.3328	143.3328	143.3328	143.3328	143.3328	143.3328	143.3328	143.3328	143.3328	143.3328 (217)

Fuel for water heating, kWh/month

155.5670	137.2398	144.9646	125.4843	120.2972	106.9385	104.4874	109.4573	111.5654	126.1518	136.2737	153.6111 (219)

Space cooling fuel requirement

(221)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa 19.5213	17.6322	19.5213	18.8916	19.5213	18.8916	19.5213	19.5213	18.8916	19.5213	18.8916	19.5213 (231)
Lighting 23.2634	18.6628	16.8037	12.3111	9.5095	7.7693	8.6749	11.2759	14.6463	19.2167	21.7053	23.9100 (232)

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

(233a)m -11.3740	-19.7594	-35.4250	-47.7393	-57.8443	-56.3615	-55.1905	-48.4412	-37.3737	-25.0502	-13.4828	-9.3227 (233a)

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

(234a)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)

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

(235a)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235c)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)

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

(233b)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)

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

(234b)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)

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

(235b)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235d)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year

Space heating fuel - main system 1	357.9751 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	143.3328
Water heating fuel used	1532.0382 (219)
Space cooling fuel	0.0000 (221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.1000)

mechanical ventilation fans (SFP = 1.1000)	229.8478 (230a)
Total electricity for the above, kWh/year	229.8478 (231)
Electricity for lighting (calculated in Appendix L)	187.7489 (232)

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

PV generation	-417.3648 (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	1890.2452 (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	357.9751	0.1576	56.4321 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1532.0382	0.1412	216.3924 (264)
Space and water heating			272.8245 (265)
Pumps, fans and electric keep-hot	229.8478	0.1387	31.8827 (267)
Energy for lighting	187.7489	0.1443	27.0980 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-417.3648	0.1311	-54.7345
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-54.7345 (269)
Total CO2, kg/year			277.0706 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.9000 (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	357.9751	1.5836	566.8880 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1532.0382	1.5223	2332.2049 (278)
Space and water heating			2899.0929 (279)
Pumps, fans and electric keep-hot	229.8478	1.5128	347.7137 (281)
Energy for lighting	187.7489	1.5338	287.9755 (282)

Energy saving/generation technologies			
PV Unit electricity used in dwelling	-417.3648	1.4845	-619.5729
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-619.5729 (283)
Total Primary energy kWh/year			2915.2092 (286)
Dwelling Primary energy Rate (DPER)			41.0400 (287)

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

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		71.0300 (1b)	x	3.1500 (2b)	=	223.7445 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.0300						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	223.7445	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1341	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3841	(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) =	0.2977	(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	0.3795	0.3721	0.3646	0.3274	0.3200	0.2828	0.2828	0.2753	0.2977	0.3200	0.3349	0.3498	(22b)
Effective ac	0.5720	0.5692	0.5665	0.5536	0.5512	0.5400	0.5400	0.5379	0.5443	0.5512	0.5561	0.5612	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.0900	1.0000	2.0900			(26)
TER Opening Type (Uw = 1.20)			10.3800	1.1450	11.8855			(27)
External Wall 1	31.9700	10.3800	21.5900	0.1800	3.8862			(29a)
Corridor Wall	37.9800	2.0900	35.8900	0.1800	6.4602			(29a)
Total net area of external elements Aum(A, m2)			69.9500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.3219			(33)
Party Wall 1			46.5600	0.0000	0.0000			(32)

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

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E7 Party floor between dwellings (in blocks of flats)	9.0800	0.0700	0.6356
E7 Party floor between dwellings (in blocks of flats)	24.1200	0.0700	1.6884
E16 Corner (normal)	6.3000	0.0900	0.5670
E18 Party wall between dwellings	12.6000	0.0600	0.7560
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	11.2200	0.0200	0.2244
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	29.5600	0.0000	0.0000
E17 Corner (inverted – internal area greater than external area)	6.3000	-0.0900	-0.5670
E2 Other lintels (including other steel lintels)	6.0000	0.0500	0.3000
E3 Sill	4.9900	0.0500	0.2495

E4 Jamb									16.6200	0.0500	0.8310		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												4.6849	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	29.0068	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.2353	42.0289	41.8265	40.8758	40.6979	39.8700	39.8700	39.7166	40.1889	40.6979	41.0578	41.4339	(38)
Heat transfer coeff	71.2421	71.0356	70.8333	69.8826	69.7047	68.8768	68.8768	68.7234	69.1957	69.7047	70.0646	70.4407	(39)
Average = Sum(39)m / 12 =												69.8818	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0030	1.0001	0.9972	0.9838	0.9813	0.9697	0.9697	0.9675	0.9742	0.9813	0.9864	0.9917	(40)
HLP (average)												0.9838	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2709	(42)
Hot water usage for mixer showers	62.2947	61.3585	59.9943	57.3842	55.4580	53.3099	52.0890	53.4428	54.9269	57.2333	59.8994	62.0560	(42a)
Hot water usage for baths	26.9120	26.5123	25.9495	24.9117	24.1346	23.2730	22.8076	23.3665	23.9750	24.8970	25.9561	26.8210	(42b)
Hot water usage for other uses	37.8860	36.5083	35.1306	33.7530	32.3753	30.9976	30.9976	32.3753	33.7530	35.1306	36.5083	37.8860	(42c)
Average daily hot water use (litres/day)												116.8270	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	127.0926	124.3791	121.0744	116.0488	111.9679	107.5805	105.8941	109.1846	112.6548	117.2609	122.3639	126.7629	(44)
Energy conte	201.2836	177.1141	186.0868	158.8651	150.7303	132.2828	128.0698	135.1933	138.9147	159.1219	174.3298	198.4801	(45)
Energy content (annual)										Total = Sum(45)m =		1940.4723	
Distribution loss (46)m = 0.15 x (45)m	30.1925	26.5671	27.9130	23.8298	22.6095	19.8424	19.2105	20.2790	20.8372	23.8683	26.1495	29.7720	(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	247.8785	219.1999	232.6817	203.9569	197.3252	177.3746	174.6647	181.7882	184.0065	205.7168	219.4216	245.0750	(62)
WWHRS	-28.4785	-25.1866	-26.3740	-21.8387	-20.3529	-17.4161	-16.3248	-17.3598	-18.0194	-21.2429	-24.0656	-27.9511	(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	219.4000	194.0132	206.3077	182.1182	176.9723	159.9585	158.3398	164.4284	165.9871	184.4739	195.3560	217.1239	(64)
										Total per year (kWh/year) = Sum(64)m =		2224.4792	(64)
12Total per year (kWh/year)												2224	(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	104.2027	92.5590	99.1498	88.8961	87.3938	80.0575	79.8591	82.2277	82.2626	90.1840	94.0381	103.2706	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	113.5434	113.5434	113.5434	113.5434	113.5434	113.5434	113.5434	113.5434	113.5434	113.5434	113.5434	113.5434	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	107.0601	118.5308	107.0601	110.6287	107.0601	110.6287	107.0601	107.0601	110.6287	107.0601	110.6287	107.0601	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	199.6890	201.7611	196.5394	185.4229	171.3904	158.2017	149.3909	147.3188	152.5405	163.6570	177.6895	190.8782	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.3543	34.3543	34.3543	34.3543	34.3543	34.3543	34.3543	34.3543	34.3543	34.3543	34.3543	34.3543	(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)	-90.8348	-90.8348	-90.8348	-90.8348	-90.8348	-90.8348	-90.8348	-90.8348	-90.8348	-90.8348	-90.8348	-90.8348	(71)
Water heating gains (Table 5)	140.0574	137.7366	133.2658	123.4668	117.4647	111.1910	107.3375	110.5211	114.2536	121.2150	130.6085	138.8045	(72)
Total internal gains	506.8695	518.0916	496.9283	479.5815	455.9782	437.0845	420.8516	421.9630	434.4859	451.9951	478.9898	496.8058	(73)

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6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains

			m2		Table 6a W/m2	Specific data or Table 6b		Specific data or Table 6c		factor Table 6d		W	
North			10.3800		10.6334	0.6300		0.7000		0.7700		33.7319	(74)
Solar gains	33.7319	64.4634	109.5391	175.9479	237.0179	253.7347	236.8938	187.9450	131.7015	76.7353	41.6127	28.1206	(83)
Total gains	540.6014	582.5550	606.4674	655.5294	692.9961	690.8192	657.7453	609.9079	566.1874	528.7304	520.6025	524.9264	(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, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	69.2377	69.4389	69.6373	70.5846	70.7648	71.6154	71.6154	71.7752	71.2854	70.7648	70.4013	70.0254	
alpha	5.6158	5.6293	5.6425	5.7056	5.7177	5.7744	5.7744	5.7850	5.7524	5.7177	5.6934	5.6684	
util living area													
	0.9935	0.9889	0.9784	0.9358	0.8213	0.6200	0.4579	0.5127	0.7708	0.9494	0.9866	0.9944	(86)
MIT	19.9879	20.1193	20.3267	20.6387	20.8769	20.9805	20.9971	20.9946	20.9360	20.6528	20.2841	19.9722	(87)
Th 2	20.0808	20.0833	20.0856	20.0968	20.0989	20.1087	20.1087	20.1105	20.1049	20.0989	20.0947	20.0903	(88)
util rest of house													
	0.9914	0.9854	0.9713	0.9150	0.7711	0.5413	0.3667	0.4165	0.6963	0.9286	0.9818	0.9927	(89)
MIT 2	18.9102	19.0788	19.3422	19.7320	19.9968	20.0977	20.1077	20.1086	20.0623	19.7570	19.2976	18.8973	(90)
Living area fraction										fLA = Living area / (4) =		0.2992	(91)
MIT	19.2326	19.3901	19.6367	20.0033	20.2601	20.3618	20.3738	20.3736	20.3237	20.0250	19.5927	19.2189	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2326	19.3901	19.6367	20.0033	20.2601	20.3618	20.3738	20.3736	20.3237	20.0250	19.5927	19.2189	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9889	0.9820	0.9670	0.9124	0.7808	0.5643	0.3941	0.4454	0.7158	0.9265	0.9783	0.9904	(94)
Useful gains	534.5950	572.0514	586.4360	598.1349	541.0891	389.8119	259.1870	271.6321	405.2938	489.8786	509.3016	519.9005	(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													
	1063.8330	1029.3157	930.5163	775.9246	596.6796	396.8551	259.9267	273.0826	430.6532	656.9661	875.2963	1057.9428	(97)
Space heating kWh													
	393.7531	307.2816	255.9957	128.0086	41.3593	0.0000	0.0000	0.0000	0.0000	124.3132	263.5162	400.3034	(98a)
Space heating requirement - total per year (kWh/year)												1914.5311	
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													
	393.7531	307.2816	255.9957	128.0086	41.3593	0.0000	0.0000	0.0000	0.0000	124.3132	263.5162	400.3034	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1914.5311	
Space heating per m2											(98c) / (4) =	26.9538	(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													
	393.7531	307.2816	255.9957	128.0086	41.3593	0.0000	0.0000	0.0000	0.0000	124.3132	263.5162	400.3034	(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)													
	426.6014	332.9161	277.3518	138.6875	44.8097	0.0000	0.0000	0.0000	0.0000	134.6838	285.4996	433.6982	(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													
	219.4000	194.0132	206.3077	182.1182	176.9723	159.9585	158.3398	164.4284	165.9871	184.4739	195.3560	217.1239	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.3554	85.0860	84.5448	83.2841	81.3621	79.8000	79.8000	79.8000	79.8000	83.1946	84.7316	85.4125	(217)
Fuel for water heating, kWh/month													
	257.0429	228.0200	244.0217	218.6710	217.5120	200.4493	198.4209	206.0506	208.0039	221.7380	230.5585	254.2063	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	22.2450	17.8457	16.0681	11.7722	9.0932	7.4292	8.2951	10.7823	14.0051	18.3755	20.7551	22.8632	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-13.4552	-20.3653	-31.3986	-37.9485	-43.2862	-41.2785	-40.7808	-37.3161	-31.6414	-24.4181	-15.2810	-11.4762	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)

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

(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)

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

(233b)m	-3.8784	-8.4142	-17.2142	-26.5945	-35.9045	-36.3494	-35.9184	-30.0651	-21.5907	-12.2651	-5.2508	-3.0480 (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	2074.2482 (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	2684.6951 (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)	179.5296 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-585.1393 (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	4439.3337 (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	2074.2482	0.2100	435.5921	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2684.6951	0.2100	563.7860	(264)
Space and water heating			999.3781	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	179.5296	0.1443	25.9117	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-348.6460	0.1331	-46.4147	
PV Unit electricity exported	-236.4933	0.1251	-29.5810	
Total			-75.9957	(269)
Total CO2, kg/year			961.2233	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.5300	(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	2074.2482	1.1300	2343.9005	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2684.6951	1.1300	3033.7055	(278)
Space and water heating			5377.6060	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	179.5296	1.5338	275.3685	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-348.6460	1.4919	-520.1578	
PV Unit electricity exported	-236.4933	0.4591	-108.5732	
Total			-628.7310	(283)
Total Primary energy kWh/year			5154.3443	(286)
Target Primary Energy Rate (TPER)			72.5700	(287)

Full SAP Calculation Printout

Property Reference	B1_03_2B_Copy	Issued on Date	23/03/2023
Assessment Reference	B1_03_2B_Copy	Prop Type Ref	
Property			

SAP Rating	82 B	DER	4.53	TER	14.50
Environmental	96 A	% DER < TER			68.76
CO_2 Emissions (t/year)	0.27	DFEE	38.11	TFEE	36.12
Compliance Check	See BREL	% DFEE < TFEE			-5.49
% DPER < TPER	38.88	DPER	47.55	TPER	77.80

Assessor Details	Miss Nimco Ali	Assessor ID	R572-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	61.9000	(1b)	x 3.1500	(2b) =	194.9850	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		194.9850	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.9000 (23c)

Effective ac	0.2531	0.2499	0.2467	0.2307	0.2276	0.2116	0.2116	0.2084	0.2180	0.2276	0.2339	0.2403	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			16.2500	1.1450	18.6069			(27)
Door			2.0700	1.0000	2.0700			(26)
External Wall 1	52.6100	16.2500	36.3600	0.1600	5.8176			(29a)

Corridor Wall	16.0700	2.0700	14.0000	0.1500	2.1000	(29a)
Wall to Unheated	14.8100		14.8100	0.1500	2.2215	(29a)
Total net area of external elements Aum(A, m2)			83.4900			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.8160	(33)
Party Wall 1			21.1100	0.0000	0.0000	(32)
Party Floor 1			61.9000			(32d)
Party Ceiling 1			61.9000			(32b)

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)	21.2000	0.0700	1.4840
	E7 Party floor between dwellings (in blocks of flats)	10.2000	0.1100	1.1220
	E16 Corner (normal)	9.4500	0.0900	0.8505
	E18 Party wall between dwellings	3.1500	0.0600	0.1890
	E23 Balcony within or between dwellings, balcony support penetrates wall insulation	12.2000	0.0630	0.7686
	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	13.4000	0.0000	0.0000
	E17 Corner (inverted – internal area greater than external area)	3.1500	-0.0900	-0.2835
	E7 Party floor between dwellings (in blocks of flats)	9.4000	0.1100	1.0340
	E25 Staggered party wall between dwellings	3.1500	0.2400	0.7560
	E2 Other lintels (including other steel lintels)	9.3200	0.0600	0.5592
	E3 Sill	8.3200	0.0400	0.3328
	E4 Jamb	23.1400	0.0500	1.1570

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.9696 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 38.7856 (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	16.2833	16.0782	15.8731	14.8476	14.6425	13.6170	13.6170	13.4119	14.0272	14.6425	15.0527	15.4629	(38)
Heat transfer coeff	55.0689	54.8638	54.6587	53.6332	53.4281	52.4026	52.4026	52.1975	52.8128	53.4281	53.8383	54.2485	(39)

Average = Sum(39)m / 12 = 53.5819

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8896	0.8863	0.8830	0.8664	0.8631	0.8466	0.8466	0.8433	0.8532	0.8631	0.8698	0.8764	(40)
HLP (average)												0.8656	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0348 (42)

Hot water usage for mixer showers	58.3367	57.4600	56.1825	53.7383	51.9344	49.9228	48.7794	50.0473	51.4371	53.5969	56.0937	58.1132 (42a)
Hot water usage for baths	25.2099	24.8355	24.3083	23.3362	22.6082	21.8011	21.3651	21.8887	22.4587	23.3224	24.3145	25.1247 (42b)
Hot water usage for other uses	35.4685	34.1788	32.8890	31.5992	30.3095	29.0197	29.0197	30.3095	31.5992	32.8890	34.1788	35.4685 (42c)

Average daily hot water use (litres/day) 109.4022 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	119.0152	116.4743	113.3798	108.6736	104.8521	100.7436	99.1643	102.2454	105.4950	109.8083	114.5870	118.7064	(44)
Energy conte	188.4909	165.8579	174.2605	148.7688	141.1511	123.8760	119.9306	126.6012	130.0859	149.0088	163.2502	185.8656	(45)
Energy content (annual)										Total = Sum(45)m =		1817.1475	
Distribution loss (46)m = 0.15 x (45)m	28.2736	24.8787	26.1391	22.3153	21.1727	18.5814	17.9896	18.9902	19.5129	22.3513	24.4875	27.8798	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2960	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.6998	(55)
Total storage loss	21.6950	19.5955	21.6950	20.9952	21.6950	20.9952	21.6950	21.6950	20.9952	21.6950	20.9952	21.6950	(56)
If cylinder contains dedicated solar storage	21.6950	19.5955	21.6950	20.9952	21.6950	20.9952	21.6950	21.6950	20.9952	21.6950	20.9952	21.6950	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	210.1860	185.4534	195.9556	169.7640	162.8462	144.8712	141.6256	148.2962	151.0811	170.7039	184.2454	207.5606	(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	210.1860	185.4534	195.9556	169.7640	162.8462	144.8712	141.6256	148.2962	151.0811	170.7039	184.2454	207.5606	(64)
										Total per year (kWh/year) = Sum(64)m =		2072.5891	(64)
12Total per year (kWh/year)												2073	(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	62.6732	55.1477	57.9416	49.4656	46.9328	41.1888	39.8769	42.0949	43.2536	49.5454	54.2807	61.8003	(65)

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

Metabolic gains (Table 5), Watts

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

(66)m	101.7407	101.7407	101.7407	101.7407	101.7407	101.7407	101.7407	101.7407	101.7407	101.7407	101.7407	101.7407	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	89.6353	99.2391	89.6353	92.6232	89.6353	92.6232	89.6353	89.6353	92.6232	89.6353	92.6232	89.6353	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	177.7121	179.5562	174.9091	165.0161	152.5279	140.7907	132.9496	131.1055	135.7526	145.6456	158.1338	169.8710	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.1741	33.1741	33.1741	33.1741	33.1741	33.1741	33.1741	33.1741	33.1741	33.1741	33.1741	33.1741	(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)													
	-81.3925	-81.3925	-81.3925	-81.3925	-81.3925	-81.3925	-81.3925	-81.3925	-81.3925	-81.3925	-81.3925	-81.3925	(71)
Water heating gains (Table 5)													
	84.2382	82.0651	77.8785	68.7022	63.0817	57.2066	53.5980	56.5792	60.0744	66.5933	75.3898	83.0649	(72)
Total internal gains													
	405.1078	414.3826	395.9452	379.8637	358.7671	344.1428	329.7052	330.8422	341.9724	355.3965	379.6690	396.0934	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.6500	19.6403	0.4000	0.8000	0.7700	46.3853	(76)
South	5.6000	46.7521	0.4000	0.8000	0.7700	58.0593	(78)

Solar gains	104.4446	185.8257	270.5579	354.8372	409.7494	410.7047	394.4425	353.8640	300.3263	210.2294	126.6571	88.3136	(83)
Total gains	509.5525	600.2083	666.5031	734.7009	768.5164	754.8475	724.1477	684.7062	642.2986	565.6259	506.3261	484.4070	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.0588	78.3506	78.6446	80.1483	80.4560	82.0305	82.0305	82.3528	81.3934	80.4560	79.8430	79.2393	
alpha	6.2039	6.2234	6.2430	6.3432	6.3637	6.4687	6.4687	6.4902	6.4262	6.3637	6.3229	6.2826	
util living area													
	0.9884	0.9692	0.9245	0.8048	0.6317	0.4430	0.3183	0.3504	0.5608	0.8564	0.9710	0.9911	(86)
Living	20.2437	20.4513	20.6790	20.8947	20.9792	20.9982	20.9998	20.9997	20.9923	20.8698	20.5315	20.2139	
Non living	19.4994	19.7035	19.9202	20.1207	20.1868	20.2124	20.2131	20.2159	20.2039	20.1077	19.7956	19.4796	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	11	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	20	28	5	0	0	0	0	0	0	0	0	31	
MIT	20.7236	20.6893	20.7015	20.8947	20.9792	20.9982	20.9998	20.9997	20.9923	20.8698	20.5315	20.5548	(87)
Th 2	20.1763	20.1791	20.1820	20.1961	20.1989	20.2132	20.2132	20.2160	20.2075	20.1989	20.1933	20.1876	(88)
util rest of house													
	0.9850	0.9610	0.9063	0.7684	0.5822	0.3891	0.2614	0.2908	0.4992	0.8184	0.9619	0.9885	(89)
MIT 2	19.9290	19.9097	19.9385	20.1207	20.1868	20.2124	20.2131	20.2159	20.2039	20.1077	19.7956	19.7866	(90)
Living area fraction										fLA = Living area / (4) =		0.4701	(91)
MIT	20.3026	20.2762	20.2972	20.4846	20.5593	20.5818	20.5830	20.5844	20.5746	20.4660	20.1416	20.1477	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3026	20.2762	20.2972	20.4846	20.5593	20.5818	20.5830	20.5844	20.5746	20.4660	20.1416	20.1477	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9856	0.9621	0.9091	0.7820	0.6048	0.4144	0.2882	0.3189	0.5280	0.8319	0.9612	0.9883	(94)
Useful gains	502.2276	577.4425	605.9258	574.5475	464.7729	312.8395	208.6696	218.3243	339.1313	470.5476	486.6650	478.7484	(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													
	881.2427	843.5965	754.1367	621.3186	473.3344	313.4629	208.7172	218.4138	341.9399	527.1205	702.1358	865.1404	(97)
Space heating kWh													
	281.9872	178.8554	110.2689	33.6752	6.3698	0.0000	0.0000	0.0000	0.0000	42.0902	155.1390	287.4757	(98a)
Space heating requirement - total per year (kWh/year)												1095.8614	
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													
	281.9872	178.8554	110.2689	33.6752	6.3698	0.0000	0.0000	0.0000	0.0000	42.0902	155.1390	287.4757	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1095.8614	
Space heating per m2											(98c) / (4) =	17.7037	(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 %)	248.2391	(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

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Space heating requirement
              281.9872   178.8554   110.2689    33.6752     6.3698     0.0000     0.0000     0.0000     0.0000    42.0902   155.1390   287.4757 (98)
Space heating efficiency (main heating system 1)
              248.2391   248.2391   248.2391   248.2391   248.2391     0.0000     0.0000     0.0000     0.0000   248.2391   248.2391   248.2391 (210)
Space heating fuel (main heating system)
              113.5950    72.0497    44.4204    13.5656     2.5660     0.0000     0.0000     0.0000     0.0000    16.9555    62.4958   115.8060 (211)
Space heating efficiency (main heating system 2)
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (212)
Space heating fuel (main heating system 2)
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (213)
Space heating fuel (secondary)
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (215)

Water heating
Water heating requirement
              210.1860   185.4534   195.9556   169.7640   162.8462   144.8712   141.6256   148.2962   151.0811   170.7039   184.2454   207.5606 (64)
Efficiency of water heater                                                                                                                 139.5252 (216)
(217)m        139.5252   139.5252   139.5252   139.5252   139.5252   139.5252   139.5252   139.5252   139.5252   139.5252   139.5252   139.5252 (217)
Fuel for water heating, kWh/month
              150.6437   132.9174   140.4445   121.6726   116.7145   103.8316   101.5054   106.2863   108.2823   122.3462   132.0516   148.7621 (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   16.4897    14.8939    16.4897    15.9577    16.4897    15.9577    16.4897    16.4897    15.9577    16.4897    15.9577    16.4897 (231)
Lighting       19.0233    15.2612    13.7410    10.0673     7.7763     6.3533     7.0938     9.2207    11.9768    15.7142    17.7492    19.5520 (232)
Electricity generated by PVs (Appendix M) (negative quantity)
(233a)m       -10.0087   -17.4098   -31.1900   -42.1126   -51.1499   -49.8533   -48.8105   -42.7837   -32.9329   -22.0433   -11.8645    -8.2001 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)
(234a)m         0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)
(235a)m         0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)
(235c)m         0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)
(233b)m         0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)
(234b)m         0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)
(235b)m         0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)
(235d)m         0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (235d)
Annual totals kWh/year
Space heating fuel - main system 1                                                                                                         441.4541 (211)
Space heating fuel - main system 2                                                                                                           0.0000 (213)
Space heating fuel - secondary                                                                                                               0.0000 (215)
Efficiency of water heater                                                                                                                 139.5252
Water heating fuel used                                                                                                                   1485.4581 (219)
Space cooling fuel                                                                                                                           0.0000 (221)

Electricity for pumps and fans:
    (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.1000)
   mechanical ventilation fans (SFP =       1.1000)                                                                                        194.1524 (230a)
Total electricity for the above, kWh/year                                                                                                  194.1524 (231)
Electricity for lighting (calculated in Appendix L)                                                                                        153.5292 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation                                                                                                                             -368.3595 (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                                                                                                       1906.2343 (238)


-------------------------------------------------------------------------------------------------------
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP
-------------------------------------------------------------------------------------------------------
                                                                  Energy       Emission factor            Emissions
                                                                 kWh/year           kg CO2/kWh          kg CO2/year
Space heating - main system 1                                    441.4541               0.1580              69.7381 (261)
Total CO2 associated with community systems                                                                   0.0000 (373)
Water heating (other fuel)                                      1485.4581               0.1412             209.7837 (264)
Space and water heating                                                                                   279.5217 (265)
Pumps, fans and electric keep-hot                                194.1524               0.1387              26.9313 (267)
Energy for lighting                                              153.5292               0.1443              22.1590 (268)

 Energy saving/generation technologies
PV Unit electricity used in dwelling                            -368.3595               0.1311             -48.2990
PV Unit electricity exported                                       0.0000               0.0000               0.0000
Total                                                                                                     -48.2990 (269)
Total CO2, kg/year                                                                                        280.3131 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)                                                             4.5300 (273)


-------------------------------------------------------------------------------------------------------
13a. Primary energy - Individual heating systems including micro-CHP
-------------------------------------------------------------------------------------------------------
                                                                  Energy Primary energy factor        Primary energy
                                                                 kWh/year           kg CO2/kWh          kWh/year
Space heating - main system 1                                    441.4541               1.5848             699.5990 (275)
Total CO2 associated with community systems                                                                   0.0000 (473)
Water heating (other fuel)                                      1485.4581               1.5222            2261.1861 (278)
```

Space and water heating			2960.7851 (279)
Pumps, fans and electric keep-hot	194.1524	1.5128	293.7138 (281)
Energy for lighting	153.5292	1.5338	235.4881 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-368.3595	1.4844	-546.7916
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-546.7916 (283)
Total Primary energy kWh/year			2943.1954 (286)
Dwelling Primary energy Rate (DPER)			47.5500 (287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	61.9000	(1b)	x 3.1500	(2b) =	194.9850	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		194.9850	(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) =	0.1026	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3526	(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) =	0.2997	(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	0.3821	0.3746	0.3671	0.3297	0.3222	0.2847	0.2847	0.2772	0.2997	0.3222	0.3371	0.3521	(22b)
Effective ac	0.5730	0.5702	0.5674	0.5543	0.5519	0.5405	0.5405	0.5384	0.5449	0.5519	0.5568	0.5620	(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			2.0700	1.0000	2.0700			(26)
TER Opening Type (Uw = 1.20)			13.4000	1.1450	15.3435			(27)
External Wall 1	52.6100	13.4000	39.2100	0.1800	7.0578			(29a)
Corridor Wall	16.0700	2.0700	14.0000	0.1800	2.5200			(29a)
Wall to Unheated	14.8100		14.8100	0.1800	2.6658			(29a)
Total net area of external elements Aum(A, m2)			83.4900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.6571			(33)
Party Wall 1			21.1100	0.0000	0.0000			(32)

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

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E7 Party floor between dwellings (in blocks of flats)	21.2000	0.0700	1.4840
E7 Party floor between dwellings (in blocks of flats)	10.2000	0.0700	0.7140
E16 Corner (normal)	9.4500	0.0900	0.8505
E18 Party wall between dwellings	3.1500	0.0600	0.1890

E23 Balcony within or between dwellings, balcony support penetrates wall insulation	12.2000	0.0200	0.2440
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	13.4000	0.0000	0.0000
E17 Corner (inverted – internal area greater than external area)	3.1500	-0.0900	-0.2835
E7 Party floor between dwellings (in blocks of flats)	9.4000	0.0700	0.6580
E25 Staggered party wall between dwellings	3.1500	0.0600	0.1890
E2 Other lintels (including other steel lintels)	9.3200	0.0500	0.4660
E3 Sill	8.3200	0.0500	0.4160
E4 Jamb	23.1400	0.0500	1.1570

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.0840 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 35.7411 (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	36.8697	36.6873	36.5085	35.6688	35.5117	34.7803	34.7803	34.6448	35.0620	35.5117	35.8295	36.1618	(38)
Heat transfer coeff	72.6108	72.4284	72.2497	71.4099	71.2528	70.5214	70.5214	70.3859	70.8031	71.2528	71.5706	71.9029	(39)

Average = Sum(39)m / 12 = 71.4091

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1730	1.1701	1.1672	1.1536	1.1511	1.1393	1.1393	1.1371	1.1438	1.1511	1.1562	1.1616	(40)
HLP (average)												1.1536	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0348 (42)

Hot water usage for mixer showers

58.3367	57.4600	56.1825	53.7383	51.9344	49.9228	48.7794	50.0473	51.4371	53.5969	56.0937	58.1132	(42a)

Hot water usage for baths

25.2099	24.8355	24.3083	23.3362	22.6082	21.8011	21.3651	21.8887	22.4587	23.3224	24.3145	25.1247	(42b)

Hot water usage for other uses

35.4685	34.1788	32.8890	31.5992	30.3095	29.0197	29.0197	30.3095	31.5992	32.8890	34.1788	35.4685	(42c)

Average daily hot water use (litres/day) 109.4022 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	119.0152	116.4743	113.3798	108.6736	104.8521	100.7436	99.1643	102.2454	105.4950	109.8083	114.5870	118.7064	(44)
Energy conte	188.4909	165.8579	174.2605	148.7688	141.1511	123.8760	119.9306	126.6012	130.0859	149.0088	163.2502	185.8656	(45)
Energy content (annual)										Total = Sum(45)m =		1817.1475	

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

28.2736	24.8787	26.1391	22.3153	21.1727	18.5814	17.9896	18.9902	19.5129	22.3513	24.4875	27.8798	(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)
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)
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)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

235.0858	207.9436	220.8554	193.8606	187.7460	168.9679	166.5255	173.1961	175.1777	195.6037	208.3420	232.4605	(62)
-26.6691	-23.5864	-24.6983	-20.4512	-19.0598	-16.3096	-15.2876	-16.2568	-16.8745	-19.8932	-22.5366	-26.1752	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

208.4167	184.3572	196.1571	173.4094	168.6863	152.6583	151.2379	156.9392	158.3032	175.7105	185.8054	206.2852	(64)

Total per year (kWh/year) = Sum(64)m = 2117.9667 (64)
12Total per year (kWh/year) 2118 (64)
Electric shower(s)

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

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month

99.9492	88.8163	95.2176	85.5391	84.2087	77.2623	77.1528	79.3708	79.3270	86.8214	90.3542	99.0762	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	101.7407	101.7407	101.7407	101.7407	101.7407	101.7407	101.7407	101.7407	101.7407	101.7407	101.7407	101.7407	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	89.7225	99.3356	89.7225	92.7132	89.7225	92.7132	89.7225	89.7225	92.7132	89.7225	92.7132	89.7225	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	177.7121	179.5562	174.9091	165.0161	152.5279	140.7907	132.9496	131.1055	135.7526	145.6456	158.1338	169.8710	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1741	33.1741	33.1741	33.1741	33.1741	33.1741	33.1741	33.1741	33.1741	33.1741	33.1741	33.1741	(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)	-81.3925	-81.3925	-81.3925	-81.3925	-81.3925	-81.3925	-81.3925	-81.3925	-81.3925	-81.3925	-81.3925	-81.3925	(71)
Water heating gains (Table 5)	134.3403	132.1671	127.9806	118.8043	113.1837	107.3087	103.7000	106.6812	110.1764	116.6954	125.4919	133.1670	(72)
Total internal gains	458.2970	467.5811	449.1344	433.0558	411.9563	394.3349	379.8943	381.0314	392.1644	408.5857	432.8611	449.2826	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	8.7800	19.6403	0.6300	0.7000	0.7700	52.7004 (76)
South	4.6200	46.7521	0.6300	0.7000	0.7700	66.0107 (78)

Solar gains	118.7111	211.2017	307.4908	403.2570	465.6498	466.7309	448.2521	402.1460	341.3163	238.9339	143.9564	100.3776 (83)
Total gains	577.0081	678.7828	756.6252	836.3128	877.6061	861.0658	828.1465	783.1773	733.4808	647.5196	576.8175	549.6602 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.2007	59.3498	59.4966	60.1963	60.3290	60.9547	60.9547	61.0720	60.7122	60.3290	60.0611	59.7835	
alpha	4.9467	4.9567	4.9664	5.0131	5.0219	5.0636	5.0636	5.0715	5.0475	5.0219	5.0041	4.9856	
util living area	0.9865	0.9702	0.9356	0.8470	0.6998	0.5145	0.3731	0.4107	0.6348	0.8848	0.9714	0.9892	(86)
MIT	19.8905	20.1243	20.4135	20.7305	20.9160	20.9856	20.9977	20.9962	20.9602	20.7089	20.2484	19.8521	(87)
Th 2	19.9416	19.9440	19.9463	19.9573	19.9593	19.9689	19.9689	19.9707	19.9652	19.9593	19.9552	19.9508	(88)
util rest of house	0.9824	0.9616	0.9175	0.8089	0.6379	0.4358	0.2865	0.3202	0.5518	0.8460	0.9616	0.9858	(89)
MIT 2	18.6827	18.9767	19.3321	19.7060	19.8957	19.9615	19.9682	19.9695	19.9418	19.6947	19.1442	18.6410	(90)
Living area fraction									fLA = Living area / (4) =			0.4701	(91)
MIT	19.2505	19.5162	19.8405	20.1876	20.3753	20.4429	20.4522	20.4522	20.4205	20.1715	19.6633	19.2103	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2505	19.5162	19.8405	20.1876	20.3753	20.4429	20.4522	20.4522	20.4205	20.1715	19.6633	19.2103	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9790	0.9573	0.9154	0.8180	0.6636	0.4725	0.3273	0.3628	0.5894	0.8548	0.9582	0.9827	(94)
Useful gains	564.8641	649.8220	692.6423	684.0727	582.3685	406.8454	271.0134	284.1325	432.3409	553.4971	552.7155	540.1615	(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	1085.5699	1058.6272	963.8447	806.0499	618.1424	412.0498	271.6600	285.2156	447.5145	681.9961	899.1619	1079.2875	(97)
Space heating kWh	387.4051	274.7170	201.7746	87.8236	26.6158	0.0000	0.0000	0.0000	0.0000	95.6032	249.4415	401.1097	(98a)
Space heating requirement - total per year (kWh/year)												1724.4906	
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	387.4051	274.7170	201.7746	87.8236	26.6158	0.0000	0.0000	0.0000	0.0000	95.6032	249.4415	401.1097	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1724.4906	
Space heating per m2										(98c) / (4) =		27.8593	(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	387.4051	274.7170	201.7746	87.8236	26.6158	0.0000	0.0000	0.0000	0.0000	95.6032	249.4415	401.1097	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	419.7239	297.6349	218.6074	95.1502	28.8362	0.0000	0.0000	0.0000	0.0000	103.5788	270.2508	434.5718	(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	208.4167	184.3572	196.1571	173.4094	168.6863	152.6583	151.2379	156.9392	158.3032	175.7105	185.8054	206.2852	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.4297	84.9524	84.1232	82.6150	80.9176	79.8000	79.8000	79.8000	79.8000	82.7555	84.7210	85.5241	(217)
Fuel for water heating, kWh/month	243.9628	217.0124	233.1785	209.9008	208.4666	191.3011	189.5211	196.6657	198.3750	212.3250	219.3145	241.2012	(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	18.6426	14.9558	13.4660	9.8658	7.6206	6.2261	6.9518	9.0362	11.7371	15.3997	17.3939	19.1607 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-11.7636	-17.8275	-27.5246	-33.3202	-38.0620	-36.3233	-35.8883	-32.8114	-27.7816	-21.3978	-13.3682	-10.0311 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-3.3420	-7.2527	-14.8397	-22.9266	-30.9498	-31.3265	-30.9523	-25.9088	-18.6081	-10.5702	-4.5246	-2.6262 (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	1868.3539 (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	2561.2247 (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)	150.4561 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-509.9271 (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	4156.1075 (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	1868.3539	0.2100	392.3543	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2561.2247	0.2100	537.8572	(264)
Space and water heating			930.2115	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	150.4561	0.1443	21.7155	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-306.0994	0.1331	-40.7405	
PV Unit electricity exported	-203.8277	0.1251	-25.4956	
Total			-66.2361	(269)
Total CO2, kg/year			897.6201	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.5000	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1868.3539	1.1300	2111.2399	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2561.2247	1.1300	2894.1839	(278)
Space and water heating			5005.4237	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	150.4561	1.5338	230.7746	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-306.0994	1.4918	-456.6432	
PV Unit electricity exported	-203.8277	0.4591	-93.5786	
Total			-550.2218	(283)
Total Primary energy kWh/year			4816.0774	(286)
Target Primary Energy Rate (TPER)			77.8000	(287)

Full SAP Calculation Printout

elmhurst energy

Property Reference	B2_04_2B_Copy	Issued on Date	23/03/2023
Assessment Reference	00001_Copy	Prop Type Ref	
Property			

SAP Rating	81 B	DER	4.71	TER	16.39
Environmental	96 A	% DER < TER			71.26
CO_2 Emissions (t/year)	0.28	DFEE	41.15	TFEE	45.03
Compliance Check	See BREL	% DFEE < TFEE			8.63
% DPER < TPER	43.87	DPER	49.38	TPER	87.97

Assessor Details	Miss Nimco Ali	Assessor ID	R572-0001
Client			

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

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		62.4700 (1b)	x	3.1500 (2b)	=	196.7805	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.4700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	196.7805	(5)

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2. Ventilation rate
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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1388 (21)

	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	0.1769	0.1734	0.1700	0.1526	0.1492	0.1318	0.1318	0.1283	0.1388	0.1492	0.1561	0.1630	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.9000 (23c)

Effective ac	0.2674	0.2639	0.2605	0.2431	0.2397	0.2223	0.2223	0.2188	0.2292	0.2397	0.2466	0.2535	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			15.5700	1.1450	17.8282			(27)
External Wall 1	57.4600	15.5700	41.8900	0.1600	6.7024			(29a)
Corridor wall	10.4300		10.4300	0.1500	1.5645			(29a)

External Roof	33.1000	33.1000	0.0900	2.9790	(30)
Total net area of external elements Aum(A, m2)		100.9900			(31)
Fabric heat loss, W/K = Sum (A x U)		(26)...(30) + (32) =		29.0741	(33)
Party Wall 1		44.5100	0.0000	0.0000	(32)
Party Floor 1		62.4700			(32d)
Party Ceiling 1		29.3700			(32b)

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)	18.2400	0.0700	1.2768
E15 Flat roof with parapet	18.2400	0.3000	5.4720
E7 Party floor between dwellings (in blocks of flats)	6.6200	0.1100	0.7282
E16 Corner (normal)	9.4500	0.0900	0.8505
E18 Party wall between dwellings	3.1500	-0.0900	-0.2835
E25 Staggered party wall between dwellings	9.4500	0.2400	2.2680
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	24.1900	0.0000	0.0000
E2 Other lintels (including other steel lintels)	8.4200	0.0600	0.5052
E3 Sill	8.4200	0.0400	0.3368
E4 Jamb	21.6000	0.0500	1.0800
E24 Eaves (insulation at ceiling level - inverted)	14.4900	0.1500	2.1735

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 14.4075 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 43.4816 (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	17.3647	17.1395	16.9142	15.7879	15.5627	14.4364	14.4364	14.2112	14.8869	15.5627	16.0132	16.4637	(38)
Heat transfer coeff	60.8464	60.6211	60.3959	59.2696	59.0443	57.9181	57.9181	57.6928	58.3686	59.0443	59.4948	59.9453	(39)

Average = Sum(39)m / 12 = 59.2133

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9740	0.9704	0.9668	0.9488	0.9452	0.9271	0.9271	0.9235	0.9343	0.9452	0.9524	0.9596	(40)
HLP (average)												0.9479	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0505 (42)

Hot water usage for mixer showers												
58.6004	57.7198	56.4365	53.9812	52.1692	50.1485	48.9999	50.2735	51.6696	53.8392	56.3472	58.3759	(42a)
Hot water usage for baths												
25.3233	24.9472	24.4176	23.4411	22.7099	21.8991	21.4612	21.9871	22.5597	23.4273	24.4239	25.2377	(42b)
Hot water usage for other uses												
35.6296	34.3340	33.0383	31.7427	30.4471	29.1515	29.1515	30.4471	31.7427	33.0383	34.3340	35.6296	(42c)

Average daily hot water use (litres/day) 109.8969 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	119.5533	117.0010	113.8924	109.1650	105.3262	101.1991	99.6126	102.7077	105.9720	110.3048	115.1051	119.2432	(44)
Energy conte	189.3432	166.6078	175.0484	149.4414	141.7893	124.4361	120.4728	127.1736	130.6741	149.6826	163.9883	186.7060	(45)

Energy content (annual) Total = Sum(45)m = 1825.3637

Distribution loss (46)m = 0.15 x (45)m												
28.4015	24.9912	26.2573	22.4162	21.2684	18.6654	18.0709	19.0760	19.6011	22.4524	24.5982	28.0059	(46)

Water storage loss:

Store volume 150.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.2960 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.6998 (55)

Total storage loss												
21.6950	19.5955	21.6950	20.9952	21.6950	20.9952	21.6950	21.6950	20.9952	21.6950	20.9952	21.6950	(56)
If cylinder contains dedicated solar storage												
21.6950	19.5955	21.6950	20.9952	21.6950	20.9952	21.6950	21.6950	20.9952	21.6950	20.9952	21.6950	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month												
211.0383	186.2033	196.7435	170.4366	163.4844	145.4313	142.1679	148.8686	151.6693	171.3776	184.9835	208.4010	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h												
211.0383	186.2033	196.7435	170.4366	163.4844	145.4313	142.1679	148.8686	151.6693	171.3776	184.9835	208.4010	(64)

Total per year (kWh/year) = Sum(64)m = 2080.8053 (64)

12Total per year (kWh/year) 2081 (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												
62.9566	55.3971	58.2036	49.6893	47.1449	41.3750	40.0572	42.2852	43.4491	49.7695	54.5261	62.0797	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	102.5270	102.5270	102.5270	102.5270	102.5270	102.5270	102.5270	102.5270	102.5270	102.5270	102.5270	102.5270	(66)

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

	90.3508	100.0313	90.3508	93.3625	90.3508	93.3625	90.3508	90.3508	93.3625	90.3508	93.3625	90.3508 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	179.1306	180.9894	176.3052	166.3332	153.7454	141.9145	134.0108	132.1520	136.8362	146.8082	159.3960	171.2269 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	33.2527	33.2527	33.2527	33.2527	33.2527	33.2527	33.2527	33.2527	33.2527	33.2527	33.2527	33.2527 (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)												
	-82.0216	-82.0216	-82.0216	-82.0216	-82.0216	-82.0216	-82.0216	-82.0216	-82.0216	-82.0216	-82.0216	-82.0216 (71)
Water heating gains (Table 5)												
	84.6191	82.4361	78.2307	69.0129	63.3669	57.4653	53.8403	56.8350	60.3460	66.8944	75.7307	83.4405 (72)
Total internal gains												
	407.8586	417.2149	398.6448	382.4667	361.2211	346.5004	331.9601	333.0959	344.3028	357.8115	382.2474	398.7763 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	3.0700	19.6403	0.4000	0.8000	0.7700	13.3712 (76)
South	7.1900	46.7521	0.4000	0.8000	0.7700	74.5440 (78)
Southwest	3.7800	36.7938	0.4000	0.8000	0.7700	30.8425 (79)
West	1.5300	19.6403	0.4000	0.8000	0.7700	6.6638 (80)

Solar gains	125.4215	213.8128	291.9403	358.9640	398.2832	393.4001	380.1380	351.3336	315.3535	236.2481	150.2836	107.2835 (83)
Total gains	533.2801	631.0277	690.5851	741.4308	759.5043	739.9005	712.0981	684.4295	659.6563	594.0596	532.5309	506.0598 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.2975	71.5624	71.8293	73.1943	73.4735	74.9023	74.9023	75.1947	74.3241	73.4735	72.9172	72.3692	
alpha	5.7532	5.7708	5.7886	5.8796	5.8982	5.9935	5.9935	6.0130	5.9549	5.8982	5.8611	5.8246	
util living area													
	0.9882	0.9699	0.9332	0.8400	0.6899	0.4970	0.3574	0.3870	0.5975	0.8688	0.9716	0.9909	(86)
Living	20.1328	20.3543	20.5895	20.8320	20.9552	20.9947	20.9994	20.9990	20.9847	20.8254	20.4490	20.1012	
Non living	19.3311	19.5491	19.7746	20.0037	20.1026	20.1423	20.1443	20.1473	20.1313	20.0061	19.6563	19.3099	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	18	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	13	28	24	0	0	0	0	0	0	0	0	31	
MIT	20.7940	20.6343	20.7273	20.8320	20.9552	20.9947	20.9994	20.9990	20.9847	20.8254	20.4490	20.4909	(87)
Th 2	20.1050	20.1081	20.1111	20.1262	20.1293	20.1445	20.1445	20.1475	20.1384	20.1293	20.1232	20.1171	(88)
util rest of house													
	0.9847	0.9617	0.9159	0.8046	0.6356	0.4324	0.2882	0.3157	0.5283	0.8308	0.9624	0.9882	(89)
MIT 2	19.9212	19.7915	19.8876	20.0037	20.1026	20.1423	20.1443	20.1473	20.1313	20.0061	19.6563	19.6600	(90)
Living area fraction										fLA = Living area / (4) =		0.4865	(91)
MIT	20.3458	20.2015	20.2961	20.4066	20.5173	20.5570	20.5603	20.5616	20.5464	20.4047	20.0419	20.0642	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3458	20.2015	20.2961	20.4066	20.5173	20.5570	20.5603	20.5616	20.5464	20.4047	20.0419	20.0642	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9858	0.9626	0.9199	0.8166	0.6604	0.4637	0.3219	0.3504	0.5616	0.8438	0.9614	0.9880	(94)
Useful gains	525.6914	607.4488	635.2447	605.4883	501.5539	343.1050	229.1978	239.8097	370.4421	501.2458	511.9755	499.9723	(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													
	976.3305	927.5934	833.2257	681.9938	520.6141	345.0165	229.3728	240.0964	376.2695	578.9114	769.9772	950.9854	(97)
Space heating kWh													
	335.2755	215.1372	147.2978	55.0839	14.1808	0.0000	0.0000	0.0000	0.0000	57.7833	185.7612	335.5538	(98a)
Space heating requirement - total per year (kWh/year)												1346.0735	
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													
	335.2755	215.1372	147.2978	55.0839	14.1808	0.0000	0.0000	0.0000	0.0000	57.7833	185.7612	335.5538	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1346.0735	
Space heating per m2											(98c) / (4) =	21.5475	(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 %)	256.5455 (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												
	335.2755	215.1372	147.2978	55.0839	14.1808	0.0000	0.0000	0.0000	0.0000	57.7833	185.7612	335.5538 (98)
Space heating efficiency (main heating system 1)												
	256.5455	256.5455	256.5455	256.5455	256.5455	0.0000	0.0000	0.0000	0.0000	256.5455	256.5455	256.5455 (210)
Space heating fuel (main heating system)												
	130.6885	83.8593	57.4159	21.4714	5.5276	0.0000	0.0000	0.0000	0.0000	22.5236	72.4087	130.7970 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	211.0383	186.2033	196.7435	170.4366	163.4844	145.4313	142.1679	148.8686	151.6693	171.3776	184.9835	208.4010 (64)
Efficiency of water heater												138.4867 (216)
(217)m	138.4867	138.4867	138.4867	138.4867	138.4867	138.4867	138.4867	138.4867	138.4867	138.4867	138.4867	138.4867 (217)
Fuel for water heating, kWh/month												
	152.3889	134.4558	142.0667	123.0708	118.0506	105.0147	102.6582	107.4967	109.5190	123.7503	133.5750	150.4845 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	15.8767	14.3403	15.8767	15.3646	15.8767	15.3646	15.8767	15.8767	15.3646	15.8767	15.3646	15.8767 (231)
Lighting	19.2456	15.4396	13.9016	10.1849	7.8671	6.4275	7.1767	9.3285	12.1168	15.8979	17.9566	19.7805 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-10.1613	-17.6816	-31.7238	-42.8179	-51.8635	-50.4220	-49.3657	-43.2799	-33.3256	-22.3670	-12.0411	-8.3216 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	524.6919 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	138.4867
Water heating fuel used	1502.5311 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.1000)	
mechanical ventilation fans (SFP = 1.1000)	186.9355 (230a)
Total electricity for the above, kWh/year	186.9355 (231)
Electricity for lighting (calculated in Appendix L)	155.3234 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-373.3709 (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	1996.1110 (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	524.6919	0.1575	82.6212	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1502.5311	0.1412	212.1969	(264)
Space and water heating			294.8181	(265)
Pumps, fans and electric keep-hot	186.9355	0.1387	25.9303	(267)
Energy for lighting	155.3234	0.1443	22.4180	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-373.3709	0.1312	-48.9679	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-48.9679	(269)
Total CO2, kg/year			294.1985	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.7100	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	524.6919	1.5829	830.5362	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1502.5311	1.5222	2287.1826	(278)

Space and water heating			3117.7188 (279)
Pumps, fans and electric keep-hot	186.9355	1.5128	282.7961 (281)
Energy for lighting	155.3234	1.5338	238.2402 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-373.3709	1.4845	-554.2752
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-554.2752 (283)
Total Primary energy kWh/year			3084.4799 (286)
Dwelling Primary energy Rate (DPER)			49.3800 (287)

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

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)	Volume (m3)	
Ground floor		62.4700 (1b)	x	3.1500 (2b) =	196.7805 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.4700					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	196.7805	(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) =	0.1016 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.3516 (18)
Number of sides sheltered			1 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.3253 (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	0.4147	0.4066	0.3984	0.3578	0.3497	0.3090	0.3090	0.3009	0.3253	0.3497	0.3659	0.3822	(22b)
Effective ac	0.5860	0.5827	0.5794	0.5640	0.5611	0.5477	0.5477	0.5453	0.5529	0.5611	0.5669	0.5730	(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 Opening Type (Uw = 1.20)			15.5700	1.1450	17.8282			(27)
External Wall 1	57.4600	15.5700	41.8900	0.1800	7.5402			(29a)
Corridor wall	10.4300		10.4300	0.1800	1.8774			(29a)
External Roof	33.1000		33.1000	0.1100	3.6410			(30)
Total net area of external elements Aum(A, m2)			100.9900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.8868			(33)
Party Wall 1			44.5100	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)	18.2400	0.0700	1.2768
E15 Flat roof with parapet	18.2400	0.5600	10.2144
E7 Party floor between dwellings (in blocks of flats)	6.6200	0.0700	0.4634
E16 Corner (normal)	9.4500	0.0900	0.8505
E18 Party wall between dwellings	3.1500	0.0600	0.1890

E25 Staggered party wall between dwellings	9.4500	0.0600	0.5670	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	24.1900	0.0000	0.0000	
E2 Other lintels (including other steel lintels)	8.4200	0.0500	0.4210	
E3 Sill	8.4200	0.0500	0.4210	
E4 Jamb	21.6000	0.0500	1.0800	
E24 Eaves (insulation at ceiling level - inverted)	14.4900	0.2400	3.4776	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.9607 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 49.8475 (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	38.0529	37.8361	37.6235	36.6252	36.4384	35.5689	35.5689	35.4079	35.9039	36.4384	36.8163	37.2113	(38)
Heat transfer coeff	87.9005	87.6836	87.4711	86.4728	86.2860	85.4165	85.4165	85.2555	85.7514	86.2860	86.6638	87.0589	(39)

Average = Sum(39)m / 12 = 86.4719

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4071	1.4036	1.4002	1.3842	1.3812	1.3673	1.3673	1.3647	1.3727	1.3812	1.3873	1.3936	(40)
HLP (average)												1.3842	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0505 (42)

Hot water usage for mixer showers

58.6004	57.7198	56.4365	53.9812	52.1692	50.1485	48.9999	50.2735	51.6696	53.8392	56.3472	58.3759	(42a)

Hot water usage for baths

25.3233	24.9472	24.4176	23.4411	22.7099	21.8991	21.4612	21.9871	22.5597	23.4273	24.4239	25.2377	(42b)

Hot water usage for other uses

35.6296	34.3340	33.0383	31.7427	30.4471	29.1515	29.1515	30.4471	31.7427	33.0383	34.3340	35.6296	(42c)

Average daily hot water use (litres/day) 109.8969 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	119.5533	117.0010	113.8924	109.1650	105.3262	101.1991	99.6126	102.7077	105.9720	110.3048	115.1051	119.2432	(44)
Energy conte	189.3432	166.6078	175.0484	149.4414	141.7893	124.4361	120.4728	127.1736	130.6741	149.6826	163.9883	186.7060	(45)

Energy content (annual) Total = Sum(45)m = 1825.3637

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

28.4015	24.9912	26.2573	22.4162	21.2684	18.6654	18.0709	19.0760	19.6011	22.4524	24.5982	28.0059	(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

235.9381	208.6935	221.6433	194.5333	188.3842	169.5280	167.0677	173.7685	175.7659	196.2775	209.0802	233.3009	(62)
WWHRS -26.7897	-23.6930	-24.8099	-20.5436	-19.1459	-16.3833	-15.3567	-16.3303	-16.9508	-19.9831	-22.6384	-26.2936	(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

209.1485	185.0005	196.8334	173.9897	169.2383	153.1447	151.7110	157.4382	158.8151	176.2944	186.4417	207.0073	(64)

Total per year (kWh/year) = Sum(64)m = 2125.0628 (64)
12Total per year (kWh/year) 2125 (64)
Electric shower(s)

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

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

Heat gains from water heating, kWh/month

100.2325	89.0657	95.4795	85.7627	84.4209	77.4485	77.3331	79.5611	79.5226	87.0454	90.5996	99.3557	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	102.5270	102.5270	102.5270	102.5270	102.5270	102.5270	102.5270	102.5270	102.5270	102.5270	102.5270	102.5270	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	90.3508	100.0313	90.3508	93.3625	90.3508	93.3625	90.3508	90.3508	93.3625	90.3508	93.3625	90.3508	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	179.1306	180.9894	176.3052	166.3332	153.7454	141.9145	134.0108	132.1520	136.8362	146.8082	159.3960	171.2269	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.2527	33.2527	33.2527	33.2527	33.2527	33.2527	33.2527	33.2527	33.2527	33.2527	33.2527	33.2527	(69)
Pumps, fans 3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-82.0216	-82.0216	-82.0216	-82.0216	-82.0216	-82.0216	-82.0216	-82.0216	-82.0216	-82.0216	-82.0216	-82.0216	(71)
Water heating gains (Table 5)	134.7212	132.5382	128.3327	119.1149	113.4689	107.5673	103.9424	106.9370	110.4481	116.9965	125.8328	133.5426	(72)
Total internal gains	460.9607	470.3169	451.7469	435.5688	414.3232	396.6025	382.0621	383.1979	394.4048	410.9136	435.3494	451.8783	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.0700	19.6403	0.6300	0.7000	0.7700	18.4271	(76)
South	7.1900	46.7521	0.6300	0.7000	0.7700	102.7310	(78)
Southwest	3.7800	36.7938	0.6300	0.7000	0.7700	42.5049	(79)
West	1.5300	19.6403	0.6300	0.7000	0.7700	9.1835	(80)

Solar gains	172.8465	294.6607	402.3302	494.6973	548.8840	542.1545	523.8777	484.1816	434.5965	325.5793	207.1096	147.8500	(83)
Total gains	633.8072	764.9777	854.0771	930.2661	963.2072	938.7570	905.9399	867.3796	829.0014	736.4929	642.4590	599.7284	(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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.3535	49.4755	49.5958	50.1683	50.2769	50.7887	50.7887	50.8847	50.5904	50.2769	50.0577	49.8306	
alpha	4.2902	4.2984	4.3064	4.3446	4.3518	4.3859	4.3859	4.3923	4.3727	4.3518	4.3372	4.3220	
util living area	0.9843	0.9658	0.9322	0.8573	0.7324	0.5583	0.4097	0.4444	0.6578	0.8837	0.9684	0.9874	(86)
MIT	19.6164	19.8963	20.2251	20.5906	20.8403	20.9628	20.9923	20.9890	20.9236	20.5941	20.0419	19.5698	(87)
Th 2	19.7579	19.7606	19.7632	19.7754	19.7777	19.7885	19.7885	19.7905	19.7843	19.7777	19.7731	19.7682	(88)
util rest of house	0.9794	0.9555	0.9122	0.8173	0.6642	0.4627	0.2995	0.3315	0.5628	0.8414	0.9570	0.9833	(89)
MIT 2	18.2056	18.5565	18.9606	19.3950	19.6567	19.7697	19.7864	19.7872	19.7401	19.4138	18.7526	18.1540	(90)
Living area fraction									fLA = Living area / (4) =			0.4865	(91)
MIT	18.8919	19.2083	19.5757	19.9766	20.2325	20.3501	20.3730	20.3718	20.3158	19.9880	19.3798	18.8428	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8919	19.2083	19.5757	19.9766	20.2325	20.3501	20.3730	20.3718	20.3158	19.9880	19.3798	18.8428	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9748	0.9498	0.9086	0.8246	0.6910	0.5082	0.3533	0.3865	0.6063	0.8497	0.9524	0.9793	(94)
Useful gains	617.8446	726.5842	776.0002	767.0639	665.5879	477.0587	320.0387	335.2841	502.5945	625.7836	611.8639	587.3007	(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	1282.6346	1254.6007	1143.7497	957.8272	736.2332	491.1554	322.2787	338.6202	533.0176	810.0528	1064.2145	1274.7839	(97)
Space heating kWh	494.6037	354.8271	273.6056	137.3496	52.5601	0.0000	0.0000	0.0000	0.0000	137.0963	325.6925	511.4875	(98a)
Space heating requirement - total per year (kWh/year)												2287.2224	
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	494.6037	354.8271	273.6056	137.3496	52.5601	0.0000	0.0000	0.0000	0.0000	137.0963	325.6925	511.4875	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2287.2224	
Space heating per m2										(98c) / (4) =		36.6131	(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	494.6037	354.8271	273.6056	137.3496	52.5601	0.0000	0.0000	0.0000	0.0000	137.0963	325.6925	511.4875	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	535.8653	384.4280	296.4308	148.8078	56.9449	0.0000	0.0000	0.0000	0.0000	148.5333	352.8629	554.1577	(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	209.1485	185.0005	196.8334	173.9897	169.2383	153.1447	151.7110	157.4382	158.8151	176.2944	186.4417	207.0073	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.9202	85.4955	84.7985	83.5350	81.7638	79.8000	79.8000	79.8000	79.8000	83.5023	85.2978	86.0054	(217)
Fuel for water heating, kWh/month	243.4219	216.3862	232.1190	208.2835	206.9845	191.9106	190.1140	197.2909	199.0165	211.1253	218.5773	240.6912	(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	18.7731	15.0605	13.5603	9.9349	7.6740	6.2697	7.0005	9.0995	11.8193	15.5075	17.5157	19.2949 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-11.8690	-17.9857	-27.7662	-33.6094	-38.3890	-36.6337	-36.1945	-33.0927	-28.0221	-21.5857	-13.4873	-10.1211 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-3.3757	-7.3255	-14.9882	-23.1554	-31.2582	-31.6390	-31.2615	-26.1683	-18.7949	-10.6766	-4.5703	-2.6528 (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	2478.0308 (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	2555.9210 (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)	151.5098 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-514.6227 (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	4756.8389 (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	2478.0308	0.2100	520.3865	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2555.9210	0.2100	536.7434	(264)
Space and water heating			1057.1299	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	151.5098	0.1443	21.8675	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-308.7563	0.1331	-41.0948	
PV Unit electricity exported	-205.8664	0.1251	-25.7507	
Total			-66.8455	(269)
Total CO2, kg/year			1024.0812	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			16.3900	(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	2478.0308	1.1300	2800.1748	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2555.9210	1.1300	2888.1907	(278)
Space and water heating			5688.3656	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	151.5098	1.5338	232.3908	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-308.7563	1.4918	-460.6092	
PV Unit electricity exported	-205.8664	0.4591	-94.5149	
Total			-555.1241	(283)
Total Primary energy kWh/year			5495.7330	(286)
Target Primary Energy Rate (TPER)			87.9700	(287)

Full SAP Calculation Printout

Property Reference	B2_05_2B_Copy	Issued on Date	23/03/2023
Assessment Reference	B2_05_2B_Copy	Prop Type Ref	
Property			

SAP Rating	83 B	DER	4.43	TER	16.10
Environmental	96 A	% DER < TER			72.48
CO_2 Emissions (t/year)	0.3	DFEE	44.43	TFEE	48.07
Compliance Check	See BREL	% DFEE < TFEE			7.57
% DPER < TPER	46.34	DPER	46.25	TPER	86.19

Assessor Details	Miss Nimco Ali	Assessor ID	R572-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.0600 (1b)	x	3.0200 (2b)	=	229.7012 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 76.0600						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	229.7012	(5)

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2. Ventilation rate
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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.9000 (23c)

Effective ac	0.2387	0.2358	0.2329	0.2184	0.2155	0.2009	0.2009	0.1980	0.2067	0.2155	0.2213	0.2271	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			17.2600	1.1450	19.7634			(27)
Door			1.6800	1.0000	1.6800			(26)
External Wall 1	54.7800	17.2600	37.5200	0.1600	6.0032			(29a)

Corridor Wall	32.1000	1.6800	30.4200	0.1500	4.5630	(29a)
External Roof 1	76.0600		76.0600	0.0900	6.8454	(30)
Total net area of external elements Aum(A, m2)			162.9400			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.8550	(33)
Party Wall 1			38.9900	0.0000	0.0000	(32)
Party Floor 1			76.0600			(32d)

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)	5.8600	0.0700	0.4102
E7 Party floor between dwellings (in blocks of flats)	10.6300	0.1100	1.1693
E16 Corner (normal)	6.0400	0.0900	0.5436
E18 Party wall between dwellings	6.0400	0.0600	0.3624
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	12.2800	0.0630	0.7736
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	12.9100	0.0000	0.0000
E17 Corner (inverted – internal area greater than external area)	6.0400	-0.0900	-0.5436
E25 Staggered party wall between dwellings	6.0400	0.2400	1.4496
P4 Party wall - Roof (insulation at ceiling level)	12.9100	0.0150	0.1936
E14 Flat roof	10.6300	0.1600	1.7008
E15 Flat roof with parapet	18.1400	0.3000	5.4420
E2 Other lintels (including other steel lintels)	9.1100	0.0600	0.5466
E3 Sill	8.3000	0.0400	0.3320
E4 Jamb	20.7800	0.0500	1.0390

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.4192 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 52.2741 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	18.0952	17.8749	17.6546	16.5531	16.3328	15.2313	15.2313	15.0110	15.6719	16.3328	16.7734	17.2140	(38)
Heat transfer coeff	70.3694	70.1491	69.9288	68.8273	68.6070	67.5055	67.5055	67.2852	67.9461	68.6070	69.0476	69.4882	(39)

Average = Sum(39)m / 12 = 68.7722

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9252	0.9223	0.9194	0.9049	0.9020	0.8875	0.8875	0.8846	0.8933	0.9020	0.9078	0.9136	(40)
HLP (average)												0.9042	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3839 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
64.1891	63.2245	61.8188	59.1293	57.1445	54.9311	53.6730	55.0681	56.5973	58.9738	61.7210	63.9432	(42a)

Hot water usage for baths

27.7266	27.3149	26.7350	25.6658	24.8652	23.9775	23.4980	24.0738	24.7008	25.6507	26.7419	27.6329	(42b)

Hot water usage for other uses

39.0431	37.6233	36.2036	34.7838	33.3641	31.9443	31.9443	33.3641	34.7838	36.2036	37.6233	39.0431	(42c)

Average daily hot water use (litres/day) 120.3809 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	130.9588	128.1626	124.7573	119.5789	115.3738	110.8529	109.1153	112.5059	116.0819	120.8280	126.0862	130.6191	(44)
Energy conte	207.4067	182.5019	191.7474	163.6976	155.3153	136.3066	131.9656	139.3058	143.1405	163.9625	179.6329	204.5180	(45)
Energy content (annual)										Total = Sum(45)m =		1999.5009	
Distribution loss (46)m = 0.15 x (45)m	31.1110	27.3753	28.7621	24.5546	23.2973	20.4460	19.7948	20.8959	21.4711	24.5944	26.9449	30.6777	(46)

Water storage loss:

Store volume 150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.2960 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.6998 (55)

Total storage loss

21.6950	19.5955	21.6950	20.9952	21.6950	20.9952	21.6950	21.6950	20.9952	21.6950	20.9952	21.6950	(56)

If cylinder contains dedicated solar storage

21.6950	19.5955	21.6950	20.9952	21.6950	20.9952	21.6950	21.6950	20.9952	21.6950	20.9952	21.6950	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

229.1018	202.0974	213.4424	184.6928	177.0104	157.3018	153.6606	161.0009	164.1357	185.6575	200.6281	226.2130	(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

229.1018	202.0974	213.4424	184.6928	177.0104	157.3018	153.6606	161.0009	164.1357	185.6575	200.6281	226.2130	(64)
									Total per year (kWh/year) = Sum(64)m =		2254.9425	(64)

12Total per year (kWh/year) 2255 (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

68.9627	60.6819	63.7560	54.4294	51.6424	45.3220	43.8785	46.3192	47.5942	54.5175	59.7280	68.0022	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.1928	119.1928	119.1928	119.1928	119.1928	119.1928	119.1928	119.1928	119.1928	119.1928	119.1928	119.1928	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	106.4301	117.8334	106.4301	109.9778	106.4301	109.9778	106.4301	106.4301	109.9778	106.4301	109.9778	106.4301	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	211.0096	213.1993	207.6815	195.9348	181.1067	167.1704	157.8601	155.6705	161.1883	172.9350	187.7630	201.6993	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.9193	34.9193	34.9193	34.9193	34.9193	34.9193	34.9193	34.9193	34.9193	34.9193	34.9193	34.9193	(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)													
	-95.3542	-95.3542	-95.3542	-95.3542	-95.3542	-95.3542	-95.3542	-95.3542	-95.3542	-95.3542	-95.3542	-95.3542	(71)
Water heating gains (Table 5)													
	92.6919	90.3004	85.6936	75.5965	69.4118	62.9472	58.9765	62.2570	66.1031	73.2762	82.9555	91.4009	(72)
Total internal gains													
	468.8895	480.0909	458.5630	440.2669	415.7065	398.8532	382.0246	383.1154	396.0270	411.3992	439.4542	458.2881	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
West	17.2600	19.6403	0.4000	0.8000	0.7700	75.1746	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	75.1746	147.0575	242.1828	353.2092	432.8711	443.1206	421.8689	362.3791	281.6686	174.4962	93.7339	61.8200	(83)
Total gains	544.0641	627.1484	700.7458	793.4761	848.5776	841.9738	803.8935	745.4946	677.6956	585.8953	533.1881	520.1081	(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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	75.0603	75.2960	75.5332	76.7420	76.9884	78.2447	78.2447	78.5008	77.7373	76.9884	76.4972	76.0121	
alpha	6.0040	6.0197	6.0355	6.1161	6.1326	6.2163	6.2163	6.2334	6.1825	6.1326	6.0998	6.0675	
util living area													
	0.9947	0.9869	0.9641	0.8794	0.7146	0.5091	0.3690	0.4142	0.6683	0.9292	0.9875	0.9959	(86)
Living	20.0683	20.2494	20.5022	20.8008	20.9532	20.9950	20.9994	20.9989	20.9764	20.7504	20.3612	20.0435	
Non living	19.3015	19.4822	19.7297	20.0138	20.1374	20.1760	20.1780	20.1803	20.1617	19.9785	19.6040	19.2849	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	31	0	0	0	0	0	0	0	0	0	0	8	
16 / 9	0	28	31	0	0	0	0	0	0	0	17	23	
MIT	21.0000	20.5749	20.7181	20.8008	20.9532	20.9950	20.9994	20.9989	20.9764	20.7504	20.5182	20.5981	(87)
Th 2	20.1461	20.1486	20.1511	20.1633	20.1658	20.1781	20.1781	20.1806	20.1732	20.1658	20.1609	20.1560	(88)
util rest of house													
	0.9931	0.9830	0.9536	0.8493	0.6618	0.4456	0.3003	0.3409	0.5975	0.9036	0.9830	0.9946	(89)
MIT 2	20.1461	19.7712	19.9124	20.0138	20.1374	20.1760	20.1780	20.1803	20.1617	19.9785	19.7408	19.7899	(90)
Living area fraction										fLA = Living area / (4) =		0.4449	(91)
MIT	20.5260	20.1288	20.2709	20.3640	20.5004	20.5404	20.5434	20.5445	20.5242	20.3220	20.0867	20.1495	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5260	20.1288	20.2709	20.3640	20.5004	20.5404	20.5434	20.5445	20.5242	20.3220	20.0867	20.1495	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9939	0.9829	0.9552	0.8570	0.6836	0.4738	0.3309	0.3736	0.6283	0.9090	0.9826	0.9946	(94)
Useful gains	540.7219	616.4024	669.3804	680.0483	580.0764	398.9131	266.0195	278.4819	425.8098	532.5767	523.8857	517.2931	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1141.8159	1068.2837	962.9794	789.0328	603.7685	401.0110	266.2044	278.8623	436.5000	666.9937	896.6994	1108.3000	(97)
Space heating kWh													
	447.2139	303.6642	218.4377	78.4688	17.6269	0.0000	0.0000	0.0000	0.0000	100.0063	268.4258	439.7091	(98a)
Space heating requirement - total per year (kWh/year)												1873.5527	
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													
	447.2139	303.6642	218.4377	78.4688	17.6269	0.0000	0.0000	0.0000	0.0000	100.0063	268.4258	439.7091	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1873.5527	
Space heating per m2											(98c) / (4) =	24.6326	(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 %)	266.1704	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

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

Space heating requirement												
	447.2139	303.6642	218.4377	78.4688	17.6269	0.0000	0.0000	0.0000	0.0000	100.0063	268.4258	439.7091 (98)
Space heating efficiency (main heating system 1)												
	266.1704	266.1704	266.1704	266.1704	266.1704	0.0000	0.0000	0.0000	0.0000	266.1704	266.1704	266.1704 (210)
Space heating fuel (main heating system)												
	168.0179	114.0864	82.0669	29.4807	6.6224	0.0000	0.0000	0.0000	0.0000	37.5723	100.8474	165.1984 (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												
	229.1018	202.0974	213.4424	184.6928	177.0104	157.3018	153.6606	161.0009	164.1357	185.6575	200.6281	226.2130 (64)
Efficiency of water heater												139.4724 (216)
(217)m	139.4724	139.4724	139.4724	139.4724	139.4724	139.4724	139.4724	139.4724	139.4724	139.4724	139.4724	139.4724 (217)
Fuel for water heating, kWh/month												
	164.2632	144.9014	153.0357	132.4225	126.9143	112.7835	110.1728	115.4357	117.6833	133.1142	143.8480	162.1920 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	17.1082	15.4526	17.1082	16.5563	17.1082	16.5563	17.1082	17.1082	16.5563	17.1082	16.5563	17.1082 (231)
Lighting	24.2816	19.4796	17.5392	12.8500	9.9257	8.1094	9.0545	11.7694	15.2873	20.0578	22.6553	24.9564 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-12.2704	-21.3364	-38.2041	-51.2212	-61.6747	-59.8510	-58.5978	-51.4720	-39.7616	-26.9274	-14.5386	-10.0480 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	703.8923 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	139.4724
Water heating fuel used	1616.7666 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.1000)	
mechanical ventilation fans (SFP = 1.1000)	201.4352 (230a)
Total electricity for the above, kWh/year	201.4352 (231)
Electricity for lighting (calculated in Appendix L)	195.9663 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-445.9031 (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	2272.1573 (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	703.8923	0.1571	110.5520	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1616.7666	0.1413	228.3739	(264)
Space and water heating			338.9259	(265)
Pumps, fans and electric keep-hot	201.4352	0.1387	27.9415	(267)
Energy for lighting	195.9663	0.1443	28.2840	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-445.9031	0.1312	-58.5223	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-58.5223	(269)
Total CO2, kg/year			336.6291	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.4300	(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	703.8923	1.5814	1113.1452	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1616.7666	1.5223	2461.2388	(278)

Space and water heating			3574.3841 (279)
Pumps, fans and electric keep-hot	201.4352	1.5128	304.7312 (281)
Energy for lighting	195.9663	1.5338	300.5797 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-445.9031	1.4849	-662.1082
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-662.1082 (283)
Total Primary energy kWh/year			3517.5867 (286)
Dwelling Primary energy Rate (DPER)			46.2500 (287)

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

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)	Volume (m3)	
Ground floor		76.0600 (1b)	x	3.0200 (2b) =	229.7012 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	229.7012 (5)	

2. Ventilation rate

		m3 per hour	
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		3 * 10 =	30.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		30.0000 / (5) =	0.1306 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.3806 (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) =	0.2950 (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	0.3761	0.3687	0.3613	0.3245	0.3171	0.2802	0.2802	0.2728	0.2950	0.3171	0.3318	0.3466	(22b)
Effective ac	0.5707	0.5680	0.5653	0.5526	0.5503	0.5393	0.5393	0.5372	0.5435	0.5503	0.5551	0.5601	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.6800	1.0000	1.6800			(26)
TER Opening Type (Uw = 1.20)			17.2600	1.1450	19.7634			(27)
External Wall 1	54.7800	17.2600	37.5200	0.1800	6.7536			(29a)
Corridor Wall	32.1000	1.6800	30.4200	0.1800	5.4756			(29a)
External Roof 1	76.0600		76.0600	0.1100	8.3666			(30)
Total net area of external elements Aum(A, m2)			162.9400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.0392			(33)
Party Wall 1			38.9900	0.0000	0.0000			(32)

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

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E7 Party floor between dwellings (in blocks of flats)	5.8600	0.0700	0.4102
E7 Party floor between dwellings (in blocks of flats)	10.6300	0.0700	0.7441
E16 Corner (normal)	6.0400	0.0900	0.5436
E18 Party wall between dwellings	6.0400	0.0600	0.3624

E23 Balcony within or between dwellings, balcony support penetrates wall insulation	12.2800	0.0200	0.2456	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	12.9100	0.0000	0.0000	
E17 Corner (inverted – internal area greater than external area)	6.0400	-0.0900	-0.5436	
E25 Staggered party wall between dwellings	6.0400	0.0600	0.3624	
P4 Party wall - Roof (insulation at ceiling level)	12.9100	0.1200	1.5492	
E14 Flat roof	10.6300	0.0800	0.8504	
E15 Flat roof with parapet	18.1400	0.5600	10.1584	
E2 Other lintels (including other steel lintels)	9.1100	0.0500	0.4555	
E3 Sill	8.3000	0.0500	0.4150	
E4 Jamb	20.7800	0.0500	1.0390	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.5922 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 58.6314 (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	43.2614	43.0532	42.8492	41.8908	41.7115	40.8768	40.8768	40.7222	41.1983	41.7115	42.0742	42.4535	(38)
Heat transfer coeff	101.8927	101.6846	101.4805	100.5222	100.3428	99.5081	99.5081	99.3536	99.8297	100.3428	100.7056	101.0848	(39)

Average = Sum(39)m / 12 = 100.5213

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3396	1.3369	1.3342	1.3216	1.3193	1.3083	1.3083	1.3063	1.3125	1.3193	1.3240	1.3290	(40)
HLP (average)												1.3216	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3839 (42)

Hot water usage for mixer showers

64.1891	63.2245	61.8188	59.1293	57.1445	54.9311	53.6730	55.0681	56.5973	58.9738	61.7210	63.9432	(42a)

Hot water usage for baths

27.7266	27.3149	26.7350	25.6658	24.8652	23.9775	23.4980	24.0738	24.7008	25.6507	26.7419	27.6329	(42b)

Hot water usage for other uses

39.0431	37.6233	36.2036	34.7838	33.3641	31.9443	31.9443	33.3641	34.7838	36.2036	37.6233	39.0431	(42c)

Average daily hot water use (litres/day) 120.3809 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	130.9588	128.1626	124.7573	119.5789	115.3738	110.8529	109.1153	112.5059	116.0819	120.8280	126.0862	130.6191	(44)
Energy conte	207.4067	182.5019	191.7474	163.6976	155.3153	136.3066	131.9656	139.3058	143.1405	163.9625	179.6329	204.5180	(45)

Energy content (annual) Total = Sum(45)m = 1999.5009

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

31.1110	27.3753	28.7621	24.5546	23.2973	20.4460	19.7948	20.8959	21.4711	24.5944	26.9449	30.6777	(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

254.0016	224.5876	238.3423	208.7894	201.9102	181.3985	178.5605	185.9008	188.2324	210.5574	224.7248	251.1129	(62)
WWHRS -29.3446	-25.9526	-27.1760	-22.5028	-20.9718	-17.9458	-16.8213	-17.8877	-18.5674	-21.8889	-24.7974	-28.8012	(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

224.6571	198.6350	211.1663	186.2866	180.9384	163.4527	161.7392	168.0130	169.6650	188.6685	199.9273	222.3117	(64)

Total per year (kWh/year) = Sum(64)m = 2275.4608 (64)

12Total per year (kWh/year) 2275 (64)

Electric shower(s)

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

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

Heat gains from water heating, kWh/month

106.2387	94.3505	101.0319	90.5029	88.9183	81.3954	81.1545	83.5951	83.6677	91.7934	95.8014	105.2782	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.1928	119.1928	119.1928	119.1928	119.1928	119.1928	119.1928	119.1928	119.1928	119.1928	119.1928	119.1928	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	106.4087	117.8097	106.4087	109.9557	106.4087	109.9557	106.4087	106.4087	109.9557	106.4087	109.9557	106.4087	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	211.0096	213.1993	207.6815	195.9348	181.1067	167.1704	157.8601	155.6705	161.1883	172.9350	187.7630	201.6993	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.9193	34.9193	34.9193	34.9193	34.9193	34.9193	34.9193	34.9193	34.9193	34.9193	34.9193	34.9193	(69)
Pumps, fans 3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-95.3542	-95.3542	-95.3542	-95.3542	-95.3542	-95.3542	-95.3542	-95.3542	-95.3542	-95.3542	-95.3542	-95.3542	(71)
Water heating gains (Table 5)	142.7939	140.4025	135.7956	125.6985	119.5138	113.0492	109.0786	112.3590	116.2051	123.3783	133.0575	141.5029	(72)

Total internal gains

	521.9701	533.1692	511.6436	493.3468	468.7871	448.9331	432.1053	433.1961	446.1069	464.4798	492.5341	511.3688 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
West	17.2600	19.6403	0.6300	0.7000	0.7700	103.6000 (80)

Solar gains	103.6000	202.6637	333.7582	486.7664	596.5505	610.6756	581.3881	499.4038	388.1746	240.4775	129.1771	85.1956 (83)
Total gains	625.5701	735.8329	845.4018	980.1132	1065.3376	1059.6087	1013.4933	932.5998	834.2815	704.9573	621.7111	596.5644 (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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.8383	51.9444	52.0488	52.5451	52.6390	53.0805	53.0805	53.1631	52.9096	52.6390	52.4494	52.2526	
alpha	4.4559	4.4630	4.4699	4.5030	4.5093	4.5387	4.5387	4.5442	4.5273	4.5093	4.4966	4.4835	
util living area	0.9926	0.9843	0.9625	0.8944	0.7605	0.5757	0.4265	0.4801	0.7331	0.9375	0.9854	0.9940	(86)
MIT	19.5278	19.7558	20.1030	20.5357	20.8318	20.9633	20.9924	20.9873	20.8943	20.4768	19.9246	19.4915	(87)
Th 2	19.8099	19.8120	19.8141	19.8239	19.8258	19.8343	19.8343	19.8359	19.8310	19.8258	19.8221	19.8182	(88)
util rest of house	0.9902	0.9792	0.9501	0.8615	0.6956	0.4814	0.3164	0.3636	0.6412	0.9102	0.9797	0.9920	(89)
MIT 2	18.1302	18.4202	18.8555	19.3790	19.6954	19.8154	19.8322	19.8320	19.7657	19.3273	18.6439	18.0897	(90)
Living area fraction									fLA = Living area / (4) =			0.4449	(91)
MIT	18.7520	19.0144	19.4105	19.8936	20.2010	20.3261	20.3484	20.3460	20.2678	19.8387	19.2137	18.7134	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7520	19.0144	19.4105	19.8936	20.2010	20.3261	20.3484	20.3460	20.2678	19.8387	19.2137	18.7134	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9872	0.9746	0.9449	0.8637	0.7177	0.5224	0.3655	0.4156	0.6780	0.9105	0.9757	0.9894	(94)
Useful gains	617.5628	717.1630	798.8467	846.5431	764.6433	553.5047	370.4617	387.5816	565.6048	641.8862	606.6252	590.2552	(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	1472.5535	1435.2191	1310.1655	1105.1016	853.0148	569.7966	372.9956	392.0465	615.7298	927.0405	1219.9200	1467.0798	(97)
Space heating kWh	636.1131	482.5337	380.4212	186.1622	65.7483	0.0000	0.0000	0.0000	0.0000	212.1548	441.5722	652.3575	(98a)
Space heating requirement - total per year (kWh/year)												3057.0631	
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	636.1131	482.5337	380.4212	186.1622	65.7483	0.0000	0.0000	0.0000	0.0000	212.1548	441.5722	652.3575	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3057.0631	
Space heating per m2										(98c) / (4) =		40.1928	(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	636.1131	482.5337	380.4212	186.1622	65.7483	0.0000	0.0000	0.0000	0.0000	212.1548	441.5722	652.3575	(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)	689.1800	522.7884	412.1573	201.6925	71.2333	0.0000	0.0000	0.0000	0.0000	229.8535	478.4098	706.7796	(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	224.6571	198.6350	211.1663	186.2866	180.9384	163.4527	161.7392	168.0130	169.6650	188.6685	199.9273	222.3117	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.2609	85.9725	85.3635	84.0583	82.0155	79.8000	79.8000	79.8000	79.8000	84.3235	85.7847	86.3254	(217)
Fuel for water heating, kWh/month													

	260.4391	231.0448	247.3730	221.6160	220.6150	204.8280	202.6807	210.5426	212.6128	223.7436	233.0570	257.5275 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	22.1096	17.7372	15.9704	11.7006	9.0379	7.3840	8.2446	10.7167	13.9199	18.2637	20.6288	22.7241 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-14.3666	-21.7239	-33.4633	-40.4076	-46.0586	-43.9074	-43.3706	-39.6944	-33.6787	-26.0224	-16.3064	-12.2553 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-4.1946	-9.0937	-18.5920	-28.7060	-38.7400	-39.2177	-38.7601	-32.4584	-23.3230	-13.2585	-5.6795	-3.2975 (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	3312.0944 (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	2726.0800 (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)	178.4374 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-626.5760 (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	5676.0358 (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	3312.0944	0.2100	695.5398	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2726.0800	0.2100	572.4768	(264)
Space and water heating			1268.0166	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	178.4374	0.1443	25.7540	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-371.2551	0.1331	-49.4320	
PV Unit electricity exported	-255.3209	0.1251	-31.9393	
Total			-81.3713	(269)
Total CO2, kg/year			1224.3286	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			16.1000	(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	3312.0944	1.1300	3742.6667	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2726.0800	1.1300	3080.4704	(278)
Space and water heating			6823.1371	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	178.4374	1.5338	273.6932	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-371.2551	1.4920	-553.9168	
PV Unit electricity exported	-255.3209	0.4591	-117.2292	
Total			-671.1460	(283)
Total Primary energy kWh/year			6555.7851	(286)
Target Primary Energy Rate (TPER)			86.1900	(287)

Full SAP Calculation Printout

Property Reference	End House_Copy	Issued on Date	23/03/2023
Assessment Reference	End House_Copy	Prop Type Ref	
Property			

SAP Rating	86 B	DER	3.35	TER	10.34
Environmental	97 A	% DER < TER			67.60
CO_2 Emissions (t/year)	0.31	DFEE	37.45	TFEE	37.96
Compliance Check	See BREL	% DFEE < TFEE			1.33
% DPER < TPER	35.72	DPER	34.69	TPER	53.97

Assessor Details	Miss Nimco Ali	Assessor ID	R572-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	53.4800 (1b)	x	2.5000 (2b)	=	133.7000 (1b)	-
First floor	53.4800 (1c)	x	2.8200 (2c)	=	150.8136 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.9600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	284.5136	(5)

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2. Ventilation rate
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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.2000 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1850 (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	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.2000 (23c)

Effective ac	0.3399	0.3353	0.3306	0.3075	0.3029	0.2797	0.2797	0.2751	0.2890	0.3029	0.3121	0.3214	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			16.3000	1.1450	18.6641			(27)
Door			1.9200	1.0000	1.9200			(26)

Heatloss Floor 1			53.4800	0.1000	5.3480	(28a)
External Wall 1	110.0700	18.2200	91.8500	0.1600	14.6960	(29a)
External Roof 1	53.4800		53.4800	0.0900	4.8132	(30)
Total net area of external elements Aum(A, m2)			217.0300			(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.4413	(33)
Party Wall 1			55.1200	0.0000	0.0000	(32)

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

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E5 Ground floor (normal)	20.6900	0.1600	3.3104
E6 Intermediate floor within a dwelling	20.6900	0.0000	0.0000
E16 Corner (normal)	10.6400	0.0900	0.9576
E18 Party wall between dwellings	10.6400	0.0600	0.6384
P2 Party wall - Intermediate floor within a dwelling	10.3600	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	10.3600	0.0150	0.1554
E10 Eaves (insulation at ceiling level)	20.6900	0.1200	2.4828
P1 Party wall - Ground floor	10.3600	0.1600	1.6576
E2 Other lintels (including other steel lintels)	10.9500	0.0600	0.6570
E3 Sill	10.0400	0.0400	0.4016
E4 Jamb	34.6800	0.0500	1.7340

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.9948 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	57.4361 (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	31.9107	31.4765	31.0422	28.8710	28.4368	26.2656	26.2656	25.8313	27.1341	28.4368	29.3053	30.1737	(38)
Heat transfer coeff	89.3468	88.9126	88.4783	86.3071	85.8729	83.7017	83.7017	83.2675	84.5702	85.8729	86.7414	87.6099	(39)
Average = Sum(39)m / 12 =												86.1986	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8353	0.8313	0.8272	0.8069	0.8029	0.7826	0.7826	0.7785	0.7907	0.8029	0.8110	0.8191	(40)
HLP (average)												0.8059	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7953 (42)
Hot water usage for mixer showers	71.0877	70.0194	68.4626	65.4841	63.2860	60.8347	59.4414	60.9864	62.6799	65.3119	68.3544	70.8153 (42a)
Hot water usage for baths	30.6933	30.2374	29.5955	28.4119	27.5257	26.5430	26.0122	26.6496	27.3436	28.3952	29.6031	30.5895 (42b)
Hot water usage for other uses	43.2566	41.6836	40.1107	38.5377	36.9647	35.3918	35.3918	36.9647	38.5377	40.1107	41.6836	43.2566 (42c)
Average daily hot water use (litres/day)												133.3221 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.0375	141.9404	138.1688	132.4337	127.7764	122.7695	120.8453	124.6007	128.5613	133.8177	139.6411	144.6614	(44)
Energy conte	229.7040	202.1213	212.3603	181.2952	172.0116	150.9594	146.1520	154.2817	158.5289	181.5893	198.9444	226.5048	(45)
Energy content (annual)										Total = Sum(45)m =		2214.4528	
Distribution loss (46)m = 0.15 x (45)m	34.4556	30.3182	31.8540	27.1943	25.8017	22.6439	21.9228	23.1423	23.7793	27.2384	29.8417	33.9757	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2960	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.6998	(55)
Total storage loss	21.6950	19.5955	21.6950	20.9952	21.6950	20.9952	21.6950	21.6950	20.9952	21.6950	20.9952	21.6950	(56)
If cylinder contains dedicated solar storage	21.6950	19.5955	21.6950	20.9952	21.6950	20.9952	21.6950	21.6950	20.9952	21.6950	20.9952	21.6950	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	251.3990	221.7168	234.0553	202.2904	193.7067	171.9546	167.8470	175.9767	179.5241	203.2844	219.9396	248.1998	(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	251.3990	221.7168	234.0553	202.2904	193.7067	171.9546	167.8470	175.9767	179.5241	203.2844	219.9396	248.1998	(64)
										Total per year (kWh/year) = Sum(64)m =		2469.8944	(64)
12Total per year (kWh/year)												2470	(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	76.3766	67.2053	70.6098	60.2806	57.1939	50.1940	48.5955	51.2987	52.7109	60.3785	66.1490	75.3128	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	(66)

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

	138.3614	153.1859	138.3614	142.9735	138.3614	142.9735	138.3614	138.3614	142.9735	138.3614	142.9735	138.3614 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	267.1138	269.8856	262.9007	248.0308	229.2602	211.6184	199.8327	197.0609	204.0457	218.9157	237.6863	255.3280 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765 (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)												
	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117 (71)
Water heating gains (Table 5)												
	102.6567	100.0079	94.9056	83.7231	76.8735	69.7139	65.3166	68.9498	73.2095	81.1538	91.8736	101.2269 (72)
Total internal gains												
	573.0613	588.0088	561.0972	539.6568	509.4245	489.2352	468.4401	469.3015	485.1581	503.3603	537.4628	559.8458 (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	8.3700	10.6334	0.4000	0.8000	0.7700	19.7370 (74)
East	1.3400	19.6403	0.4000	0.8000	0.7700	5.8363 (76)
South	6.5900	46.7521	0.4000	0.8000	0.7700	68.3234 (78)

Solar gains	93.8966	161.0315	225.4307	291.4675	340.1610	344.4199	329.2103	291.3954	247.8234	179.1364	112.6118	80.2909 (83)
Total gains	666.9580	749.0403	786.5279	831.1243	849.5855	833.6551	797.6503	760.6969	732.9815	682.4968	650.0745	640.1367 (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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	83.1342	83.5402	83.9502	86.0621	86.4973	88.7411	88.7411	89.2038	87.8297	86.4973	85.6313	84.7824	
alpha	6.5423	6.5693	6.5967	6.7375	6.7665	6.9161	6.9161	6.9469	6.8553	6.7665	6.7088	6.6522	
util living area	0.9971	0.9932	0.9843	0.9471	0.8428	0.6315	0.4605	0.5014	0.7553	0.9564	0.9926	0.9978	(86)
Living	20.1207	20.2684	20.4582	20.7251	20.9116	20.9900	20.9990	20.9983	20.9679	20.7429	20.4014	20.1115	
Non living	19.4167	19.5663	19.7564	20.0270	20.1922	20.2640	20.2682	20.2715	20.2447	20.0499	19.7134	19.4191	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	31	28	6	0	0	0	0	0	0	0	0	31	
16 / 9	0	0	25	18	0	0	0	0	0	0	30	0	
MIT	21.0000	21.0000	20.7526	20.7966	20.9116	20.9900	20.9990	20.9983	20.9679	20.7429	20.6610	21.0000	(87)
Th 2	20.2228	20.2263	20.2298	20.2473	20.2509	20.2685	20.2685	20.2720	20.2614	20.2509	20.2438	20.2368	(88)
util rest of house	0.9962	0.9911	0.9792	0.9303	0.7998	0.5641	0.3846	0.4232	0.6896	0.9391	0.9899	0.9971	(89)
MIT 2	20.2228	20.2263	20.0136	20.0843	20.1922	20.2640	20.2682	20.2715	20.2447	20.0499	19.9434	20.2368	(90)
Living area fraction										fLA = Living area / (4) =		0.1537	(91)
MIT	20.3423	20.3452	20.1272	20.1938	20.3028	20.3756	20.3805	20.3832	20.3559	20.1564	20.0537	20.3541	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3423	20.3452	20.1272	20.1938	20.3028	20.3756	20.3805	20.3832	20.3559	20.1564	20.0537	20.3541	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9914	0.9784	0.9290	0.8030	0.5742	0.3963	0.4352	0.6985	0.9365	0.9891	0.9972	(94)
Useful gains	664.5597	742.6261	769.5352	772.0829	682.2410	478.6741	316.1173	331.0848	511.9931	639.1268	642.9989	638.3431	(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	1433.3260	1373.2753	1205.7076	974.7363	738.7479	483.4254	316.4366	331.6712	529.0598	820.6373	1123.6221	1415.2603	(97)
Space heating kWh	571.9621	423.7963	324.5122	145.9104	42.0411	0.0000	0.0000	0.0000	0.0000	135.0438	346.0487	578.0264	(98a)
Space heating requirement - total per year (kWh/year)												2567.3410	
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	571.9621	423.7963	324.5122	145.9104	42.0411	0.0000	0.0000	0.0000	0.0000	135.0438	346.0487	578.0264	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2567.3410	
Space heating per m2										(98c) / (4) =		24.0028	(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 %)	278.1678 (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												

	571.9621	423.7963	324.5122	145.9104	42.0411	0.0000	0.0000	0.0000	0.0000	135.0438	346.0487	578.0264 (98)
Space heating efficiency (main heating system 1)												
	278.1678	278.1678	278.1678	278.1678	278.1678	0.0000	0.0000	0.0000	0.0000	278.1678	278.1678	278.1678 (210)
Space heating fuel (main heating system)												
	205.6176	152.3527	116.6606	52.4541	15.1136	0.0000	0.0000	0.0000	0.0000	48.5476	124.4028	207.7977 (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												
	251.3990	221.7168	234.0553	202.2904	193.7067	171.9546	167.8470	175.9767	179.5241	203.2844	219.9396	248.1998 (64)
Efficiency of water heater												141.6845 (216)
(217)m	141.6845	141.6845	141.6845	141.6845	141.6845	141.6845	141.6845	141.6845	141.6845	141.6845	141.6845	141.6845 (217)
Fuel for water heating, kWh/month												
	177.4358	156.4862	165.1947	142.7752	136.7169	121.3644	118.4653	124.2032	126.7069	143.4768	155.2319	175.1778 (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	23.0995	20.8641	23.0995	22.3544	23.0995	22.3544	23.0995	23.0995	22.3544	23.0995	22.3544	23.0995 (231)
Lighting	34.3476	27.5549	24.8101	18.1770	14.0404	11.4711	12.8081	16.6485	21.6248	28.3728	32.0471	35.3022 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-25.3216	-43.0022	-74.6462	-96.2722	-111.5881	-106.2003	-104.0886	-93.2495	-74.3004	-52.8248	-29.6277	-20.8496 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	922.9467 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	141.6845
Water heating fuel used	1743.2351 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.3375)	
mechanical ventilation fans (SFP = 1.3375)	271.9782 (230a)
Total electricity for the above, kWh/year	271.9782 (231)
Electricity for lighting (calculated in Appendix L)	277.2047 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-831.9713 (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	2383.3934 (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	922.9467	0.1566	144.4954	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1743.2351	0.1413	246.2873	(264)
Space and water heating			390.7828	(265)
Pumps, fans and electric keep-hot	271.9782	0.1387	37.7267	(267)
Energy for lighting	277.2047	0.1443	40.0092	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-831.9713	0.1320	-109.7881	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-109.7881	(269)
Total CO2, kg/year			358.7306	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.3500	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	922.9467	1.5796	1457.8925	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1743.2351	1.5224	2653.9493	(278)
Space and water heating			4111.8417	(279)

Pumps, fans and electric keep-hot	271.9782	1.5128	411.4486 (281)
Energy for lighting	277.2047	1.5338	425.1858 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-831.9713	1.4876	-1237.6147
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1237.6147 (283)
Total Primary energy kWh/year			3710.8614 (286)
Dwelling Primary energy Rate (DPER)			34.6900 (287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	53.4800 (1b)	x	2.5000 (2b)	=	133.7000 (1b)	-
First floor	53.4800 (1c)	x	2.8200 (2c)	=	150.8136 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.9600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	284.5136 (5)	

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1406	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3906	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3613	(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	0.4607	0.4516	0.4426	0.3974	0.3884	0.3432	0.3432	0.3342	0.3613	0.3884	0.4065	0.4245	(22b)
Effective ac	0.6061	0.6020	0.5979	0.5790	0.5754	0.5589	0.5589	0.5558	0.5653	0.5754	0.5826	0.5901	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.9200	1.0000	1.9200			(26)
TER Opening Type (Uw = 1.20)			16.3000	1.1450	18.6641			(27)
Heatloss Floor 1			53.4800	0.1300	6.9524			(28a)
External Wall 1	110.0700	18.2200	91.8500	0.1800	16.5330			(29a)
External Roof 1	53.4800		53.4800	0.1100	5.8828			(30)
Total net area of external elements Aum(A, m2)			217.0300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.9523			(33)
Party Wall 1			55.1200	0.0000	0.0000			(32)

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

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E5 Ground floor (normal)	20.6900	0.1600	3.3104
E6 Intermediate floor within a dwelling	20.6900	0.0000	0.0000
E16 Corner (normal)	10.6400	0.0900	0.9576
E18 Party wall between dwellings	10.6400	0.0600	0.6384

P2 Party wall - Intermediate floor within a dwelling	10.3600	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	10.3600	0.1200	1.2432	
E10 Eaves (insulation at ceiling level)	20.6900	0.0600	1.2414	
P1 Party wall - Ground floor	10.3600	0.0800	0.8288	
E2 Other lintels (including other steel lintels)	10.9500	0.0500	0.5475	
E3 Sill	10.0400	0.0500	0.5020	
E4 Jamb	34.6800	0.0500	1.7340	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.0033 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 60.9556 (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	56.9065	56.5197	56.1405	54.3596	54.0263	52.4752	52.4752	52.1880	53.0727	54.0263	54.7004	55.4051	(38)
Heat transfer coeff	117.8621	117.4753	117.0961	115.3152	114.9820	113.4308	113.4308	113.1436	114.0283	114.9820	115.6560	116.3608	(39)

Average = Sum(39)m / 12 = 115.3136

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1019	1.0983	1.0948	1.0781	1.0750	1.0605	1.0605	1.0578	1.0661	1.0750	1.0813	1.0879	(40)
HLP (average)												1.0781	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7953 (42)

Hot water usage for mixer showers

71.0877	70.0194	68.4626	65.4841	63.2860	60.8347	59.4414	60.9864	62.6799	65.3119	68.3544	70.8153	(42a)

Hot water usage for baths

30.6933	30.2374	29.5955	28.4119	27.5257	26.5430	26.0122	26.6496	27.3436	28.3952	29.6031	30.5895	(42b)

Hot water usage for other uses

43.2566	41.6836	40.1107	38.5377	36.9647	35.3918	35.3918	36.9647	38.5377	40.1107	41.6836	43.2566	(42c)

Average daily hot water use (litres/day) 133.3221 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.0375	141.9404	138.1688	132.4337	127.7764	122.7695	120.8453	124.6007	128.5613	133.8177	139.6411	144.6614	(44)
Energy conte	229.7040	202.1213	212.3603	181.2952	172.0116	150.9594	146.1520	154.2817	158.5289	181.5893	198.9444	226.5048	(45)

Energy content (annual) Total = Sum(45)m = 2214.4528

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

34.4556	30.3182	31.8540	27.1943	25.8017	22.6439	21.9228	23.1423	23.7793	27.2384	29.8417	33.9757	(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

276.2989	244.2070	258.9552	226.3870	218.6065	196.0512	192.7469	200.8766	203.6207	228.1842	244.0362	273.0997	(62)
WWHRS -32.4983	-28.7418	-30.0967	-24.9213	-23.2257	-19.8744	-18.6291	-19.8102	-20.5629	-24.2413	-27.4625	-31.8965	(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

243.8006	215.4652	228.8585	201.4657	195.3808	176.1768	174.1178	181.0664	183.0579	203.9429	216.5737	241.2032	(64)

Total per year (kWh/year) = Sum(64)m = 2461.1094 (64)

12Total per year (kWh/year) 2461 (64)

Electric shower(s)

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

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

Heat gains from water heating, kWh/month

113.6525	100.8739	107.8857	96.3541	94.4698	86.2675	85.8715	88.5746	88.7843	97.6544	102.2225	112.5888	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	141.9519	157.1610	141.9519	146.6836	141.9519	146.6836	141.9519	141.9519	146.6836	141.9519	146.6836	141.9519	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	267.1138	269.8856	262.9007	248.0308	229.2602	211.6184	199.8327	197.0609	204.0457	218.9157	237.6863	255.3280	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	(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)	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	(71)
Water heating gains (Table 5)	152.7587	150.1100	145.0077	133.8252	126.9755	119.8159	115.4186	119.0519	123.3116	131.2559	141.9757	151.3290	(72)
Total internal gains	629.7538	645.0860	617.7897	596.4690	566.1170	543.0474	522.1325	522.9940	538.9703	560.0528	594.2749	616.5383	(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	8.3700	10.6334	0.6300	0.7000	0.7700	27.2000 (74)
East	1.3400	19.6403	0.6300	0.7000	0.7700	8.0431 (76)
South	6.5900	46.7521	0.6300	0.7000	0.7700	94.1582 (78)

Solar gains	129.4013	221.9215	310.6716	401.6787	468.7844	474.6537	453.6929	401.5793	341.5316	246.8724	155.1931	110.6509 (83)
Total gains	759.1551	867.0074	928.4613	998.1476	1034.9014	1017.7010	975.8254	924.5733	880.5018	806.9252	749.4680	727.1892 (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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.0209	63.2284	63.4332	64.4128	64.5995	65.4829	65.4829	65.6491	65.1398	64.5995	64.2230	63.8340	
alpha	5.2014	5.2152	5.2289	5.2942	5.3066	5.3655	5.3655	5.3766	5.3427	5.3066	5.2815	5.2556	
util living area	0.9957	0.9907	0.9802	0.9450	0.8549	0.6756	0.5045	0.5514	0.7914	0.9560	0.9904	0.9965	(86)
MIT	19.7741	19.9554	20.2025	20.5409	20.8124	20.9608	20.9931	20.9892	20.9084	20.5688	20.1218	19.7530	(87)
Th 2	19.9993	20.0022	20.0051	20.0187	20.0213	20.0332	20.0332	20.0354	20.0286	20.0213	20.0161	20.0107	(88)
util rest of house	0.9942	0.9876	0.9735	0.9258	0.8067	0.5887	0.3973	0.4417	0.7143	0.9367	0.9868	0.9954	(89)
MIT 2	18.5779	18.8106	19.1250	19.5522	19.8623	20.0108	20.0310	20.0316	19.9672	19.5943	19.0338	18.5592	(90)
Living area fraction									fLA = Living area / (4) =			0.1537	(91)
MIT	18.7618	18.9866	19.2906	19.7041	20.0083	20.1568	20.1789	20.1788	20.1118	19.7441	19.2011	18.7427	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7618	18.9866	19.2906	19.7041	20.0083	20.1568	20.1789	20.1788	20.1118	19.7441	19.2011	18.7427	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9917	0.9833	0.9671	0.9183	0.8059	0.6004	0.4138	0.4585	0.7217	0.9297	0.9825	0.9932	(94)
Useful gains	752.8434	852.5691	897.9512	916.5653	834.0666	611.0451	403.8034	423.8811	635.4251	750.1648	736.3503	722.2669	(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	1704.4932	1654.8247	1497.7275	1245.8818	955.3045	630.3106	405.9553	427.5425	685.5196	1051.4081	1399.5597	1692.1989	(97)
Space heating kWh	708.0275	539.1157	446.2336	237.1078	90.2010	0.0000	0.0000	0.0000	0.0000	224.1250	477.5107	721.6294	(98a)
Space heating requirement - total per year (kWh/year)												3443.9506	
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	708.0275	539.1157	446.2336	237.1078	90.2010	0.0000	0.0000	0.0000	0.0000	224.1250	477.5107	721.6294	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3443.9506	
Space heating per m2										(98c) / (4) =		32.1985	(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	708.0275	539.1157	446.2336	237.1078	90.2010	0.0000	0.0000	0.0000	0.0000	224.1250	477.5107	721.6294	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	767.0937	584.0907	483.4600	256.8882	97.7259	0.0000	0.0000	0.0000	0.0000	242.8223	517.3464	781.8303	(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	243.8006	215.4652	228.8585	201.4657	195.3808	176.1768	174.1178	181.0664	183.0579	203.9429	216.5737	241.2032	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.3068	86.0295	85.5299	84.4260	82.4390	79.8000	79.8000	79.8000	79.8000	84.2719	85.7813	86.3600	(217)
Fuel for water heating, kWh/month	282.4814	250.4550	267.5772	238.6298	237.0004	220.7729	218.1927	226.9002	229.3958	242.0059	252.4721	279.2996	(219)

Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	29.4948	23.6618	21.3048	15.6088	12.0567	9.8504	10.9985	14.2963	18.5695	24.3642	27.5193	30.3145 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-48.6150	-67.8153	-96.4413	-107.2118	-114.5419	-106.4775	-105.1059	-99.7159	-90.0871	-76.9215	-53.1678	-42.1112 (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	-29.6903	-62.1970	-123.1685	-184.3628	-243.2042	-244.2086	-241.3851	-204.6805	-150.3903	-88.7957	-39.5855	-23.5024 (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	3731.2575 (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	2945.1830 (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)	238.0399 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2643.3830 (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	4357.0974 (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	3731.2575	0.2100	783.5641	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2945.1830	0.2100	618.4884	(264)
Space and water heating			1402.0525	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	238.0399	0.1443	34.3565	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1008.2123	0.1348	-135.9377	
PV Unit electricity exported	-1635.1707	0.1260	-206.0175	
Total			-341.9552	(269)
Total CO2, kg/year			1106.3831	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.3400	(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	3731.2575	1.1300	4216.3209	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2945.1830	1.1300	3328.0568	(278)
Space and water heating			7544.3777	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	238.0399	1.5338	365.1135	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1008.2123	1.4983	-1510.6288	
PV Unit electricity exported	-1635.1707	0.4625	-756.2324	
Total			-2266.8612	(283)
Total Primary energy kWh/year			5772.7308	(286)
Target Primary Energy Rate (TPER)			53.9700	(287)

Full SAP Calculation Printout

Property Reference	Mid House_Copy	Issued on Date	23/03/2023
Assessment Reference	00001_Copy	Prop Type Ref	
Property			

SAP Rating	87 B	DER	2.93	TER	8.96
Environmental	97 A	% DER < TER			67.30
CO_2 Emissions (t/year)	0.27	DFEE	30.91	TFEE	31.47
Compliance Check	See BREL	% DFEE < TFEE			1.77
% DPER < TPER	34.67	DPER	30.43	TPER	46.58

Assessor Details	Miss Nimco Ali	Assessor ID	R572-0001
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 (m2)		Storey height (m)		Volume (m3)	
Ground floor		53.4800 (1b)	x	2.8200 (2b)	=	150.8136 (1b)	-
First floor		53.4800 (1c)	x	2.5000 (2c)	=	133.7000 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.9600						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	284.5136	(5)

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2. Ventilation rate
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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

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

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

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.2000 (23c)

Effective ac	0.3207	0.3165	0.3123	0.2910	0.2867	0.2655	0.2655	0.2612	0.2740	0.2867	0.2953	0.3037	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			14.9600	1.1450	17.1298			(27)
door			1.9200	1.0000	1.9200			(26)

Heatloss Floor 1			53.4800	0.1000	5.3480	(28a)
External Wall 1	54.9000	16.8800	38.0200	0.1600	6.0832	(29a)
External Roof 1	53.4800		53.4800	0.0900	4.8132	(30)
Total net area of external elements Aum(A, m2)			161.8600			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.2942	(33)
Party Wall 1			110.2300	0.0000	0.0000	(32)

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

List of Thermal Bridges

	Length	Psi-value	Total
E5 Ground floor (normal)	10.3200	0.1600	1.6512
E2 Other lintels (including other steel lintels)	8.9200	0.0600	0.5352
E3 Sill	8.9200	0.0400	0.3568
E4 Jamb	25.6600	0.0500	1.2830
E6 Intermediate floor within a dwelling	10.3200	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	10.3200	0.1200	1.2384
E18 Party wall between dwellings	21.2800	0.0600	1.2768
P1 Party wall - Ground floor	20.7200	0.1600	3.3152
P4 Party wall - Roof (insulation at ceiling level)	20.7200	0.0150	0.3108
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	20.7200	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.9674 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 45.2616 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	30.1151	29.7160	29.3170	27.3218	26.9228	24.9277	24.9277	24.5286	25.7257	26.9228	27.7209	28.5189	(38)
Heat transfer coeff	75.3766	74.9776	74.5786	72.5834	72.1844	70.1892	70.1892	69.7902	70.9873	72.1844	72.9824	73.7805	(39)

Average = Sum(39)m / 12 = 72.4837

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7047	0.7010	0.6973	0.6786	0.6749	0.6562	0.6562	0.6525	0.6637	0.6749	0.6823	0.6898	(40)
HLP (average)												0.6777	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7953 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	71.0877	70.0194	68.4626	65.4841	63.2860	60.8347	59.4414	60.9864	62.6799	65.3119	68.3544	70.8153	(42a)
Hot water usage for baths	30.6933	30.2374	29.5955	28.4119	27.5257	26.5430	26.0122	26.6496	27.3436	28.3952	29.6031	30.5895	(42b)
Hot water usage for other uses	43.2566	41.6836	40.1107	38.5377	36.9647	35.3918	35.3918	36.9647	38.5377	40.1107	41.6836	43.2566	(42c)

Average daily hot water use (litres/day) 133.3221 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.0375	141.9404	138.1688	132.4337	127.7764	122.7695	120.8453	124.6007	128.5613	133.8177	139.6411	144.6614	(44)
Energy conte	229.7040	202.1213	212.3603	181.2952	172.0116	150.9594	146.1520	154.2817	158.5289	181.5893	198.9444	226.5048	(45)

Energy content (annual) Total = Sum(45)m = 2214.4528

Distribution loss (46)m = 0.15 x (45)m	34.4556	30.3182	31.8540	27.1943	25.8017	22.6439	21.9228	23.1423	23.7793	27.2384	29.8417	33.9757	(46)

Water storage loss:

Store volume 150.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.2960 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.6998 (55)

Total storage loss	21.6950	19.5955	21.6950	20.9952	21.6950	20.9952	21.6950	21.6950	20.9952	21.6950	20.9952	21.6950	(56)
If cylinder contains dedicated solar storage	21.6950	19.5955	21.6950	20.9952	21.6950	20.9952	21.6950	21.6950	20.9952	21.6950	20.9952	21.6950	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	251.3990	221.7168	234.0553	202.2904	193.7067	171.9546	167.8470	175.9767	179.5241	203.2844	219.9396	248.1998	(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	251.3990	221.7168	234.0553	202.2904	193.7067	171.9546	167.8470	175.9767	179.5241	203.2844	219.9396	248.1998	(64)

Total per year (kWh/year) = Sum(64)m = 2469.8944 (64)

12Total per year (kWh/year) 2470 (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	76.3766	67.2053	70.6098	60.2806	57.1939	50.1940	48.5955	51.2987	52.7109	60.3785	66.1490	75.3128	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	(66)

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

	140.5860	155.6487	140.5860	145.2722	140.5860	145.2722	140.5860	140.5860	145.2722	140.5860	145.2722	140.5860	(67)

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

267.1138	269.8856	262.9007	248.0308	229.2602	211.6184	199.8327	197.0609	204.0457	218.9157	237.6863	255.3280 (68)

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

36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765 (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)

-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117 (71)

Water heating gains (Table 5)

102.6567	100.0079	94.9056	83.7231	76.8735	69.7139	65.3166	68.9498	73.2095	81.1538	91.8736	101.2269 (72)

Total internal gains

575.2859	590.4717	563.3217	541.9555	511.6490	491.5339	470.6646	471.5260	487.4568	505.5849	539.7615	562.0703 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.3700	10.6334	0.4000	0.8000	0.7700	19.7370	(74)
South	6.5900	46.7521	0.4000	0.8000	0.7700	68.3234	(78)

Solar gains	88.0604	149.6145	206.6285	264.0457	306.5546	310.0177	296.4580	263.2617	225.9557	165.5892	105.3346	75.4914 (83)
Total gains	663.3462	740.0861	769.9503	806.0012	818.2036	801.5516	767.1226	734.7877	713.4125	671.1741	645.0961	637.5617 (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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	98.5422	99.0666	99.5967	102.3344	102.9001	105.8250	105.8250	106.4301	104.6353	102.9001	101.7749	100.6740	
alpha	7.5695	7.6044	7.6398	7.8223	7.8600	8.0550	8.0550	8.0953	7.9757	7.8600	7.7850	7.7116	
util living area													
	0.9963	0.9905	0.9773	0.9209	0.7829	0.5581	0.4024	0.4366	0.6755	0.9302	0.9891	0.9971	(86)
Living	20.3479	20.4825	20.6407	20.8508	20.9662	20.9979	20.9999	20.9998	20.9913	20.8613	20.5876	20.3395	
Non living	19.7383	19.8743	20.0319	20.2432	20.3415	20.3787	20.3796	20.3829	20.3687	20.2582	19.9929	19.7412	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	31	0	0	0	0	0	0	0	0	0	0	17	
16 / 9	0	28	31	0	0	0	0	0	0	0	23	14	
MIT	21.0000	20.7069	20.7965	20.8508	20.9662	20.9979	20.9999	20.9998	20.9913	20.8613	20.7247	20.8311	(87)
Th 2	20.3367	20.3400	20.3433	20.3598	20.3631	20.3797	20.3797	20.3830	20.3730	20.3631	20.3565	20.3499	(88)
util rest of house													
	0.9952	0.9877	0.9706	0.9001	0.7403	0.5051	0.3458	0.3782	0.6186	0.9075	0.9854	0.9962	(89)
MIT 2	20.3367	20.0762	20.1669	20.2432	20.3415	20.3787	20.3796	20.3829	20.3687	20.2582	20.1138	20.1942	(90)
Living area fraction										fLA = Living area / (4) =		0.1912	(91)
MIT	20.4635	20.1968	20.2873	20.3594	20.4610	20.4971	20.4982	20.5009	20.4877	20.3735	20.2306	20.3159	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.4635	20.1968	20.2873	20.3594	20.4610	20.4971	20.4982	20.5009	20.4877	20.3735	20.2306	20.3159	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9954	0.9870	0.9700	0.9001	0.7471	0.5152	0.3566	0.3894	0.6293	0.9080	0.9845	0.9962	(94)
Useful gains	660.2979	730.4798	746.8343	725.4747	611.2871	412.9368	273.5691	286.1147	448.9188	609.4002	635.1072	635.1328	(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													
	1218.3495	1146.9173	1028.2354	831.7623	632.4058	413.9153	273.6126	286.1993	453.4464	705.4931	958.3031	1189.0427	(97)
Space heating kWh													
	415.1904	279.8460	209.3624	76.5271	15.7123	0.0000	0.0000	0.0000	0.0000	71.4931	232.7010	412.1090	(98a)
Space heating requirement - total per year (kWh/year)												1712.9412	
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													
	415.1904	279.8460	209.3624	76.5271	15.7123	0.0000	0.0000	0.0000	0.0000	71.4931	232.7010	412.1090	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1712.9412	
Space heating per m2											(98c) / (4) =	16.0148	(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 %)	275.3296 (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													
	415.1904	279.8460	209.3624	76.5271	15.7123	0.0000	0.0000	0.0000	0.0000	71.4931	232.7010	412.1090	(98)
Space heating efficiency (main heating system 1)													

	275.3296	275.3296	275.3296	275.3296	275.3296	0.0000	0.0000	0.0000	0.0000	275.3296	275.3296	275.3296 (210)
Space heating fuel (main heating system)												
	150.7976	101.6404	76.0406	27.7947	5.7067	0.0000	0.0000	0.0000	0.0000	25.9664	84.5172	149.6784 (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												
	251.3990	221.7168	234.0553	202.2904	193.7067	171.9546	167.8470	175.9767	179.5241	203.2844	219.9396	248.1998 (64)
Efficiency of water heater												143.7687 (216)
(217)m	143.7687	143.7687	143.7687	143.7687	143.7687	143.7687	143.7687	143.7687	143.7687	143.7687	143.7687	143.7687 (217)
Fuel for water heating, kWh/month												
	174.8635	154.2177	162.7999	140.7054	134.7349	119.6050	116.7479	122.4026	124.8700	141.3968	152.9815	172.6383 (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	25.4606	22.9967	25.4606	24.6393	25.4606	24.6393	25.4606	25.4606	24.6393	25.4606	24.6393	25.4606 (231)
Lighting	34.8998	27.9979	25.2090	18.4692	14.2662	11.6556	13.0141	16.9162	21.9724	28.8290	32.5623	35.8698 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-25.1242	-42.4572	-73.5809	-94.8969	-110.8005	-106.2748	-104.1768	-93.3178	-74.3432	-52.3477	-29.3717	-20.6906 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	622.1421 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	143.7687
Water heating fuel used	1717.9635 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.3375)	
mechanical ventilation fans (SFP = 1.3375)	299.7785 (230a)
Total electricity for the above, kWh/year	299.7785 (231)
Electricity for lighting (calculated in Appendix L)	281.6615 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-827.3824 (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	2094.1632 (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	622.1421	0.1574	97.8957	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1717.9635	0.1413	242.7169	(264)
Space and water heating			340.6126	(265)
Pumps, fans and electric keep-hot	299.7785	0.1387	41.5830	(267)
Energy for lighting	281.6615	0.1443	40.6525	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-827.3824	0.1319	-109.1073	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-109.1073	(269)
Total CO2, kg/year			313.7408	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.9300	(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	622.1421	1.5825	984.5498	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1717.9635	1.5224	2615.4750	(278)
Space and water heating			3600.0249	(279)
Pumps, fans and electric keep-hot	299.7785	1.5128	453.5050	(281)
Energy for lighting	281.6615	1.5338	432.0217	(282)

Energy saving/generation technologies				
PV Unit electricity used in dwelling	-827.3824	1.4872	-1230.5032	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1230.5032	(283)
Total Primary energy kWh/year			3255.0484	(286)
Dwelling Primary energy Rate (DPER)			30.4300	(287)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	53.4800 (1b)	x	2.8200 (2b)	=	150.8136 (1b)	-
First floor	53.4800 (1c)	x	2.5000 (2c)	=	133.7000 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.9600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	284.5136	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1406	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3906	(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) =	0.3320	(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	0.4233	0.4150	0.4067	0.3652	0.3569	0.3154	0.3154	0.3071	0.3320	0.3569	0.3735	0.3901	(22b)
Effective ac	0.5896	0.5861	0.5827	0.5667	0.5637	0.5497	0.5497	0.5472	0.5551	0.5637	0.5698	0.5761	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.9200	1.0000	1.9200			(26)
TER Opening Type (Uw = 1.20)			14.9600	1.1450	17.1298			(27)
Heatloss Floor 1			53.4800	0.1300	6.9524			(28a)
External Wall 1	54.9000	16.8800	38.0200	0.1800	6.8436			(29a)
External Roof 1	53.4800		53.4800	0.1100	5.8828			(30)
Total net area of external elements Aum(A, m2)			161.8600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.7286			(33)
Party Wall 1			110.2300	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
E5	Ground floor (normal)	10.3200	0.1600	1.6512
E2	Other lintels (including other steel lintels)	8.9200	0.0500	0.4460
E3	Sill	8.9200	0.0500	0.4460
E4	Jamb	25.6600	0.0500	1.2830
E6	Intermediate floor within a dwelling	10.3200	0.0000	0.0000
E10	Eaves (insulation at ceiling level)	10.3200	0.0600	0.6192

E18 Party wall between dwellings	21.2800	0.0600	1.2768	
P1 Party wall - Ground floor	20.7200	0.0800	1.6576	
P4 Party wall - Roof (insulation at ceiling level)	20.7200	0.1200	2.4864	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	20.7200	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.8662 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 48.5948 (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	55.3566	55.0299	54.7097	53.2059	52.9245	51.6147	51.6147	51.3722	52.1192	52.9245	53.4937	54.0888	(38)
Heat transfer coeff	103.9513	103.6247	103.3045	101.8007	101.5193	100.2095	100.2095	99.9670	100.7140	101.5193	102.0885	102.6836	(39)
Average = Sum(39)m / 12 =												101.7993	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9719	0.9688	0.9658	0.9518	0.9491	0.9369	0.9369	0.9346	0.9416	0.9491	0.9545	0.9600	(40)
HLP (average)												0.9518	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7953 (42)
Hot water usage for mixer showers

71.0877	70.0194	68.4626	65.4841	63.2860	60.8347	59.4414	60.9864	62.6799	65.3119	68.3544	70.8153	(42a)

Hot water usage for baths

30.6933	30.2374	29.5955	28.4119	27.5257	26.5430	26.0122	26.6496	27.3436	28.3952	29.6031	30.5895	(42b)

Hot water usage for other uses

43.2566	41.6836	40.1107	38.5377	36.9647	35.3918	35.3918	36.9647	38.5377	40.1107	41.6836	43.2566	(42c)

Average daily hot water use (litres/day) 133.3221 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.0375	141.9404	138.1688	132.4337	127.7764	122.7695	120.8453	124.6007	128.5613	133.8177	139.6411	144.6614	(44)
Energy conte	229.7040	202.1213	212.3603	181.2952	172.0116	150.9594	146.1520	154.2817	158.5289	181.5893	198.9444	226.5048	(45)
Energy content (annual)										Total = Sum(45)m =		2214.4528	
Distribution loss (46)m = 0.15 x (45)m	34.4556	30.3182	31.8540	27.1943	25.8017	22.6439	21.9228	23.1423	23.7793	27.2384	29.8417	33.9757	(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	276.2989	244.2070	258.9552	226.3870	218.6065	196.0512	192.7469	200.8766	203.6207	228.1842	244.0362	273.0997	(62)
WWHRS	-32.4983	-28.7418	-30.0967	-24.9213	-23.2257	-19.8744	-18.6291	-19.8102	-20.5629	-24.2413	-27.4625	-31.8965	(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	243.8006	215.4652	228.8585	201.4657	195.3808	176.1768	174.1178	181.0664	183.0579	203.9429	216.5737	241.2032	(64)
										Total per year (kWh/year) = Sum(64)m =		2461.1094	(64)
12Total per year (kWh/year)												2461	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	113.6525	100.8739	107.8857	96.3541	94.4698	86.2675	85.8715	88.5746	88.7843	97.6544	102.2225	112.5888	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	144.5689	160.0584	144.5689	149.3878	144.5689	149.3878	144.5689	144.5689	149.3878	144.5689	149.3878	144.5689	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	267.1138	269.8856	262.9007	248.0308	229.2602	211.6184	199.8327	197.0609	204.0457	218.9157	237.6863	255.3280	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	(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)	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	(71)
Water heating gains (Table 5)	152.7587	150.1100	145.0077	133.8252	126.9755	119.8159	115.4186	119.0519	123.3116	131.2559	141.9757	151.3290	(72)
Total internal gains	632.3708	647.9834	620.4067	599.1732	568.7340	545.7516	524.7495	525.6110	541.6745	562.6698	596.9792	619.1553	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.3700	10.6334	0.6300	0.7000	0.7700	27.2000	(74)
South	6.5900	46.7521	0.6300	0.7000	0.7700	94.1582	(78)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	121.3582	206.1874	284.7599	363.8880	422.4705	427.2432	408.5561	362.8075	311.3952	228.2027	145.1643	104.0366	(83)
Total gains	753.7290	854.1708	905.1666	963.0612	991.2045	972.9948	933.3057	888.4185	853.0697	790.8725	742.1434	723.1919	(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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.4544	71.6796	71.9018	72.9639	73.1662	74.1225	74.1225	74.3023	73.7512	73.1662	72.7582	72.3366	
alpha	5.7636	5.7786	5.7935	5.8643	5.8777	5.9415	5.9415	5.9535	5.9167	5.8777	5.8505	5.8224	
util living area	0.9954	0.9897	0.9779	0.9368	0.8330	0.6392	0.4695	0.5126	0.7554	0.9468	0.9891	0.9963	(86)
MIT	19.9789	20.1470	20.3646	20.6573	20.8768	20.9797	20.9972	20.9954	20.9474	20.6806	20.2882	19.9571	(87)
Th 2	20.1068	20.1094	20.1119	20.1237	20.1259	20.1363	20.1363	20.1382	20.1323	20.1259	20.1215	20.1168	(88)
util rest of house	0.9939	0.9865	0.9708	0.9165	0.7849	0.5613	0.3789	0.4192	0.6818	0.9254	0.9851	0.9951	(89)
MIT 2	18.9186	19.1340	19.4100	19.7769	20.0227	20.1247	20.1353	20.1365	20.0976	19.8120	19.3237	18.8983	(90)
Living area fraction									fLA = Living area / (4) =			0.1912	(91)
MIT	19.1213	19.3277	19.5925	19.9453	20.1860	20.2882	20.3001	20.3007	20.2601	19.9781	19.5081	19.1007	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1213	19.3277	19.5925	19.9453	20.1860	20.2882	20.3001	20.3007	20.2601	19.9781	19.5081	19.1007	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9916	0.9827	0.9655	0.9116	0.7885	0.5755	0.3963	0.4371	0.6934	0.9210	0.9814	0.9932	(94)
Useful gains	747.4295	839.4248	873.8976	877.9525	781.6098	559.9158	369.8566	388.3111	591.5023	728.4308	728.3254	718.3050	(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	1540.6941	1495.0638	1352.5179	1124.4139	861.4884	570.0087	370.7855	389.9418	620.4046	952.0581	1266.7246	1530.0590	(97)
Space heating kWh	590.1888	440.5894	356.0935	177.4522	59.4297	0.0000	0.0000	0.0000	0.0000	166.3787	387.6474	603.9450	(98a)
Space heating requirement - total per year (kWh/year)												2781.7248	
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	590.1888	440.5894	356.0935	177.4522	59.4297	0.0000	0.0000	0.0000	0.0000	166.3787	387.6474	603.9450	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2781.7248	
Space heating per m2											(98c) / (4) =	26.0072	(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	590.1888	440.5894	356.0935	177.4522	59.4297	0.0000	0.0000	0.0000	0.0000	166.3787	387.6474	603.9450	(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)	639.4245	477.3450	385.8001	192.2559	64.3875	0.0000	0.0000	0.0000	0.0000	180.2586	419.9864	654.3282	(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	243.8006	215.4652	228.8585	201.4657	195.3808	176.1768	174.1178	181.0664	183.0579	203.9429	216.5737	241.2032	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.9657	85.6283	85.0473	83.7764	81.7320	79.8000	79.8000	79.8000	79.8000	83.6071	85.3497	86.0309	(217)
Fuel for water heating, kWh/month	283.6020	251.6285	269.0956	240.4803	239.0505	220.7729	218.1927	226.9002	229.3958	243.9302	253.7485	280.3682	(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	30.0386	24.0980	21.6976	15.8966	12.2790	10.0320	11.2013	14.5599	18.9119	24.8134	28.0266	30.8734	(232)

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

(233a)m	-48.6333	-67.8463	-96.4883	-107.2631	-114.5926	-106.5225	-105.1561	-99.7738	-90.1460	-76.9677	-53.1927	-42.1269 (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	-29.6720	-62.1660	-123.1215	-184.3114	-243.1535	-244.1637	-241.3348	-204.6226	-150.3314	-88.7495	-39.5606	-23.4867 (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	3013.7863 (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	2957.1657 (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)	242.4283 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2643.3830 (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	3655.9974 (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	3013.7863	0.2100	632.8951	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2957.1657	0.2100	621.0048	(264)
Space and water heating			1253.8999	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	242.4283	0.1443	34.9899	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1008.7092	0.1348	-136.0041	
PV Unit electricity exported	-1634.6738	0.1260	-205.9505	
Total			-341.9546	(269)
Total CO2, kg/year			958.8645	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.9600	(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	3013.7863	1.1300	3405.5786	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2957.1657	1.1300	3341.5972	(278)
Space and water heating			6747.1758	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	242.4283	1.5338	371.8447	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1008.7092	1.4983	-1511.3711	
PV Unit electricity exported	-1634.6738	0.4625	-755.9863	
Total			-2267.3574	(283)
Total Primary energy kWh/year			4981.7639	(286)
Target Primary Energy Rate (TPER)			46.5800	(287)

Full SAP Calculation Printout

elmhurst energy

Property Reference	Be Green	Issued on Date	23/03/2023
Assessment Reference	Be Green	Prop Type Ref	
Property			

SAP Rating	52 E	DER	9.36	TER	7.49
Environmental	90 B	% DER < TER			-24.97
CO_2 Emissions (t/year)	1.56	DFEE	97.62	TFEE	36.34
Compliance Check	See BREL	% DFEE < TFEE			-168.61
% DPER < TPER	-144.11	DPER	96.69	TPER	39.61

Assessor Details	Miss Nimco Ali	Assessor ID	R572-0001
Client			

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

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		109.1700 (1b)	x	2.0200 (2b)	=	220.5234 (1b)	-
First floor		87.9800 (1c)	x	2.0200 (2c)	=	177.7196 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	197.1500						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	398.2430	(5)

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2. Ventilation rate
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			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		3 * 10 =	30.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		30.0000 / (5) =	0.0753	(8)
Pressure test			No	
Pressure Test Method			Blower Door	
Measured/design AP50			15.0000	(17)
Infiltration rate			0.8253	(18)
Number of sides sheltered			0	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.8253	(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	1.0523	1.0317	1.0110	0.9079	0.8872	0.7841	0.7841	0.7634	0.8253	0.8872	0.9285	0.9698	(22b)
Effective ac	1.0523	1.0317	1.0110	0.9121	0.8936	0.8074	0.8074	0.7914	0.8406	0.8936	0.9311	0.9702	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.70)			21.6300	1.5918	34.4298			(27)
Door			3.8800	3.0000	11.6400			(26)
Heatloss Floor 1			109.1700	0.7000	76.4190			(28a)
External Wall 1	197.1800	25.5100	171.6700	0.3000	51.5010			(29a)
External Roof 1	67.9800		67.9800	0.3500	23.7930			(30)
Ground Floor Roof	24.5900		24.5900	0.3500	8.6065			(30)
Flat Side Roof	7.5000		7.5000	0.3500	2.6250			(30)

Sloped Side Roof				16.2100			16.2100	0.3500	5.6735				(30)
Total net area of external elements Aum(A, m2)							422.6300						(31)
Fabric heat loss, W/K = Sum (A x U)								(26)...(30) + (32) =	214.6878				(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												250.0000	(35)
Thermal bridges (Default value 0.200 * total exposed area)												84.5260	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss										(33) + (36) + (36a) =		299.2138	(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	138.2931	135.5814	132.8698	119.8695	117.4357	106.1058	106.1058	104.0077	110.4699	117.4357	122.3592	127.5066	(38)
Heat transfer coeff	437.5068	434.7952	432.0836	419.0832	416.6494	405.3196	405.3196	403.2215	409.6837	416.6494	421.5730	426.7204	(39)
Average = Sum(39)m / 12 =												419.0505	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.2192	2.2054	2.1916	2.1257	2.1134	2.0559	2.0559	2.0453	2.0780	2.1134	2.1383	2.1644	(40)
HLP (average)												2.1255	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9982	(42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	90.4577	89.1143	87.2225	83.7343	81.1224	78.2262	76.6618	78.5404	80.5858	83.6849	87.2449	90.1519	(42b)
Hot water usage for other uses	47.7207	45.9854	44.2501	42.5148	40.7795	39.0442	39.0442	40.7795	42.5148	44.2501	45.9854	47.7207	(42c)
Average daily hot water use (litres/day)												127.2510	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	138.1784	135.0997	131.4726	126.2491	121.9019	117.2704	115.7060	119.3199	123.1007	127.9350	133.2303	137.8726	(44)
Energy conte	218.8409	192.3802	202.0685	172.8287	164.1034	144.1976	139.9364	147.7430	151.7954	173.6066	189.8110	215.8752	(45)
Energy content (annual)										Total = Sum(45)m =		2113.1869	
Distribution loss (46)m = 0.15 x (45)m	32.8261	28.8570	30.3103	25.9243	24.6155	21.6296	20.9905	22.1614	22.7693	26.0410	28.4716	32.3813	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0260	(55)
Total storage loss	31.8060	28.7280	31.8060	30.7800	31.8060	30.7800	31.8060	31.8060	30.7800	31.8060	30.7800	31.8060	(56)
If cylinder contains dedicated solar storage	31.8060	28.7280	31.8060	30.7800	31.8060	30.7800	31.8060	31.8060	30.7800	31.8060	30.7800	31.8060	(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	273.9093	242.1194	257.1369	226.1207	219.1718	197.4896	195.0048	202.8114	205.0874	228.6750	243.1030	270.9436	(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	273.9093	242.1194	257.1369	226.1207	219.1718	197.4896	195.0048	202.8114	205.0874	228.6750	243.1030	270.9436	(64)
										Total per year (kWh/year) = Sum(64)m =		2761.5729	(64)
12Total per year (kWh/year)												2762	(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	116.8193	103.7578	111.2425	100.0991	98.6191	90.5793	90.5836	93.1793	93.1056	101.7789	105.7458	115.8332	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	149.9105	149.9105	149.9105	149.9105	149.9105	149.9105	149.9105	149.9105	149.9105	149.9105	149.9105	149.9105	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	210.3089	232.8420	210.3089	217.3192	210.3089	217.3192	210.3089	210.3089	217.3192	210.3089	217.3192	210.3089	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	368.3286	372.1507	362.5192	342.0147	316.1315	291.8050	275.5533	271.7312	281.3628	301.8672	327.7504	352.0770	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9911	37.9911	37.9911	37.9911	37.9911	37.9911	37.9911	37.9911	37.9911	37.9911	37.9911	37.9911	(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)	-119.9284	-119.9284	-119.9284	-119.9284	-119.9284	-119.9284	-119.9284	-119.9284	-119.9284	-119.9284	-119.9284	-119.9284	(71)
Water heating gains (Table 5)	157.0152	154.4014	149.5195	139.0266	132.5526	125.8046	121.7521	125.2409	129.3133	136.7996	146.8691	155.6898	(72)
Total internal gains	803.6259	827.3673	790.3207	766.3337	726.9661	702.9019	675.5875	675.2542	695.9684	716.9489	759.9119	786.0489	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	4.2300	10.6334	0.7600	0.7000	0.7700	16.5828 (74)
East	4.8500	19.6403	0.7600	0.7000	0.7700	35.1183 (76)
South	8.1300	46.7521	0.7600	0.7000	0.7700	140.1316 (78)
West	4.4200	19.6403	0.7600	0.7000	0.7700	32.0048 (80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	223.8375	392.4970	562.4355	732.2852	847.3350	851.7464	816.8909	730.3655	621.6311	441.0670	270.2554	190.1096	(83)
Total gains	1027.4634	1219.8644	1352.7562	1498.6189	1574.3011	1554.6483	1492.4784	1405.6197	1317.5995	1158.0159	1030.1673	976.1585	(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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	31.2932	31.4883	31.6859	32.6689	32.8597	33.7782	33.7782	33.9540	33.4184	32.8597	32.4759	32.0842	
alpha	3.0862	3.0992	3.1124	3.1779	3.1906	3.2519	3.2519	3.2636	3.2279	3.1906	3.1651	3.1389	
util living area	0.9980	0.9963	0.9933	0.9853	0.9657	0.9145	0.8278	0.8587	0.9527	0.9891	0.9966	0.9983	(86)
Living	18.1415	18.3618	18.7508	19.3405	19.9108	20.4528	20.7443	20.6972	20.2690	19.5254	18.7730	18.1572	
Non living	17.2526	17.4772	17.8703	18.4804	19.0488	19.5902	19.8427	19.8125	19.4137	18.6703	17.9110	17.2867	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	31	28	31	30	31	30	31	31	30	31	30	31	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	(87)
Th 2	19.8904	19.8973	19.9042	19.9371	19.9433	19.9721	19.9721	19.9774	19.9610	19.9433	19.9308	19.9178	(88)
util rest of house	0.9975	0.9955	0.9917	0.9810	0.9533	0.8744	0.7301	0.7753	0.9294	0.9852	0.9957	0.9980	(89)
MIT 2	19.8904	19.8973	19.9042	19.9371	19.9433	19.9721	19.9721	19.9774	19.9610	19.9433	19.9308	19.9178	(90)
Living area fraction										fLA = Living area / (4) =		0.0992	(91)
MIT	20.0005	20.0067	20.0129	20.0426	20.0482	20.0740	20.0740	20.0788	20.0641	20.0482	20.0369	20.0251	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0005	20.0067	20.0129	20.0426	20.0482	20.0740	20.0740	20.0788	20.0641	20.0482	20.0369	20.0251	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9956	0.9919	0.9815	0.9547	0.8792	0.7421	0.7856	0.9323	0.9857	0.9958	0.9980	(94)
Useful gains	1024.9800	1214.4749	1341.7624	1470.8998	1503.0344	1366.9126	1107.5521	1104.2985	1228.3440	1141.4400	1025.8862	974.2299	(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	6869.0790	6568.3214	5838.7006	4669.6753	3478.2545	2218.7354	1408.0962	1483.3843	2443.3820	3936.5689	5453.8513	6752.9137	(97)
Space heating kWh	4348.0097	3597.7849	3345.7220	2303.1184	1469.5638	0.0000	0.0000	0.0000	0.0000	2079.5759	3188.1349	4299.3407	(98a)
Space heating requirement - total per year (kWh/year)												24631.2503	
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	4348.0097	3597.7849	3345.7220	2303.1184	1469.5638	0.0000	0.0000	0.0000	0.0000	2079.5759	3188.1349	4299.3407	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												24631.2503	
Space heating per m2											(98c) / (4) =	124.9366	(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 %)	261.5277 (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	4348.0097	3597.7849	3345.7220	2303.1184	1469.5638	0.0000	0.0000	0.0000	0.0000	2079.5759	3188.1349	4299.3407	(98)
Space heating efficiency (main heating system 1)	261.5277	261.5277	261.5277	261.5277	261.5277	0.0000	0.0000	0.0000	0.0000	261.5277	261.5277	261.5277	(210)
Space heating fuel (main heating system)	1662.5429	1375.6804	1279.2994	880.6404	561.9152	0.0000	0.0000	0.0000	0.0000	795.1648	1219.0430	1643.9334	(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	273.9093	242.1194	257.1369	226.1207	219.1718	197.4896	195.0048	202.8114	205.0874	228.6750	243.1030	270.9436	(64)

Efficiency of water heater												112.5000 (216)
(217)m	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000 (217)
Fuel for water heating, kWh/month												
	243.4749	215.2172	228.5661	200.9962	194.8194	175.5464	173.3376	180.2768	182.2999	203.2666	216.0915	240.8388 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	44.7103	35.8683	32.2954	23.6610	18.2764	14.9320	16.6724	21.6714	28.1490	36.9330	41.7157	45.9529 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	9418.2195 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	112.5000
Water heating fuel used	2454.7314 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	360.8376 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	12233.7886 (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	9418.2195	0.1537	1447.1196	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2454.7314	0.1409	345.8188	(264)
Space and water heating			1792.9384	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	360.8376	0.1443	52.0800	(268)
Total CO2, kg/year			1845.0184	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			9.3600	(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	9418.2195	1.5689	14775.8078	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2454.7314	1.5209	3733.4411	(278)
Space and water heating			18509.2489	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	360.8376	1.5338	553.4648	(282)
Total Primary energy kWh/year			19062.7137	(286)
Dwelling Primary energy Rate (DPER)			96.6900	(287)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	109.1700 (1b)	x	2.0200 (2b)	=	220.5234 (1b)	-
First floor	87.9800 (1c)	x	2.0200 (2c)	=	177.7196 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	197.1500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	398.2430	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1004	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3504	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3504	(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	0.4468	0.4381	0.4293	0.3855	0.3767	0.3329	0.3329	0.3242	0.3504	0.3767	0.3942	0.4118	(22b)
Effective ac	0.5998	0.5959	0.5921	0.5743	0.5710	0.5554	0.5554	0.5525	0.5614	0.5710	0.5777	0.5848	(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			3.8800	1.0000	3.8800			(26)
TER Opening Type (Uw = 1.20)			21.6300	1.1450	24.7672			(27)
Heatloss Floor 1			109.1700	0.1300	14.1921			(28a)
External Wall 1	197.1800	25.5100	171.6700	0.1800	30.9006			(29a)
External Roof 1	67.9800		67.9800	0.1100	7.4778			(30)
Ground Floor Roof	24.5900		24.5900	0.1100	2.7049			(30)
Flat Side Roof	7.5000		7.5000	0.1100	0.8250			(30)
Sloped Side Roof	16.2100		16.2100	0.1100	1.7831			(30)
Total net area of external elements Aum(A, m2)			422.6300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		86.5307			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)							21.1315	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss					(33) + (36) + (36a) =		107.6622	(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	78.8286	78.3191	77.8198	75.4745	75.0357	72.9931	72.9931	72.6148	73.7799	75.0357	75.9234	76.8515	(38)
Heat transfer coeff	186.4907	185.9813	185.4820	183.1367	182.6979	180.6553	180.6553	180.2770	181.4421	182.6979	183.5856	184.5136	(39)
Average = Sum(39)m / 12 =												183.1346	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9459	0.9433	0.9408	0.9289	0.9267	0.9163	0.9163	0.9144	0.9203	0.9267	0.9312	0.9359	(40)
HLP (average)												0.9289	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy											2.9982	(42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	85.9348	84.6586	82.8613	79.5476	77.0663	74.3149	72.8287	74.6134	76.5566	79.5006	82.8826	85.6443	(42b)
Hot water usage for other uses	45.3347	43.6861	42.0376	40.3891	38.7405	37.0920	37.0920	38.7405	40.3891	42.0376	43.6861	45.3347	(42c)
Average daily hot water use (litres/day)												120.8885	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	131.2695	128.3447	124.8990	119.9367	115.8068	111.4069	109.9207	113.3539	116.9456	121.5382	126.5688	130.9790	(44)
Energy conte	207.8988	182.7612	191.9650	164.1873	155.8982	136.9878	132.9396	140.3558	144.2057	164.9262	180.3204	205.0815	(45)
Energy content (annual)										Total = Sum(45)m =		2007.5275	
Distribution loss (46)m = 0.15 x (45)m													
	31.1848	27.4142	28.7948	24.6281	23.3847	20.5482	19.9409	21.0534	21.6308	24.7389	27.0481	30.7622	(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													
	254.4937	224.8469	238.5600	209.2791	202.4931	182.0796	179.5345	186.9507	189.2975	211.5211	225.4123	251.6764	(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													
	254.4937	224.8469	238.5600	209.2791	202.4931	182.0796	179.5345	186.9507	189.2975	211.5211	225.4123	251.6764	(64)
										Total per year (kWh/year) = Sum(64)m =		2556.1449	(64)
12Total per year (kWh/year)												2556	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						0.0000	(64a)
Heat gains from water heating, kWh/month													
	106.4023	94.4367	101.1043	90.6657	89.1121	81.6219	81.4783	83.9442	84.0219	92.1139	96.0300	105.4655	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	149.9105	149.9105	149.9105	149.9105	149.9105	149.9105	149.9105	149.9105	149.9105	149.9105	149.9105	149.9105	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	210.3089	232.8420	210.3089	217.3192	210.3089	217.3192	210.3089	210.3089	217.3192	210.3089	217.3192	210.3089	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	368.3286	372.1507	362.5192	342.0147	316.1315	291.8050	275.5533	271.7312	281.3628	301.8672	327.7504	352.0770	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.9911	37.9911	37.9911	37.9911	37.9911	37.9911	37.9911	37.9911	37.9911	37.9911	37.9911	37.9911	(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)													
	-119.9284	-119.9284	-119.9284	-119.9284	-119.9284	-119.9284	-119.9284	-119.9284	-119.9284	-119.9284	-119.9284	-119.9284	(71)
Water heating gains (Table 5)													
	143.0138	140.5308	135.8929	125.9246	119.7743	113.3638	109.5139	112.8283	116.6970	123.8090	133.3750	141.7547	(72)
Total internal gains													
	792.6245	816.4966	779.6941	756.2317	717.1879	690.4611	663.3493	662.8415	683.3522	706.9583	749.4178	775.1138	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.2300	10.6334	0.6300	0.7000	0.7700	13.7462	(74)
East	4.8500	19.6403	0.6300	0.7000	0.7700	29.1113	(76)
South	8.1300	46.7521	0.6300	0.7000	0.7700	116.1618	(78)
West	4.4200	19.6403	0.6300	0.7000	0.7700	26.5303	(80)

Solar gains	185.5495	325.3594	466.2295	607.0259	702.3961	706.0529	677.1595	605.4345	515.2995	365.6213	224.0275	157.5909	(83)
Total gains	978.1740	1141.8560	1245.9236	1363.2576	1419.5840	1396.5140	1340.5088	1268.2761	1198.6516	1072.5796	973.4453	932.7046	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	73.4137	73.6148	73.8129	74.7582	74.9378	75.7851	75.7851	75.9441	75.4564	74.9378	74.5754	74.2003	
alpha	5.8942	5.9077	5.9209	5.9839	5.9959	6.0523	6.0523	6.0629	6.0304	5.9959	5.9717	5.9467	
util living area													
	0.9993	0.9979	0.9943	0.9782	0.9217	0.7662	0.5825	0.6357	0.8757	0.9856	0.9980	0.9994	(86)
MIT	19.7932	19.9520	20.1800	20.5001	20.7786	20.9510	20.9920	20.9869	20.8852	20.5222	20.1051	19.7736	(87)
Th 2	20.1286	20.1308	20.1329	20.1430	20.1449	20.1536	20.1536	20.1553	20.1503	20.1449	20.1411	20.1371	(88)
util rest of house													
	0.9990	0.9972	0.9923	0.9696	0.8902	0.6882	0.4760	0.5282	0.8174	0.9784	0.9972	0.9993	(89)
MIT 2	18.6977	18.9027	19.1955	19.6071	19.9418	20.1228	20.1508	20.1501	20.0644	19.6398	19.1067	18.6788	(90)
Living area fraction										fLA = Living area / (4) =		0.0992	(91)
MIT	18.8064	19.0068	19.2932	19.6957	20.0248	20.2050	20.2343	20.2331	20.1458	19.7274	19.2058	18.7874	(92)

Temperature adjustment												0.0000	
adjusted MIT	18.8064	19.0068	19.2932	19.6957	20.0248	20.2050	20.2343	20.2331	20.1458	19.7274	19.2058	18.7874	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984	0.9958	0.9894	0.9637	0.8849	0.6933	0.4864	0.5385	0.8171	0.9735	0.9959	0.9988	(94)
Useful gains	976.6186	1137.1079	1232.7230	1313.8081	1256.1203	968.1990	652.0637	682.9923	979.4051	1044.1333	969.4784	931.5872	(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													
	2705.3040	2623.5989	2372.9075	1977.0890	1520.9300	1012.5722	656.5472	691.0223	1096.9656	1667.5517	2222.4464	2691.5773	(97)
Space heating kWh													
	1286.1419	998.9220	848.2972	477.5622	197.0184	0.0000	0.0000	0.0000	0.0000	463.8233	902.1370	1309.4326	(98a)
Space heating requirement - total per year (kWh/year)												6483.3346	
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													
	1286.1419	998.9220	848.2972	477.5622	197.0184	0.0000	0.0000	0.0000	0.0000	463.8233	902.1370	1309.4326	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6483.3346	
Space heating per m2											(98c) / (4) =	32.8853	(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													
	1286.1419	998.9220	848.2972	477.5622	197.0184	0.0000	0.0000	0.0000	0.0000	463.8233	902.1370	1309.4326	(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)													
	1393.4365	1082.2557	919.0653	517.4022	213.4544	0.0000	0.0000	0.0000	0.0000	502.5171	977.3965	1418.6702	(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													
	254.4937	224.8469	238.5600	209.2791	202.4931	182.0796	179.5345	186.9507	189.2975	211.5211	225.4123	251.6764	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.1759	86.9973	86.6549	85.8498	83.9983	79.8000	79.8000	79.8000	79.8000	85.7703	86.8420	87.2142	(217)
Fuel for water heating, kWh/month													
	291.9313	258.4528	275.2990	243.7735	241.0680	228.1699	224.9806	234.2741	237.2149	246.6136	259.5659	288.5725	(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	43.6980	35.0562	31.5642	23.1253	17.8626	14.5939	16.2949	21.1807	27.5117	36.0968	40.7713	44.9125	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-88.9317	-119.1480	-162.7181	-173.3551	-179.0022	-164.0769	-161.8271	-156.4539	-146.1070	-131.3576	-95.4364	-77.6189	(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	-70.9147	-146.2492	-285.5765	-421.8429	-551.2735	-551.7871	-545.4731	-464.9178	-344.7852	-206.9249	-93.9033	-56.3196	(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	7024.1979 (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	3029.9163 (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)	352.6682 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-5396.0008 (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	5096.7815 (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	7024.1979	0.2100	1475.0816	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3029.9163	0.2100	636.2824	(264)
Space and water heating			2111.3640	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	352.6682	0.1443	50.9009	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1656.0329	0.1357	-224.8008	
PV Unit electricity exported	-3739.9679	0.1264	-472.6757	
Total			-697.4765	(269)
Total CO2, kg/year			1476.7176	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			7.4900	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	7024.1979	1.1300	7937.3436	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3029.9163	1.1300	3423.8054	(278)
Space and water heating			11361.1490	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	352.6682	1.5338	540.9342	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1656.0329	1.5018	-2486.9648	
PV Unit electricity exported	-3739.9679	0.4639	-1735.1237	
Total			-4222.0884	(283)
Total Primary energy kWh/year			7810.0956	(286)
Target Primary Energy Rate (TPER)			39.6100	(287)

Full SAP Calculation Printout

Property Reference	Mid House_0.35g_S/N	Issued on Date	04/04/2023
Assessment Reference	Mid-house S/N	Prop Type Ref	
Property			

SAP Rating	85 B	DER	10.72	TER	8.99
Environmental	90 B	% DER < TER			-19.24
CO_2 Emissions (t/year)	1.01	DFEE	31.00	TFEE	31.76
Compliance Check	See BREL	% DFEE < TFEE			2.40
% DPER < TPER	-36.13	DPER	63.56	TPER	46.69

Assessor Details	Miss Eleanor Ballinger	Assessor ID	M976-0001
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 (m2)		Storey height (m)		Volume (m3)	
Ground floor		53.4800 (1b)	x	2.8200 (2b)	=	150.8136 (1b)	-
First floor		53.4800 (1c)	x	2.5000 (2c)	=	133.7000 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.9600						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	284.5136	(5)

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2. Ventilation rate
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		m3 per hour		
Number of open chimneys		0 * 80	=	0.0000 (6a)
Number of open flues		0 * 20	=	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10	=	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20	=	0.0000 (6d)
Number of flues attached to other heater		0 * 35	=	0.0000 (6e)
Number of blocked chimneys		0 * 20	=	0.0000 (6f)
Number of intermittent extract fans		0 * 10	=	0.0000 (7a)
Number of passive vents		0 * 10	=	0.0000 (7b)
Number of flueless gas fires		0 * 40	=	0.0000 (7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		0.0000 / (5)	=	0.0000 (8)
Pressure test				Yes
Pressure Test Method				Blower Door
Measured/design AP50				4.0000 (17)
Infiltration rate				0.2000 (18)
Number of sides sheltered				2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20)	=	0.1700 (21)

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

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.2000 (23c)

Effective ac	0.3207	0.3165	0.3123	0.2910	0.2867	0.2655	0.2655	0.2612	0.2740	0.2867	0.2953	0.3037	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (0.35g) (Uw = 1.10)			7.8900	1.0536	8.3132			(27)
door			1.9100	1.0000	1.9100			(26)

Windows (N, W, E) (Uw = 1.10)			9.1000	1.0536	9.5881	(27)
Heatloss Floor 1			53.4800	0.1000	5.3480	(28a)
External Wall 1	54.9000	18.9000	36.0000	0.1600	5.7600	(29a)
External Roof 1	53.4800		53.4800	0.0900	4.8132	(30)
Total net area of external elements Aum(A, m2)			161.8600			(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.7325	(33)
Party Wall 1			110.2300	0.0000	0.0000	(32)

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

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E5 Ground floor (normal)	10.3200	0.1600	1.6512
E2 Other lintels (including other steel lintels)	9.9500	0.0600	0.5970
E3 Sill	9.0400	0.0400	0.3616
E4 Jamb	33.5800	0.0500	1.6790
E6 Intermediate floor within a dwelling	10.3200	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	10.3200	0.1200	1.2384
E18 Party wall between dwellings	21.2800	0.0600	1.2768
P1 Party wall - Ground floor	20.7200	0.1600	3.3152
P4 Party wall - Roof (insulation at ceiling level)	20.7200	0.0150	0.3108
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	20.7200	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.4300 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	46.1625 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	30.1151	29.7160	29.3170	27.3218	26.9228	24.9277	24.9277	24.5286	25.7257	26.9228	27.7209	28.5189	(38)
Heat transfer coeff	76.2776	75.8786	75.4795	73.4844	73.0854	71.0902	71.0902	70.6912	71.8883	73.0854	73.8834	74.6815	(39)
Average = Sum(39)m / 12 =												73.3846	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7131	0.7094	0.7057	0.6870	0.6833	0.6646	0.6646	0.6609	0.6721	0.6833	0.6908	0.6982	(40)
HLP (average)												0.6861	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7953 (42)
Hot water usage for mixer showers	71.0877	70.0194	68.4626	65.4841	63.2860	60.8347	59.4414	60.9864	62.6799	65.3119	68.3544	70.8153 (42a)
Hot water usage for baths	30.6933	30.2374	29.5955	28.4119	27.5257	26.5430	26.0122	26.6496	27.3436	28.3952	29.6031	30.5895 (42b)
Hot water usage for other uses	43.2566	41.6836	40.1107	38.5377	36.9647	35.3918	35.3918	36.9647	38.5377	40.1107	41.6836	43.2566 (42c)
Average daily hot water use (litres/day)												133.3221 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.0375	141.9404	138.1688	132.4337	127.7764	122.7695	120.8453	124.6007	128.5613	133.8177	139.6411	144.6614	(44)
Energy conte	229.7040	202.1213	212.3603	181.2952	172.0116	150.9594	146.1520	154.2817	158.5289	181.5893	198.9444	226.5048	(45)
Energy content (annual)										Total = Sum(45)m =		2214.4528	
Distribution loss (46)m = 0.15 x (45)m	34.4556	30.3182	31.8540	27.1943	25.8017	22.6439	21.9228	23.1423	23.7793	27.2384	29.8417	33.9757	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2960	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.6998	(55)
Total storage loss	21.6950	19.5955	21.6950	20.9952	21.6950	20.9952	21.6950	21.6950	20.9952	21.6950	20.9952	21.6950	(56)
If cylinder contains dedicated solar storage	21.6950	19.5955	21.6950	20.9952	21.6950	20.9952	21.6950	21.6950	20.9952	21.6950	20.9952	21.6950	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	274.6614	242.7280	257.3177	224.8024	216.9691	194.4666	191.1094	199.2391	202.0361	226.5468	242.4516	271.4622	(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	274.6614	242.7280	257.3177	224.8024	216.9691	194.4666	191.1094	199.2391	202.0361	226.5468	242.4516	271.4622	(64)
										Total per year (kWh/year) = Sum(64)m =		2743.7904	(64)
12Total per year (kWh/year)												2744	(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	112.3425	99.6907	106.5758	95.0864	93.1598	84.9998	84.5615	87.2646	87.5166	96.3444	100.9548	111.2788	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	(66)

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

	137.4210	152.1447	137.4210	142.0017	137.4210	142.0017	137.4210	137.4210	142.0017	137.4210	142.0017	137.4210	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	267.1138	269.8856	262.9007	248.0308	229.2602	211.6184	199.8327	197.0609	204.0457	218.9157	237.6863	255.3280	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	(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)													
	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	(71)
Water heating gains (Table 5)													
	150.9980	148.3493	143.2470	132.0644	125.2148	118.0552	113.6579	117.2911	121.5509	129.4952	140.2150	149.5683	(72)
Total internal gains													
	623.4622	638.3089	611.4981	590.0263	559.8254	536.6047	515.8410	516.7024	532.5277	553.7612	587.8323	610.2467	(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	
South	7.8900	46.7521	0.3500	0.8000	0.7700	71.5763	(78)
North	9.1000	10.6334	0.4500	0.8000	0.7700	24.1406	(74)

Solar gains	95.7169	163.3575	227.7149	294.6854	345.4895	350.8342	334.8995	295.0960	250.2381	181.3531	114.6229	81.9733	(83)
Total gains	719.1791	801.6664	839.2130	884.7117	905.3149	887.4390	850.7404	811.7984	782.7658	735.1143	702.4552	692.2200	(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, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	97.3782	97.8903	98.4078	101.0797	101.6316	104.4838	104.4838	105.0736	103.3239	101.6316	100.5338	99.4594	
alpha	7.4919	7.5260	7.5605	7.7386	7.7754	7.9656	7.9656	8.0049	7.8883	7.7754	7.7023	7.6306	
util living area													
	0.9939	0.9852	0.9651	0.8878	0.7289	0.5115	0.3676	0.4004	0.6272	0.9003	0.9824	0.9952	(86)
MIT	20.3913	20.5294	20.6897	20.8865	20.9783	20.9988	20.9999	20.9999	20.9944	20.8924	20.6315	20.3821	(87)
Th 2	20.3292	20.3325	20.3358	20.3523	20.3556	20.3722	20.3722	20.3755	20.3655	20.3556	20.3490	20.3424	(88)
util rest of house													
	0.9922	0.9810	0.9556	0.8622	0.6852	0.4619	0.3152	0.3461	0.5723	0.8721	0.9768	0.9938	(89)
MIT 2	19.6179	19.7949	19.9966	20.2417	20.3384	20.3715	20.3721	20.3754	20.3621	20.2545	19.9382	19.6170	(90)
Living area fraction										fLA = Living area / (4) =		0.1912	(91)
MIT	19.7658	19.9353	20.1291	20.3650	20.4607	20.4914	20.4922	20.4948	20.4830	20.3765	20.0707	19.7633	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.6158	19.7853	19.9791	20.2150	20.3107	20.3414	20.3422	20.3448	20.3330	20.2265	19.9207	19.6133	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9897	0.9768	0.9494	0.8563	0.6821	0.4594	0.3127	0.3435	0.5694	0.8657	0.9721	0.9917	(94)
Useful gains	711.7626	783.0349	796.7661	757.5351	617.4802	407.7062	266.0143	278.8287	445.7104	636.3652	682.8519	686.4535	(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													
	1168.2506	1129.4751	1017.3998	831.4746	629.3171	408.1599	266.0317	278.8640	448.0778	703.5530	947.2403	1151.0889	(97)
Space heating kWh													
	339.6270	232.8078	164.1515	53.2364	8.8066	0.0000	0.0000	0.0000	0.0000	49.9877	190.3596	345.6887	(98a)
Space heating requirement - total per year (kWh/year)												1384.6655	
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													
	339.6270	232.8078	164.1515	53.2364	8.8066	0.0000	0.0000	0.0000	0.0000	49.9877	190.3596	345.6887	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1384.6655	
Space heating per m2											(98c) / (4) =	12.9456	(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 %)												88.8000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	339.6270	232.8078	164.1515	53.2364	8.8066	0.0000	0.0000	0.0000	0.0000	49.9877	190.3596	345.6887	(98)
Space heating efficiency (main heating system 1)													
	88.8000	88.8000	88.8000	88.8000	88.8000	0.0000	0.0000	0.0000	0.0000	88.8000	88.8000	88.8000	(210)
Space heating fuel (main heating system)													
	382.4629	262.1710	184.8552	59.9509	9.9174	0.0000	0.0000	0.0000	0.0000	56.2925	214.3689	389.2891	(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												
	274.6614	242.7280	257.3177	224.8024	216.9691	194.4666	191.1094	199.2391	202.0361	226.5468	242.4516	271.4622 (64)
Efficiency of water heater												79.8000 (216)
(217)m	84.5370	83.9663	83.0795	81.3792	80.1167	79.8000	79.8000	79.8000	79.8000	81.2893	83.5232	84.6030 (217)
Fuel for water heating, kWh/month												
	324.9007	289.0779	309.7249	276.2404	270.8162	243.6925	239.4855	249.6731	253.1781	278.6921	290.2806	320.8661 (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	46.7340	42.2113	46.7340	45.2264	46.7340	45.2264	46.7340	46.7340	45.2264	46.7340	45.2264	46.7340 (231)
Lighting	34.1141	27.3676	24.6415	18.0534	13.9450	11.3932	12.7211	16.5353	21.4778	28.1800	31.8292	35.0623 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	1559.3080 (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	3346.6281 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.3375)	
mechanical ventilation fans (SFP = 1.3375)	464.2551 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	550.2551 (231)
Electricity for lighting (calculated in Appendix L)	275.3205 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	5731.5116 (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	1559.3080	0.2100	327.4547	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3346.6281	0.2100	702.7919	(264)
Space and water heating			1030.2466	(265)
Pumps, fans and electric keep-hot	550.2551	0.1387	76.3272	(267)
Energy for lighting	275.3205	0.1443	39.7373	(268)
Total CO2, kg/year			1146.3110	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			10.7200	(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	1559.3080	1.1300	1762.0180	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3346.6281	1.1300	3781.6898	(278)
Space and water heating			5543.7078	(279)
Pumps, fans and electric keep-hot	550.2551	1.5128	832.4259	(281)
Energy for lighting	275.3205	1.5338	422.2957	(282)
Total Primary energy kWh/year			6798.4294	(286)
Dwelling Primary energy Rate (DPER)			63.5600	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	53.4800 (1b)	x	2.8200 (2b)	=	150.8136 (1b)	-
First floor	53.4800 (1c)	x	2.5000 (2c)	=	133.7000 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.9600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	284.5136	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1406	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3906	(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) =	0.3320	(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	0.4233	0.4150	0.4067	0.3652	0.3569	0.3154	0.3154	0.3071	0.3320	0.3569	0.3735	0.3901	(22b)
Effective ac	0.5896	0.5861	0.5827	0.5667	0.5637	0.5497	0.5497	0.5472	0.5551	0.5637	0.5698	0.5761	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.9100	1.0000	1.9100			(26)
TER Opening Type (Uw = 1.20)			16.9900	1.1450	19.4542			(27)
Heatloss Floor 1			53.4800	0.1300	6.9524			(28a)
External Wall 1	54.9000	18.9000	36.0000	0.1800	6.4800			(29a)
External Roof 1	53.4800		53.4800	0.1100	5.8828			(30)
Total net area of external elements Aum(A, m2)			161.8600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.6794			(33)
Party Wall 1			110.2300	0.0000	0.0000			(32)

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

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E5 Ground floor (normal)	10.3200	0.1600	1.6512
E2 Other lintels (including other steel lintels)	9.9500	0.0500	0.4975
E3 Sill	9.0400	0.0500	0.4520
E4 Jamb	33.5800	0.0500	1.6790
E6 Intermediate floor within a dwelling	10.3200	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	10.3200	0.0600	0.6192
E18 Party wall between dwellings	21.2800	0.0600	1.2768
P1 Party wall - Ground floor	20.7200	0.0800	1.6576
P4 Party wall - Roof (insulation at ceiling level)	20.7200	0.1200	2.4864
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	20.7200	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.3197 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 50.9991 (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	55.3566	55.0299	54.7097	53.2059	52.9245	51.6147	51.6147	51.3722	52.1192	52.9245	53.4937	54.0888	(38)

Heat transfer coeff

	106.3556	106.0290	105.7088	104.2050	103.9236	102.6138	102.6138	102.3713	103.1183	103.9236	104.4928	105.0879 (39)
Average = Sum(39)m / 12 =												104.2036

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9943	0.9913	0.9883	0.9742	0.9716	0.9594	0.9594	0.9571	0.9641	0.9716	0.9769	0.9825	(40)
HLP (average)												0.9742	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7953 (42)
Hot water usage for mixer showers												
	71.0877	70.0194	68.4626	65.4841	63.2860	60.8347	59.4414	60.9864	62.6799	65.3119	68.3544	70.8153 (42a)
Hot water usage for baths												
	30.6933	30.2374	29.5955	28.4119	27.5257	26.5430	26.0122	26.6496	27.3436	28.3952	29.6031	30.5895 (42b)
Hot water usage for other uses												
	43.2566	41.6836	40.1107	38.5377	36.9647	35.3918	35.3918	36.9647	38.5377	40.1107	41.6836	43.2566 (42c)
Average daily hot water use (litres/day)												133.3221 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	145.0375	141.9404	138.1688	132.4337	127.7764	122.7695	120.8453	124.6007	128.5613	133.8177	139.6411	144.6614	(44)
Energy conte	229.7040	202.1213	212.3603	181.2952	172.0116	150.9594	146.1520	154.2817	158.5289	181.5893	198.9444	226.5048	(45)
Energy content (annual)										Total = Sum(45)m =		2214.4528	
Distribution loss (46)m = 0.15 x (45)m													
	34.4556	30.3182	31.8540	27.1943	25.8017	22.6439	21.9228	23.1423	23.7793	27.2384	29.8417	33.9757	(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													
	276.2989	244.2070	258.9552	226.3870	218.6065	196.0512	192.7469	200.8766	203.6207	228.1842	244.0362	273.0997	(62)
WWHRS	-32.4983	-28.7418	-30.0967	-24.9213	-23.2257	-19.8744	-18.6291	-19.8102	-20.5629	-24.2413	-27.4625	-31.8965	(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													
	243.8006	215.4652	228.8585	201.4657	195.3808	176.1768	174.1178	181.0664	183.0579	203.9429	216.5737	241.2032	(64)
										Total per year (kWh/year) = Sum(64)m =		2461.1094	(64)
12Total per year (kWh/year)												2461	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	113.6525	100.8739	107.8857	96.3541	94.4698	86.2675	85.8715	88.5746	88.7843	97.6544	102.2225	112.5888	(65)

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

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	140.7613	155.8428	140.7613	145.4533	140.7613	145.4533	140.7613	140.7613	145.4533	140.7613	145.4533	140.7613	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	267.1138	269.8856	262.9007	248.0308	229.2602	211.6184	199.8327	197.0609	204.0457	218.9157	237.6863	255.3280	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	(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)													
	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	(71)
Water heating gains (Table 5)													
	152.7587	150.1100	145.0077	133.8252	126.9755	119.8159	115.4186	119.0519	123.3116	131.2559	141.9757	151.3290	(72)
Total internal gains													
	628.5632	643.7678	616.5991	595.2387	564.9264	541.8171	520.9419	521.8034	537.7400	558.8622	593.0447	615.3477	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.1000	10.6334	0.6300	0.7000	0.7700	29.5723	(74)
South	7.8900	46.7521	0.6300	0.7000	0.7700	112.7326	(78)

Solar gains	142.3049	241.1412	331.2134	420.0578	484.7774	489.0080	468.1291	417.6995	361.1363	266.4103	170.1078	122.0643	(83)
Total gains	770.8681	884.9090	947.8125	1015.2965	1049.7037	1030.8251	989.0710	939.5029	898.8762	825.2725	763.1525	737.4120	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	69.8391	70.0542	70.2664	71.2804	71.4734	72.3857	72.3857	72.5572	72.0316	71.4734	71.0841	70.6816	
alpha	5.6559	5.6703	5.6844	5.7520	5.7649	5.8257	5.8257	5.8371	5.8021	5.7649	5.7389	5.7121	
util living area	0.9949	0.9882	0.9741	0.9271	0.8148	0.6196	0.4539	0.4968	0.7382	0.9405	0.9880	0.9960	(86)
MIT	19.9591	20.1408	20.3706	20.6691	20.8848	20.9812	20.9973	20.9956	20.9502	20.6844	20.2772	19.9342	(87)
Th 2	20.0880	20.0906	20.0931	20.1049	20.1071	20.1173	20.1173	20.1192	20.1134	20.1071	20.1026	20.0979	(88)
util rest of house	0.9933	0.9846	0.9659	0.9044	0.7642	0.5416	0.3643	0.4040	0.6629	0.9171	0.9837	0.9948	(89)
MIT 2	18.8791	19.1115	19.4022	19.7736	20.0120	20.1068	20.1165	20.1177	20.0811	19.7998	19.2953	18.8548	(90)
Living area fraction									fLA = Living area / (4) =			0.1912	(91)
MIT	19.0856	19.3083	19.5874	19.9448	20.1789	20.2740	20.2849	20.2855	20.2473	19.9689	19.4830	19.0612	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0856	19.3083	19.5874	19.9448	20.1789	20.2740	20.2849	20.2855	20.2473	19.9689	19.4830	19.0612	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9909	0.9805	0.9601	0.8997	0.7686	0.5558	0.3814	0.4218	0.6750	0.9127	0.9796	0.9927	(94)
Useful gains	763.8377	867.6180	910.0207	913.4512	806.8264	572.9535	377.2571	396.2442	606.7422	753.2544	747.5848	732.0234	(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	1572.5302	1527.6937	1383.4499	1150.9235	881.1556	582.2291	378.1205	397.7680	633.8956	973.6546	1293.9348	1561.7317	(97)
Space heating kWh	601.6672	443.5709	352.2313	170.9800	55.3009	0.0000	0.0000	0.0000	0.0000	163.9777	393.3720	617.3030	(98a)
Space heating requirement - total per year (kWh/year)												2798.4031	
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	601.6672	443.5709	352.2313	170.9800	55.3009	0.0000	0.0000	0.0000	0.0000	163.9777	393.3720	617.3030	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2798.4031	
Space heating per m2										(98c) / (4) =		26.1631	(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	601.6672	443.5709	352.2313	170.9800	55.3009	0.0000	0.0000	0.0000	0.0000	163.9777	393.3720	617.3030	(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)	651.8604	480.5752	381.6157	185.2438	59.9143	0.0000	0.0000	0.0000	0.0000	177.6573	426.1886	668.8007	(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	243.8006	215.4652	228.8585	201.4657	195.3808	176.1768	174.1178	181.0664	183.0579	203.9429	216.5737	241.2032	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.0030	85.6421	85.0234	83.6941	81.6250	79.8000	79.8000	79.8000	79.8000	83.5752	85.3809	86.0726	(217)
Fuel for water heating, kWh/month	283.4791	251.5879	269.1712	240.7167	239.3639	220.7729	218.1927	226.9002	229.3958	244.0233	253.6560	280.2322	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	29.2474	23.4634	21.1262	15.4779	11.9556	9.7678	10.9063	14.1764	18.4138	24.1598	27.2885	30.0603	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-48.6067	-67.8012	-96.4199	-107.1884	-114.5189	-106.4571	-105.0830	-99.6896	-90.0603	-76.9004	-53.1565	-42.1040	(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	-29.6986	-62.2111	-123.1899	-184.3862	-243.2273	-244.2290	-241.4079	-204.7069	-150.4171	-88.8168	-39.5969	-23.5095	(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	3031.8560 (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	2957.4920 (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)	236.0433 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2643.3830 (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	3668.0084 (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	3031.8560	0.2100	636.6898	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2957.4920	0.2100	621.0733	(264)
Space and water heating			1257.7631	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	236.0433	0.1443	34.0683	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1007.9860	0.1348	-135.9075	
PV Unit electricity exported	-1635.3970	0.1260	-206.0480	
Total			-341.9555	(269)
Total CO2, kg/year			961.8052	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.9900	(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	3031.8560	1.1300	3425.9973	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2957.4920	1.1300	3341.9660	(278)
Space and water heating			6767.9633	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	236.0433	1.5338	362.0512	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1007.9860	1.4983	-1510.2909	
PV Unit electricity exported	-1635.3970	0.4625	-756.3445	
Total			-2266.6353	(283)
Total Primary energy kWh/year			4993.4799	(286)
Target Primary Energy Rate (TPER)			46.6900	(287)

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Appendix C

GLA carbon emissions reporting spreadsheet

The applicant should complete all the light blue cells including information on the modelled units, the area per unit, the number of units, the TER/DER/BER and the TFEE/DFEE.

RESIDENTIAL CO_2 ANALYSIS (PART L1)

				Baseline		'Be Lean'	'Be Clean'	'Be Green'	Fabric Energy Efficiency (FEE)		Baseline		'Be Lean'			'Be Clean'			'Be Green'	
Unit identifier (e.g. plot number, dwelling type etc.)	Model total floor area	Number of units	Total area represented by model	TER	Energy saving/generation technologies (-)	DER	DER	DER	Target Fabric Energy Efficiency	Dwelling Fabric Energy Efficiency	Part L 2021 CO_2 emissions	Energy saving/generation technologies	Part L 2021 CO_2 emissions	Part L 2021 CO_2 emissions with Notional PV savings included	'Be Lean' savings	Part L 2021 CO_2 emissions	Part L 2021 CO_2 emissions with Notional PV savings included	'Be Clean' savings	Part L 2021 CO_2 emissions	'Be Green' savings
	(m^2) (Row 4)		(m^2)	($kgCO_2$ / m^2) (Row 273)	($kgCO_2$ p.a.) (Row 269)	($kgCO_2$ / m^2) (Row 273 or 384)	($kgCO_2$ / m^2) (Row 273 or 384)	($kgCO_2$ / m^2) (Row 273 or 384)	(kWh/m^2)	(kWh/m^2)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)
B1_00_2B	*62.57*	*1*	*1005*	**15.25**	**-66.95**	**14.29**	**14.29**	**4.62**	39.77	40.08	**15,326**	**-1,075**	**14,361**	**13,286**	**2,040**	**14,361**	**13,286**	**0**	**4,643**	**8,643**
B1_02_2B	*71.03*	*1*	*2257*	**13.53**	**-76.00**	**12.02**	**12.02**	**3.90**	33.98	33.49	**30,537**	**-2,415**	**27,129**	**24,714**	**5,823**	**27,129**	**24,714**	**0**	**8,802**	**15,912**
B1_03_2B	*61.9*	*1*	*800*	**14.50**	**-66.23**	**13.96**	**13.96**	**4.53**	36.12	38.11	**11,600**	**-856**	**11,168**	**10,312**	**1,288**	**11,168**	**10,312**	**0**	**3,624**	**6,688**
B2_04_2B	*62.47*	*1*	*422*	**16.39**	**-66.85**	**14.65**	**14.65**	**4.71**	45.03	41.15	**6,917**	**-452**	**6,182**	**5,731**	**1,186**	**6,182**	**5,731**	**0**	**1,988**	**3,743**
B2_05_2B	*76.06*	*1*	*708*	**16.10**	**-81.37**	**14.06**	**14.06**	**4.43**	48.07	44.43	**11,399**	**-757**	**9,954**	**9,197**	**2,202**	**9,954**	**9,197**	**0**	**3,136**	**6,061**
End House	*106.96*	*1*	*427.2*	**10.32**	**-341.96**	**12.13**	**12.13**	**3.35**	38.01	37.19	**4,409**	**-1,366**	**5,182**	**3,816**	**593**	**5,182**	**3,816**	**0**	**1,431**	**2,385**
Mid House	*106.96*	*1*	*320.4*	**8.99**	**-341.95**	**10.72**	**10.72**	**2.93**	31.76	31.00	**2,880**	**-1,024**	**3,435**	**2,410**	**470**	**3,435**	**2,410**	**0**	**939**	**1,472**
Sum		*7.00*	*5,939.60*	*13.99*	*-106.62*	*13.03*	*13.03*	*4.14*	*37.88*	*37.21*	*83,067.94*	*-7,945.25*	*77,411.99*	*69,466.74*	*13,601.20*	*77,411.99*	*69,466.74*	*0.00*	*24,563.35*	*44,903.39*

Part L 2021 Performance

Residential

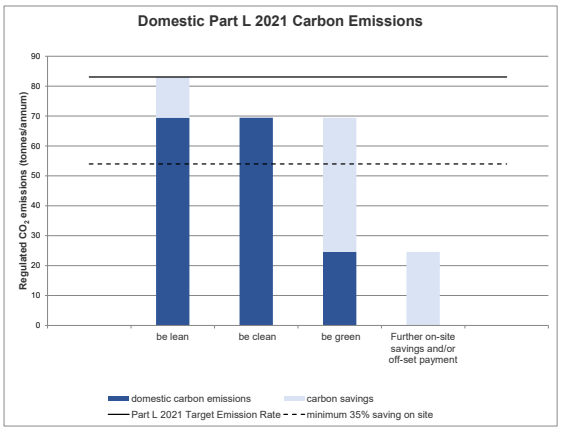
Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for residential buildings

	Carbon Dioxide Emissions for residential buildings (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2021 of the Building Regulations Compliant Development	83.1	40.2
After energy demand reduction (be lean)	69.5	40.2
After heat network connection (be clean)	69.5	40.2
After renewable energy (be green)	24.6	40.2

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for residential buildings

	Regulated residential carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Be lean: savings from energy demand reduction	13.6	16%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	44.9	54%
Cumulative on site savings	**58.5**	**70%**
Annual savings from off-set payment	24.6	-
	(Tonnes CO_2)	
Cumulative savings for off-set payment	**737**	-
Cash in-lieu contribution (£)	**70,006**	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab



Non-residential

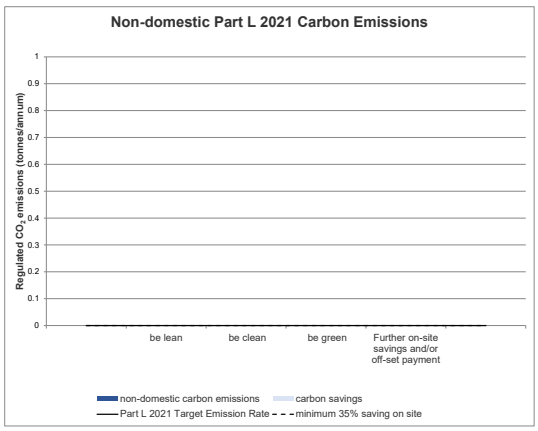
Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-residential buildings

	Carbon Dioxide Emissions for non-residential buildings (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2021 of the Building Regulations Compliant Development	0.0	
After energy demand reduction (be lean)	0.0	
After heat network connection (be clean)	0.0	
After renewable energy (be green)	0.0	

Table 4: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for non-residential buildings

	Regulated non-residential carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Be lean: savings from energy demand reduction	0.0	0%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	0.0	0%
Total Cumulative Savings	**0.0**	**0%**
Annual savings from off-set payment	0.0	-
	(Tonnes CO_2)	
Cumulative savings for off-set payment	**0**	-
Cash in-lieu contribution (£)	**0**	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab



SITE-WIDE

	Total regulated emissions (Tonnes CO_2 / year)	CO_2 savings (Tonnes CO_2 / year)	Percentage savings (%)
Part L 2021 baseline	83.1		
Be lean	69.5	13.6	16%
Be clean	69.5	0.0	0%
Be green	24.6	44.9	54%
Total Savings	-	58.5	70%
	-	**CO_2 savings off-set (Tonnes CO_2)**	-
Off-set	-	**736.9**	-

	Target Fabric Energy Efficiency (kWh/m²)	Dwelling Fabric Energy Efficiency (kWh/m²)	Improvement (%)
Development total	37.88	37.21	2%

	Area weighted non-residential cooling demand (MJ/m^2)	Total non-residential cooling demand (MJ/year)
Actual		
Notional		

EUI & space heating demand (predicted energy use)

Residential

Building type	EUI (kWh/m²/year) (excluding renewable energy)	Space heating demand (kWh/m²/year) (excluding renewable energy)	EUI value from Table 4 of the guidance (kWh/m²/year) (excluding renewable energy)	Space heating demand from Table 4 of the guidance(kWh/m²/year) (excluding renewable energy)	Methodology used (e.g. 'be seen' methodology or an alternative predictive energy modelling methodology)	Explanatory notes (if expected performance differs from the Table 4 values in the guidance)

Non-residential

Building type	EUI (kWh/m²/year) (excluding renewable energy)	Space heating demand (kWh/m²/year) (excluding renewable energy)	EUI value from Table 4 of the guidance (kWh/m²/year) (excluding renewable energy)	Space heating demand from Table 4 of the guidance(kWh/m²/year) (excluding renewable energy)	Methodology used (e.g. 'be seen' methodology or an alternative predictive energy modelling methodology)	Explanatory notes (if expected performance differs from the Table 4 values in the guidance)