Hampstead Police Station – 26 Rosslyn Hill, London, NW3 1PD

Energy Statement

February 2024

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Executive summary

This energy assessment has been prepared to support the planning application for the redevelopment of the Grade II listed building most recently used as Hampstead Police Station located at Rosslyn Hill in the London Borough of Camden.

The proposals include refurbishment and extension of the existing building to provide commercial spaces and residential dwellings created by change of use. The refurbishment will include restoration of existing heritage features of the building and enhancing existing fabric where possible to improve energy efficiency of the building. The refurbished building will provide commercial office space on lower ground and ground floors; and 5 no. residential dwellings over first to second floors.

The design team has carried out research into potential improvements that can be applied to existing building fabric whilst retaining historic features such as cornices, skirtings and window reveals. Preservation of heritage features have been carefully considered in the proposed improvements to existing building fabric which include providing insulation to the roof, floor and replacement of existing single glazed windows with thin profile double-glazed units. Energy modelling has been carried out in accordance with GLA guidance and energy hierarchy providing details of carbon emission savings at each step of the energy hierarchy.

In Camden Planning Guidance energy efficiency and adaptation, Appendix 2 sets out relevant guidance on policy application for mixed use developments. This has been applied to the proposed development as follows:

- The residential part of the development falls under the 'medium' classification as the new floor area being added to the existing building is less than 1,000 m².
- Since the extension to the non-residential part of the proposed development would not be defined as 'large' under the guidance set out in Approved Document L2A, and subsequently forms part of the refurbishment, the whole of the non-residential parts should be assessed as a refurbishment.

On this basis, the applicable energy and carbon targets from the CPG are as follows.

Development should comply with these standards/provide this information	Residential Refurbishment **(assessed under L1B)**	Non-domestic Refurbishment **(assessed under L2B)**
Baseline: Part L 2021 of the Building Regulations Compliant Development	Medium (5-9 units)	Major (Refurbishment)
Energy and carbon reduction targets		
Overall carbon reduction targets	Greatest possible reduction - meeting Part L1B for retained thermal elements (London Plan 5.4, Local Plan CC1)	Greatest possible reduction, meeting Part L2B for retained thermal elements. (London Plan 5.4, Local Plan CC1)
Reduction in CO_2 from onsite renewables (after all other energy efficiency measures have been incorporated)	20% (Camden Local Plan CC1)	20% (Camden Local Plan CC1)

Table 1 Carbon Emissions Target Reduction

The energy strategy for the proposed development incorporates the following key measures.

Demand Reduction

- New and renovated/retained thermal elements (e.g. floor and roof)
- New controlled fittings (windows and doors)
- Mechanical ventilation with heat recovery
- High efficiency lighting using LED lamps/light sources

Heating Infrastructure

- Separate heating systems for each dwelling and for the commercial areas.

Renewable Energy

- Air Source Heat pumps

Carbon dioxide emissions after each stage of the energy hierarchy are shown in Table 2 and Table 3, for the domestic and non-domestic parts of the building respectively.

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO_2 per annum)	
	Regulated	**Unregulated**
Baseline: Part L 2021 of the Building Regulations Compliant Development	8.5	4.7
After energy demand reduction	16.1	4.7
After heat network / CHP	16.1	4.7
After renewable energy	4.7	4.7

Table 2 Carbon Dioxide Emissions after each stage of the Energy Hierarchy for dwellings

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO_2 per annum)	
	Regulated	**Unregulated**
Baseline: Part L 2021 of the Building Regulations Compliant Development	12.0	6.8
After energy demand reduction	11.5	6.8
After heat network / CHP	11.5	6.8
After renewable energy	10.5	6.8

Table 3 Carbon Dioxide Emissions after each stage of the Energy Hierarchy for commercial areas

Table 2 indicates an increase in carbon emissions at the first stage of energy hierarchy. The increase in carbon emissions is in comparison to the existing building energy model that would be compliant with current building regulations Part L but as the existing building is Grade 2 listed with un-insulated fabric and single glazed windows. At the first stage of the energy hierarchy, the existing building is modelled with the proposed fabric improvements (roof, floor insulation and double glazed windows) which results in a higher carbon emission compared to baseline model.

Following application of all three stages of the energy hierarchy, the proposed development achieves a 25% energy-related carbon emission reduction through the following design measures:

- Efficient fabric improvements and passive measures to reduce energy demand (Be Lean)
- Onsite energy supply (Be Clean)
- Use of highly-efficient energy source as an all-electric air source heat pump (Be Green)

The energy and emission rates are calculated under Part L 2021 of the Building Regulations using SAP 10.2 methodology as per the London Plan Energy Statement Guidance. The results shown in Table 4 and Table 5 show compliance against the current building regulations (Part L 2021). SAP 10.2 calculations and worksheets are included in the Appendices to provide details of carbon emissions and predicted energy usage for dwellings.

London Borough of Camden policy target of a 20% reduction in CO_2 emissions through the use of renewable energy is easily met, through the use of air source heat pumps to meet all heat demand in the building, with the exception of the modest domestic hot water demand in the office.

The applicant commits to the key measures and CO_2 reductions identified for each stage of the energy hierarchy as set out in this Energy Assessment report.

GLA Energy Hierarchy

Be Lean

As part of a ‘fabric first approach’, the building fabric has been carefully considered and specified to exceed the current Building Regulation Part L 2021 minimum requirement. As this project involves refurbishment of an existing Grade II listed building, the extent of improvements to existing fabric whilst preserving heritage features of the building is quite limited therefore the proposal is to replace existing single glazed windows with thin profile double-glazed units that provide better thermal performance without having a significant impact on existing appearance of the building. Existing floor and roof can be insulated without having a significant impact on heritage features of the building therefore it is proposed to provide insulation to existing floors and roof to meet the requirements of Part L Volume 2. The proposed replacement of existing single glazed windows with thin profile double glazed units will contribute towards approximately 15% of carbon savings. Extension and all new fabric will be built to exceed minimum fabric performance requirements listed in current building regulations Part L Volume 2.

Be Clean

London Plan Policy SI3 Energy Infrastructure encourages developments in heat network priority areas to consider connection to local existing heat networks, designed to allow connection to planned heat networks in the area, to enable use of low-carbon heat sources to meet heating and hot water requirements of the development.

Given the lack of existing nearby district heating or community heating infrastructure to connect to at present and cost-effective connection options in the near future and due to the small scale of the project, it is proposed to provide an onsite low-carbon energy supply option in the form of Air Source Heat Pumps.

Be Green

Heat pumps extract heat from the environment to provide space heating and domestic hot water and are included under a third "Be Green" element of the GLA energy assessment guidance. It is proposed to provide 2 no air source heat pumps for each residential dwelling.

Two all-electric air source heat pump systems (per dwelling) with wet radiators are proposed to provide space heating and generate domestic hot water via hot water cylinder.

Refrigerant heat pump (VRF) systems are proposed for commercial areas to provide heating and comfort cooling.

Be seen measures

The new GLA's London Plan Policy requires the major developments to monitor their energy performance and report on the GLA's online post-construction monitoring platform.

This development is not considered as a major development and “Be seen” measures will be voluntary and not recommended due to the small scale of this project.

Summertime Overheating

As per the requirements of *London Plan Policy SI4 Managing Heat Risk*, An overheating risk assessment has been undertaken in line with the guidance and data sets in CIBSE TM59 Design methodology for the assessment of overheating risk in homes and TM49 Design Summer Years for London. Although building regulations Part O only applies to new build projects, the overheating assessment indicates all proposed dwellings comply with requirements of building regulations Part O when assessed with openable windows to reduce overheating.

It is proposed to provide appropriate energy-efficient mechanical ventilation systems such as continuous Mechanical Ventilation with Heat Recovery (MVHR) to provide background ventilation. Additionally, all dwellings will be provided with openable windows to allow purge ventilation and reduce overheating risk. Natural ventilation will be available via openable windows and balcony doors.

Voluntarily, an overheating assessment for the commercial areas has been carried out which indicates the commercial spaces comply with the requirements of CIBSE TM52 when assessed using Design Summer Year 1 weather data (moderate summer temperatures) but fail to comply with TM52 when assessed using Design Summer Year 2 and 3 (extreme, prolonged summer temperatures). To meet expectations of the target commercial occupiers, it is proposed to install high efficiency VRF systems with mechanical ventilation to all commercial areas.

Energy Hierarchy Tables

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO_2 per annum)	
	Regulated	**Unregulated**
Baseline: Part L 2021 of the Building Regulations Compliant Development	8.5	4.7
After energy demand reduction	16.1	4.7
After heat network / CHP	16.1	4.7
After renewable energy	4.7	4.7

Table 4 Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	**(%)**
Savings from energy demand reduction	-7.7	-90%
Savings from heat network / CHP	0.0	0%
Savings from renewable energy	11.4	135%
Cumulative onsite savings	3.7	44%

Table 5 Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings

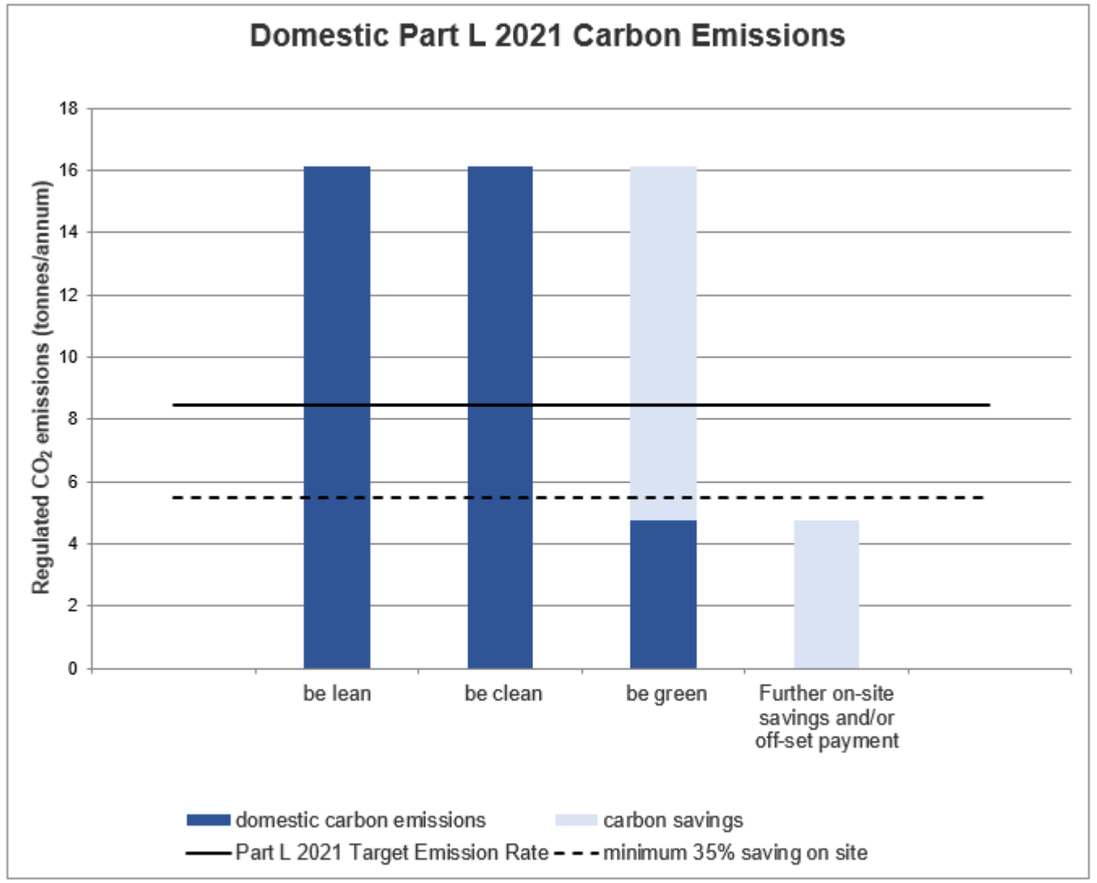

Figure 1 Domestic Energy relates to Carbon Dioxide Emissions (SAP 10)

Table 4 and Table 5 indicates an increase in carbon emissions at the first stage of energy hierarchy. The increase in carbon emissions is in comparison to the existing building energy model that would be compliant with current building regulations Part L but as the existing building is Grade 2 listed with un-insulated fabric and single glazed windows. At the first stage of the energy hierarchy, the existing building is modelled with the proposed fabric improvements (roof, floor insulation and double glazed windows) which results in a higher carbon emission compared to baseline model.

	Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO_2 per annum)	
	Regulated	**Unregulated**
Baseline: Part L 2021 of the Building Regulations Compliant Development	12.0	6.8
After energy demand reduction	11.5	6.8
After heat network / CHP	11.5	6.8
After renewable energy	10.5	6.8

Table 6 Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-domestic buildings

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	**(%)**
Savings from energy demand reduction	0.5	4%
Savings from heat network / CHP	0.0	0%
Savings from renewable energy	1.0	8%
Cumulative onsite savings	1.4	12%
Annual savings from offset payment	10.5	-

Table 7 Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for non-domestic buildings.

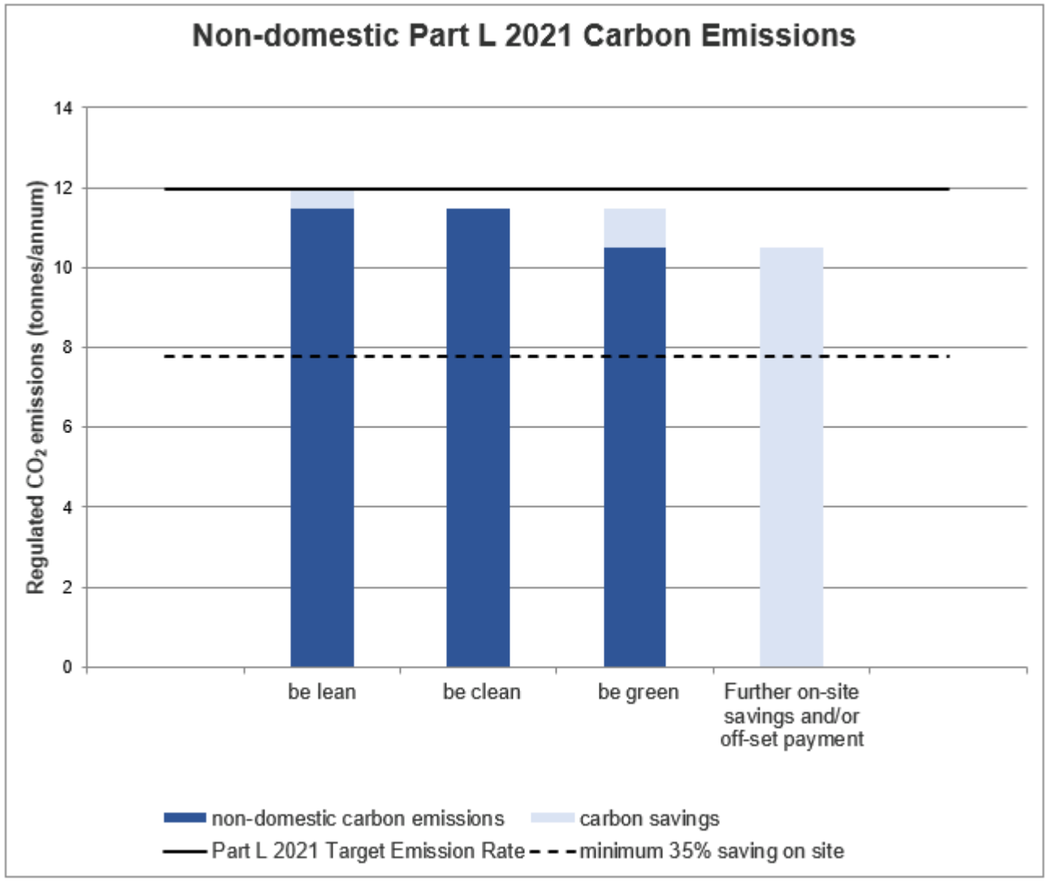

Figure 2 Non-domestic Energy relates to Carbon Dioxide Emissions (SAP 10)

	Total regulated emissions (Tonnes CO_2 / year)	CO_2 savings (Tonnes CO_2 / year)	Percentage savings (%)
Part L 2013 baseline	20.4		
Be lean	27.6	-7.2	-35%
Be clean	27.6	0.0	0%
Be green	15.2	12.4	61%
Total Savings		5.2	25%

Table 8 Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for whole site

1. Introduction

1.1 Peter Deer and Associates Ltd (PDA) have been appointed to carry out an energy assessment and provide an Energy Statement to support the planning application for the redevelopment of the Grade II listed building most recently used as Hampstead Police Station located at Rosslyn Hill in the London Borough of Camden.

1.2 This report has been prepared to demonstrate how the proposed development meets planning policies in respect of operational energy use and carbon dioxide emissions.

1.3 The proposals include refurbishment and extension of existing building to provide commercial space and residential dwellings. The refurbishment will include restoration of existing heritage features of the building and enhancing existing fabric where possible to improve energy efficiency of the building. The refurbished building will provide commercial office space on lower ground and ground floors and 5 no. residential dwellings over first and second floors.

1.4 This document should be read in conjunction with:

- Design and Access Statement
- Sustainability report

Site location

1.5 Location: 26 Rosslyn Hill, London, NW3 1PD. Proposed dwelling units face southwest.

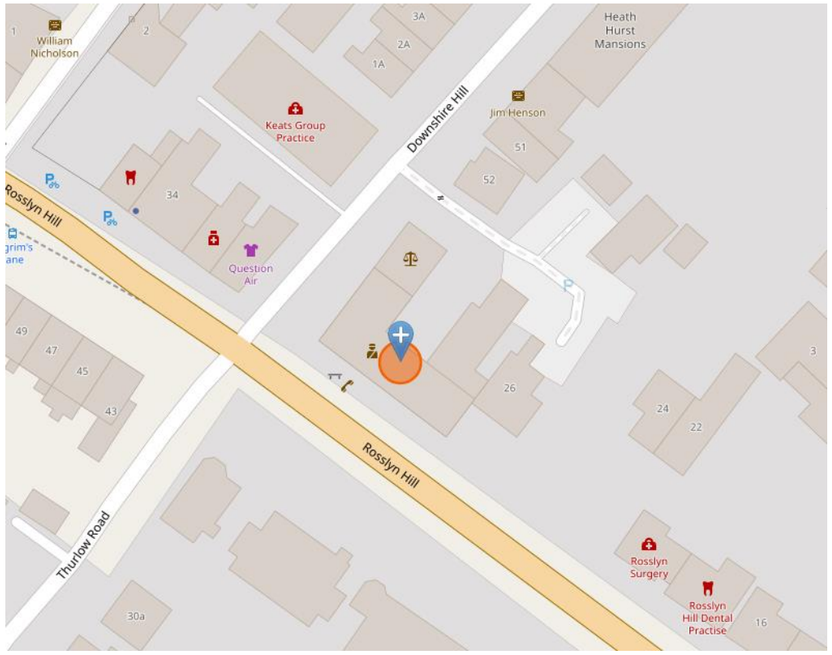

Figure 3 Site location (Open Street Map 2023)

1.6 The site is located in Hampstead within the London Borough of Camden. It is located on the junction of Rosslyn Hill and Downshire Hill.

Proposed development

1.7 This development contains 5 dwelling units, commercial office space and Class E space for private medical use. Each dwelling would have access to a private terrace.

1.8 The residential entrances plus cycle and waste storage areas are accessible from the public street.

1.9 DMFK Architects have designed replacement windows to be openable, allowing crossflow ventilation through the dwellings. This recommended design strategy is supported by CIBSE overheating guidance documents.

1.10 Full details of the proposal are set out in DMFK Architect's Design and Access Statement. The proposed development includes 5no. dwellings, and it is not regarded as major development according to the London Borough of Camden planning guidance documents.

Ref	Type	Floor Area	Living Room Area
Unit 01	2B_3P	105.00 m²	29.45 m²
Unit 02	1B_2P	92.00 m²	43.34 m²
Unit 03	2B_3P	119.00 m²	25.15 m²
Unit 04	1B_2P	102.00 m²	47.46 m²
Unit 05	3B_6P	225.00 m²	58.08 m²
Commercial Space	Office	1600.00m²	-

Table 9 Accommodation Tenure Schedule

Potential for District Heating

1.11 The New London Plan Heating Hierarchy (2021), in line with Policy SI 3 D, states that the priority is for new major developments to connect to local existing or planned district heat networks where the operator has or is in the process of developing a strategy to decarbonise the network and has shared it with the GLA.

1.12 This development is not regarded as a major development and is not within the heat network priority area. Although there is an existing decentralised heat network within 500m of site, there are no future plans to extend the heat network to boundary of site.

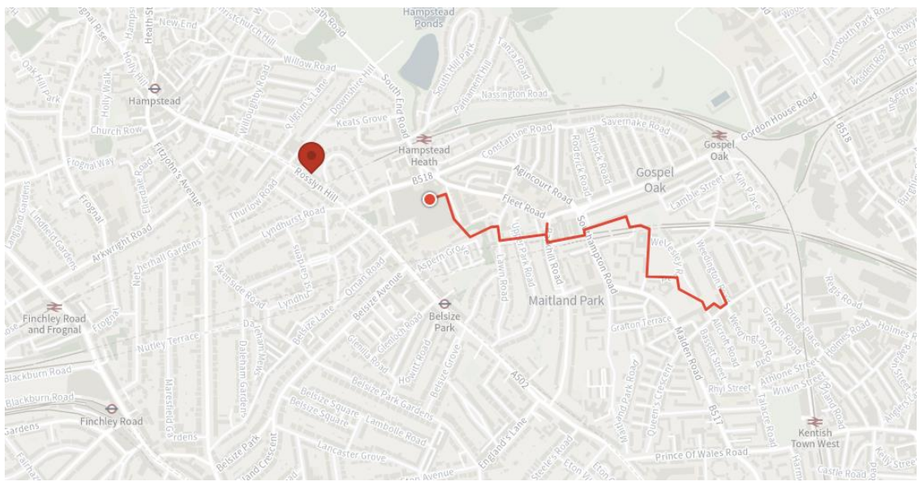

Figure 4 Heat Map for the site (https://maps.london.gov.uk/heatmap)

Transport

1.13 The location provides a range of transport options, including the London Overground (Hampstead Heath Station), London Underground (Hampstead Underground Station) and local bus routes. The Public Transport Accessibility Level (PTAL) rating of 4 confirms that the site has good public transport.

2. Planning Policy Requirements

2.1 The National Planning Policy Framework (NPPF) document sets out the Government's planning policies for England and was updated December 2023.

2.2 With regards to climate change, the NPPF supports a reduction in greenhouse gas emissions and the delivery of renewable and low carbon energy. Climate change is covered in Section 14 'Meeting the challenge of climate change, flooding and coastal change'. In summary the framework advises that to support the move to a low carbon future, local planning authorities should:

2.3 Plan for new developments in locations which reduce greenhouse gas emissions.

2.4 Actively support energy efficiency improvements to existing buildings

2.5 Adopt nationally described standards when setting any local requirement for a building's sustainability.

2.6 In determining planning applications, local planning authorities should expect a new development to:

- Comply with adopted Local Planning policies on local requirements for decentralised energy supply, unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable.
- Take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

London Plan

2.7 The London Plan (March 2021) is the mayor's planning strategy for Greater London. It sets borough-level housing targets and identifies locations for future growth of London-wide importance.

2.8 The London Plan is the overall strategic Plan for London, setting out an integrated economic, environmental, transport and social framework for the development of London over the next 20 to 25 years.

2.9 The London Plan is part of the Development Plan. It guides boroughs' development plans to ensure that they work toward a shared vision for London. It establishes policies that allow everyone involved in new developments to know what is expected.

Policy SI 2 Minimising greenhouse gas emissions

A) Major development should be net zero-carbon. This means reducing greenhouse gas emissions in operation and minimising both annual and peak energy demand under 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 onsite.*
- *4) be seen; monitor, verify and report on energy performance.*

B) Major development proposals should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the Framework of the energy hierarchy.

C) A minimum onsite 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. Where it is demonstrated that the zero-carbon target cannot be fully achieved onsite, any shortfall should be provided, in agreement with the borough, either:
- *A. Through cash in lieu contribution to the borough's carbon offset fund, or*
- *B. off-site provided that an alternative proposal is identified and delivery is certain.*

D) Boroughs must establish and administer a carbon offset fund. Offset fund payments must be ring-fenced to implement projects that deliver carbon reductions. The operation of offset funds should be monitored and reported annually.

E) Major development proposals should calculate and minimise carbon emissions from any other part of the development, including plant or equipment, that are not covered by Building Regulations, i.e., unregulated emissions.

F) Development proposals referable to the Mayor should calculate whole lifecycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions.

Table 10 GLA Policy SI 2 Minimising greenhouse gas emissions

2.10 Policy SI 2 above is aimed at all major developments but as this development is not considered as a major development, the above policy is not applicable to this project.

2.11 The mayor is committed to London becoming a zero-carbon city. This will require the reduction of all greenhouse gases, of which carbon dioxide is the most prominent. London homes and workplaces are responsible for producing approximately 78 percent of its greenhouse gas emissions. New developments need to meet the Framework's requirements as London aims to become a zero-carbon city by 2050. Development involving major refurbishment should also aim to meet this Framework.

2.12 The energy hierarchy should inform new buildings' design, construction, and operation. The priority is to minimise energy demand and address how energy will be supplied and renewable technologies incorporated. An important aspect of managing demand will be to reduce peak energy loadings.

2.13 Boroughs should ensure that all developments maximise onsite electricity and heat production opportunities from solar technologies (photovoltaic and thermal) and use innovative building materials and smart technologies. This approach will reduce carbon emissions, reduce energy costs to occupants, improve London's energy resilience and support the growth of green jobs.

2.14 A zero-carbon target for major residential developments has been in place for London since October 2016 and applies to major non-residential developments on the final publication of this Plan.

2.15 As this project involves conversion of an existing Grade II listed building with minimal scope for upgrading building fabric to preserve the listed features of the building; the 35% carbon reduction target is not applicable to this project.

2.16 The minimum improvement over the Target Emission Rate (TER) will increase over time to achieve the zero-carbon London ambition and reflect the costs of more efficient construction methods. This will be reflected in future updates to the London Plan.

2.17 The Mayor recognises that Building Regulations use outdated carbon emission factors and that this will continue to cause uncertainty until Government updates them. Interim guidance has been published in the Mayor's Energy Planning Guidance on using appropriate emissions factors. This guidance will be updated once Building Regulations are updated to help developers determine how these policies are implemented.

2.18 Major Developments are expected to achieve carbon reductions beyond Part L from energy efficiency measures alone to reduce energy demand as far as possible. Residential development should achieve 10%, and non-residential development should achieve 15% over Part L.

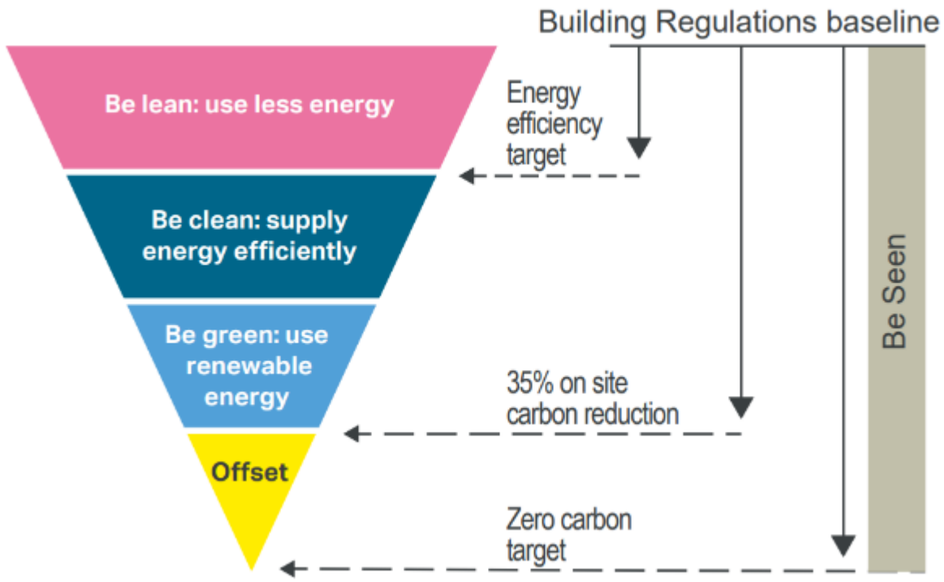

Figure 5 London Plan Energy Hierarchy

2.19 The cost for offsetting carbon is regularly reviewed. Changes to the GLA's suggested carbon offset price will be updated in future guidance. All new major developments are expected to get as close as possible to zero-carbon target rather than relying on offset fund payments to make up for any shortfall in emissions. However, offset funds can unlock carbon savings from the existing building stock through energy efficiency programmes and by installing renewable technologies – typically more expensive to deliver in London due to the building's age, type, and tenure.

2.20 As this development is not considered as a major development no carbon offset payment is required.

Policy SI 3 Energy Infrastructure

A) Boroughs and developers should engage with relevant energy companies and bodies at an early stage to establish the future energy and infrastructure requirements arising from large-scale development proposals such as Opportunity Areas, Town Centres, other growth areas or clusters of significant new development.

B) Energy masterplans should be developed for large-scale development locations (such as those outlined in Part A and other opportunities), establishing the most effective energy supply options. Energy masterplans should identify:

1) major heat loads (including anchor heat loads, with reference to sites such as universities, hospitals, and social housing)
2) heat loads from existing buildings that can be connected to future phases of a heat network.
3) major heat supply plant including opportunities to utilise heat from energy from waste plants.
4) secondary heat sources, including both environmental and waste heat.
5) opportunities for low and ambient temperature heat networks
6) possible land for energy centres and/or energy storage
7) possible heating and cooling network routes
8) opportunities for futureproofing utility infrastructure networks to minimise the impact of road works.
9) infrastructure and land requirements for electricity and gas supplies
10) implementation options for delivering feasible projects, considering issues of procurement, funding and risk, and the role of the public sector.
11) opportunities to maximise renewable Electricity generation and incorporate demand-side response measures.

C) Development Plans should:

1) identify the need for, and suitable sites for, any necessary energy infrastructure requirements, including energy centres, energy storage and upgrades to existing infrastructure.
2) 2) identify existing heating and cooling networks, identify proposed locations for future heating and cooling networks and identify opportunities for expanding and inter-connecting existing networks and establishing new networks.

D) Major development proposals within Heat Network Priority Areas should have a communal low-temperature heating system:

1) the heat source for the communal heating system should be Electricity following 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)
b) 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)
c) use ultra-low NO_x gas boilers.
2) CHP and ultra-low NO_x gas boiler communal or district heating systems should be designed to ensure that they meet the requirements in Part B of Policy SI 1 Improving air quality.
3) where a heat network is planned but not yet in existence, the development should be designed to allow a cost-effective connection later.

E) *Heat networks should achieve good practice design and specification standards for primary, secondary, and tertiary systems comparable to those in the CIBSE/ADE Code of Practice CP1 or equivalent.*

Table 11 GLA Policy SI 3 Energy Infrastructure

2.21 Policy SI 3 above is aimed at all major developments but as this development is not considered as a major development, the above policy is not applicable to this project.

2.22 The mayor will work with boroughs, energy companies, and major developers to promote London's energy system's timely and effective development (energy production, distribution, storage, supply, and consumption).

2.23 London is part of a national energy system and currently sources approximately 95 per cent of its energy from outside the GLA boundary. Meeting the Mayor's zero-carbon target by 2050 requires changes to how we use and supply energy to generate power and heat for our buildings and transport from clean, low-carbon, and renewable sources. London will need to shift from relying on natural gas as its main energy source to a more diverse range of low and zero-carbon sources, including renewable energy and secondary heat sources.

Decentralised energy and local secondary heat sources will become an increasingly important element of London's energy supply. They will help London become more self-sufficient and resilient concerning its energy needs.

2.24 The heating system should be designed to facilitate cost-effective future connections where developments are proposed within Heat Network Priority Areas but are beyond existing heat networks. This may include, for example, allocating space in plant rooms for heat exchangers and thermal stores, safeguarding suitable routes for pipework from the site boundary and making provision for connections to the future network at the site boundary. The Mayor is taking a more direct role in delivering district-level heat networks. Newer communally-heated developments will connect to them and develop a comprehensive decentralised energy support package. Further details are available in the London Environment Strategy.

2.25 Electricity is essential for the functioning of any modern city. Demand is expected to rise in London in response to a long-term growing population and economy, the increased take-up of electric vehicles, and the switch to electric heating systems (such as through heat pumps). The electricity network and substations are at or near capacity in several areas, especially in central London. The Mayor will work with the Electricity and heat industry, boroughs, and developers to ensure that appropriate infrastructure is integrated within a wider smart energy system designed to meet London's needs.

Policy SI 4 Managing Heat Risk.

A) *Development proposals should minimise adverse impacts on the urban heat island through design, layout, orientation, materials, and green infrastructure.*
B) *Major development proposals should demonstrate through an energy strategy how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the following cooling hierarchy:*
   1) *reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation, and the provision of green infrastructure.*
   2) *minimise internal heat generation through energy-efficient design.*
   3) *manage the heat within the building through exposed internal thermal mass and high ceilings.*
   4) *provide passive ventilation.*
   5) *provide mechanical ventilation.*
   6) *provide active cooling systems.*

Table 12 GLA Policy SI 4 Managing Heat Risk

2.26 Climate change means London is already experiencing higher than historical average temperatures and more severe hot weather events. This, combined with a growing population, urbanisation, and the urban heat island effect, means London must manage heat risk in new developments, using the cooling hierarchy above. The cooling hierarchy applies to major developments, and the principles can also be applied to minor development.

2.27 In managing heat risk, new developments in London face two challenges – the need to ensure London does not overheat (the urban heat island effect) and that individual buildings do not overheat. The urban heat island effect is caused by extensive built-up areas absorbing and retaining heat day and night, leading to parts of London being several degrees warmer than the surrounding area. This can become problematic on the hottest days of the year as daytime temperatures can reach well over 30°C and not drop below 18°C at night. These circumstances can lead many people to feel too hot or not sleep, but for certain health conditions and 'at risk' groups such as some young or elderly Londoners, the effects can be serious and worsen health conditions. Green infrastructure can mitigate this effect by shading roof surfaces and through evapotranspiration. Development proposals should incorporate green infrastructure in line with Policy G1 Green Infrastructure and Policy G5 Urban Greening.

London Borough of Camden

2.28 The Council aims to tackle the causes of climate change in the borough by ensuring developments use less energy and assessing the feasibility of decentralised energy and renewable energy technologies.

2.29 Any new development in Camden can potentially increase carbon dioxide emissions in the borough. Suppose we are to achieve local and support national carbon dioxide reduction targets. In that case, it is crucial that planning policy limits carbon dioxide emissions from new development wherever possible and supports sensitive energy efficiency improvements to existing buildings.

2.30 The Council will seek to minimise and mitigate climate change by requiring developments to incorporate the three aspects of the energy hierarchy of the London Plan 2021: Firstly, reducing the demand for energy (lean option), secondly supplying energy in the most efficient way (clean option), and thirdly using renewable energy sources (green option).

Policy CC1 Climate change Mitigation

The Council will require all development to minimise the effects of climate change and encourage all developments to meet the highest possible environmental standards that are financially viable during construction and occupation.

We will:

a. promote zero carbon development and require all development to reduce carbon dioxide emissions through following the steps in the energy hierarchy.
b. require all major development to demonstrate how London Plan targets for carbon dioxide emissions have been me.;
c. ensure that the location of development and mix of land uses minimise the need to travel by car and help to support decentralised energy networks.
d. support and encourage sensitive energy efficiency improvements to existing buildings.
e. require all proposals that involve substantial demolition to demonstrate that it is not possible to retain and improve the existing building; and
f. expect all developments to optimise resource efficiency.

For decentralised energy networks, we will promote decentralised energy by:

g. working with local organisations and developers to implement decentralised energy networks in the parts of Camden most likely to support them.
h. protecting existing decentralised energy networks (e.g. at Gower Street, Bloomsbury, King's Cross, Gospel Oak and Somers Town) and safeguarding potential network routes; and
i. requiring all major developments to assess the feasibility of connecting to an existing decentralised energy network, or where this is not possible establishing a new network.

To ensure that the Council can monitor the effectiveness of renewable and low carbon technologies, major developments will be required to install appropriate monitoring equipment.

Table 13 Camden Local Plan CC1 (March 2021)

2.31 New developments in Camden will be expected to be designed to minimise energy use and CO_2 emissions in operation through the application of the energy hierarchy. The Council's Sustainability Plan 'Green Action for Change' commits the Council to seek low and zero-carbon buildings. It is understood that some sustainable design measures may be challenging for listed buildings and some conservation areas, and we would advise developers to engage early with the Council to develop innovative solutions.

2.32 Adapting to a changing climate is identified in Camden's environmental sustainability plan, Green Action for Change (2011-2020). The three key risks that require adaptation are flooding, drought and overheating. Specific design measures and 'green infrastructure' such as green roofs, green walls and open spaces can help mitigate some of these risks.

Policy CC2 Adapting to climate change.

The Council will require development to be resilient to climate change. All development should adopt appropriate climate change adaptation measures such as:

The protection of existing green spaces and promoting new appropriate green infrastructure.

a. *not increasing, and wherever possible reducing, surface water runoff through increasing permeable surfaces and use of Sustainable Drainage Systems.*
b. *incorporating bio-diverse roofs, combination green and blue roofs and green walls where appropriate; and*
c. *measures to reduce the impact of urban and dwelling overheating, including the application of the cooling hierarchy.*
d. *Any development involving 5 or more residential units or 500 sqm or more of any additional floorspace is required to demonstrate the above in a Sustainability Statement.*
e. *Sustainable design and construction measures*
f. *The Council will promote and measure sustainable design and construction by:*
g. *ensuring development schemes demonstrate how adaptation measures and sustainable development principles have been incorporated into the design and proposed implementation.*
h. *encourage new build residential development to use the Home Quality Mark and Passivhaus design standards.*
i. *encouraging conversions and extensions of 500 sqm of residential floorspace or above or five or more dwellings to achieve "excellent" in BREEAM domestic refurbishment; and*
j. *expecting non-domestic developments of 500 sqm of floorspace or above to achieve "excellent" in BREEAM assessments and encouraging zero carbon in new development from 2019.*

Table 14 Camden Local Plan CC2 (March 2021)

2.33 To minimise the risks of climate change, the London Borough of Camden will expect the design of developments to consider anticipated changes to the climate.

2.34 Development should also consider the impacts of overheating and flooding on human health and should be designed so that they are adaptable by policies CC2 Adapting to climate change and CC3 Water and flooding.

2.35 As noted in Policy CC2 Adapting to climate change, flooding and drought are key risks which require mitigation and adaptation measures in the borough. Camden experienced significant flooding in 1975 and 2002, and the probability of such recurring events is likely to increase due to climate change. Changes to our climate can also threaten the quantity and quality of our water supply. Such risks impact the health and well-being of Camden residents.

2.36 This development is retaining the existing ground floor slab, and much of the 1st floor slab, boundary walls and the steel frame therefore utilising much of the embodied carbon of the existing building in the creation of the new dwellings.

2.37 Despite the re-use of most of the existing fabric the development is considered as a newly built development and the BREEAM Domestic Refurbishment is not relevant to this scheme.

Policy CC3: Water and Flooding

Council will seek to ensure that development does not increase flood risk and reduces the risk of flooding where possible.

We will require development to:

a. *incorporate water efficiency measures.*
b. *avoid harm to the water environment and improve water quality.*
c. *consider the impact of development in areas at risk of flooding (including drainage).*
d. *incorporate flood resilient measures in areas prone to flooding.*
e. *utilise Sustainable Drainage Systems (SuDS) in line with the drainage hierarchy to achieve a greenfield run-off rate where feasible; and*
f. *not locate vulnerable development in flood-prone areas.*

Where an assessment of flood risk is required, developments should consider surface water flooding in detail and groundwater flooding where applicable. The Council will protect the borough's existing drinking water and foul water infrastructure, including the reservoirs at Barrow Hill, Hampstead Heath, Highgate and Kidderpore.

Table 15 Camden Local Plan CC3 (March 2021)

2.38 Developments must be designed to be water efficient. This can be achieved by installing water-efficient fittings and appliances (which can help reduce energy consumption and water consumption) and by capturing and reusing rainwater and grey water onsite. Residential developments will be expected to meet the requirement of 110 litres per person per day (including 5 litres for external water use). Refurbishments and other non-domestic development will be expected to meet BREEAM water efficiency credits. Major and high or intense water use developments, such as hotels, hostels and student housing, should include grey water and rainwater harvesting systems. Where such a system is not feasible or practical, developers must demonstrate to the Council's satisfaction that this is the case.

2.39 Air pollution is associated with many adverse health impacts, and it particularly affects the most vulnerable in society. It is recognised that parts of Camden have some of the poorest air quality levels in London, and since 2000 the whole of the borough has been declared an Air Quality Management Area (AQMA) for both NO_2 (Nitrogen Dioxide) and PM10 (Particulate Matter). Camden is also working to assess and address PM2.5 (the smallest fraction of particulate) despite Camden meeting EU limit values for PM2.5, research suggests that particulates of this size have the worst health impacts.

Policy CC4: Air quality

The Council will ensure that the impact of development on air quality is mitigated and ensure that exposure to poor air quality is reduced in the borough.

The Council will take into account the impact of air quality when assessing development proposals, through the consideration of both the exposure of occupants to air pollution and the effect of the development on air quality. Consideration must be taken to the actions identified in the Council's Air Quality Action Plan.

Air Quality Assessments (AQAs) are required where development is likely to expose residents to high levels of air pollution. Where the AQA shows that a development would cause harm to air quality, the Council will not grant planning permission unless measures are adopted to mitigate the impact. Similarly, developments that introduce sensitive receptors (i.e. housing, schools) in locations of poor air quality will not be acceptable unless designed to mitigate the impact.

Development that involves significant demolition, construction or earthworks will also be required to assess the risk of dust and emissions impacts in an AQA and include appropriate mitigation measures to be secured in a Construction Management Plan.

Table 16 Camden Local Plan CC4 (March 2021)

2.40 To help reduce air pollution and adhere to London planning policy, developments must demonstrate that they comply with Policy 7.14 of the London Plan (to be at least air quality neutral).

2.41 Developments will also be expected to include measures to ensure that occupants' exposure to air pollution is reduced to acceptable levels. In addition to mitigation, major developments in these areas will be expected to address local problems of air quality which may include various design solutions and buffers. Measures that can be taken to reduce exposure to air pollution are contained in our supplementary planning document Camden Planning Guidance on amenity.

Policy CC5: Waste

The Council will seek to make Camden a low waste borough. We will:

g. aim to reduce the amount of waste produced in the borough and increase recycling and the reuse of materials to meet the London Plan targets of 50% of household waste recycled/composted by 2020 and aspiring to achieve 60% by 2031;

h. deal with North London's waste by working with our partner boroughs in North London to produce a Waste Plan, which will ensure that sufficient land is allocated to manage the amount of waste apportioned to the area in the London Plan;

i. safeguard Camden's existing waste site at Regis Road unless a suitable compensatory waste site is provided that replaces the maximum throughput achievable at the existing site; and

j. make sure that developments include facilities for the storage and collection of waste and recycling.

Table 17 Camden Local Plan CC5 (March 2021)

2.42 The Council recognises that Camden cannot adequately deal with its isolated waste. Therefore, it is a member of the North London Waste Authority, which is responsible for the disposal of waste collected in the boroughs of Barnet, Camden, Enfield, Haringey, Hackney, Islington and Waltham Forest and is working in partnership with these authorities to prepare a joint North London Waste Plan (NLWP).

Conclusion

2.43 The London plan policy summarised in this section apply to major developments and this development is not considered to be a major development according to the London Borough of Camden but it is regarded as medium development. The Camden Planning Guidance expects this development to achieve minimum of 20% carbon emission reduction through Be Lean, Be Clean, and Be Green measures in place (refer to Table 2a Energy reduction targets, domestic, Energy efficiency and adaptation, January2021).

2.44 In Camden Planning Guidance Energy efficiency and adaptation, Appendix 2 sets out relevant guidance on policy application for mixed use developments. This has been applied to the proposed development as follows.

2.45 Although the residential spaces fall under the 'medium' classification, the applicant should follow the guidance relating to major applications, as the total (residential and non-residential) floorspace exceeds 1,000 m².

2.46 Since the extension to the non-residential part of the proposed development would not be defined as 'large' under the guidance set out in Approved Document L2A, and subsequently forms part of the refurbishment, the whole of the non-residential parts should be assessed as a refurbishment. All new fabric elements will be constructed in compliance with Part L.

2.47 On this basis, the applicable energy and carbon targets from the CPG are as follows:

Development should comply with these standards/provide **this information**	Residential Refurbishment **(assessed under Part L Volume 1)**	**Non-domestic Refurbishment (assessed under Part L Volume 2)**
Baseline: Part L 2021 of the Building Regulations Compliant Development	Medium (5-9 units)	Major (Refurbishment)
Energy and carbon reduction targets		
Overall carbon reduction targets	Greatest possible reduction - meeting Part L1B for retained thermal elements (London Plan 5.4, Local Plan CC1)	Greatest possible reduction, meeting Part L2B for retained thermal elements. (London Plan 5.4, Local Plan CC1)
Reduction in CO_2 from onsite renewables (after all other energy efficiency measures have been incorporated)	20% (Camden Local Plan CC1)	20% (Camden Local Plan CC1)

2.48 This scheme is design to follow the Camden local plan policies mentioned in this section. All possible design options have been considered to maximise use of sustainable design principle by followings:

- Efficient fabric design and passive measures to reduce energy demand (Be Lean)
- Onsite energy supply (Be Clean)
- Use of a highly efficient energy source such as an all-electric air source heat pump and proposed onsite renewable energy generation (Be Green)

- It is proposed to retain majority of the existing structure and building fabric due to Grade II listing therefore, utilising much of the embodied carbon of the existing building in the creation of the new dwellings.
- The inclusion of a green roof will reduce rate of surface water run-off, reduce overheating risk and improve local air quality.
- The dwellings will be fitted with bins to allow for the segregation of waste to allow for recycling in accordance with Local plan policy CC5.

3. Energy Strategy Approach

3.1 The proposed energy strategy for the development will follow the London Plan Energy Hierarchy approach of Be Lean, Be Clean and Be Green to enable the maximum viable reductions in regulated and total CO_2 emissions over the baseline.

- Be Lean - Use less energy
- Be Clean - Supply energy efficiently;
- Be Green - Use renewable energy systems.

3.2 The proposed energy supply solutions aim to match the development's energy profiles, ensuring effective use. The proposed solutions also consider the viability and flexibility of the scheme from a technical and economic point of view by identifying an optimal combination of energy efficiency measures as well as decentralised and renewable energy supply solutions. Applying these principles the Council is aiming to achieve the following objectives:

- Comply with the relevant regulatory requirements.
- Improve the viability of the scheme by developing a technically robust and viable energy strategy.

3.3 The proposed energy supply solutions aim to match the development's energy profiles, ensuring effective use. The proposed solutions also consider the viability and flexibility of the scheme from a technical and economic point of view by identifying an optimal combination of energy efficiency measures as well as decentralised and renewable energy supply solutions.

SAP Energy Modelling

3.4 The predicted regulated energy consumption defined within the Building Regulations is assessed using BRE Standard Assessment Procedure 10.2 (SAP 10.2). The energy for domestic appliances and cooking is separately calculated using BRE Domestic Energy Model 12, Formula.

3.5 Since January 2019, applicants submitting GLA referable applications have been encouraged to use the SAP 10.2 emission factors.

3.6 This report primarily uses the current SAP 10.2 energy compliance model and emission factors to calculate the regulated emission savings shown in Table 18.

3.7 The dwellings are assessed as new dwellings created by change of use therefore it is not possible to comply with TER, TFEE and TPER in SAP 10.2.

3.8 Using a heat pump in the ‘Be Green’ scenario, the dwelling exceeds the minimum requirement of 20% carbon emission reduction in accordance with Camden Energy Efficiency and Adaptation planning guidance document.

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2021 of the Building Regulations Compliant Development	8.5	4.7
After energy demand reduction	16.1	4.7
After heat network / CHP	16.1	4.7
After renewable energy	4.7	4.7

Table 18 Carbon Dioxide Emissions after each stage of the Energy Hierarchy.

3.9 The Dwelling CO_2 Emission Rate is used to comply with building regulations. It equals the annual CO_2 emissions per unit floor area for space heating, water heating, ventilation, and lighting, less the emissions saved by energy generation technologies, expressed in kg CO_2/m^2/year.

3.10 The Baseline Energy Emission is calculated per GLA Energy Assessment Guidance (2022) Appendix 4. It uses the information of the building services equipment installed, which has produced a similar EPC rating to the published EPC rating.

3.11 The energy modelling uses SAP 10.2 Grid Electricity emission factor (0.1360 kgCO_2 /kWh).

Carbon Offset

Camden Council, Carbon Offset Fund

3.12 Changes were made to the Carbon Offset Fund on 1st October 2016. The London Plan forms part of the Council's development plan and is considered in planning decisions. In March 2016, the Greater London Authority (GLA) adopted a revised Housing Supplementary Planning Guidance (SPG), which includes changes in the level and type of financial contributions to Borough Level Carbon Offset Funds to mitigate additional carbon emissions from new housing developments. Financial contributions will be required to offset all carbon emissions from housing developments, i.e., 100% of carbon emissions. No carbon offset payment is required for this development as 25% carbon reduction is achieved by implementing the energy hierarchy.

3.13 Camden Local Plan requires developments of 5 or more dwellings to achieve a 20% reduction in carbon dioxide emissions from on-site renewable energy generation. The proposed use of ASHP allows this development to comply with requirements of Camden Local Plan.

Baseline CO_2 Emissions

3.14 Where major refurbishments are being carried out, an estimate of the CO_2 savings from the refurbishment of the building is expected. To provide this, applicants are required to estimate the CO_2 emission baseline performance of the existing building using Building Regulations approved compliance software.

3.15 The total baseline CO_2 emissions for the proposed development are defined as regulated CO_2 emissions covered by Building Regulations Part L and unregulated CO_2 emissions not covered by Part L. Unregulated CO_2 emissions should be excluded when compliance with the planning policy is calculated.

3.16 The GLA's Energy Assessment Guidance notes that there will be instances where the energy performance of existing elements exceeds that set out in the 'notional' specification of Approved document L, in which case the actual energy performance of the building element should be used instead. However, it is also acknowledged that *"the Approved Documents allow for flexibility in meeting the recommended standards due to potential restrictions to building work upgrades, for instance listed building status or heritage projects"*.

3.17 The baseline CO_2 emissions are summarised in

	Total regulated emissions (Tonnes CO_2 per annum)
Domestic	8.5
Non-domestic	12.0

Table 19 Regulated Carbon Dioxide Emissions for Baseline Energy Model

4. Energy Demand Reduction (Be Lean)

4.1 In accordance with the London Plan Energy Hierarchy, the key focus of the proposed energy strategy is to reduce the energy demands of the development as far as practically possible and viable by implementing various energy demand reduction measures. The aim is to achieve Part L 2021 Building Regulations compliance without contribution from low carbon or renewable energy sources.

4.2 The design approach follows the GLA's Energy Assessment Guidance for existing buildings, which "have been developed to determine a consistent baseline across refurbishment planning applications rather than to be prescriptive specifications for developments".

4.3 While fabric upgrades are proposed for the roof and the controlled fittings, in this case improvements to other elements are not permitted, due to the building's listing and location in a conservation area.

4.4 For the non-domestic areas, proposed energy efficiency improvements to the fixed building services more than compensate for not being able to upgrade some parts of the building fabric. Overall, demand reduction measures achieve a 22% improvement over the baseline, which compares favourably to the 20% policy target set by London Borough of Camden.

4.5 For the domestic accommodation, there are significantly fewer opportunities for energy efficiency improvements to the fixed building services. Consequently, at the 'be lean' stage, the dwellings' CO_2 emissions are higher than those for the nominal baseline.

4.6 The development will incorporate passive solar design measures. The proposed windows will aim to maximise daylight and, at the same time, minimise overheating. The glazing specification will be selected to provide a balance of solar control and access to passive solar gain.

4.7 It is proposed that dwellings will utilise openable windows for purge ventilation, with a whole house background mechanical ventilation system with heat recovery. The MVHR provides background ventilation with heat recovery from the exhaust air and a summer bypass of the heat recovery element.

4.8 Table 20 summarises the carbon reduction achieved at first stage of the energy hierarchy. The results in table below indicate an increase in carbon emissions in comparison to the baseline model (existing building energy model that would be compliant with current building regulations Part L) but as the existing building is Grade 2 listed with un-insulated fabric and single glazed windows. At the first stage of the energy hierarchy, the existing building is modelled with the proposed fabric improvements (roof, floor insulation and double glazed windows) which results in a higher carbon emission compared to baseline model.

	Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO_2 per annum)		Carbon Dioxide Emissions for domestic buildings (Tonnes CO_2 per annum)	
	Regulated	**Unregulated**	**Regulated**	**Unregulated**
Baseline: Part L 2021 of the Building Regulations Compliant Development	12.0	6.8	8.5	4.7
After energy demand reduction (Be Lean)	11.5	6.8	16.1	4.7
Percentage Savings	4%	-	-90%	-

Table 20 Carbon reduction at first stage of the Energy Hierarchy

Thermal Elements

4.9 A "fabric first" approach to building design includes maximising the components and materials that make up the building fabric before considering efficient mechanical or electricity building services systems. This can help to reduce capital and operational costs, improve energy efficiency, and reduce carbon emissions whilst reducing ongoing maintenance costs.

4.10 A "fabric first" approach is to reduce building energy usage and CO_2 through five different factors as follows:

- High-Quality Insulation
  - Promotes heat retention.
  - Reduces heat loss.
  - Increased Air Tightness.
  - Consider air leakage through gaps/cracks in the building envelope.

The best result is dependent on the construction method.

- Structural Insulated Panels (SIP) or Insulated Concrete Form (ICF) generally provide great airtightness.
- Check the frames on windows and doors.

Avoid Thermal Bridging

- Thermal bridging occurs in areas with higher thermal conductivity, allowing an easier path for heat loss, e.g., where the Floor and walls meet.
- Consider your insulation system to reduce thermal bridging.

Maximise Solar Gain

- Think about your build orientation.
- Choose your window positions carefully.
- Consider triple glazed windows for further heat retention.
- Mixed-mode Natural Ventilation.
- Mechanical ventilation with heat recovery
- Reduces condensation and mould.
- Consider a low-level air inlet for fresh air and a high-level vent to remove stale air.
- Think about the amount of wind around your location.

4.11 Due to the listed nature of the existing building, the extent of potential improvements for existing fabric whilst retaining listed features is very limited, therefore, it is proposed to provide insulation to existing floor, roof and replace all existing windows with modern double-glazed units. The proposed U Values for the thermal elements are indicated in Table 21 Building Fabric thermal U Values.

Element	U-Value (used in energy modelling)	Building Regulation Notional dwelling	Building Regulation Limiting fabric parameters
External wall	1.5 W/m²K	0.18 W/m²K	0.26 W/m²K
Flat roof	0.16 W/m²K	0.11 W/m²K	0.16 W/m²K
Ground/external floor	0.18 W/m²K	0.13 W/m²K	0.18 W/m²K
Party wall	0.00 W/m²K	0.00 W/m²K	0.20 W/m²K
All windows, including frames Window frame Factor 0.8. g value 0.55	1.40 W/m²K	1.20 W/m²K	1.60 W/m²K
Rooflight (FF:0.80, g value:0.40)	1.40 W/m²K	1.70 W/m²K	2.20 W/m²K
External Door (Secure by design PAS 24)	3.00 W/m²K	1.00 W/m²K	1.60 W/m²K
Air permeability rate	25m³/m².h@50pa	5m³/m².h@50pa	8m³/m².h@50pa

Table 21 Building Fabric thermal U Values

Air Tightness

4.12 Building airtightness is a major saving of heating energy, more important than external wall U values. Most new build domestic dwellings typically achieve permeability rates of less than 4m³/m²h@50Pa.

4.13 As the new dwellings & commercial spaces are created by change of use of an existing building, the existing building air permeability is considered as 15m³/h.m².

Hot water

4.14 Hot water cylinders designed specifically to be used with heat pumps have larger heat transfer surfaces (bigger coils) within the cylinder. The hot water storage temperature is set at 60°C in accordance with guidance from WRAS.

4.15 A cylinder with 300 litres of the storage volume is proposed for each dwelling, and the proposed cylinder is suitable for use with a heat pump.

Mechanical Ventilation with Heat Recovery

4.16 Whole house mechanical ventilation units (MVHR) provide filtered fresh air from outside and extract air from kitchen, toilets & utility rooms. MVHR units are generally designed to meet the minimum requirements of the Building Regulations, which only require a background airflow rate to replace window trickle vents.

4.17 At this stage, it is proposed to provide appropriate energy-efficient mechanical ventilation systems such as continuous Mechanical Ventilation with Heat Recovery (MVHR) to meet the overheating and fresh air supply requirements.

4.18 It is proposed to provide MVHR ventilation which can provide 0.5 air changes per hour within the dwellings. This reduces the number of times the occupants must leave the window open to maintain internal comfort.

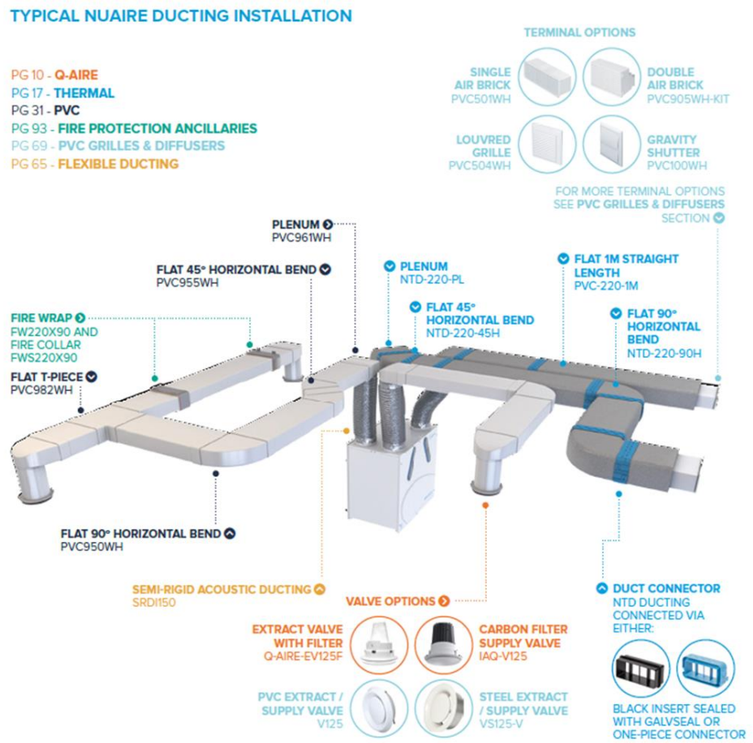

Figure 6 Typical MVHR Installation with Carbon filter supply air Valves. (Nuaire Brochure May 2021)

Manufacturer	The Nuaire Group
Brand	Nuaire
Model Name	MRXBOX-ECO3
Main Type	Balanced whole-house mechanical ventilation with heat recovery
Efficiency (heat exchanger)	91%

Table 22 MVHR specification

Kitchen Extract

4.19 A separate cooker hood extractor unit is specified to extract air above the cooker and vent to the outside through dedicated ductwork. This is required to avoid contaminating the MVHR heat exchanger unit with grease from cooking.

Lighting

4.20 The proposed windows maximise daylight to minimise the need for artificial lighting. The specified lighting for the dwellings will be 100% low energy using integrated LED light fittings.

Energy Efficient Appliances

4.21 It is very challenging to design and construct living spaces to reduce unregulated electricity demands because this is almost entirely dependent on the occupant and can vary substantially.

4.22 Unregulated energy demand and the associated CO_2 emissions can be reduced by providing energy-efficient white goods. Quality saving is difficult, but it is assumed that these measures can reduce the unregulated CO_2 emissions associated with residential development by circa 6-10%. These savings have not been accounted for in this report.

External Communal Lighting

4.23 The designer will use LED lighting.

4.24 The presence detection control will be specified in internal spaces and stairwells.

4.25 Wall-mounted luminaires along walkways linked to daylight sensors for on/off operation. The fittings will allow for a lower light level after midnight and before dawn. This may be made up of a second luminaire at a lower level.

4.26 Courtyard lighting will be designed using low energy LED with daylight on/off control and reduced light levels between midnight and dawn.

Onsite electricity supply

4.27 The electricity supply for the residential units will be from the local LV Network supplied by the local DNO. Each unit will be metered individually with a separate landlord meter for common areas.

Overheating and Cooling

4.28 There is an expectation that designers can design new residential properties without the assistance of an active cooling system to avoid overheating. GLA and Camden Council guidance requires that natural ventilation and other passive measures are used to address the risk of overheating to avoid unnecessarily increasing a development's energy demand and carbon emissions. The GLA requires London Borough Councils to reject planning proposals with active cooling systems in new residential developments.

4.29 It is noted that Part O of the Building Regulations, which address overheating, is "[applicable] to new residential buildings only" and would therefore not be applied in this case if planning permission were to be granted.

4.30 The cooling strategy for the proposed development has been considered in accordance with Policy SI 4 of the London Plan and the GLA's Energy Assessment Guidance. The approach is summarised in Table 23 Application of cooling hierarchy.

4.31 Since the proposed development primarily comprises the refurbishment of an existing building, there are limited opportunities to include the passive design.

Stage of hierarchy	Relevant design proposals
Reduce the amount of heat entering the building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure. It is also expected that external shading will form part of major proposals.	The building benefits from some overshadowing from mature trees and adjacent buildings. It is also proposed to provide new green roofs where possible.
Minimise internal heat generation through energy efficient design:	High efficacy lighting and the use of lighting controls in the office and landlord's demise would minimise internal heat gains.
Manage the heat within the building through exposed internal thermal mass and high ceilings: Increasing the amount of exposed thermal mass can help to absorb excess heat within the building. Efficient thermal mass should be coupled with night time purge ventilation.	The building is considered to have a medium level of thermal mass. Existing soffit in commercial areas will be kept exposed to maximise floor to ceiling hights.
Provide passive ventilation through the use of openable windows with dual aspect units or designing in the 'stack effect' where possible.	The existing building would have originally been designed for passive ventilation, with shallow floorplates and openable windows. All new dwellings will be dual aspect with cross flow ventilation via openable windows.
Provide mechanical ventilation: Mechanical ventilation can be used to make use of 'free cooling' where the outside air temperature is below that in the building during summer months. This will require a by-pass on the heat recovery system for summer mode operation.	Mechanical ventilation with heat recovery and summer bypass is proposed for each dwelling and for the office spaces.
Provide active cooling systems: The increased use of air conditioning systems is generally not supported, as these have significant energy requirements and, under conventional operation, expel hot air, thereby adding to the urban heat island effect. However, once passive measures have been prioritised if there is still a need for active cooling systems, such as air conditioning systems, these should be designed in a very efficient way and should aim to reuse the waste heat they produce.	There is no proposal for active cooling within the dwellings. Due to the limited opportunities to influence the passive design and the high internal heat gains from equipment and occupants in office buildings, active cooling is proposed for the office, for occupant comfort and commercial requirements.

Table 23 Application of cooling hierarchy

4.32 An overheating risk assessment for residential dwellings has been undertaken in line with the guidance and data sets in CIBSE TM59 Design methodology for the assessment of overheating risk in homes and TM49 Design Summer Years for London respectively.

4.33 The results of the overheating risk assessment are summarised in Table 24. These show the results for dynamic thermal modelling using three weather files, each representing a different type of design summer year (DSY).

- DSY1: Moderately warm summer
- DSY2: Short, intense warm spell
- DSY3: Long, less intense warm spell

Part of proposed development	Compliance rate (%) **DSY1**	Compliance rate (%) **DSY2**	Compliance rate (%) **DSY3**
Dwellings	100 %	50 %	11 %

Table 24 Overheating assessment results.

4.34 Although the cooling hierarchy has been applied to the non-residential part of the proposed development, building regulations Part O and an overheating risk assessment based on dynamic thermal modelling is not required for commercial buildings, on the following basis.

4.35 Voluntarily, an overheating assessment for the commercial areas has been carried out which indicates the commercial spaces comply with the requirements of CIBSE TM52 when assessed using Design Summer Year 1 weather data (moderate summer temperatures) but fail to comply with TM52 when assessed using Design Summer Year 2 and 3 (extreme, prolonged summer temperatures). To meet expectations of the target commercial occupiers, it is proposed to install high efficiency VRF systems with mechanical ventilation to all commercial areas.

4.36 Comfort cooling is proposed for the normally occupied commercial spaces to achieve optimum thermal comfort and meet commercial requirements of the space.

5. Heating Infrastructure (Be Clean)

5.1 The New London Plan Heating Hierarchy (2021), in line with Policy SI 3 D, states that the priority is for new major developments to connect to local existing or planned district heat networks where the operator has or is in the process of developing a strategy to decarbonise the network and has shared it with the GLA. The London plan outlines the following order of preference:

- Connection to existing heating or cooling network
- Site-wide heat network
- Communal heating and cooling

5.2 The inclusion of decentralised heating has been investigated in terms of appropriateness to the proposed development as it can help to provide the greatest reductions in CO_2 emissions.

5.3 The Part L GLA carbon emission reporting spreadsheet will be submitted as part of the planning application document and it will include Be Clean DER reports of the dwellings and predicts the residential regulated CO_2 emissions baseline.

5.4 Table 25 summarises carbon emission reduction at the first 2 stages of energy hierarchy.

	Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO_2 per annum)		Carbon Dioxide Emissions for domestic buildings (Tonnes CO_2 per annum)	
	Regulated	**Unregulated**	**Regulated**	**Unregulated**
Baseline: Part L 2021 of the Building Regulations Compliant Development	12.0	6.8	8.5	4.7
After energy demand reduction (Be lean)	11.5	6.8	16.1	4.7
After heat network / CHP (Be clean)	11.5	6.8	16.1	4.7
Percentage Savings	4%	-	-90%	-

Table 25 Carbon reduction at second stage of the Energy Hierarchy

Connection to existing district heating networks

5.5 The London Heat Map was investigated to identify an existing or planned district heating network. Figure 4 indicates that this proposed development is not within the heat network priority area.

5.6 Given the lack of existing nearby district heating or community heating infrastructure to connect to at present and cost-effective connection options in the near future and due to the small scale of the project, it is proposed to provide an onsite energy supply option.

Onsite Heat Supply

5.7 The provision of a communal heating system for the development has been considered. The assessment showed that, due to the small size and the development layout, it is not well suited for a communal heating system. In addition, the communal heating system will require significant plant room and riser space, which is very difficult and costly to accommodate within the design. In addition, due to its small size, the communal heating system will likely significantly increase the residents' energy bills, which will go against the target to reduce fuel poverty.

5.8 Technically, a small communal heating system can be provided for the development. However, practically, it will unnecessarily complicate the design and significantly increase the heating system's capital and operating costs. The provision of a community heating system for the development is considered impractical.

5.9 2no. Air source heat pumps are proposed for each residential dwelling to provide space heating via radiators and domestic hot water via hot water cylinder.

5.10 An air source heat pump is considered to be a low carbon technology as it extracts heat from the outside air like a fridge extracts heat from its inside. It can get heat from the air even when it is as low as -15° C.

Affordability of heat

5.11 In line with the GLA London plan, the following measures will be taken into consideration to achieve the affordability of heat:

- Use the "fabric first approach" by improving the U-values for building fabric elements to increase fabric energy efficiency and reduce the energy demand of the building.
- Use highly efficient Heat Pumps to improve the efficiency of the heating system.
- Install PV and use Electricity generated by PV to operate heat pumps.

5.12 An all-electric air source heat pump heating system is proposed to futureproof this development and ensure that the development can be constructed post-2025.

6. Renewable Energy (Be Green)

6.1 In accordance with GLA London Plan Policy SI 2, Development proposals should seek to utilise renewable energy technologies such as biomass heating, cooling and electricity; renewable energy from waste; photovoltaics; solar water heating; wind and heat pumps. The mayor encourages using a full range of renewable energy technologies, which should be incorporated wherever site conditions make them feasible and where they contribute to the highest overall and most cost-effective carbon dioxide emissions savings for a development proposal.

6.2 The GLA London Plan Policy SI 2 expects all major development proposals to maximise onsite renewable energy generation. In particular, solar PV should be maximised on roof spaces. This is regardless of whether the 35% onsite target has already been reached through earlier stages of the energy hierarchy.

6.3 This development is not considered a major development according to the London Plan 2021, but it is regarded as medium development by Camden. the Camden Planning Guidance expects this development to achieve minimum of 20% carbon emission reduction (refer to Table 2a Energy reduction targets, domestic, Energy efficiency and adaptation, January 2021).

6.4 The Part L GLA carbon emission reporting spreadsheet will be submitted as part of the planning application document and it will include Be Green DER reports of the dwellings and predicts the residential regulated CO_2 emissions baseline.

6.5 Table 26 summarises carbon emission reduction at each stage of the energy hierarchy and an overall percentage saving after application of all stages of energy hierarchy.

	Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO_2 per annum)		Carbon Dioxide Emissions for domestic buildings (Tonnes CO_2 per annum)	
	Regulated	**Unregulated**	**Regulated**	**Unregulated**
Baseline: Part L 2021 of the Building Regulations Compliant Development	12.0	6.8	8.5	4.7
After energy demand reduction (Be lean)	11.5	6.8	16.1	4.7
After heat network / CHP (Be clean)	11.5	6.8	16.1	4.7
After renewable energy (Be green)	10.5	6.8	4.7	4.7
Percentage Savings	12%	-	44%	-

Table 26 Carbon reduction at final stage of the Energy Hierarchy

Heat Pumps

6.6 Heat pumps should always be categorised under 'Be Green' of the energy hierarchy unless they serve district heating networks. In that case, they should be categorised under' Be Clean' category.

6.7 Where heat pumps are proposed, a high energy efficiency specification will be expected to ensure the system operates efficiently and reduces peak electricity demand. This applies to any heat pump proposal, including air source heat pumps (ASHPs), ground source heat pumps (GSHPs), water source heat pumps (WSHPs), or hybrid ambient loop systems.

6.8 Heat pumps operate on a similar principle to a domestic refrigerator. Low-grade heat is extracted from air and absorbed by a refrigerant solution which is then compressed to a high temperature. The compressed heat is used to provide domestic hot water and space heating.

6.9 Heat pumps are not boilers and should not be set up like a boiler. For efficient operation, a thermal buffer is proposed with the heat pump installation to ensure efficient operation of heat pumps.

6.10 The following low and zero carbon technologies have been considered and compared for this particular development:

- Photovoltaic Panels (PV)
- Ground Source Heat Pump (GSHP)
- Wind Turbines
- Biomass Boiler
- Solar Thermal

6.11 The assessment of these technologies shows that ASHP installation is the only feasible solution of using low carbon energy for this development .

Alternative renewable energy options

6.12 The following alternative renewable options have been considered but found not to be appropriate for this scheme:

- **Solar thermal collector**- it can be used to provide hot water using the irradiation from the sun. They can generally provide approximately 50% of domestic hot water demand. However, the carbon savings are quite low and it is a high-cost technology. **So solar thermal collectors are not recommended for this scheme.**
- **Biomass** – Solid, liquid or gaseous fuels derived from plant material can provide boiler heat for space and water heating. A biomass boiler would supplement a standard gas heating system so some of the cost may be offset through money saved on using smaller traditional boiler's reliability of fuel access/supply can be a problem. **Not suitable for an urban location** as installation will reduce local air quality through smoke emission and increase vehicle movement from the transportation of biomass fuel. **Therefore it is not recommended for this scheme.**

  Ground Source Heat Pump – Ground Source Heat pump (GSHP) Utilise horizontal loops or vertical boreholes, GSHP make use of the grounds almost constant temperature to provide heating and/or cooling using a heat exchanger connected to a space/water heating delivery system. Optimum efficiency with underfloor heating systems. **It is not a feasible technology for the site** since there is limited external space available to install boreholes. **Therefore it is not recommended for this scheme.**

- **Wind Turbines** – Vertical and horizontal axis wind turbines enable electricity to be generated using the power within the wind Not suitable for urban environments due to low wind conditions and obstructions. It is unsuitable in an urban location with turbulent airflow around the building, generating a reasonable amount of electricity requires a substantial unit with a blade diameter over 6m. **Therefore wind turbines are not recommended for this scheme.**

7. Conclusion

7.1 Due to the low impact of upgrading thermal properties of existing walls on carbon emission reduction, it is proposed to retain and restore the existing walls with heritage features, however, it is proposed to upgrade the existing roof, floor and install replacement glazing to improve the existing fabric. The energy strategy for the proposed development incorporates the following key measures.

7.2 Demand reduction

- New and renovated/retained thermal elements (e.g. floor and roof)
- New controlled fittings (replacement glazing and doors)
- Mechanical ventilation with heat recovery
- High efficacy light fittings

7.3 Heating Infrastructure

- Individual heating systems for each dwelling
- VRF heating and cooling system for commercial office areas

7.4 Renewable Energy

- Air source heat pumps to provide space heating and domestic hot water to each dwelling.

7.5 London Borough of Camden's target carbon emission reduction of 20% is exceeded and a total of 25% reduction in carbon emissions is achieved over the whole development (domestic & non-domestic).

8. Glossary

Building Emissions Rate (BER) or Dwelling Emission Rate (DER)

The actual building/dwelling CO_2 emission rate, is expressed in terms of the mass of CO_2 emitted per year per square metre of the total useful floor area of the building (kg/m^2/year). In order to comply with Part L of the Building Regulations, the BER/DER must be less than the TER (see below).

Target CO_2 Emission Rate (TER)

The minimum energy performance requirement for a new dwelling/building. It is expressed in terms of the mass of CO_2 emitted per year per square metre of the total useful floor area of the building (kg/m^2/year).

DER Dwelling Emission Rate

This is the dwelling Emission Rate as kgCO_2/m^2

TPER Target Primary Energy Rate

The Target Primary Energy Rate will consider how much energy (in kilowatt hours) is required to provide heating and hot water to a newly built dwelling. It will also include energy used by lighting, ventilation, cooling systems and showers et of flow and return pipes circulating hot water to the apartment blocks (and dwellings contained therein) and non-domestic buildings on a development. Expressed as kWhPE/m2/year and determined using the standard assessment procedure. The maximum primary energy use for the dwelling in a year

DPER

The Dwelling Primary Energy Rate is **the actual primary energy rate of the actual new dwelling, expressed as** Expressed as kWh$_{PE}$/m^2/year and determined using the standard assessment procedure.

TFEE Target Fabric Energy Efficiency Rate

The Target Fabric Energy Efficiency Rate is defined as the space heating and cooling requirements per square metre of floor area, presented in kWh/m^2/year, and is based on how well the fabric of the dwelling performs. This is the target dwelling heat loss through the building fabric expressed as kWh/m^2. year

DFEE Dwelling Fabric Energy Efficiency Rate

The Dwelling Fabric Energy Efficiency rate is **the actual energy performance of the new dwelling**. In accordance with regulation 26A of the building regulations, the calculated Dwelling Fabric Energy Efficiency rate must not be greater than the Target Fabric Energy Efficiency rate. kWh/m^2/year and determined using the standard assessment procedure.

Dwelling

A dwelling is self-contained unit to accommodate a single household.

Energy Assessment/Strategy

An energy assessment/strategy is a document which explains how the London Plan targets for CO_2 reduction will be met for a particular development within the context of the energy hierarchy.

Air Source Heat Pump

An air source heat pump, sometimes referred to as an air-to-water source heat pump, **transfers heat from the outside air to water, which heats rooms via radiators or underfloor heating**. It can also heat water stored in a hot water cylinder for hot taps, showers and baths.

Kilowatt (kW)

One thousand watts. A watt is a measure of power.

Part L of the Building Regulations

Approved documents L1A and L2A of the Building Regulations relate to the conservation of fuel and power in new dwellings and buildings.

Regulated CO_2 emissions

The CO_2 emissions arising from energy used by fixed building services, as defined in Approved Document Part L of the Building Regulations. These include fixed systems for lighting, heating, hot water, air conditioning and mechanical ventilation.

Standard Assessment Procedure (SAP)

A methodology for assessing and comparing the energy and environmental performance of dwellings. Its purpose is to provide accurate and reliable assessments of dwelling energy performances that are needed to underpin Building Regulations and other policy initiatives.

Air permeability

The measure of airtightness of the building fabric. It is defined as the air leakage rate per hour per m^2 of envelope area at the test reference pressure differential of 50Pa.

- The limiting air permeability is the worst allowable air permeability.
- The design air permeability is the target value set at the design stage.
- The assessed air permeability is the value used in establishing the building emission rate and the building primary energy rate. The assessed air permeability is based on a measurement of the air permeability of the building concerned.

Airtightness

The resistance of the building envelope to infiltration when ventilators are closed. The greater the airtightness at a given pressure difference across the envelope, the lower the infiltration.

Renewable technology

Technology that uses renewable resources, which are naturally replenished on a human timescale, to produce Electricity. Resources include wind, wave, marine, hydro, biomass and solar.

Existing district heat network

A district heat network that is either in operation or is under construction on 15th June 2022. For these purposes, under construction means any of the following.

- The building to house the energy centre has been constructed.
- There is a heat offtake agreement signed between the heat network and a third party.
- Excavation for pipework has been completed.

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9. Appendices

Appendix A. Domestic SAP Reports

Full SAP Calculation Printout

Property Reference	Apartment 1	**Issued on Date**	21/12/2023
Assessment Reference	231207ac-Unit 1 - Be Green	**Prop Type Ref**	Flat
Property	Apartment 1, 26, Rosslyn Hill, London, NW3 1PD		

SAP Rating	68 D	**DER**		**TER**	
Environmental	93 A	**% DER < TER**			N/A
CO_2 Emissions (t/year)	0.75	**DFEE**		**TFEE**	
Compliance Check	See BREL	**% DFEE < TFEE**			
% DPER < TPER		**DPER**		**TPER**	

Assessor Details	Ms. Anna Sung	**Assessor ID**	BK81-0001
Client			

SAP 10 WORKSHEET FOR Conversion (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		120.0000	(1b)	x 3.1500	(2b) =	378.0000	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.0000						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	378.0000	(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		No	
Pressure Test Method		Blower Door	
Measured/design AP50		15.0000	(17)
Infiltration rate		0.7500	(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) =	0.6375	(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	0.8128	0.7969	0.7809	0.7013	0.6853	0.6056	0.6056	0.5897	0.6375	0.6853	0.7172	0.7491	(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	0.9168	0.9009	0.8849	0.8053	0.7893	0.7096	0.7096	0.6937	0.7415	0.7893	0.8212	0.8531	(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 = 1.40)			25.4000	1.3258	33.6742			(27)
External Wall Existing	120.9000	25.4000	95.5000	1.5500	148.0250	9.0000	859.5000	(29a)
Total net area of external elements Aum(A, m2)			120.9000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	181.6992			(33)
Party Wall 1			36.2200	0.0000	0.0000	110.0000	3984.2000	(32)
Party Floor 1			120.0000			80.0000	9600.0000	(32d)
Party Ceiling 1			120.0000			20.0000	2400.0000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 16843.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	140.3642 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E1 Steel lintel with perforated steel base plate	13.9500	1.0000	13.9500
E3 Sill	13.9500	0.1000	1.3950
E4 Jamb	43.7600	0.1000	4.3760

E7 Party floor between dwellings (in blocks of flats)	70.8100	0.2800	19.8268	
E15 Flat roof with parapet	7.0800	0.3000	2.1240	
E16 Corner (normal)	3.1500	0.1800	0.5670	
E18 Party wall between dwellings	6.2900	0.2400	1.5096	
E24 Eaves (insulation at ceiling level - inverted)	13.8900	0.1500	2.0835	
E25 Staggered party wall between dwellings	3.1500	0.2400	0.7560	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	49.7600	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				46.5879 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	228.2871 (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	114.3632	112.3752	110.3871	100.4469	98.4588	88.5186	88.5186	86.5306	92.4947	98.4588	102.4349	106.4110	(38)
Heat transfer coeff	342.6503	340.6623	338.6742	328.7340	326.7460	316.8058	316.8058	314.8177	320.7819	326.7460	330.7221	334.6982	(39)
Average = Sum(39)m / 12 =												328.2370	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.8554	2.8389	2.8223	2.7395	2.7229	2.6400	2.6400	2.6235	2.6732	2.7229	2.7560	2.7892	(40)
HLP (average)												2.7353	
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												2.8633	(42)
Hot water usage for mixer showers	99.3138	97.8213	95.6464	91.4852	88.4144	84.9898	83.0432	85.2016	87.5676	91.2446	95.4952	98.9333	(42a)
Hot water usage for baths	32.8250	32.3375	31.6510	30.3852	29.4374	28.3864	27.8187	28.5004	29.2427	30.3672	31.6591	32.7140	(42b)
Hot water usage for other uses	46.2665	44.5841	42.9017	41.2193	39.5369	37.8544	37.8544	39.5369	41.2193	42.9017	44.5841	46.2665	(42c)
Average daily hot water use (litres/day)												164.0584	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	178.4053	174.7428	170.1991	163.0897	157.3886	151.2306	148.7164	153.2389	158.0296	164.5135	171.7384	177.9138	(44)
Energy conte	282.5503	248.8315	261.5896	223.2616	211.8753	185.9557	179.8596	189.7418	194.8663	223.2433	244.6728	278.5700	(45)
Energy content (annual)										Total = Sum(45)m =		2725.0179	
Distribution loss (46)m = 0.15 x (45)m	42.3825	37.3247	39.2384	33.4892	31.7813	27.8934	26.9789	28.4613	29.2299	33.4865	36.7009	41.7855	(46)
Water storage loss:													
Store volume												250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7560	(55)
Total storage loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(56)
If cylinder contains dedicated solar storage	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(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	329.2487	291.0107	308.2880	268.4536	258.5737	231.1477	226.5580	236.4402	240.0583	269.9417	289.8648	325.2684	(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	329.2487	291.0107	308.2880	268.4536	258.5737	231.1477	226.5580	236.4402	240.0583	269.9417	289.8648	325.2684	(64)
										Total per year (kWh/year) = Sum(64)m =		3274.8539	(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	131.3067	116.4798	124.3373	110.3881	107.8073	97.9839	97.1620	100.4479	100.9466	111.5871	117.5073	129.9832	(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	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.7761	28.2233	22.9527	17.3767	12.9893	10.9661	11.8493	15.4021	20.6727	26.2487	30.6361	32.6593	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	425.6913	430.1086	418.9771	395.2793	365.3651	337.2500	318.4674	314.0500	325.1816	348.8794	378.7936	406.9087	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	(71)
Water heating gains (Table 5)	176.4875	173.3331	167.1200	153.3168	144.9022	136.0887	130.5941	135.0106	140.2037	149.9827	163.2046	174.7086	(72)
Total internal gains	746.2644	743.9745	721.3593	678.2823	635.5661	596.6143	573.2203	576.7722	598.3674	637.4203	684.9438	726.5861	(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	3.6600	10.6334	0.6000	0.8500	0.7700	13.7549	(74)
East	3.8500	19.6403	0.6000	0.8500	0.7700	26.7246	(76)
Southwest	11.3000	36.7938	0.6000	0.8500	0.7700	146.9457	(79)
West	6.5900	19.6403	0.6000	0.8500	0.7700	45.7442	(80)

Solar gains	233.1694	418.3535	620.6079	836.5857	989.2394	1002.4995	958.2088	842.8845	696.0626	476.1438	283.3356	196.8165	(83)
Total gains	979.4338	1162.3280	1341.9671	1514.8680	1624.8056	1599.1138	1531.4290	1419.6567	1294.4300	1113.5640	968.2793	923.4026	(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	13.6548	13.7344	13.8151	14.2328	14.3194	14.7687	14.7687	14.8620	14.5856	14.3194	14.1472	13.9792	
alpha	1.9103	1.9156	1.9210	1.9489	1.9546	1.9846	1.9846	1.9908	1.9724	1.9546	1.9431	1.9319	
util living area													
	0.9714	0.9592	0.9385	0.8998	0.8376	0.7401	0.6332	0.6722	0.8192	0.9211	0.9613	0.9744	(86)
Living	16.5922	16.9493	17.6039	18.5270	19.4077	20.1853	20.5906	20.5217	19.8946	18.7485	17.5440	16.5774	
Non living	14.1230	14.5686	15.3834	16.5294	17.5819	18.4588	18.8153	18.7817	18.1763	16.8275	15.3287	14.1106	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	18.7504	16.9493	17.6039	18.5270	19.4077	20.1853	20.5906	20.5217	19.8946	18.7485	17.5440	17.1974	(87)
Th 2	18.8240	18.8327	18.8415	18.8859	18.8950	18.9408	18.9408	18.9501	18.9223	18.8950	18.8770	18.8591	(88)
util rest of house													
	0.9637	0.9482	0.9206	0.8671	0.7742	0.6137	0.4173	0.4690	0.7207	0.8884	0.9489	0.9675	(89)
MIT 2	16.9224	14.5686	15.3834	16.5294	17.5819	18.4588	18.8153	18.7817	18.1763	16.8275	15.3287	14.9571	(90)
Living area fraction										fLA = Living area / (4) =		0.2454	(91)
MIT	17.3711	15.1529	15.9284	17.0196	18.0300	18.8825	19.2510	19.2087	18.5980	17.2990	15.8724	15.5069	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.3711	15.1529	15.9284	17.0196	18.0300	18.8825	19.2510	19.2087	18.5980	17.2990	15.8724	15.5069	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9567	0.9155	0.8809	0.8234	0.7376	0.6091	0.4582	0.5020	0.6989	0.8483	0.9178	0.9496	(94)
Useful gains	936.9842	1064.1178	1182.1109	1247.3006	1198.4640	973.9726	701.7333	712.6529	904.6614	944.6330	888.6440	876.9090	(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													
	4478.8003	3492.7726	3193.1439	2669.1947	2068.2915	1356.7162	839.8565	884.2305	1442.8739	2188.8565	2901.2203	3784.3920	(97)
Space heating kWh													
	2635.1112	1632.0560	1496.2085	1023.7638	647.1517	0.0000	0.0000	0.0000	0.0000	925.7023	1449.0550	2163.1674	(98a)
Space heating requirement - total per year (kWh/year)												11972.2159	
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													
	2635.1112	1632.0560	1496.2085	1023.7638	647.1517	0.0000	0.0000	0.0000	0.0000	925.7023	1449.0550	2163.1674	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												11972.2159	
Space heating per m2											(98c) / (4) =	99.7685	(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 %) 423.5180 (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													
	2635.1112	1632.0560	1496.2085	1023.7638	647.1517	0.0000	0.0000	0.0000	0.0000	925.7023	1449.0550	2163.1674	(98)
Space heating efficiency (main heating system 1)													
	423.5180	423.5180	423.5180	423.5180	423.5180	0.0000	0.0000	0.0000	0.0000	423.5180	423.5180	423.5180	(210)
Space heating fuel (main heating system)													
	622.1957	385.3569	353.2809	241.7285	152.8038	0.0000	0.0000	0.0000	0.0000	218.5745	342.1472	510.7616	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	329.2487	291.0107	308.2880	268.4536	258.5737	231.1477	226.5580	236.4402	240.0583	269.9417	289.8648	325.2684	(64)
Efficiency of water heater												193.0444	(216)
(217)m	193.0444	193.0444	193.0444	193.0444	193.0444	193.0444	193.0444	193.0444	193.0444	193.0444	193.0444	193.0444	(217)
Fuel for water heating, kWh/month													
	170.5559	150.7480	159.6980	139.0631	133.9452	119.7381	117.3606	122.4797	124.3539	139.8340	150.1545	168.4940	(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	58.6722	52.9942	58.6722	56.7795	58.6722	56.7795	58.6722	58.6722	56.7795	58.6722	56.7795	58.6722	(231)
Lighting	27.8135	22.3130	20.0904	14.7191	11.3694	9.2889	10.3716	13.4814	17.5110	22.9753	25.9506	28.5865	(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 2826.8491 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 193.0444

Water heating fuel used 1696.4249 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4980)

mechanical ventilation fans (SFP = 1.4980)	690.8177	(230a)
Total electricity for the above, kWh/year	690.8177	(231)
Electricity for lighting (calculated in Appendix L)	224.4706	(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	5438.5624	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2826.8491	16.4900	466.1474	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1696.4249	16.4900	279.7405	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	690.8177	16.4900	113.9158	(249)
Energy for lighting	224.4706	16.4900	37.0152	(250)
Additional standing charges			0.0000	(251)
Total energy cost			896.8189	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.9567	(257)
SAP value		68.2820	
SAP rating (Section 12)		68	(258)
SAP band		D	

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	2826.8491	0.1544	436.5088	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1696.4249	0.1411	239.3606	(264)
Space and water heating			675.8694	(265)
Pumps, fans and electric keep-hot	690.8177	0.1387	95.8249	(267)
Energy for lighting	224.4706	0.1443	32.3981	(268)
Total CO2, kg/year			804.0924	(272)
CO2 emissions per m2			6.7000	(273)
EI value			93.4698	
EI rating			93	(274)
EI band			A	

SAP 10 WORKSHEET FOR Conversion (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	120.0000 (1b)	x 3.1500 (2b)	= 378.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 120.0000				(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	378.0000	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 = 0.0000	(6a)
Number of open flues	0 * 20 = 0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000	(6d)
Number of flues attached to other heater	0 * 35 = 0.0000	(6e)
Number of blocked chimneys	0 * 20 = 0.0000	(6f)
Number of intermittent extract fans	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	No	
Pressure Test Method	Blower Door	
Measured/design AP50	15.0000	(17)
Infiltration rate	0.7500	(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) = 0.6375 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.5000	4.4000	4.1000	4.1000	3.7000	3.8000	3.7000	3.7000	4.0000	3.9000	4.3000	(22)
Wind factor	1.1500	1.1250	1.1000	1.0250	1.0250	0.9250	0.9500	0.9250	0.9250	1.0000	0.9750	1.0750	(22a)
Adj infilt rate	0.7331	0.7172	0.7013	0.6534	0.6534	0.5897	0.6056	0.5897	0.5897	0.6375	0.6216	0.6853	(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	0.8371	0.8212	0.8053	0.7574	0.7574	0.6937	0.7096	0.6937	0.6937	0.7415	0.7256	0.7893	(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 = 1.40)			25.4000	1.3258	33.6742			(27)
External Wall Existing	120.9000	25.4000	95.5000	1.5500	148.0250	9.0000	859.5000	(29a)
Total net area of external elements Aum(A, m2)			120.9000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	181.6992			(33)
Party Wall 1			36.2200	0.0000	0.0000	110.0000	3984.2000	(32)
Party Floor 1			120.0000			80.0000	9600.0000	(32d)
Party Ceiling 1			120.0000			30.0000	3600.0000	(32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 18043.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 150.3642 (35)
List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E1	Steel lintel with perforated steel base plate	13.9500	1.0000	13.9500
E3	Sill	13.9500	0.1000	1.3950
E4	Jamb	43.7600	0.1000	4.3760
E7	Party floor between dwellings (in blocks of flats)	70.8100	0.2800	19.8268
E15	Flat roof with parapet	7.0800	0.3000	2.1240
E16	Corner (normal)	3.1500	0.1800	0.5670
E18	Party wall between dwellings	6.2900	0.2400	1.5096
E24	Eaves (insulation at ceiling level - inverted)	13.8900	0.1500	2.0835
E25	Staggered party wall between dwellings	3.1500	0.2400	0.7560
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	49.7600	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 46.5879 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 228.2871 (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	104.4230	102.4349	100.4469	94.4828	94.4828	86.5306	88.5186	86.5306	86.5306	92.4947	90.5067	98.4588	(38)
Heat transfer coeff	332.7101	330.7221	328.7340	322.7699	322.7699	314.8177	316.8058	314.8177	314.8177	320.7819	318.7938	326.7460	(39)

Average = Sum(39)m / 12 = 322.1072

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.7726	2.7560	2.7395	2.6897	2.6897	2.6235	2.6400	2.6235	2.6235	2.6732	2.6566	2.7229	(40)
HLP (average)												2.6842	
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 2.8633 (42)
Hot water usage for mixer showers

99.3138	97.8213	95.6464	91.4852	88.4144	84.9898	83.0432	85.2016	87.5676	91.2446	95.4952	98.9333	(42a)

Hot water usage for baths

32.8250	32.3375	31.6510	30.3852	29.4374	28.3864	27.8187	28.5004	29.2427	30.3672	31.6591	32.7140	(42b)

Hot water usage for other uses

46.2665	44.5841	42.9017	41.2193	39.5369	37.8544	37.8544	39.5369	41.2193	42.9017	44.5841	46.2665	(42c)

Average daily hot water use (litres/day) 164.0584 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	178.4053	174.7428	170.1991	163.0897	157.3886	151.2306	148.7164	153.2389	158.0296	164.5135	171.7384	177.9138	(44)
Energy conte	282.5503	248.8315	261.5896	223.2616	211.8753	185.9557	179.8596	189.7418	194.8663	223.2433	244.6728	278.5700	(45)

Energy content (annual) Total = Sum(45)m = 2725.0179
Distribution loss (46)m = 0.15 x (45)m

42.3825	37.3247	39.2384	33.4892	31.7813	27.8934	26.9789	28.4613	29.2299	33.4865	36.7009	41.7855	(46)

Water storage loss:
Store volume 250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.4000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.7560 (55)
Total storage loss

23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(56)

If cylinder contains dedicated solar storage

23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(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

329.2487	291.0107	308.2880	268.4536	258.5737	231.1477	226.5580	236.4402	240.0583	269.9417	289.8648	325.2684	(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

329.2487	291.0107	308.2880	268.4536	258.5737	231.1477	226.5580	236.4402	240.0583	269.9417	289.8648	325.2684	(64)

Total per year (kWh/year) = Sum(64)m = 3274.8539 (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

131.3067	116.4798	124.3373	110.3881	107.8073	97.9839	97.1620	100.4479	100.9466	111.5871	117.5073	129.9832	(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	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	(66)

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

	31.7761	28.2233	22.9527	17.3767	12.9893	10.9661	11.8493	15.4021	20.6727	26.2487	30.6361	32.6593	(67)

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

	425.6913	430.1086	418.9771	395.2793	365.3651	337.2500	318.4674	314.0500	325.1816	348.8794	378.7936	406.9087	(68)

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

	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	(71)

Water heating gains (Table 5)

	176.4875	173.3331	167.1200	153.3168	144.9022	136.0887	130.5941	135.0106	140.2037	149.9827	163.2046	174.7086	(72)

Total internal gains

	746.2644	743.9745	721.3593	678.2823	635.5661	596.6143	573.2203	576.7722	598.3674	637.4203	684.9438	726.5861	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6600	11.5821	0.6000	0.8500	0.7700	14.9820	(74)
East	3.8500	21.5869	0.6000	0.8500	0.7700	29.3735	(76)
Southwest	11.3000	39.1209	0.6000	0.8500	0.7700	156.2395	(79)
West	6.5900	21.5869	0.6000	0.8500	0.7700	50.2782	(80)

Solar gains	250.8732	404.5637	603.7402	842.4767	971.4477	1051.8348	1002.4995	903.0625	744.3031	503.2693	314.9008	207.8455	(83)
Total gains	997.1376	1148.5382	1325.0995	1520.7590	1607.0139	1648.4491	1575.7198	1479.8347	1342.6705	1140.6896	999.8446	934.4316	(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	15.0646	15.1551	15.2468	15.5285	15.5285	15.9208	15.8209	15.9208	15.9208	15.6248	15.7222	15.3396	
alpha	2.0043	2.0103	2.0165	2.0352	2.0352	2.0614	2.0547	2.0614	2.0614	2.0417	2.0481	2.0226	
util living area													
	0.9709	0.9603	0.9355	0.8867	0.8017	0.6364	0.4592	0.5038	0.7542	0.9051	0.9571	0.9740	(86)
Living	17.0944	17.3850	18.1291	19.0223	19.8925	20.5965	20.8769	20.8432	20.3265	19.2488	18.0915	17.0905	
Non living	14.7190	15.0840	16.0145	17.1146	18.1233	18.8121	18.9376	18.9423	18.6150	17.4192	15.9922	14.7205	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.0028	17.3850	18.1291	19.0223	19.8925	20.5965	20.8769	20.8432	20.3265	19.2488	18.0915	17.6375	(87)
Th 2	18.8680	18.8770	18.8859	18.9131	18.9131	18.9501	18.9408	18.9501	18.9501	18.9223	18.9315	18.8950	(88)
util rest of house													
	0.9623	0.9486	0.9144	0.8445	0.7098	0.4360	0.1272	0.1765	0.5999	0.8592	0.9417	0.9664	(89)
MIT 2	17.1972	15.0840	16.0145	17.1146	18.1233	18.8121	18.9376	18.9423	18.6150	17.4192	15.9922	15.4673	(90)
Living area fraction									fLA = Living area / (4) =			0.2454	(91)
MIT	17.6403	15.6487	16.5335	17.5828	18.5575	19.2500	19.4136	19.4088	19.0350	17.8682	16.5074	15.9999	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.6403	15.6487	16.5335	17.5828	18.5575	19.2500	19.4136	19.4088	19.0350	17.8682	16.5074	15.9999	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9556	0.9181	0.8767	0.8051	0.6886	0.4723	0.2158	0.2637	0.6085	0.8229	0.9108	0.9491	(94)
Useful gains	952.8605	1054.4686	1161.6801	1224.3442	1106.6117	778.5376	340.0049	390.2966	816.9504	938.6973	910.6196	886.8300	(95)
Ext temp.	5.2000	5.7000	7.7000	10.2000	13.3000	16.3000	18.3000	18.1000	15.5000	11.9000	8.2000	5.2000	(96)
Heat loss rate W													
	4139.0145	3290.2604	2903.8701	2382.9476	1696.9556	928.7114	352.7819	412.0405	1112.8753	1914.4875	2648.3471	3528.8228	(97)
Space heating kWh													
	2370.4986	1502.4521	1296.1894	834.1944	439.2159	0.0000	0.0000	0.0000	0.0000	725.9879	1251.1638	1965.6426	(98a)
Space heating requirement - total per year (kWh/year)												10385.3447	
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													
	2370.4986	1502.4521	1296.1894	834.1944	439.2159	0.0000	0.0000	0.0000	0.0000	725.9879	1251.1638	1965.6426	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												10385.3447	
Space heating per m2											(98c) / (4) =	86.5445	(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 %)	421.1633	(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													
	2370.4986	1502.4521	1296.1894	834.1944	439.2159	0.0000	0.0000	0.0000	0.0000	725.9879	1251.1638	1965.6426	(98)
Space heating efficiency (main heating system 1)													
	421.1633	421.1633	421.1633	421.1633	421.1633	0.0000	0.0000	0.0000	0.0000	421.1633	421.1633	421.1633	(210)
Space heating fuel (main heating system)													
	562.8455	356.7386	307.7641	198.0691	104.2864	0.0000	0.0000	0.0000	0.0000	172.3768	297.0733	466.7175	(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													
	329.2487	291.0107	308.2880	268.4536	258.5737	231.1477	226.5580	236.4402	240.0583	269.9417	289.8648	325.2684	(64)
Efficiency of water heater												193.1827	(216)
(217)m	193.1827	193.1827	193.1827	193.1827	193.1827	193.1827	193.1827	193.1827	193.1827	193.1827	193.1827	193.1827	(217)
Fuel for water heating, kWh/month													
	170.4338	150.6401	159.5836	138.9636	133.8493	119.6524	117.2765	122.3920	124.2649	139.7339	150.0470	168.3734	(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	58.6722	52.9942	58.6722	56.7795	58.6722	56.7795	58.6722	58.6722	56.7795	58.6722	56.7795	58.6722	(231)
Lighting	27.8135	22.3130	20.0904	14.7191	11.3694	9.2889	10.3716	13.4814	17.5110	22.9753	25.9506	28.5865	(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	2465.8715	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	193.1827	
Water heating fuel used	1695.2105	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4980)		
mechanical ventilation fans (SFP = 1.4980)	690.8177	(230a)
Total electricity for the above, kWh/year	690.8177	(231)
Electricity for lighting (calculated in Appendix L)	224.4706	(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	5076.3703	(238)

10a. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2465.8715	21.5100	530.4090	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1695.2105	21.5100	364.6398	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	690.8177	21.5100	148.5949	(249)
Energy for lighting	224.4706	21.5100	48.2836	(250)
Additional standing charges			0.0000	(251)
Total energy cost			1091.9273	(255)

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	2465.8715	0.1551	382.3759	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1695.2105	0.1411	239.1893	(264)
Space and water heating			621.5652	(265)
Pumps, fans and electric keep-hot	690.8177	0.1387	95.8249	(267)
Energy for lighting	224.4706	0.1443	32.3981	(268)
Total CO2, kg/year			749.7882	(272)

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	2465.8715	1.5740	3881.3669	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1695.2105	1.5217	2579.6626	(278)
Space and water heating			6461.0294	(279)
Pumps, fans and electric keep-hot	690.8177	1.5128	1045.0690	(281)
Energy for lighting	224.4706	1.5338	344.3006	(282)
Total Primary energy kWh/year			7850.3990	(286)

SAP 10 EPC IMPROVEMENTS

231207ac-Unit 1 - Be Green

Current energy efficiency rating:	D 68
Current environmental impact rating:	A 93

N Solar water heating — Not applicable
U Solar photovoltaic panels — Not applicable
V2 Wind turbine — Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: D 68
Potential environmental impact rating: A 93

Fuel prices for cost data on this page from database revision number 533 TEST (30 Nov 2023)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£1092	£1092	£0
Space heating	£679	£679	£0
Water heating	£365	£365	£0
Lighting	£48	£48	£0
Total cost of fuels	£1092	£1092	£0
Total cost of uses	£1092	£1092	£0
Delivered energy	42 kWh/m²	42 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.7 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	65 kWh/m²	65 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR Conversion (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	120.0000	(1b)	x 3.1500	(2b) =	378.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		378.0000	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	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		No
Pressure Test Method		Blower Door
Measured/design AP50		15.0000 (17)
Infiltration rate		0.7500 (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) =	0.6375 (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	0.8128	0.7969	0.7809	0.7013	0.6853	0.6056	0.6056	0.5897	0.6375	0.6853	0.7172	0.7491	(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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.9168	0.9009	0.8849	0.8053	0.7893	0.7096	0.7096	0.6937	0.7415	0.7893	0.8212	0.8531	(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	
Windows (Uw = 1.40)			25.4000	1.3258	33.6742			(27)

External Wall Existing	120.9000	25.4000	95.5000	1.5500	148.0250	9.0000	859.5000 (29a)
Total net area of external elements Aum(A, m2)			120.9000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	181.6992		(33)
Party Wall 1			36.2200	0.0000	0.0000	110.0000	3984.2000 (32)
Party Floor 1			120.0000			80.0000	9600.0000 (32d)
Party Ceiling 1			120.0000			20.0000	2400.0000 (32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 16843.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 140.3642 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E1 Steel lintel with perforated steel base plate	13.9500	1.0000	13.9500
E3 Sill	13.9500	0.1000	1.3950
E4 Jamb	43.7600	0.1000	4.3760
E7 Party floor between dwellings (in blocks of flats)	70.8100	0.2800	19.8268
E15 Flat roof with parapet	7.0800	0.3000	2.1240
E16 Corner (normal)	3.1500	0.1800	0.5670
E18 Party wall between dwellings	6.2900	0.2400	1.5096
E24 Eaves (insulation at ceiling level - inverted)	13.8900	0.1500	2.0835
E25 Staggered party wall between dwellings	3.1500	0.2400	0.7560
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	49.7600	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 46.5879 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 228.2871 (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	114.3632	112.3752	110.3871	100.4469	98.4588	88.5186	88.5186	86.5306	92.4947	98.4588	102.4349	106.4110	(38)
Heat transfer coeff	342.6503	340.6623	338.6742	328.7340	326.7460	316.8058	316.8058	314.8177	320.7819	326.7460	330.7221	334.6982	(39)
Average = Sum(39)m / 12 =												328.2370	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.8554	2.8389	2.8223	2.7395	2.7229	2.6400	2.6400	2.6235	2.6732	2.7229	2.7560	2.7892	(40)
HLP (average)												2.7353	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8633 (42)
Hot water usage for mixer showers

99.3138	97.8213	95.6464	91.4852	88.4144	84.9898	83.0432	85.2016	87.5676	91.2446	95.4952	98.9333	(42a)

Hot water usage for baths

32.8250	32.3375	31.6510	30.3852	29.4374	28.3864	27.8187	28.5004	29.2427	30.3672	31.6591	32.7140	(42b)

Hot water usage for other uses

46.2665	44.5841	42.9017	41.2193	39.5369	37.8544	37.8544	39.5369	41.2193	42.9017	44.5841	46.2665	(42c)

Average daily hot water use (litres/day) 164.0584 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	178.4053	174.7428	170.1991	163.0897	157.3886	151.2306	148.7164	153.2389	158.0296	164.5135	171.7384	177.9138	(44)
Energy conte	282.5503	248.8315	261.5896	223.2616	211.8753	185.9557	179.8596	189.7418	194.8663	223.2433	244.6728	278.5700	(45)
Energy content (annual)										Total = Sum(45)m =		2725.0179	
Distribution loss (46)m = 0.15 x (45)m	42.3825	37.3247	39.2384	33.4892	31.7813	27.8934	26.9789	28.4613	29.2299	33.4865	36.7009	41.7855	(46)

Water storage loss:
Store volume 250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.4000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.7560 (55)
Total storage loss

23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(56)

If cylinder contains dedicated solar storage

23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(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

329.2487	291.0107	308.2880	268.4536	258.5737	231.1477	226.5580	236.4402	240.0583	269.9417	289.8648	325.2684	(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

329.2487	291.0107	308.2880	268.4536	258.5737	231.1477	226.5580	236.4402	240.0583	269.9417	289.8648	325.2684	(64)

Total per year (kWh/year) = Sum(64)m = 3274.8539 (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

131.3067	116.4798	124.3373	110.3881	107.8073	97.9839	97.1620	100.4479	100.9466	111.5871	117.5073	129.9832	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.7761	28.2233	22.9527	17.3767	12.9893	10.9661	11.8493	15.4021	20.6727	26.2487	30.6361	32.6593	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	425.6913	430.1086	418.9771	395.2793	365.3651	337.2500	318.4674	314.0500	325.1816	348.8794	378.7936	406.9087	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	(71)
Water heating gains (Table 5)	176.4875	173.3331	167.1200	153.3168	144.9022	136.0887	130.5941	135.0106	140.2037	149.9827	163.2046	174.7086	(72)
Total internal gains	746.2644	743.9745	721.3593	678.2823	635.5661	596.6143	573.2203	576.7722	598.3674	637.4203	684.9438	726.5861	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6600	10.6334	0.6000	0.8500	0.7700	13.7549	(74)
East	3.8500	19.6403	0.6000	0.8500	0.7700	26.7246	(76)
Southwest	11.3000	36.7938	0.6000	0.8500	0.7700	146.9457	(79)
West	6.5900	19.6403	0.6000	0.8500	0.7700	45.7442	(80)

Solar gains	233.1694	418.3535	620.6079	836.5857	989.2394	1002.4995	958.2088	842.8845	696.0626	476.1438	283.3356	196.8165	(83)
Total gains	979.4338	1162.3280	1341.9671	1514.8680	1624.8056	1599.1138	1531.4290	1419.6567	1294.4300	1113.5640	968.2793	923.4026	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	13.6548	13.7344	13.8151	14.2328	14.3194	14.7687	14.7687	14.8620	14.5856	14.3194	14.1472	13.9792	
alpha	1.9103	1.9156	1.9210	1.9489	1.9546	1.9846	1.9846	1.9908	1.9724	1.9546	1.9431	1.9319	
util living area	0.9714	0.9592	0.9385	0.8998	0.8376	0.7401	0.6332	0.6722	0.8192	0.9211	0.9613	0.9744	(86)
Living	16.5922	16.9493	17.6039	18.5270	19.4077	20.1853	20.5906	20.5217	19.8946	18.7485	17.5440	16.5774	
Non living	14.1230	14.5686	15.3834	16.5294	17.5819	18.4588	18.8153	18.7817	18.1763	16.8275	15.3287	14.1106	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	18.7504	16.9493	17.6039	18.5270	19.4077	20.1853	20.5906	20.5217	19.8946	18.7485	17.5440	17.1974	(87)
Th 2	18.8240	18.8327	18.8415	18.8859	18.8950	18.9408	18.9408	18.9501	18.9223	18.8950	18.8770	18.8591	(88)
util rest of house	0.9637	0.9482	0.9206	0.8671	0.7742	0.6137	0.4173	0.4690	0.7207	0.8884	0.9489	0.9675	(89)
MIT 2	16.9224	14.5686	15.3834	16.5294	17.5819	18.4588	18.8153	18.7817	18.1763	16.8275	15.3287	14.9571	(90)
Living area fraction									fLA = Living area / (4) =			0.2454	(91)
MIT	17.3711	15.1529	15.9284	17.0196	18.0300	18.8825	19.2510	19.2087	18.5980	17.2990	15.8724	15.5069	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.3711	15.1529	15.9284	17.0196	18.0300	18.8825	19.2510	19.2087	18.5980	17.2990	15.8724	15.5069	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9567	0.9155	0.8809	0.8234	0.7376	0.6091	0.4582	0.5020	0.6989	0.8483	0.9178	0.9496	(94)
Useful gains	936.9842	1064.1178	1182.1109	1247.3006	1198.4640	973.9726	701.7333	712.6529	904.6614	944.6330	888.6440	876.9090	(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	4478.8003	3492.7726	3193.1439	2669.1947	2068.2915	1356.7162	839.8565	884.2305	1442.8739	2188.8565	2901.2203	3784.3920	(97)
Space heating kWh	2635.1112	1632.0560	1496.2085	1023.7638	647.1517	0.0000	0.0000	0.0000	0.0000	925.7023	1449.0550	2163.1674	(98a)
Space heating requirement - total per year (kWh/year)												11972.2159	
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	2635.1112	1632.0560	1496.2085	1023.7638	647.1517	0.0000	0.0000	0.0000	0.0000	925.7023	1449.0550	2163.1674	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												11972.2159	
Space heating per m2											(98c) / (4) =	99.7685	(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 %)	423.5180	(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	2635.1112	1632.0560	1496.2085	1023.7638	647.1517	0.0000	0.0000	0.0000	0.0000	925.7023	1449.0550	2163.1674	(98)
Space heating efficiency (main heating system 1)	423.5180	423.5180	423.5180	423.5180	423.5180	0.0000	0.0000	0.0000	0.0000	423.5180	423.5180	423.5180	(210)
Space heating fuel (main heating system)	622.1957	385.3569	353.2809	241.7285	152.8038	0.0000	0.0000	0.0000	0.0000	218.5745	342.1472	510.7616	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	329.2487	291.0107	308.2880	268.4536	258.5737	231.1477	226.5580	236.4402	240.0583	269.9417	289.8648	325.2684	(64)
Efficiency of water heater												193.0444	(216)
(217)m	193.0444	193.0444	193.0444	193.0444	193.0444	193.0444	193.0444	193.0444	193.0444	193.0444	193.0444	193.0444	(217)
Fuel for water heating, kWh/month	170.5559	150.7480	159.6980	139.0631	133.9452	119.7381	117.3606	122.4797	124.3539	139.8340	150.1545	168.4940	(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	58.6722	52.9942	58.6722	56.7795	58.6722	56.7795	58.6722	58.6722	56.7795	58.6722	56.7795	58.6722	(231)
Lighting	27.8135	22.3130	20.0904	14.7191	11.3694	9.2889	10.3716	13.4814	17.5110	22.9753	25.9506	28.5865	(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	2826.8491	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	193.0444	
Water heating fuel used	1696.4249	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4980)		
mechanical ventilation fans (SFP = 1.4980)	690.8177	(230a)
Total electricity for the above, kWh/year	690.8177	(231)
Electricity for lighting (calculated in Appendix L)	224.4706	(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	5438.5624	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2826.8491	16.4900	466.1474	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1696.4249	16.4900	279.7405	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	690.8177	16.4900	113.9158	(249)
Energy for lighting	224.4706	16.4900	37.0152	(250)
Additional standing charges			0.0000	(251)
Total energy cost			896.8189	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.9567	(257)
SAP value		68.2820	
SAP rating (Section 12)		68	(258)
SAP band		D	

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	2826.8491	0.1544	436.5088	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1696.4249	0.1411	239.3606	(264)
Space and water heating			675.8694	(265)
Pumps, fans and electric keep-hot	690.8177	0.1387	95.8249	(267)
Energy for lighting	224.4706	0.1443	32.3981	(268)
Total CO2, kg/year			804.0924	(272)
CO2 emissions per m2			6.7000	(273)
EI value			93.4698	
EI rating			93	(274)
EI band			A	

SAP 10 WORKSHEET FOR Conversion (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	120.0000	(1b)	x 3.1500	(2b)	= 378.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)		= 378.0000	(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		No
Pressure Test Method		Blower Door
Measured/design AP50		15.0000 (17)
Infiltration rate		0.7500 (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) =	0.6375 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.5000	4.4000	4.1000	4.1000	3.7000	3.8000	3.7000	3.7000	4.0000	3.9000	4.3000	(22)
Wind factor	1.1500	1.1250	1.1000	1.0250	1.0250	0.9250	0.9500	0.9250	0.9250	1.0000	0.9750	1.0750	(22a)
Adj infilt rate	0.7331	0.7172	0.7013	0.6534	0.6534	0.5897	0.6056	0.5897	0.5897	0.6375	0.6216	0.6853	(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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.8371	0.8212	0.8053	0.7574	0.7574	0.6937	0.7096	0.6937	0.6937	0.7415	0.7256	0.7893	(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	
Windows (Uw = 1.40)			25.4000	1.3258	33.6742			(27)
External Wall Existing	120.9000	25.4000	95.5000	1.5500	148.0250	9.0000	859.5000	(29a)
Total net area of external elements Aum(A, m2)			120.9000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		181.6992			(33)
Party Wall 1			36.2200	0.0000	0.0000	110.0000	3984.2000	(32)
Party Floor 1			120.0000			80.0000	9600.0000	(32d)
Party Ceiling 1			120.0000			30.0000	3600.0000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 18043.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	150.3642 (35)

List of Thermal Bridges

	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	13.9500	1.0000	13.9500
E3 Sill	13.9500	0.1000	1.3950
E4 Jamb	43.7600	0.1000	4.3760
E7 Party floor between dwellings (in blocks of flats)	70.8100	0.2800	19.8268
E15 Flat roof with parapet	7.0800	0.3000	2.1240
E16 Corner (normal)	3.1500	0.1800	0.5670
E18 Party wall between dwellings	6.2900	0.2400	1.5096
E24 Eaves (insulation at ceiling level - inverted)	13.8900	0.1500	2.0835
E25 Staggered party wall between dwellings	3.1500	0.2400	0.7560
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	49.7600	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		46.5879 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	228.2871 (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	104.4230	102.4349	100.4469	94.4828	94.4828	86.5306	88.5186	86.5306	86.5306	92.4947	90.5067	98.4588	(38)
Heat transfer coeff	332.7101	330.7221	328.7340	322.7699	322.7699	314.8177	316.8058	314.8177	314.8177	320.7819	318.7938	326.7460	(39)
Average = Sum(39)m / 12 =												322.1072	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.7726	2.7560	2.7395	2.6897	2.6897	2.6235	2.6400	2.6235	2.6235	2.6732	2.6566	2.7229	(40)
HLP (average)												2.6842	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8633 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
99.3138	97.8213	95.6464	91.4852	88.4144	84.9898	83.0432	85.2016	87.5676	91.2446	95.4952	98.9333	(42a)

Hot water usage for baths

32.8250	32.3375	31.6510	30.3852	29.4374	28.3864	27.8187	28.5004	29.2427	30.3672	31.6591	32.7140	(42b)

Hot water usage for other uses

46.2665	44.5841	42.9017	41.2193	39.5369	37.8544	37.8544	39.5369	41.2193	42.9017	44.5841	46.2665	(42c)

Average daily hot water use (litres/day)	164.0584 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	178.4053	174.7428	170.1991	163.0897	157.3886	151.2306	148.7164	153.2389	158.0296	164.5135	171.7384	177.9138	(44)
Energy conte	282.5503	248.8315	261.5896	223.2616	211.8753	185.9557	179.8596	189.7418	194.8663	223.2433	244.6728	278.5700	(45)
Energy content (annual)											Total = Sum(45)m =	2725.0179	
Distribution loss (46)m = 0.15 x (45)m	42.3825	37.3247	39.2384	33.4892	31.7813	27.8934	26.9789	28.4613	29.2299	33.4865	36.7009	41.7855	(46)

Water storage loss:	
Store volume	250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.4000 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.7560 (55)

Total storage loss

23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(56)

If cylinder contains dedicated solar storage

23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(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

329.2487	291.0107	308.2880	268.4536	258.5737	231.1477	226.5580	236.4402	240.0583	269.9417	289.8648	325.2684	(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	329.2487	291.0107	308.2880	268.4536	258.5737	231.1477	226.5580	236.4402	240.0583	269.9417	289.8648	325.2684	(64)
										Total per year (kWh/year) = Sum(64)m =		3274.8539	(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	131.3067	116.4798	124.3373	110.3881	107.8073	97.9839	97.1620	100.4479	100.9466	111.5871	117.5073	129.9832	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.7761	28.2233	22.9527	17.3767	12.9893	10.9661	11.8493	15.4021	20.6727	26.2487	30.6361	32.6593	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	425.6913	430.1086	418.9771	395.2793	365.3651	337.2500	318.4674	314.0500	325.1816	348.8794	378.7936	406.9087	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	(71)
Water heating gains (Table 5)	176.4875	173.3331	167.1200	153.3168	144.9022	136.0887	130.5941	135.0106	140.2037	149.9827	163.2046	174.7086	(72)
Total internal gains	746.2644	743.9745	721.3593	678.2823	635.5661	596.6143	573.2203	576.7722	598.3674	637.4203	684.9438	726.5861	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6600	11.5821	0.6000	0.8500	0.7700	14.9820	(74)
East	3.8500	21.5869	0.6000	0.8500	0.7700	29.3735	(76)
Southwest	11.3000	39.1209	0.6000	0.8500	0.7700	156.2395	(79)
West	6.5900	21.5869	0.6000	0.8500	0.7700	50.2782	(80)

Solar gains	250.8732	404.5637	603.7402	842.4767	971.4477	1051.8348	1002.4995	903.0625	744.3031	503.2693	314.9008	207.8455	(83)
Total gains	997.1376	1148.5382	1325.0995	1520.7590	1607.0139	1648.4491	1575.7198	1479.8347	1342.6705	1140.6896	999.8446	934.4316	(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	15.0646	15.1551	15.2468	15.5285	15.5285	15.9208	15.8209	15.9208	15.9208	15.6248	15.7222	15.3396	
alpha	2.0043	2.0103	2.0165	2.0352	2.0352	2.0614	2.0547	2.0614	2.0614	2.0417	2.0481	2.0226	
util living area	0.9709	0.9603	0.9355	0.8867	0.8017	0.6364	0.4592	0.5038	0.7542	0.9051	0.9571	0.9740	(86)
Living	17.0944	17.3850	18.1291	19.0223	19.8925	20.5965	20.8769	20.8432	20.3265	19.2488	18.0915	17.0905	
Non living	14.7190	15.0840	16.0145	17.1146	18.1233	18.8121	18.9376	18.9423	18.6150	17.4192	15.9922	14.7205	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.0028	17.3850	18.1291	19.0223	19.8925	20.5965	20.8769	20.8432	20.3265	19.2488	18.0915	17.6375	(87)
Th 2	18.8680	18.8770	18.8859	18.9131	18.9131	18.9501	18.9408	18.9501	18.9501	18.9223	18.9315	18.8950	(88)
util rest of house	0.9623	0.9486	0.9144	0.8445	0.7098	0.4360	0.1272	0.1765	0.5999	0.8592	0.9417	0.9664	(89)
MIT 2	17.1972	15.0840	16.0145	17.1146	18.1233	18.8121	18.9376	18.9423	18.6150	17.4192	15.9922	15.4673	(90)
Living area fraction										fLA = Living area / (4) =		0.2454	(91)
MIT	17.6403	15.6487	16.5335	17.5828	18.5575	19.2500	19.4136	19.4088	19.0350	17.8682	16.5074	15.9999	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.6403	15.6487	16.5335	17.5828	18.5575	19.2500	19.4136	19.4088	19.0350	17.8682	16.5074	15.9999	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9556	0.9181	0.8767	0.8051	0.6886	0.4723	0.2158	0.2637	0.6085	0.8229	0.9108	0.9491	(94)
Useful gains	952.8605	1054.4686	1161.6801	1224.3442	1106.6117	778.5376	340.0049	390.2966	816.9504	938.6973	910.6196	886.8300	(95)
Ext temp.	5.2000	5.7000	7.7000	10.2000	13.3000	16.3000	18.3000	18.1000	15.5000	11.9000	8.2000	5.2000	(96)
Heat loss rate W	4139.0145	3290.2604	2903.8701	2382.9476	1696.9556	928.7114	352.7819	412.0405	1112.8753	1914.4875	2648.3471	3528.8228	(97)
Space heating kWh	2370.4986	1502.4521	1296.1894	834.1944	439.2159	0.0000	0.0000	0.0000	0.0000	725.9879	1251.1638	1965.6426	(98a)
Space heating requirement - total per year (kWh/year)												10385.3447	
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	2370.4986	1502.4521	1296.1894	834.1944	439.2159	0.0000	0.0000	0.0000	0.0000	725.9879	1251.1638	1965.6426	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												10385.3447	
Space heating per m2											(98c) / (4) =	86.5445	(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 %)	421.1633	(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	2370.4986	1502.4521	1296.1894	834.1944	439.2159	0.0000	0.0000	0.0000	0.0000	725.9879	1251.1638	1965.6426	(98)
Space heating efficiency (main heating system 1)	421.1633	421.1633	421.1633	421.1633	421.1633	0.0000	0.0000	0.0000	0.0000	421.1633	421.1633	421.1633	(210)
Space heating fuel (main heating system)	562.8455	356.7386	307.7641	198.0691	104.2864	0.0000	0.0000	0.0000	0.0000	172.3768	297.0733	466.7175	(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	329.2487	291.0107	308.2880	268.4536	258.5737	231.1477	226.5580	236.4402	240.0583	269.9417	289.8648	325.2684	(64)
Efficiency of water heater												193.1827	(216)
(217)m	193.1827	193.1827	193.1827	193.1827	193.1827	193.1827	193.1827	193.1827	193.1827	193.1827	193.1827	193.1827	(217)
Fuel for water heating, kWh/month	170.4338	150.6401	159.5836	138.9636	133.8493	119.6524	117.2765	122.3920	124.2649	139.7339	150.0470	168.3734	(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	58.6722	52.9942	58.6722	56.7795	58.6722	56.7795	58.6722	58.6722	56.7795	58.6722	56.7795	58.6722	(231)
Lighting	27.8135	22.3130	20.0904	14.7191	11.3694	9.2889	10.3716	13.4814	17.5110	22.9753	25.9506	28.5865	(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	2465.8715	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	193.1827	
Water heating fuel used	1695.2105	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4980)		
mechanical ventilation fans (SFP = 1.4980)	690.8177	(230a)
Total electricity for the above, kWh/year	690.8177	(231)
Electricity for lighting (calculated in Appendix L)	224.4706	(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	5076.3703	(238)

10a. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2465.8715	21.5100	530.4090	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1695.2105	21.5100	364.6398	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	690.8177	21.5100	148.5949	(249)
Energy for lighting	224.4706	21.5100	48.2836	(250)
Additional standing charges			0.0000	(251)
Total energy cost			1091.9273	(255)

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	2465.8715	0.1551	382.3759	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1695.2105	0.1411	239.1893	(264)
Space and water heating			621.5652	(265)
Pumps, fans and electric keep-hot	690.8177	0.1387	95.8249	(267)
Energy for lighting	224.4706	0.1443	32.3981	(268)
Total CO2, kg/year			749.7882	(272)

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	2465.8715	1.5740	3881.3669	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1695.2105	1.5217	2579.6626	(278)
Space and water heating			6461.0294	(279)
Pumps, fans and electric keep-hot	690.8177	1.5128	1045.0690	(281)
Energy for lighting	224.4706	1.5338	344.3006	(282)

Total Primary energy kWh/year	7850.3990 (286)

Predicted Energy Assessment

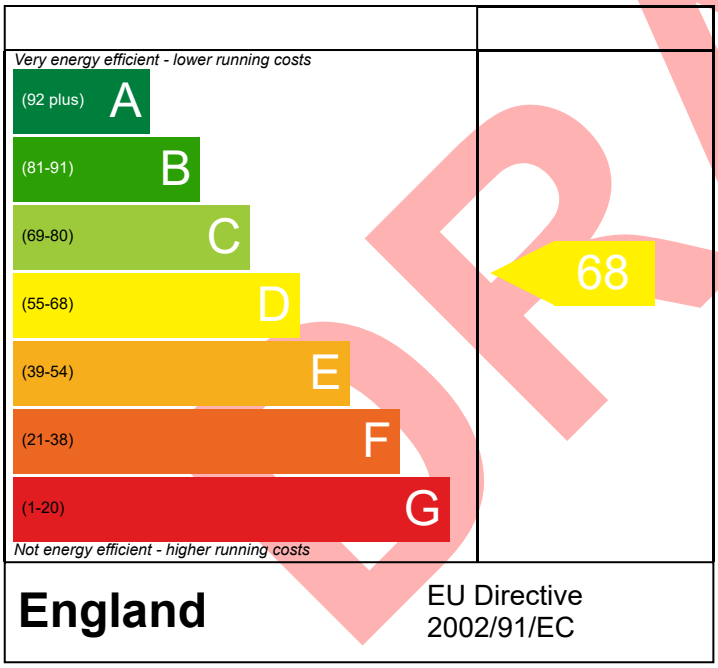
Apartment 1, 26, Rosslyn Hill, London, NW3 1PD

Dwelling type:	Flat, End-Terrace
Date of assessment:	21/12/2023
Produced by:	Anna Sung
Total floor area:	120 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

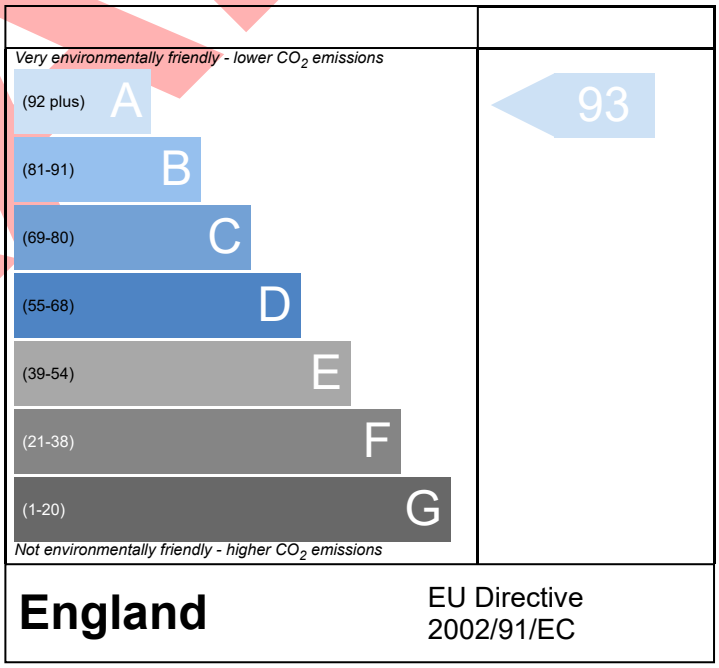
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

Summary for Input Data

elmhurst energy

Property Reference	Apartment 1	**Issued on Date**	21/12/2023
Assessment Reference	231207ac-Unit 1 - Be Green	**Prop Type Ref**	Flat
Property	Apartment 1, 26, Rosslyn Hill, London, NW3 1PD		

SAP Rating	68 D	**DER**		**TER**	
Environmental	93 A	**% DER < TER**			N/A
CO_2 Emissions (t/year)	0.75	**DFEE**		**TFEE**	
Compliance Check	See BREL	**% DFEE < TFEE**			
% DPER < TPER		**DPER**		**TPER**	

Assessor Details	Ms. Anna Sung	**Assessor ID**	BK81-0001
Client			

SUMMARY FOR INPUT DATA FOR: Conversion (As Designed)

Orientation	East
Property Tenture	ND
Transaction Type	5
Terrain Type	Suburban
1.0 Property Type	Flat, End-Terrace
Position of Flat	Mid-floor flat
Which Floor	3
2.0 Number of Storeys	1
3.0 Date Built	2023
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown
6.0 Thermal Mass Parameter	Precise calculation
7.0 Electricity Tariff	Standard
Smart electricity meter fitted	No
Smart gas meter fitted	No

7.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground floor:	38.38 m	120.00 m²	3.15 m

8.0 Living Area 29.45 m²

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
External Wall Existing	Solid Wall	Solid wall : plasterboard on dabs, insulation, any outside structure	1.55	9.00	120.90	95.50	0.00	None	25.40	Enter Gross Area

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)	Shelter Res	Shelter
Party Wall 1	Solid Wall	Single plasterboard on dabs both sides, lightweight aggregate blocks, cavity or cavity fill	0.00	110.00	36.22		None

10.1 Party Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Ceiling 1	Timber I-joists, carpeted	20.00	120.00

11.1 Party Floors

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Lowest occupied	Concrete floor slab, carpeted	100.00	120.00

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Windows	Manufacturer	Window	Double Low-E Soft 0.05			0.60		0.85	1.40

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch

Living Room	Windows	External Wall Existing	South West	6.78
M Bedroom	Windows	External Wall Existing	West	1.72
M Bedroom + Ensuite	Windows	External Wall Existing	South West	4.52
Bedroom + Ensuite	Windows	External Wall Existing	West	4.87
Kitchen	Windows	External Wall Existing	East	3.85
Hallway + WC	Windows	External Wall Existing	North	3.66

14.0 Conservatory None

15.0 Draught Proofing 100 %

16.0 Draught Lobby Yes

17.0 Thermal Bridging Calculate Bridges

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E1 Steel lintel with perforated steel base plate	Table K1 - Default	13.95	1.00	1.00	Yes
E3 Sill	Table K1 - Default	13.95	0.10	0.10	Yes
E4 Jamb	Table K1 - Default	43.76	0.10	0.10	Yes
E7 Party floor between dwellings (in blocks of flats)	Table K1 - Default	70.81	0.28	0.28	No
E15 Flat roof with parapet	Table K1 - Default	7.08	0.30	0.30	No
E16 Corner (normal)	Table K1 - Default	3.15	0.18	0.18	No
E18 Party wall between dwellings	Table K1 - Default	6.29	0.24	0.24	No
E24 Eaves (insulation at ceiling level - inverted)	Table K1 - Default	13.89	0.15	0.15	No
E25 Staggered party wall between dwellings	Table K1 - Default	3.15	0.24	0.24	No
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Table K1 - Default	49.76	0.00	0.00	No

Y-value 0.39 W/m²K

18.0 Pressure Testing No

Test Method Blower Door

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Balanced mechanical ventilation with heat recovery
MV Reference Number	500140
Configuration	3
Manufacturer SFP	1.07
Duct Type	Rigid
MVHR Efficiency	88.00
Wet Rooms	3
SFP from Installer Commissioning Certificate	No
MVHR System Location	Inside heated envelope (installed exclusively)
Duct Installation Specification	Level 1

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System No

22.0 Lighting

No Fixed Lighting No

Name	Efficacy	Power	Capacity	Count
LED	100.00	25	2500	15

24.0 Main Heating 1 Database

Description	aroTHERM plus 12kW	
Percentage of Heat	100.00	%
Database Ref. No.	104457	
Fuel Type	Electricity	
In Winter	423.52	
In Summer	193.04	
Model Name	aroTHERM plus 12kW + AI	

Summary for Input Data

Manufacturer	Vaillant Group UK Ltd
System Type	Heat Pump
Controls SAP Code	2207
Is MHS Pumped	Pump in heated space
Heating Pump Age	2013 or later
Heat Emitter	Underfloor
Underfloor Heating	Yes - Pipes in Wood
Flow Temperature	Enter value
Flow Temperature Value	35.00

25.0 Main Heating 2 — None

26.0 Heat Networks — None

	Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power Ratio	Electrical	Fuel Factor	Efficiency type
Heat source 1										
Heat source 2										
Heat source 3										
Heat source 4										
Heat source 5										

28.0 Water Heating

Water Heating	Main Heating 1
SAP Code	901
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	No
Cold Water Source	From mains
Bath Count	1
Immersion Only Heating Hot Water	No

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To

28.3 Waste Water Heat Recovery System

29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	250.00	L
Loss	1.40	kWh/day
Pipes insulation	Fully insulated primary pipework	
In Airing Cupboard	No	

31.0 Thermal Store — None

34.0 Small-scale Hydro — None

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

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

Ratings after improvement

Summary for Input Data

	Typical Cost	Typical savings per year	SAP rating	Environmental Impact
			0	0
			0	0
			0	0

Thermal Bridging

Property Reference	Apartment 1	**Issued on Date**	21/12/2023
Assessment Reference	231207ac-Unit 1 - Be Green	**Prop Type Ref**	End-Terrace Flat
Property	Apartment 1, 26, Rosslyn Hill, London, NW3 1PD		

SAP Rating	68 D	**DER**		**TER**	
Environmental	93 A	**% DER < TER**			N/A
CO_2 Emissions (t/year)	0.75	**DFEE**		**TFEE**	
Compliance Check	See BREL	**% DFEE < TFEE**			
% DPER < TPER		**DPER**		**TPER**	

Assessor Details	Ms. Anna Sung	**Assessor ID**	BK81-0001
Client			

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E1 Steel lintel with perforated steel base plate	Table K1 - Default	1.000	13.95	13.95	
External wall	E3 Sill	Table K1 - Default	0.100	13.95	1.40	
External wall	E4 Jamb	Table K1 - Default	0.100	43.76	4.38	
External wall	E7 Party floor between dwellings (in blocks of flats)	Table K1 - Default	0.280	70.81	19.83	
External wall	E15 Flat roof with parapet	Table K1 - Default	0.300	7.08	2.12	
External wall	E16 Corner (normal)	Table K1 - Default	0.180	3.15	0.57	
External wall	E18 Party wall between dwellings	Table K1 - Default	0.240	6.29	1.51	
External wall	E24 Eaves (insulation at ceiling level - inverted)	Table K1 - Default	0.150	13.89	2.08	
External wall	E25 Staggered party wall between dwellings	Table K1 - Default	0.240	3.15	0.76	
Party wall	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Table K1 - Default	0.000	49.76	0.00	

Total: 225.79 W/mK:

Y-Value: 0.39 W/m²K:

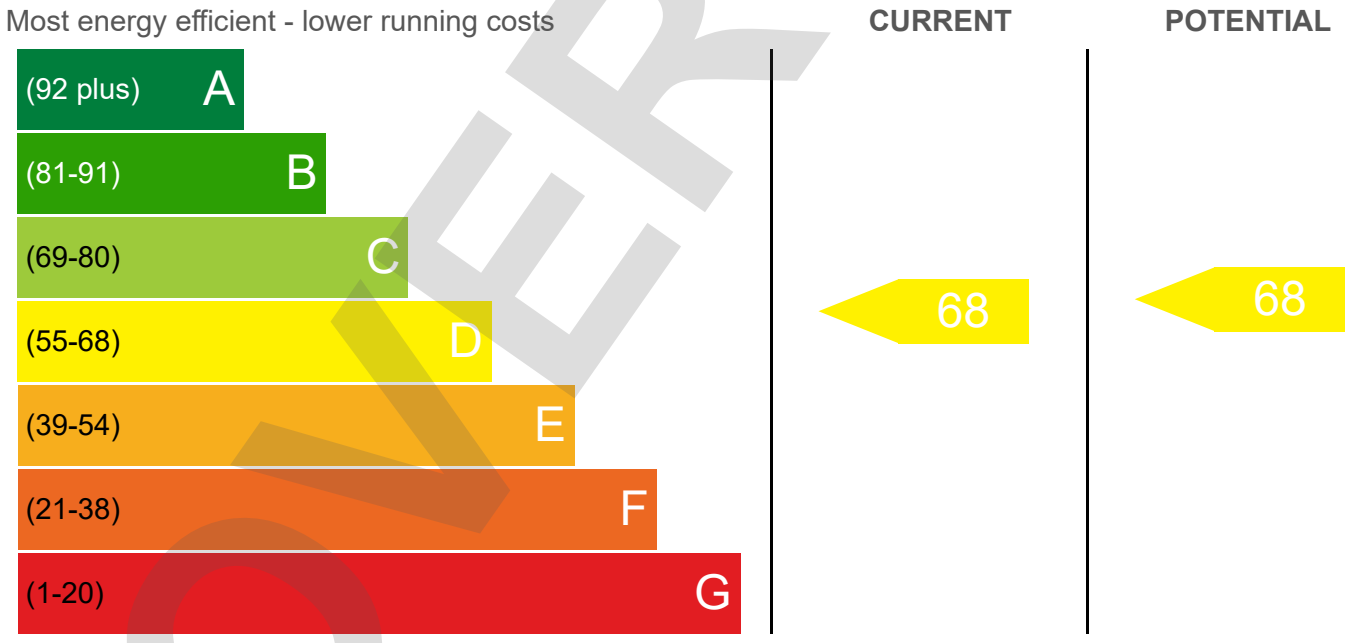
Overview Report

Dwelling Address	Apartment 1, 26, Rosslyn Hill, London, NW3 1PD
Report Date	21/12/2023
Property Type	Flat, End-Terrace
Floor Area [m^2]	120

This document is not an Energy Performance Certificate (EPC) as required by the Energy Performance of Buildings Regulations

Energy Rating

The current energy rating represents the overall energy efficiency of the dwelling. The potential energy rating is the overall energy rating of the dwelling after all of the recommend measures provided on the next page have been installed. A higher score represents a more energy efficient dwelling with lower fuel bills.



Overview Report

Breakdown of property's energy performance

Each feature is assessed as one of the following:

Very Poor	Poor	Average	Good	Very Good

Feature	Description	Energy Performance
Walls	Average thermal transmittance 1.55 W/m²K	Poor
Windows	High performance glazing	Good
Main heating	Air source heat pump, underfloor, electric	Very Good
Main heating controls	Time and temperature zone control	Very Good
Secondary heating	None	
Hot water	From main system	Average
Lighting	Excelent lighting efficiency	Very Good
Air tightness	(not tested)	

Primary Energy use

The primary energy use for this property per year is 65 kilowatt hour (kWh) per square metre

Estimated CO_2 emissions of the dwelling

The estimated CO rating provides an indication of the dwelling's impact on the environment in terms of carbon dioxide emissions; the higher the rating the less impact it has on the environment.

The estimated CO emissions for this dwellings is: **0.7** per year

With the recommended measures the potential CO emissions could be: **1** per year

Recommendations

Overview Report

The recommended measures provided below will help to improve the energy efficiency of the dwelling.
To reach the dwelling's potential energy rating all of the recommended measures shown below would need to be installed.
Having these measures installed individually or in any other order may give a different result when compared with the cumulative potential rating.

Recommended measure	Typical Yearly Saving	Potential Rating after measure installed	Cumulative savings (per year)	Cumulative Potential Rating

Estimated energy use and potential savings

Estimated energy cost for this property over a year

£1092

Over a year you could save

£0

The estimated cost and savings show how much the average household would spend in this property for heating, lighting and hot water. It is not based on how energy is used by the people living at the property.

Contacting the assessor and the accreditation scheme

Assessor contact details	
Assessor name	Ms. Anna Sung
Assessor's accreditation number	
Email Address	

Accreditation scheme contact details	
Accreditation scheme	
Telephone	
Email Address	

Overview Report

Assessment details	
Related party disclosure	
Date of assessment	19/12/2023
Date of certificate	19/12/2023
Type of assessment	SAP, existing dwelling

Full SAP Calculation Printout

Property Reference	Apartment 2	**Issued on Date**	21/12/2023
Assessment Reference	231207ac Unit 2 - Be Green	**Prop Type Ref**	Flat
Property	Apartment 2, 26, Rosslyn Hill, London, NW3 1PD		

SAP Rating	69 C	**DER**		**TER**	
Environmental	94 A	**% DER < TER**			N/A
CO_2 Emissions (t/year)	0.61	**DFEE**		**TFEE**	
Compliance Check	See BREL	**% DFEE < TFEE**			
% DPER < TPER		**DPER**		**TPER**	

Assessor Details	Ms. Anna Sung	**Assessor ID**	BK81-0001
Client			

SAP 10 WORKSHEET FOR Conversion (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	93.1700	(1b)	x 3.1500	(2b) =	293.4855	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.1700					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		293.4855	(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		No
Pressure Test Method		Blower Door
Measured/design AP50		15.0000 (17)
Infiltration rate		0.7500 (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) =	0.6375 (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	0.8128	0.7969	0.7809	0.7013	0.6853	0.6056	0.6056	0.5897	0.6375	0.6853	0.7172	0.7491	(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	0.9168	0.9009	0.8849	0.8053	0.7893	0.7096	0.7096	0.6937	0.7415	0.7893	0.8212	0.8531	(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 = 1.40)			15.7200	1.3258	20.8409			(27)
External Wall 1	66.1500	15.7200	50.4300	1.5500	78.1665	0.0000	0.0000	(29a)
Total net area of external elements Aum(A, m2)			66.1500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		99.0074			(33)
Party Wall 1			38.3900	0.0000	0.0000	0.0000	0.0000	(32)
Party Floor 1			93.1700			80.0000	7453.6000	(32d)
Party Ceiling 1			93.1700			100.0000	9317.0000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 16770.6000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	180.0000 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E1 Steel lintel with perforated steel base plate	11.8200	1.0000	11.8200
E3 Sill	11.8200	0.1000	1.1820
E4 Jamb	29.5100	0.1000	2.9510

E7 Party floor between dwellings (in blocks of flats)	41.8800	0.2800	11.7264	
E15 Flat roof with parapet	8.3400	0.3000	2.5020	
E16 Corner (normal)	3.1500	0.1800	0.5670	
E18 Party wall between dwellings	3.1500	0.2400	0.7560	
E24 Eaves (insulation at ceiling level - inverted)	17.6100	0.1500	2.6415	
E25 Staggered party wall between dwellings	6.2900	0.2400	1.5096	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	61.1600	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 35.6555 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 134.6629 (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	88.7935	87.2499	85.7064	77.9886	76.4451	68.7273	68.7273	67.1838	71.8144	76.4451	79.5322	82.6193	(38)
Heat transfer coeff	223.4564	221.9128	220.3693	212.6515	211.1080	203.3902	203.3902	201.8467	206.4773	211.1080	214.1951	217.2822	(39)

Average = Sum(39)m / 12 = 212.2657

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.3984	2.3818	2.3652	2.2824	2.2658	2.1830	2.1830	2.1664	2.2161	2.2658	2.2990	2.3321	(40)
HLP (average)												2.2783	
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 2.6667 (42)

Hot water usage for mixer showers

94.7802	93.3559	91.2803	87.3091	84.3784	81.1101	79.2525	81.3123	83.5703	87.0794	91.1360	94.4171	(42a)

Hot water usage for baths

31.3325	30.8671	30.2119	29.0036	28.0989	27.0957	26.5539	27.2046	27.9131	28.9865	30.2196	31.2265	(42b)

Hot water usage for other uses

44.1467	42.5414	40.9361	39.3307	37.7254	36.1200	36.1200	37.7254	39.3307	40.9361	42.5414	44.1467	(42c)

Average daily hot water use (litres/day) 156.5677 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	170.2594	166.7644	162.4282	155.6434	150.2027	144.3259	141.9264	146.2423	150.8141	157.0020	163.8970	169.7904	(44)
Energy conte	269.6493	237.4703	249.6461	213.0681	202.2017	177.4656	171.6477	181.0785	185.9689	213.0502	233.5013	265.8507	(45)

Energy content (annual) Total = Sum(45)m = 2600.5984

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

40.4474	35.6205	37.4469	31.9602	30.3303	26.6198	25.7471	27.1618	27.8953	31.9575	35.0252	39.8776	(46)

Water storage loss:

Store volume 250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.4000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.7560 (55)

Total storage loss

23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(56)

If cylinder contains dedicated solar storage

23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(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

316.3477	279.6495	296.3445	258.2601	248.9001	222.6576	218.3461	227.7769	231.1609	259.7486	278.6933	312.5491	(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

316.3477	279.6495	296.3445	258.2601	248.9001	222.6576	218.3461	227.7769	231.1609	259.7486	278.6933	312.5491	(64)

Total per year (kWh/year) = Sum(64)m = 3150.4344 (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

127.0171	112.7022	120.3661	106.9987	104.5908	95.1609	94.4316	97.5673	97.9883	108.1979	113.7928	125.7541	(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	160.0003	160.0003	160.0003	160.0003	160.0003	160.0003	160.0003	160.0003	160.0003	160.0003	160.0003	160.0003	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.1991	25.9344	21.0912	15.9674	11.9358	10.0767	10.8883	14.1530	18.9961	24.1199	28.1515	30.0106	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.3587	369.1500	359.5961	339.2570	313.5825	289.4521	273.3315	269.5402	279.0941	299.4332	325.1077	349.2381	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6667	53.6667	53.6667	53.6667	53.6667	53.6667	53.6667	53.6667	53.6667	53.6667	53.6667	53.6667	(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)	-106.6669	-106.6669	-106.6669	-106.6669	-106.6669	-106.6669	-106.6669	-106.6669	-106.6669	-106.6669	-106.6669	-106.6669	(71)
Water heating gains (Table 5)	170.7219	167.7117	161.7823	148.6093	140.5790	132.1679	126.9242	131.1389	136.0948	145.4273	158.0455	169.0243	(72)
Total internal gains	672.2799	669.7962	649.4698	610.8339	573.0975	538.6969	518.1440	521.8322	541.1851	575.9806	618.3049	655.2732	(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	0.9600	19.6403	0.6000	0.8500	0.7700	6.6638	(76)
South	2.4000	46.7521	0.6000	0.8500	0.7700	39.6566	(78)
Southwest	12.3600	36.7938	0.6000	0.8500	0.7700	160.7300	(79)

Solar gains	207.0504	351.7657	478.8008	588.9635	655.6947	649.1765	626.6162	577.1165	517.0050	388.1080	247.8330	177.2983	(83)
Total gains	879.3303	1021.5619	1128.2706	1199.7974	1228.7921	1187.8734	1144.7603	1098.9487	1058.1901	964.0886	866.1380	832.5715	(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	20.8475	20.9925	21.1395	21.9067	22.0669	22.9042	22.9042	23.0794	22.5618	22.0669	21.7489	21.4399	
alpha	2.3898	2.3995	2.4093	2.4604	2.4711	2.5269	2.5269	2.5386	2.5041	2.4711	2.4499	2.4293	
util living area	0.9757	0.9641	0.9458	0.9121	0.8537	0.7484	0.6240	0.6547	0.8113	0.9221	0.9651	0.9786	(86)
Living	17.7134	18.0314	18.5513	19.2725	19.9287	20.5089	20.7850	20.7505	20.3304	19.4691	18.5061	17.7177	
Non living	15.4838	15.8896	16.5486	17.4693	18.2603	18.9203	19.1470	19.1366	18.7412	17.7325	16.5206	15.5080	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.3187	18.0314	18.5513	19.2725	19.9287	20.5089	20.7850	20.7505	20.3304	19.4691	18.5061	18.1768	(87)
Th 2	19.0810	19.0909	19.1010	19.1517	19.1620	19.2141	19.2141	19.2247	19.1931	19.1620	19.1415	19.1211	(88)
util rest of house	0.9686	0.9536	0.9289	0.8816	0.7939	0.6280	0.4261	0.4665	0.7124	0.8887	0.9531	0.9724	(89)
MIT 2	17.6469	15.8896	16.5486	17.4693	18.2603	18.9203	19.1470	19.1366	18.7412	17.7325	16.5206	16.1591	(90)
Living area fraction									fLA = Living area / (4) =			0.4647	(91)
MIT	18.4238	16.8850	17.4793	18.3073	19.0357	19.6586	19.9083	19.8867	19.4798	18.5396	17.4434	17.0968	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4238	16.8850	17.4793	18.3073	19.0357	19.6586	19.9083	19.8867	19.4798	18.5396	17.4434	17.0968	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9655	0.9355	0.9083	0.8628	0.7888	0.6633	0.5130	0.5468	0.7317	0.8731	0.9365	0.9626	(94)
Useful gains	849.0108	955.6782	1024.7695	1035.2366	969.2319	787.9642	587.3159	600.8717	774.3193	841.7244	811.1450	801.4064	(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	3156.0645	2659.6160	2419.5059	2000.4795	1548.6184	1028.8651	672.8698	703.7695	1110.8000	1676.1047	2215.4953	2802.2446	(97)
Space heating kWh	1716.4480	1145.0462	1037.6839	694.9748	431.0636	0.0000	0.0000	0.0000	0.0000	620.7789	1011.1322	1488.6236	(98a)
Space heating requirement - total per year (kWh/year)												8145.7512	
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	1716.4480	1145.0462	1037.6839	694.9748	431.0636	0.0000	0.0000	0.0000	0.0000	620.7789	1011.1322	1488.6236	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8145.7512	
Space heating per m2										(98c) / (4) =		87.4289	(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 %) 402.5638 (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	1716.4480	1145.0462	1037.6839	694.9748	431.0636	0.0000	0.0000	0.0000	0.0000	620.7789	1011.1322	1488.6236	(98)
Space heating efficiency (main heating system 1)	402.5638	402.5638	402.5638	402.5638	402.5638	0.0000	0.0000	0.0000	0.0000	402.5638	402.5638	402.5638	(210)
Space heating fuel (main heating system)	426.3792	284.4385	257.7688	172.6372	107.0796	0.0000	0.0000	0.0000	0.0000	154.2064	251.1732	369.7858	(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	316.3477	279.6495	296.3445	258.2601	248.9001	222.6576	218.3461	227.7769	231.1609	259.7486	278.6933	312.5491	(64)
Efficiency of water heater												184.9763	(216)
(217)m	184.9763	184.9763	184.9763	184.9763	184.9763	184.9763	184.9763	184.9763	184.9763	184.9763	184.9763	184.9763	(217)
Fuel for water heating, kWh/month	171.0206	151.1812	160.2067	139.6179	134.5578	120.3708	118.0400	123.1384	124.9678	140.4226	150.6643	168.9671	(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	45.5541	41.1456	45.5541	44.0846	45.5541	44.0846	45.5541	45.5541	44.0846	45.5541	44.0846	45.5541	(231)
Lighting	25.5578	20.5034	18.4610	13.5253	10.4474	8.5356	9.5304	12.3880	16.0908	21.1120	23.8460	26.2681	(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 2023.4686 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 184.9763

Water heating fuel used 1703.1553 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4980)

mechanical ventilation fans (SFP = 1.4980)	536.3624	(230a)
Total electricity for the above, kWh/year	536.3624	(231)
Electricity for lighting (calculated in Appendix L)	206.2659	(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	4469.2522	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2023.4686	16.4900	333.6700	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1703.1553	16.4900	280.8503	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	536.3624	16.4900	88.4462	(249)
Energy for lighting	206.2659	16.4900	34.0133	(250)
Additional standing charges			0.0000	(251)
Total energy cost			736.9797	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.9202	(257)
SAP value		68.8737	
SAP rating (Section 12)		69	(258)
SAP band		C	

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	2023.4686	0.1544	312.4445	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1703.1553	0.1411	240.2779	(264)
Space and water heating			552.7224	(265)
Pumps, fans and electric keep-hot	536.3624	0.1387	74.4001	(267)
Energy for lighting	206.2659	0.1443	29.7705	(268)
Total CO2, kg/year			656.8930	(272)
CO2 emissions per m2			7.0500	(273)
EI value			93.6293	
EI rating			94	(274)
EI band			A	

SAP 10 WORKSHEET FOR Conversion (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		93.1700 (1b)	x	3.1500 (2b)	=	293.4855	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.1700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	293.4855	(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		No	
Pressure Test Method		Blower Door	
Measured/design AP50		15.0000	(17)
Infiltration rate		0.7500	(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) =	0.6375	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.5000	4.4000	4.1000	4.1000	3.7000	3.8000	3.7000	3.7000	4.0000	3.9000	4.3000	(22)
Wind factor	1.1500	1.1250	1.1000	1.0250	1.0250	0.9250	0.9500	0.9250	0.9250	1.0000	0.9750	1.0750	(22a)
Adj infilt rate	0.7331	0.7172	0.7013	0.6534	0.6534	0.5897	0.6056	0.5897	0.5897	0.6375	0.6216	0.6853	(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	0.8371	0.8212	0.8053	0.7574	0.7574	0.6937	0.7096	0.6937	0.6937	0.7415	0.7256	0.7893	(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 = 1.40)			15.7200	1.3258	20.8409			(27)
External Wall 1	66.1500	15.7200	50.4300	1.5500	78.1665	0.0000	0.0000	(29a)
Total net area of external elements Aum(A, m2)			66.1500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	99.0074			(33)
Party Wall 1			38.3900	0.0000	0.0000	0.0000	0.0000	(32)
Party Floor 1			93.1700			80.0000	7453.6000	(32d)
Party Ceiling 1			93.1700			80.0000	7453.6000	(32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14907.2000 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 160.0000 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E1 Steel lintel with perforated steel base plate	11.8200	1.0000	11.8200
E3 Sill	11.8200	0.1000	1.1820
E4 Jamb	29.5100	0.1000	2.9510
E7 Party floor between dwellings (in blocks of flats)	41.8800	0.2800	11.7264
E15 Flat roof with parapet	8.3400	0.3000	2.5020
E16 Corner (normal)	3.1500	0.1800	0.5670
E18 Party wall between dwellings	3.1500	0.2400	0.7560
E24 Eaves (insulation at ceiling level - inverted)	17.6100	0.1500	2.6415
E25 Staggered party wall between dwellings	6.2900	0.2400	1.5096
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	61.1600	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 35.6555 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 134.6629 (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	81.0757	79.5322	77.9886	73.3580	73.3580	67.1838	68.7273	67.1838	67.1838	71.8144	70.2709	76.4451	(38)
Heat transfer coeff	215.7386	214.1951	212.6515	208.0209	208.0209	201.8467	203.3902	201.8467	201.8467	206.4773	204.9338	211.1080	(39)

Average = Sum(39)m / 12 = 207.5064

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.3155	2.2990	2.2824	2.2327	2.2327	2.1664	2.1830	2.1664	2.1664	2.2161	2.1996	2.2658	(40)
HLP (average)												2.2272	
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 2.6667 (42)

Hot water usage for mixer showers

94.7802	93.3559	91.2803	87.3091	84.3784	81.1101	79.2525	81.3123	83.5703	87.0794	91.1360	94.4171	(42a)

Hot water usage for baths

31.3325	30.8671	30.2119	29.0036	28.0989	27.0957	26.5539	27.2046	27.9131	28.9865	30.2196	31.2265	(42b)

Hot water usage for other uses

44.1467	42.5414	40.9361	39.3307	37.7254	36.1200	36.1200	37.7254	39.3307	40.9361	42.5414	44.1467	(42c)

Average daily hot water use (litres/day) 156.5677 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	170.2594	166.7644	162.4282	155.6434	150.2027	144.3259	141.9264	146.2423	150.8141	157.0020	163.8970	169.7904	(44)
Energy conte	269.6493	237.4703	249.6461	213.0681	202.2017	177.4656	171.6477	181.0785	185.9689	213.0502	233.5013	265.8507	(45)
Energy content (annual)										Total = Sum(45)m =		2600.5984	
Distribution loss (46)m = 0.15 x (45)m	40.4474	35.6205	37.4469	31.9602	30.3303	26.6198	25.7471	27.1618	27.8953	31.9575	35.0252	39.8776	(46)

Water storage loss:

Store volume 250.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.4000 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.7560 (55)

Total storage loss

23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(56)

If cylinder contains dedicated solar storage

23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(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

316.3477	279.6495	296.3445	258.2601	248.9001	222.6576	218.3461	227.7769	231.1609	259.7486	278.6933	312.5491	(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

316.3477	279.6495	296.3445	258.2601	248.9001	222.6576	218.3461	227.7769	231.1609	259.7486	278.6933	312.5491	(64)

Total per year (kWh/year) = Sum(64)m = 3150.4344 (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

127.0171	112.7022	120.3661	106.9987	104.5908	95.1609	94.4316	97.5673	97.9883	108.1979	113.7928	125.7541	(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	160.0003	160.0003	160.0003	160.0003	160.0003	160.0003	160.0003	160.0003	160.0003	160.0003	160.0003	160.0003	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.1991	25.9344	21.0912	15.9674	11.9358	10.0767	10.8883	14.1530	18.9961	24.1199	28.1515	30.0106	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.3587	369.1500	359.5961	339.2570	313.5825	289.4521	273.3315	269.5402	279.0941	299.4332	325.1077	349.2381	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6667	53.6667	53.6667	53.6667	53.6667	53.6667	53.6667	53.6667	53.6667	53.6667	53.6667	53.6667	(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)	-106.6669	-106.6669	-106.6669	-106.6669	-106.6669	-106.6669	-106.6669	-106.6669	-106.6669	-106.6669	-106.6669	-106.6669	(71)
Water heating gains (Table 5)	170.7219	167.7117	161.7823	148.6093	140.5790	132.1679	126.9242	131.1389	136.0948	145.4273	158.0455	169.0243	(72)
Total internal gains	672.2799	669.7962	649.4698	610.8339	573.0975	538.6969	518.1440	521.8322	541.1851	575.9806	618.3049	655.2732	(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	0.9600	21.5869	0.6000	0.8500	0.7700	7.3243	(76)
South	2.4000	49.2853	0.6000	0.8500	0.7700	41.8054	(78)
Southwest	12.3600	39.1209	0.6000	0.8500	0.7700	170.8956	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	220.0253	335.3738	458.6747	584.9596	636.9984	674.9955	649.1765	610.5415	544.5283	404.1573	271.8937	185.0344	(83)
Total gains	892.3052	1005.1700	1108.1445	1195.7935	1210.0958	1213.6924	1167.3206	1132.3737	1085.7135	980.1379	890.1986	840.3076	(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	19.1940	19.3323	19.4726	19.9061	19.9061	20.5150	20.3593	20.5150	20.5150	20.0549	20.2060	19.6150	
alpha	2.2796	2.2888	2.2982	2.3271	2.3271	2.3677	2.3573	2.3677	2.3677	2.3370	2.3471	2.3077	
util living area	0.9648	0.9527	0.9260	0.8771	0.7901	0.6127	0.4247	0.4582	0.7108	0.8820	0.9463	0.9686	(86)
Living	17.8402	18.1138	18.7504	19.4899	20.1860	20.7380	20.9320	20.9151	20.5677	19.7168	18.7400	17.8419	
Non living	15.7053	16.0531	16.8550	17.7756	18.5799	19.1257	19.2108	19.2180	19.0010	18.0724	16.8773	15.7215	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.3836	18.1138	18.7504	19.4899	20.1860	20.7380	20.9320	20.9151	20.5677	19.7168	18.7400	18.2836	(87)
Th 2	19.1313	19.1415	19.1517	19.1827	19.1827	19.2247	19.2141	19.2247	19.2247	19.1931	19.2036	19.1620	(88)
util rest of house	0.9550	0.9396	0.9036	0.8353	0.7033	0.4367	0.1575	0.1969	0.5668	0.8319	0.9285	0.9599	(89)
MIT 2	17.7651	16.0531	16.8550	17.7756	18.5799	19.1257	19.2108	19.2180	19.0010	18.0724	16.8773	16.3415	(90)
Living area fraction										fLA = Living area / (4) =		0.4647	(91)
MIT	18.5173	17.0108	17.7359	18.5723	19.3263	19.8750	20.0107	20.0067	19.7291	18.8366	17.7430	17.2441	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5173	17.0108	17.7359	18.5723	19.3263	19.8750	20.0107	20.0067	19.7291	18.8366	17.7430	17.2441	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9510	0.9173	0.8795	0.8170	0.7117	0.5094	0.2858	0.3220	0.6149	0.8188	0.9075	0.9466	(94)
Useful gains	848.5695	922.0415	974.6314	976.9228	861.2112	618.2352	333.6111	364.5922	667.6214	802.5452	807.8176	795.4462	(95)
Ext temp.	5.2000	5.7000	7.7000	10.2000	13.3000	16.3000	18.3000	18.1000	15.5000	11.9000	8.2000	5.2000	(96)
Heat loss rate W	2873.0467	2422.7151	2134.1452	1741.6196	1253.6008	721.6081	347.9371	384.8628	853.6316	1432.2597	1955.6784	2542.5991	(97)
Space heating kWh	1506.2110	1008.4527	862.6782	550.5817	291.9379	0.0000	0.0000	0.0000	0.0000	468.5076	826.4597	1299.8818	(98a)
Space heating requirement - total per year (kWh/year)												6814.7105	
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	1506.2110	1008.4527	862.6782	550.5817	291.9379	0.0000	0.0000	0.0000	0.0000	468.5076	826.4597	1299.8818	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6814.7105	
Space heating per m2											(98c) / (4) =	73.1428	(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 %)	402.0187	(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	1506.2110	1008.4527	862.6782	550.5817	291.9379	0.0000	0.0000	0.0000	0.0000	468.5076	826.4597	1299.8818	(98)
Space heating efficiency (main heating system 1)	402.0187	402.0187	402.0187	402.0187	402.0187	0.0000	0.0000	0.0000	0.0000	402.0187	402.0187	402.0187	(210)
Space heating fuel (main heating system)	374.6619	250.8472	214.5866	136.9542	72.6180	0.0000	0.0000	0.0000	0.0000	116.5387	205.5774	323.3386	(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

	316.3477	279.6495	296.3445	258.2601	248.9001	222.6576	218.3461	227.7769	231.1609	259.7486	278.6933	312.5491 (64)
Efficiency of water heater												184.9886 (216)
(217)m	184.9886	184.9886	184.9886	184.9886	184.9886	184.9886	184.9886	184.9886	184.9886	184.9886	184.9886	184.9886 (217)
Fuel for water heating, kWh/month												
	171.0093	151.1712	160.1961	139.6086	134.5489	120.3628	118.0321	123.1302	124.9595	140.4133	150.6543	168.9558 (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	45.5541	41.1456	45.5541	44.0846	45.5541	44.0846	45.5541	45.5541	44.0846	45.5541	44.0846	45.5541 (231)
Lighting	25.5578	20.5034	18.4610	13.5253	10.4474	8.5356	9.5304	12.3880	16.0908	21.1120	23.8460	26.2681 (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	1695.1227 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	184.9886
Water heating fuel used	1703.0420 (219)
Space cooling fuel	0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4980)

mechanical ventilation fans (SFP = 1.4980)	536.3624 (230a)
Total electricity for the above, kWh/year	536.3624 (231)
Electricity for lighting (calculated in Appendix L)	206.2659 (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	4140.7931 (238)

10a. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1695.1227	21.5100	364.6209	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1703.0420	21.5100	366.3243	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	536.3624	21.5100	115.3715	(249)
Energy for lighting	206.2659	21.5100	44.3678	(250)
Additional standing charges			0.0000	(251)
Total energy cost			890.6846	(255)

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	1695.1227	0.1550	262.8029	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1703.0420	0.1411	240.2619	(264)
Space and water heating			503.0648	(265)
Pumps, fans and electric keep-hot	536.3624	0.1387	74.4001	(267)
Energy for lighting	206.2659	0.1443	29.7705	(268)
Total CO2, kg/year			607.2354	(272)

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	1695.1227	1.5739	2668.0018	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1703.0420	1.5217	2591.4588	(278)
Space and water heating			5259.4606	(279)
Pumps, fans and electric keep-hot	536.3624	1.5128	811.4090	(281)
Energy for lighting	206.2659	1.5338	316.3776	(282)
Total Primary energy kWh/year			6387.2472	(286)

SAP 10 EPC IMPROVEMENTS

231207ac Unit 2 - Be Green

Current energy efficiency rating:	C 69
Current environmental impact rating:	A 94

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 69
Potential environmental impact rating: A 94

Fuel prices for cost data on this page from database revision number 533 TEST (30 Nov 2023)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£891	£891	£0
Space heating	£480	£480	£0
Water heating	£366	£366	£0
Lighting	£44	£44	£0
Total cost of fuels	£891	£891	£0
Total cost of uses	£890	£890	£0
Delivered energy	44 kWh/m²	44 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.6 tonnes	0.0 tonnes
CO2 emissions per m²	7 kg/m²	7 kg/m²	0 kg/m²
Primary energy	69 kWh/m²	69 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR Conversion (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	93.1700 (1b)	x	3.1500 (2b)	=	293.4855	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.1700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	293.4855	(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		No	
Pressure Test Method		Blower Door	
Measured/design AP50		15.0000	(17)
Infiltration rate		0.7500	(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) =	0.6375	(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	0.8128	0.7969	0.7809	0.7013	0.6853	0.6056	0.6056	0.5897	0.6375	0.6853	0.7172	0.7491	(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	0.9168	0.9009	0.8849	0.8053	0.7893	0.7096	0.7096	0.6937	0.7415	0.7893	0.8212	0.8531	(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	
Windows (Uw = 1.40)			15.7200	1.3258	20.8409			(27)
External Wall 1	66.1500	15.7200	50.4300	1.5500	78.1665	0.0000	0.0000	(29a)
Total net area of external elements Aum(A, m2)			66.1500					(31)

Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	99.0074				(33)
Party Wall 1	38.3900	0.0000	0.0000	0.0000	0.0000	(32)
Party Floor 1	93.1700			80.0000	7453.6000	(32d)
Party Ceiling 1	93.1700			100.0000	9317.0000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	16770.6000	(34)	
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		180.0000	(35)	
List of Thermal Bridges				
K1 Element	Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate	11.8200	1.0000	11.8200	
E3 Sill	11.8200	0.1000	1.1820	
E4 Jamb	29.5100	0.1000	2.9510	
E7 Party floor between dwellings (in blocks of flats)	41.8800	0.2800	11.7264	
E15 Flat roof with parapet	8.3400	0.3000	2.5020	
E16 Corner (normal)	3.1500	0.1800	0.5670	
E18 Party wall between dwellings	3.1500	0.2400	0.7560	
E24 Eaves (insulation at ceiling level - inverted)	17.6100	0.1500	2.6415	
E25 Staggered party wall between dwellings	6.2900	0.2400	1.5096	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	61.1600	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			35.6555	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =		134.6629	(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	88.7935	87.2499	85.7064	77.9886	76.4451	68.7273	68.7273	67.1838	71.8144	76.4451	79.5322	82.6193	(38)
Heat transfer coeff	223.4564	221.9128	220.3693	212.6515	211.1080	203.3902	203.3902	201.8467	206.4773	211.1080	214.1951	217.2822	(39)
Average = Sum(39)m / 12 =												212.2657	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.3984	2.3818	2.3652	2.2824	2.2658	2.1830	2.1830	2.1664	2.2161	2.2658	2.2990	2.3321	(40)
HLP (average)												2.2783	
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												2.6667	(42)
Hot water usage for mixer showers	94.7802	93.3559	91.2803	87.3091	84.3784	81.1101	79.2525	81.3123	83.5703	87.0794	91.1360	94.4171	(42a)
Hot water usage for baths	31.3325	30.8671	30.2119	29.0036	28.0989	27.0957	26.5539	27.2046	27.9131	28.9865	30.2196	31.2265	(42b)
Hot water usage for other uses	44.1467	42.5414	40.9361	39.3307	37.7254	36.1200	36.1200	37.7254	39.3307	40.9361	42.5414	44.1467	(42c)
Average daily hot water use (litres/day)												156.5677	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	170.2594	166.7644	162.4282	155.6434	150.2027	144.3259	141.9264	146.2423	150.8141	157.0020	163.8970	169.7904	(44)
Energy conte	269.6493	237.4703	249.6461	213.0681	202.2017	177.4656	171.6477	181.0785	185.9689	213.0502	233.5013	265.8507	(45)
Energy content (annual)										Total = Sum(45)m =		2600.5984	
Distribution loss (46)m = 0.15 x (45)m	40.4474	35.6205	37.4469	31.9602	30.3303	26.6198	25.7471	27.1618	27.8953	31.9575	35.0252	39.8776	(46)
Water storage loss:													
Store volume												250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7560	(55)
Total storage loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(56)
If cylinder contains dedicated solar storage	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(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	316.3477	279.6495	296.3445	258.2601	248.9001	222.6576	218.3461	227.7769	231.1609	259.7486	278.6933	312.5491	(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	316.3477	279.6495	296.3445	258.2601	248.9001	222.6576	218.3461	227.7769	231.1609	259.7486	278.6933	312.5491	(64)
									Total per year (kWh/year) = Sum(64)m =			3150.4344	(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	127.0171	112.7022	120.3661	106.9987	104.5908	95.1609	94.4316	97.5673	97.9883	108.1979	113.7928	125.7541	(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	160.0003	160.0003	160.0003	160.0003	160.0003	160.0003	160.0003	160.0003	160.0003	160.0003	160.0003	160.0003	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.1991	25.9344	21.0912	15.9674	11.9358	10.0767	10.8883	14.1530	18.9961	24.1199	28.1515	30.0106	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.3587	369.1500	359.5961	339.2570	313.5825	289.4521	273.3315	269.5402	279.0941	299.4332	325.1077	349.2381	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6667	53.6667	53.6667	53.6667	53.6667	53.6667	53.6667	53.6667	53.6667	53.6667	53.6667	53.6667	(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)	-106.6669	-106.6669	-106.6669	-106.6669	-106.6669	-106.6669	-106.6669	-106.6669	-106.6669	-106.6669	-106.6669	-106.6669	(71)
Water heating gains (Table 5)	170.7219	167.7117	161.7823	148.6093	140.5790	132.1679	126.9242	131.1389	136.0948	145.4273	158.0455	169.0243	(72)
Total internal gains	672.2799	669.7962	649.4698	610.8339	573.0975	538.6969	518.1440	521.8322	541.1851	575.9806	618.3049	655.2732	(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	
East	0.9600	19.6403	0.6000	0.8500	0.7700	6.6638	(76)
South	2.4000	46.7521	0.6000	0.8500	0.7700	39.6566	(78)
Southwest	12.3600	36.7938	0.6000	0.8500	0.7700	160.7300	(79)

Solar gains	207.0504	351.7657	478.8008	588.9635	655.6947	649.1765	626.6162	577.1165	517.0050	388.1080	247.8330	177.2983	(83)
Total gains	879.3303	1021.5619	1128.2706	1199.7974	1228.7921	1187.8734	1144.7603	1098.9487	1058.1901	964.0886	866.1380	832.5715	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.8475	20.9925	21.1395	21.9067	22.0669	22.9042	22.9042	23.0794	22.5618	22.0669	21.7489	21.4399	
alpha	2.3898	2.3995	2.4093	2.4604	2.4711	2.5269	2.5269	2.5386	2.5041	2.4711	2.4499	2.4293	
util living area	0.9757	0.9641	0.9458	0.9121	0.8537	0.7484	0.6240	0.6547	0.8113	0.9221	0.9651	0.9786	(86)
Living	17.7134	18.0314	18.5513	19.2725	19.9287	20.5089	20.7850	20.7505	20.3304	19.4691	18.5061	17.7177	
Non living	15.4838	15.8896	16.5486	17.4693	18.2603	18.9203	19.1470	19.1366	18.7412	17.7325	16.5206	15.5080	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.3187	18.0314	18.5513	19.2725	19.9287	20.5089	20.7850	20.7505	20.3304	19.4691	18.5061	18.1768	(87)
Th 2	19.0810	19.0909	19.1010	19.1517	19.1620	19.2141	19.2141	19.2247	19.1931	19.1620	19.1415	19.1211	(88)
util rest of house	0.9686	0.9536	0.9289	0.8816	0.7939	0.6280	0.4261	0.4665	0.7124	0.8887	0.9531	0.9724	(89)
MIT 2	17.6469	15.8896	16.5486	17.4693	18.2603	18.9203	19.1470	19.1366	18.7412	17.7325	16.5206	16.1591	(90)
Living area fraction										fLA = Living area / (4) =		0.4647	(91)
MIT	18.4238	16.8850	17.4793	18.3073	19.0357	19.6586	19.9083	19.8867	19.4798	18.5396	17.4434	17.0968	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4238	16.8850	17.4793	18.3073	19.0357	19.6586	19.9083	19.8867	19.4798	18.5396	17.4434	17.0968	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9655	0.9355	0.9083	0.8628	0.7888	0.6633	0.5130	0.5468	0.7317	0.8731	0.9365	0.9626	(94)
Useful gains	849.0108	955.6782	1024.7695	1035.2366	969.2319	787.9642	587.3159	600.8717	774.3193	841.7244	811.1450	801.4064	(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	3156.0645	2659.6160	2419.5059	2000.4795	1548.6184	1028.8651	672.8698	703.7695	1110.8000	1676.1047	2215.4953	2802.2446	(97)
Space heating kWh	1716.4480	1145.0462	1037.6839	694.9748	431.0636	0.0000	0.0000	0.0000	0.0000	620.7789	1011.1322	1488.6236	(98a)
Space heating requirement - total per year (kWh/year)												8145.7512	
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	1716.4480	1145.0462	1037.6839	694.9748	431.0636	0.0000	0.0000	0.0000	0.0000	620.7789	1011.1322	1488.6236	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8145.7512	
Space heating per m2										(98c) / (4) =		87.4289	(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 %)	402.5638 (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	1716.4480	1145.0462	1037.6839	694.9748	431.0636	0.0000	0.0000	0.0000	0.0000	620.7789	1011.1322	1488.6236	(98)
Space heating efficiency (main heating system 1)	402.5638	402.5638	402.5638	402.5638	402.5638	0.0000	0.0000	0.0000	0.0000	402.5638	402.5638	402.5638	(210)
Space heating fuel (main heating system)	426.3792	284.4385	257.7688	172.6372	107.0796	0.0000	0.0000	0.0000	0.0000	154.2064	251.1732	369.7858	(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	316.3477	279.6495	296.3445	258.2601	248.9001	222.6576	218.3461	227.7769	231.1609	259.7486	278.6933	312.5491	(64)
Efficiency of water heater												184.9763	(216)
(217)m	184.9763	184.9763	184.9763	184.9763	184.9763	184.9763	184.9763	184.9763	184.9763	184.9763	184.9763	184.9763	(217)
Fuel for water heating, kWh/month	171.0206	151.1812	160.2067	139.6179	134.5578	120.3708	118.0400	123.1384	124.9678	140.4226	150.6643	168.9671	(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	45.5541	41.1456	45.5541	44.0846	45.5541	44.0846	45.5541	45.5541	44.0846	45.5541	44.0846	45.5541	(231)
Lighting	25.5578	20.5034	18.4610	13.5253	10.4474	8.5356	9.5304	12.3880	16.0908	21.1120	23.8460	26.2681	(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	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2023.4686	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	184.9763	
Water heating fuel used	1703.1553	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4980)		
mechanical ventilation fans (SFP = 1.4980)	536.3624	(230a)
Total electricity for the above, kWh/year	536.3624	(231)
Electricity for lighting (calculated in Appendix L)	206.2659	(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	4469.2522	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2023.4686	16.4900	333.6700	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1703.1553	16.4900	280.8503	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	536.3624	16.4900	88.4462	(249)
Energy for lighting	206.2659	16.4900	34.0133	(250)
Additional standing charges			0.0000	(251)
Total energy cost			736.9797	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.9202	(257)
SAP value		68.8737	
SAP rating (Section 12)		69	(258)
SAP band		C	

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	2023.4686	0.1544	312.4445	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1703.1553	0.1411	240.2779	(264)
Space and water heating			552.7224	(265)
Pumps, fans and electric keep-hot	536.3624	0.1387	74.4001	(267)
Energy for lighting	206.2659	0.1443	29.7705	(268)
Total CO2, kg/year			656.8930	(272)
CO2 emissions per m2			7.0500	(273)
EI value			93.6293	
EI rating			94	(274)
EI band			A	

SAP 10 WORKSHEET FOR Conversion (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		93.1700	(1b)	x 3.1500	(2b) =	293.4855	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.1700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		293.4855	(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 No
Pressure Test Method Blower Door
Measured/design AP50 15.0000 (17)
Infiltration rate 0.7500 (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) = 0.6375 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.5000	4.4000	4.1000	4.1000	3.7000	3.8000	3.7000	3.7000	4.0000	3.9000	4.3000	(22)
Wind factor	1.1500	1.1250	1.1000	1.0250	1.0250	0.9250	0.9500	0.9250	0.9250	1.0000	0.9750	1.0750	(22a)
Adj infilt rate	0.7331	0.7172	0.7013	0.6534	0.6534	0.5897	0.6056	0.5897	0.5897	0.6375	0.6216	0.6853	(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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.8371	0.8212	0.8053	0.7574	0.7574	0.6937	0.7096	0.6937	0.6937	0.7415	0.7256	0.7893	(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	
Windows (Uw = 1.40)			15.7200	1.3258	20.8409			(27)
External Wall 1	66.1500	15.7200	50.4300	1.5500	78.1665	0.0000	0.0000	(29a)
Total net area of external elements Aum(A, m2)			66.1500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		99.0074			(33)
Party Wall 1			38.3900	0.0000	0.0000	0.0000	0.0000	(32)
Party Floor 1			93.1700			80.0000	7453.6000	(32d)
Party Ceiling 1			93.1700			80.0000	7453.6000	(32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14907.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 160.0000 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	11.8200	1.0000	11.8200
E3 Sill	11.8200	0.1000	1.1820
E4 Jamb	29.5100	0.1000	2.9510
E7 Party floor between dwellings (in blocks of flats)	41.8800	0.2800	11.7264
E15 Flat roof with parapet	8.3400	0.3000	2.5020
E16 Corner (normal)	3.1500	0.1800	0.5670
E18 Party wall between dwellings	3.1500	0.2400	0.7560
E24 Eaves (insulation at ceiling level - inverted)	17.6100	0.1500	2.6415
E25 Staggered party wall between dwellings	6.2900	0.2400	1.5096
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	61.1600	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 35.6555 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 134.6629 (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	81.0757	79.5322	77.9886	73.3580	73.3580	67.1838	68.7273	67.1838	67.1838	71.8144	70.2709	76.4451	(38)
Heat transfer coeff	215.7386	214.1951	212.6515	208.0209	208.0209	201.8467	203.3902	201.8467	201.8467	206.4773	204.9338	211.1080	(39)
Average = Sum(39)m / 12 =												207.5064	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.3155	2.2990	2.2824	2.2327	2.2327	2.1664	2.1830	2.1664	2.1664	2.2161	2.1996	2.2658	(40)
HLP (average)												2.2272	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6667 (42)
Hot water usage for mixer showers

94.7802	93.3559	91.2803	87.3091	84.3784	81.1101	79.2525	81.3123	83.5703	87.0794	91.1360	94.4171	(42a)

Hot water usage for baths

31.3325	30.8671	30.2119	29.0036	28.0989	27.0957	26.5539	27.2046	27.9131	28.9865	30.2196	31.2265	(42b)

Hot water usage for other uses

44.1467	42.5414	40.9361	39.3307	37.7254	36.1200	36.1200	37.7254	39.3307	40.9361	42.5414	44.1467	(42c)

Average daily hot water use (litres/day) 156.5677 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	170.2594	166.7644	162.4282	155.6434	150.2027	144.3259	141.9264	146.2423	150.8141	157.0020	163.8970	169.7904	(44)
Energy conte	269.6493	237.4703	249.6461	213.0681	202.2017	177.4656	171.6477	181.0785	185.9689	213.0502	233.5013	265.8507	(45)
Energy content (annual)										Total = Sum(45)m =		2600.5984	
Distribution loss (46)m = 0.15 x (45)m	40.4474	35.6205	37.4469	31.9602	30.3303	26.6198	25.7471	27.1618	27.8953	31.9575	35.0252	39.8776	(46)

Water storage loss:
Store volume 250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.4000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.7560 (55)
Total storage loss

23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(56)

If cylinder contains dedicated solar storage

23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(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

316.3477	279.6495	296.3445	258.2601	248.9001	222.6576	218.3461	227.7769	231.1609	259.7486	278.6933	312.5491	(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

	316.3477	279.6495	296.3445	258.2601	248.9001	222.6576	218.3461	227.7769	231.1609	259.7486	278.6933	312.5491 (64)
										Total per year (kWh/year) = Sum(64)m =		3150.4344 (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												
	127.0171	112.7022	120.3661	106.9987	104.5908	95.1609	94.4316	97.5673	97.9883	108.1979	113.7928	125.7541 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0003	160.0003	160.0003	160.0003	160.0003	160.0003	160.0003	160.0003	160.0003	160.0003	160.0003	160.0003	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	29.1991	25.9344	21.0912	15.9674	11.9358	10.0767	10.8883	14.1530	18.9961	24.1199	28.1515	30.0106	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.3587	369.1500	359.5961	339.2570	313.5825	289.4521	273.3315	269.5402	279.0941	299.4332	325.1077	349.2381	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6667	53.6667	53.6667	53.6667	53.6667	53.6667	53.6667	53.6667	53.6667	53.6667	53.6667	53.6667	(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)													
	-106.6669	-106.6669	-106.6669	-106.6669	-106.6669	-106.6669	-106.6669	-106.6669	-106.6669	-106.6669	-106.6669	-106.6669	(71)
Water heating gains (Table 5)													
	170.7219	167.7117	161.7823	148.6093	140.5790	132.1679	126.9242	131.1389	136.0948	145.4273	158.0455	169.0243	(72)
Total internal gains													
	672.2799	669.7962	649.4698	610.8339	573.0975	538.6969	518.1440	521.8322	541.1851	575.9806	618.3049	655.2732	(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	0.9600	21.5869	0.6000	0.8500	0.7700	7.3243	(76)
South	2.4000	49.2853	0.6000	0.8500	0.7700	41.8054	(78)
Southwest	12.3600	39.1209	0.6000	0.8500	0.7700	170.8956	(79)

Solar gains	220.0253	335.3738	458.6747	584.9596	636.9984	674.9955	649.1765	610.5415	544.5283	404.1573	271.8937	185.0344	(83)
Total gains	892.3052	1005.1700	1108.1445	1195.7935	1210.0958	1213.6924	1167.3206	1132.3737	1085.7135	980.1379	890.1986	840.3076	(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	19.1940	19.3323	19.4726	19.9061	19.9061	20.5150	20.3593	20.5150	20.5150	20.0549	20.2060	19.6150	
alpha	2.2796	2.2888	2.2982	2.3271	2.3271	2.3677	2.3573	2.3677	2.3677	2.3370	2.3471	2.3077	
util living area													
	0.9648	0.9527	0.9260	0.8771	0.7901	0.6127	0.4247	0.4582	0.7108	0.8820	0.9463	0.9686	(86)
Living	17.8402	18.1138	18.7504	19.4899	20.1860	20.7380	20.9320	20.9151	20.5677	19.7168	18.7400	17.8419	
Non living	15.7053	16.0531	16.8550	17.7756	18.5799	19.1257	19.2108	19.2180	19.0010	18.0724	16.8773	15.7215	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.3836	18.1138	18.7504	19.4899	20.1860	20.7380	20.9320	20.9151	20.5677	19.7168	18.7400	18.2836	(87)
Th 2	19.1313	19.1415	19.1517	19.1827	19.1827	19.2247	19.2141	19.2247	19.2247	19.1931	19.2036	19.1620	(88)
util rest of house													
	0.9550	0.9396	0.9036	0.8353	0.7033	0.4367	0.1575	0.1969	0.5668	0.8319	0.9285	0.9599	(89)
MIT 2	17.7651	16.0531	16.8550	17.7756	18.5799	19.1257	19.2108	19.2180	19.0010	18.0724	16.8773	16.3415	(90)
Living area fraction										fLA = Living area / (4) =		0.4647	(91)
MIT	18.5173	17.0108	17.7359	18.5723	19.3263	19.8750	20.0107	20.0067	19.7291	18.8366	17.7430	17.2441	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5173	17.0108	17.7359	18.5723	19.3263	19.8750	20.0107	20.0067	19.7291	18.8366	17.7430	17.2441	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9510	0.9173	0.8795	0.8170	0.7117	0.5094	0.2858	0.3220	0.6149	0.8188	0.9075	0.9466	(94)
Useful gains	848.5695	922.0415	974.6314	976.9228	861.2112	618.2352	333.6111	364.5922	667.6214	802.5452	807.8176	795.4462	(95)
Ext temp.	5.2000	5.7000	7.7000	10.2000	13.3000	16.3000	18.3000	18.1000	15.5000	11.9000	8.2000	5.2000	(96)
Heat loss rate W													
	2873.0467	2422.7151	2134.1452	1741.6196	1253.6008	721.6081	347.9371	384.8628	853.6316	1432.2597	1955.6784	2542.5991	(97)
Space heating kWh													
	1506.2110	1008.4527	862.6782	550.5817	291.9379	0.0000	0.0000	0.0000	0.0000	468.5076	826.4597	1299.8818	(98a)
Space heating requirement - total per year (kWh/year)												6814.7105	
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													
	1506.2110	1008.4527	862.6782	550.5817	291.9379	0.0000	0.0000	0.0000	0.0000	468.5076	826.4597	1299.8818	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6814.7105	
Space heating per m2											(98c) / (4) =	73.1428	(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 %)	402.0187	(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												

	1506.2110	1008.4527	862.6782	550.5817	291.9379	0.0000	0.0000	0.0000	0.0000	468.5076	826.4597	1299.8818 (98)
Space heating efficiency (main heating system 1)												
	402.0187	402.0187	402.0187	402.0187	402.0187	0.0000	0.0000	0.0000	0.0000	402.0187	402.0187	402.0187 (210)
Space heating fuel (main heating system)												
	374.6619	250.8472	214.5866	136.9542	72.6180	0.0000	0.0000	0.0000	0.0000	116.5387	205.5774	323.3386 (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												
	316.3477	279.6495	296.3445	258.2601	248.9001	222.6576	218.3461	227.7769	231.1609	259.7486	278.6933	312.5491 (64)
Efficiency of water heater												184.9886 (216)
(217)m	184.9886	184.9886	184.9886	184.9886	184.9886	184.9886	184.9886	184.9886	184.9886	184.9886	184.9886	184.9886 (217)
Fuel for water heating, kWh/month												
	171.0093	151.1712	160.1961	139.6086	134.5489	120.3628	118.0321	123.1302	124.9595	140.4133	150.6543	168.9558 (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	45.5541	41.1456	45.5541	44.0846	45.5541	44.0846	45.5541	45.5541	44.0846	45.5541	44.0846	45.5541 (231)
Lighting	25.5578	20.5034	18.4610	13.5253	10.4474	8.5356	9.5304	12.3880	16.0908	21.1120	23.8460	26.2681 (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	1695.1227 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	184.9886
Water heating fuel used	1703.0420 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4980)	
mechanical ventilation fans (SFP = 1.4980)	536.3624 (230a)
Total electricity for the above, kWh/year	536.3624 (231)
Electricity for lighting (calculated in Appendix L)	206.2659 (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	4140.7931 (238)

10a. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1695.1227	21.5100	364.6209	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1703.0420	21.5100	366.3243	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	536.3624	21.5100	115.3715	(249)
Energy for lighting	206.2659	21.5100	44.3678	(250)
Additional standing charges			0.0000	(251)
Total energy cost			890.6846	(255)

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	1695.1227	0.1550	262.8029	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1703.0420	0.1411	240.2619	(264)
Space and water heating			503.0648	(265)
Pumps, fans and electric keep-hot	536.3624	0.1387	74.4001	(267)
Energy for lighting	206.2659	0.1443	29.7705	(268)
Total CO2, kg/year			607.2354	(272)

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	1695.1227	1.5739	2668.0018	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1703.0420	1.5217	2591.4588	(278)
Space and water heating			5259.4606	(279)
Pumps, fans and electric keep-hot	536.3624	1.5128	811.4090	(281)
Energy for lighting	206.2659	1.5338	316.3776	(282)
Total Primary energy kWh/year			6387.2472	(286)

Predicted Energy Assessment

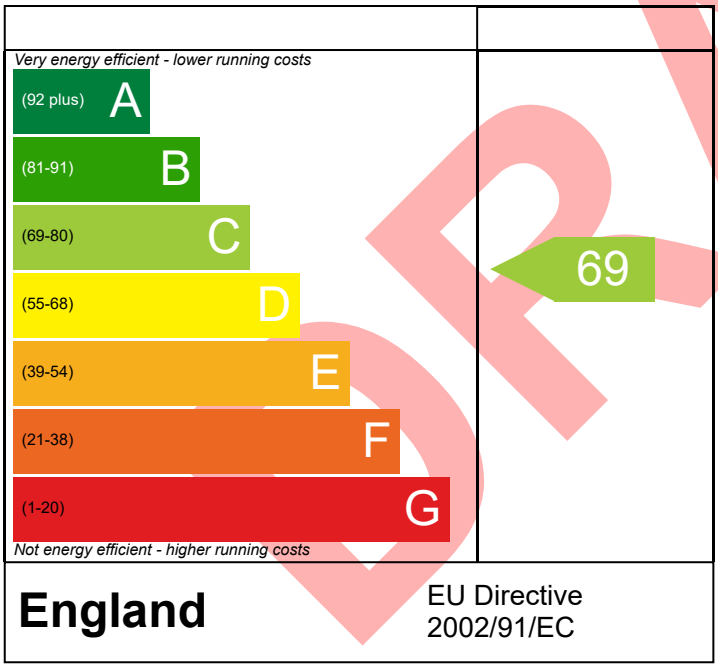
Apartment 2, 26, Rosslyn Hill, London, NW3 1PD

Dwelling type:	Flat, End-Terrace
Date of assessment:	21/12/2023
Produced by:	Anna Sung
Total floor area:	93.17 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

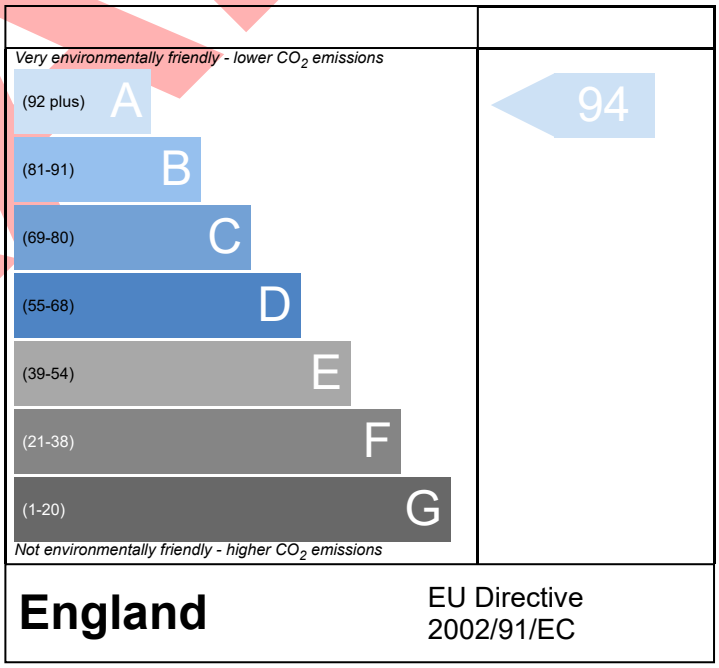
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

Summary for Input Data

elmhurst energy

Property Reference	Apartment 2	**Issued on Date**	21/12/2023
Assessment Reference	231207ac Unit 2 - Be Green	**Prop Type Ref**	Flat
Property	Apartment 2, 26, Rosslyn Hill, London, NW3 1PD		

SAP Rating	69 C	**DER**		**TER**	
Environmental	94 A	**% DER < TER**			N/A
CO_2 Emissions (t/year)	0.61	**DFEE**		**TFEE**	
Compliance Check	See BREL	**% DFEE < TFEE**			
% DPER < TPER		**DPER**		**TPER**	

Assessor Details	Ms. Anna Sung	**Assessor ID**	BK81-0001
Client			

SUMMARY FOR INPUT DATA FOR: Conversion (As Designed)

Orientation	West
Property Tenture	ND
Transaction Type	5
Terrain Type	Suburban
1.0 Property Type	Flat, End-Terrace
Position of Flat	Mid-floor flat
Which Floor	3
2.0 Number of Storeys	1
3.0 Date Built	2023
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown
6.0 Thermal Mass Parameter	Precise calculation
7.0 Electricity Tariff	Standard
Smart electricity meter fitted	No
Smart gas meter fitted	No

7.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground floor:	32.00 m	93.17 m²	3.15 m

8.0 Living Area 43.30 m²

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
External Wall 1	Solid Wall	Other	1.55	0.00	66.15	50.43	0.00	None	15.72	Enter Gross Area

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)	Shelter Res	Shelter
Party Wall 1	Solid Wall	Other	0.00	0.00	38.39		None

10.1 Party Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Ceiling 1	Concrete floor slab, carpeted	100.00	93.17

11.1 Party Floors

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Lowest occupied	Concrete floor slab, carpeted	100.00	93.17

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Windows	Manufacturer	Window	Double Low-E Soft 0.05			0.60		0.85	1.40

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
M Bedroom + Ensuite	Windows	External Wall 1	South West	7.57	
Living Room	Windows	External Wall 1	South West	4.79	

Summary for Input Data

Living Room	Windows	External Wall 1	South	2.40
Living Room	Windows	External Wall 1	East	0.96

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	Yes	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E1 Steel lintel with perforated steel base plate	Table K1 - Default	11.82	1.00	1.00	No
E3 Sill	Table K1 - Default	11.82	0.10	0.10	No
E4 Jamb	Table K1 - Default	29.51	0.10	0.10	No
E7 Party floor between dwellings (in blocks of flats)	Table K1 - Default	41.88	0.28	0.28	No
E15 Flat roof with parapet	Table K1 - Default	8.34	0.30	0.30	No
E16 Corner (normal)	Table K1 - Default	3.15	0.18	0.18	No
E18 Party wall between dwellings	Table K1 - Default	3.15	0.24	0.24	No
E24 Eaves (insulation at ceiling level - inverted)	Table K1 - Default	17.61	0.15	0.15	No
E25 Staggered party wall between dwellings	Table K1 - Default	6.29	0.24	0.24	No
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Table K1 - Default	61.16	0.00	0.00	No

Y-value	0.54	W/m²K
18.0 Pressure Testing	No	
Test Method	Blower Door	

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present	Yes	
Approved Installation	No	
Mechanical Ventilation data Type	Database	
Type	Balanced mechanical ventilation with heat recovery	
MV Reference Number	500140	
Configuration	3	
Manufacturer SFP	1.07	
Duct Type	Rigid	
MVHR Efficiency	88.00	
Wet Rooms	3	
SFP from Installer Commissioning Certificate	No	
MVHR System Location	Inside heated envelope (installed exclusively)	
Duct Installation Specification	Level 1	

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System	No	
22.0 Lighting		
No Fixed Lighting	No	

Name	Efficacy	Power	Capacity	Count
LED	100.00	25	2500	15

24.0 Main Heating 1	Database	
Description	ASHP - aroTHERM plus 12kW + AI	
Percentage of Heat	100.00	%
Database Ref. No.	104457	
Fuel Type	Electricity	
In Winter	402.56	
In Summer	184.98	
Model Name	aroTHERM plus 12kW + AI	
Manufacturer	Vaillant Group UK Ltd	
System Type	Heat Pump	

Summary for Input Data

elmhurst energy

Controls SAP Code	2207
Is MHS Pumped	Pump in heated space
Heating Pump Age	2013 or later
Heat Emitter	Underfloor
Underfloor Heating	Yes - Pipes in Wood
Flow Temperature	Enter value
Flow Temperature Value	35.00

25.0 Main Heating 2 — None

26.0 Heat Networks — None

	Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power Ratio	Electrical	Fuel Factor	Efficiency type
Heat source 1										
Heat source 2										
Heat source 3										
Heat source 4										
Heat source 5										

28.0 Water Heating

Water Heating	Main Heating 1
SAP Code	901
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	No
Cold Water Source	From mains
Bath Count	1
Immersion Only Heating Hot Water	No

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To

28.3 Waste Water Heat Recovery System

29.0 Hot Water Cylinder — Hot Water Cylinder

Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	250.00	L
Loss	1.40	kWh/day
Pipes insulation	Fully insulated primary pipework	
In Airing Cupboard	No	

31.0 Thermal Store — None

34.0 Small-scale Hydro — None

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

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
			0	0
			0	0
			0	0

Thermal Bridging

elmhurst energy

Property Reference	Apartment 2	**Issued on Date**	21/12/2023
Assessment Reference	231207ac Unit 2 - Be Green	**Prop Type Ref**	End-Terrace Flat
Property	Apartment 2, 26, Rosslyn Hill, London, NW3 1PD		

SAP Rating	69 C	**DER**		**TER**	
Environmental	94 A	**% DER < TER**			N/A
CO_2 Emissions (t/year)	0.61	**DFEE**		**TFEE**	
Compliance Check	See BREL	**% DFEE < TFEE**			
% DPER < TPER		**DPER**		**TPER**	

Assessor Details	Ms. Anna Sung	**Assessor ID**	BK81-0001
Client			

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E1 Steel lintel with perforated steel base plate	Table K1 - Default	1.000	11.82	11.82	
External wall	E3 Sill	Table K1 - Default	0.100	11.82	1.18	
External wall	E4 Jamb	Table K1 - Default	0.100	29.51	2.95	
External wall	E7 Party floor between dwellings (in blocks of flats)	Table K1 - Default	0.280	41.88	11.73	
External wall	E15 Flat roof with parapet	Table K1 - Default	0.300	8.34	2.50	
External wall	E16 Corner (normal)	Table K1 - Default	0.180	3.15	0.57	
External wall	E18 Party wall between dwellings	Table K1 - Default	0.240	3.15	0.76	
External wall	E24 Eaves (insulation at ceiling level - inverted)	Table K1 - Default	0.150	17.61	2.64	
External wall	E25 Staggered party wall between dwellings	Table K1 - Default	0.240	6.29	1.51	
Party wall	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Table K1 - Default	0.000	61.16	0.00	

Total: 194.73 W/mK:

Y-Value: 0.54 W/m²K:

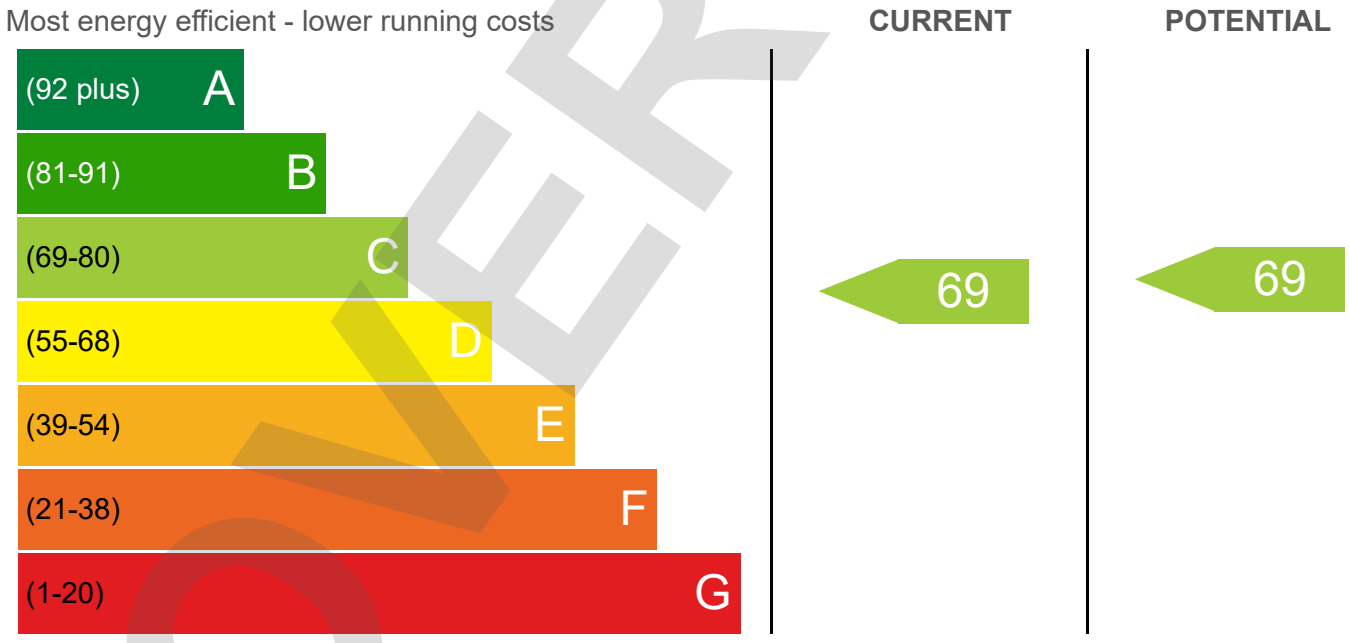
Overview Report

Dwelling Address	Apartment 2, 26, Rosslyn Hill, London, NW3 1PD
Report Date	21/12/2023
Property Type	Flat, End-Terrace
Floor Area [m^2]	93

This document is not an Energy Performance Certificate (EPC) as required by the Energy Performance of Buildings Regulations

Energy Rating

The current energy rating represents the overall energy efficiency of the dwelling. The potential energy rating is the overall energy rating of the dwelling after all of the recommend measures provided on the next page have been installed. A higher score represents a more energy efficient dwelling with lower fuel bills.



Overview Report

Breakdown of property's energy performance

Each feature is assessed as one of the following:

Very Poor	Poor	Average	Good	Very Good

Feature	Description	Energy Performance
Walls	Average thermal transmittance 1.55 W/m²K	Poor
Windows	High performance glazing	Good
Main heating	Air source heat pump, underfloor, electric	Very Good
Main heating controls	Time and temperature zone control	Very Good
Secondary heating	None	
Hot water	From main system	Average
Lighting	Excelent lighting efficiency	Very Good
Air tightness	(not tested)	

Primary Energy use

The primary energy use for this property per year is 69 kilowatt hour (kWh) per square metre

Estimated CO_2 emissions of the dwelling

The estimated CO rating provides an indication of the dwelling's impact on the environment in terms of carbon dioxide emissions; the higher the rating the less impact it has on the environment.

The estimated CO emissions for this dwellings is: **0.6** per year

With the recommended measures the potential CO emissions could be: **1** per year

Recommendations

Overview Report

The recommended measures provided below will help to improve the energy efficiency of the dwelling.
To reach the dwelling's potential energy rating all of the recommended measures shown below would need to be installed.
Having these measures installed individually or in any other order may give a different result when compared with the cumulative potential rating.

Recommended measure	Typical Yearly Saving	Potential Rating after measure installed	Cumulative savings (per year)	Cumulative Potential Rating

Estimated energy use and potential savings

Estimated energy cost for this property over a year

£891

Over a year you could save

£0

The estimated cost and savings show how much the average household would spend in this property for heating, lighting and hot water. It is not based on how energy is used by the people living at the property.

Contacting the assessor and the accreditation scheme

Assessor contact details	
Assessor name	Ms. Anna Sung
Assessor's accreditation number	
Email Address	

Accreditation scheme contact details	
Accreditation scheme	
Telephone	
Email Address	

Overview Report

Assessment details	
Related party disclosure	
Date of assessment	19/12/2023
Date of certificate	19/12/2023
Type of assessment	SAP, existing dwelling

Full SAP Calculation Printout

Property Reference	Apartment 3	**Issued on Date**	21/12/2023
Assessment Reference	231207ac Unit 3 - Be Green	**Prop Type Ref**	Flat
Property	Apartment 3, 26, Rosslyn Hill, London, NW3 1PD		

SAP Rating	68 D	**DER**		**TER**	
Environmental	93 A	**% DER < TER**			N/A
CO_2 Emissions (t/year)	0.77	**DFEE**		**TFEE**	
Compliance Check	See BREL	**% DFEE < TFEE**			
% DPER < TPER		**DPER**		**TPER**	

Assessor Details	Ms. Anna Sung	**Assessor ID**	BK81-0001
Client			

SAP 10 WORKSHEET FOR Conversion (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		125.0000 (1b)	x	3.1500 (2b)	=	393.7500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	393.7500	(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		No	
Pressure Test Method		Blower Door	
Measured/design AP50		15.0000	(17)
Infiltration rate		0.7500	(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) =	0.6375	(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	0.8128	0.7969	0.7809	0.7013	0.6853	0.6056	0.6056	0.5897	0.6375	0.6853	0.7172	0.7491	(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	0.9168	0.9009	0.8849	0.8053	0.7893	0.7096	0.7096	0.6937	0.7415	0.7893	0.8212	0.8531	(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 = 1.40)			26.0500	1.3258	34.5360			(27)
External Wall Existing	96.3900	16.8200	79.5700	1.5500	123.3335	9.0000	716.1300	(29a)
External Wall New	35.7600	9.2300	26.5300	0.1800	4.7754	150.0000	3979.5000	(29a)
Flat Roof	43.2000		43.2000	0.1500	6.4800	9.0000	388.8000	(30)
Total net area of external elements Aum(A, m2)			175.3500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	169.1249			(33)
Party Wall 1			33.3900	0.0000	0.0000	70.0000	2337.3000	(32)
Party Floor 1			125.0000			80.0000	10000.0000	(32d)
Party Ceiling 1			81.8000			100.0000	8180.0000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 25601.7300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	204.8138 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E1 Steel lintel with perforated steel base plate	14.1500	1.0000	14.1500

E3 Sill	14.1500	0.1000	1.4150	
E4 Jamb	36.1200	0.1000	3.6120	
E7 Party floor between dwellings (in blocks of flats)	34.2300	0.2800	9.5844	
E15 Flat roof with parapet	34.2300	0.3000	10.2690	
E16 Corner (normal)	9.1600	0.1800	1.6488	
E18 Party wall between dwellings	3.1500	0.2400	0.7560	
E24 Eaves (insulation at ceiling level - inverted)	6.6800	0.1500	1.0020	
E25 Staggered party wall between dwellings	3.0500	0.2400	0.7320	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	27.4400	0.0000	0.0000	
E17 Corner (inverted - internal area greater than external area)	3.0500	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 43.1692 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 212.2941 (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	119.1283	117.0574	114.9866	104.6322	102.5613	92.2069	92.2069	90.1360	96.3487	102.5613	106.7031	110.8448	(38)
Heat transfer coeff	331.4224	329.3515	327.2807	316.9263	314.8554	304.5010	304.5010	302.4301	308.6427	314.8554	318.9971	323.1389	(39)

Average = Sum(39)m / 12 = 316.4085

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.6514	2.6348	2.6182	2.5354	2.5188	2.4360	2.4360	2.4194	2.4691	2.5188	2.5520	2.5851	(40)
HLP (average)												2.5313	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8807 (42)

Hot water usage for mixer showers

99.7154	98.2168	96.0332	91.8552	88.7719	85.3335	83.3791	85.5462	87.9218	91.6136	95.8814	99.3333	(42a)

Hot water usage for baths

32.9572	32.4677	31.7784	30.5076	29.5560	28.5008	27.9308	28.6152	29.3605	30.4896	31.7866	32.8458	(42b)

Hot water usage for other uses

46.4543	44.7651	43.0758	41.3866	39.6973	38.0081	38.0081	39.6973	41.3866	43.0758	44.7651	46.4543	(42c)

Average daily hot water use (litres/day) 164.7219 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	179.1269	175.4496	170.8875	163.7493	158.0252	151.8423	149.3179	153.8587	158.6688	165.1790	172.4330	178.6334	(44)
Energy conte	283.6932	249.8379	262.6477	224.1646	212.7323	186.7078	180.5871	190.5093	195.6545	224.1463	245.6625	279.6967	(45)
Energy content (annual)											Total = Sum(45)m =	2736.0399	
Distribution loss (46)m = 0.15 x (45)m	42.5540	37.4757	39.3972	33.6247	31.9098	28.0062	27.0881	28.5764	29.3482	33.6219	36.8494	41.9545	(46)

Water storage loss:
Store volume 250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.4000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.7560 (55)
Total storage loss

23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(56)

If cylinder contains dedicated solar storage

23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(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

330.3916	292.0171	309.3461	269.3566	259.4307	231.8998	227.2855	237.2077	240.8465	270.8447	290.8545	326.3951	(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												
330.3916	292.0171	309.3461	269.3566	259.4307	231.8998	227.2855	237.2077	240.8465	270.8447	290.8545	326.3951	(64)

Total per year (kWh/year) = Sum(64)m = 3285.8759 (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

131.6867	116.8145	124.6891	110.6883	108.0922	98.2340	97.4039	100.7031	101.2087	111.8874	117.8364	130.3579	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	172.8441	172.8441	172.8441	172.8441	172.8441	172.8441	172.8441	172.8441	172.8441	172.8441	172.8441	172.8441	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.4863	28.8540	23.4657	17.7650	13.2796	11.2112	12.1141	15.7463	21.1347	26.8353	31.3208	33.3892	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	435.2050	439.7211	428.3407	404.1133	373.5306	344.7871	325.5847	321.0687	332.4490	356.6764	387.2591	416.0026	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1651	55.1651	55.1651	55.1651	55.1651	55.1651	55.1651	55.1651	55.1651	55.1651	55.1651	55.1651	(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)	-115.2294	-115.2294	-115.2294	-115.2294	-115.2294	-115.2294	-115.2294	-115.2294	-115.2294	-115.2294	-115.2294	-115.2294	(71)
Water heating gains (Table 5)	176.9982	173.8311	167.5928	153.7338	145.2852	136.4360	130.9193	135.3536	140.5677	150.3862	163.6616	175.2122	(72)
Total internal gains	757.4694	755.1860	732.1791	688.3920	644.8752	605.2142	581.3979	584.9484	606.9312	646.6778	695.0214	737.3838	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.9500	10.6334	0.6000	0.8500	0.7700	11.0866	(74)
Northeast	6.4000	11.2829	0.6000	0.8500	0.7700	25.5215	(75)
Southeast	5.5500	36.7938	0.6000	0.8500	0.7700	72.1724	(77)
Northwest	11.1500	11.2829	0.6000	0.8500	0.7700	44.4632	(81)

Solar gains	153.2437	286.5792	460.8689	687.7543	877.9354	919.1965	866.3696	717.0199	538.1627	335.1835	188.1815	128.1599	(83)
Total gains	910.7130	1041.7652	1193.0479	1376.1463	1522.8106	1524.4107	1447.7674	1301.9683	1145.0939	981.8613	883.2029	865.5437	(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	21.4578	21.5927	21.7293	22.4393	22.5869	23.3549	23.3549	23.5148	23.0415	22.5869	22.2936	22.0078	
alpha	2.4305	2.4395	2.4486	2.4960	2.5058	2.5570	2.5570	2.5677	2.5361	2.5058	2.4862	2.4672	
util living area	0.9896	0.9848	0.9743	0.9489	0.8963	0.8005	0.6905	0.7431	0.8921	0.9653	0.9854	0.9909	(86)
Living	17.4853	17.7473	18.2675	19.0452	19.7883	20.4276	20.7327	20.6662	20.1341	19.1966	18.2528	17.4953	
Non living	15.0876	15.4255	16.0909	17.0904	17.9974	18.7288	18.9839	18.9574	18.4413	17.3001	16.0943	15.1168	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.2020	17.7473	18.2675	19.0452	19.7883	20.4276	20.7327	20.6662	20.1341	19.1966	18.2528	17.9855	(87)
Th 2	18.9344	18.9437	18.9530	19.0003	19.0099	19.0585	19.0585	19.0684	19.0389	19.0099	18.9907	18.9718	(88)
util rest of house	0.9860	0.9795	0.9646	0.9269	0.8429	0.6761	0.4659	0.5355	0.8107	0.9460	0.9794	0.9878	(89)
MIT 2	17.4008	15.4255	16.0909	17.0904	17.9974	18.7288	18.9839	18.9574	18.4413	17.3001	16.0943	15.8115	(90)
Living area fraction										fLA = Living area / (4) =		0.2012	(91)
MIT	17.7632	15.8927	16.5288	17.4837	18.3577	19.0706	19.3357	19.3012	18.7819	17.6817	16.5286	16.2489	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.7632	15.8927	16.5288	17.4837	18.3577	19.0706	19.3357	19.3012	18.7819	17.6817	16.5286	16.2489	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9832	0.9654	0.9449	0.9006	0.8177	0.6771	0.5063	0.5683	0.7948	0.9240	0.9660	0.9809	(94)
Useful gains	895.4134	1005.7344	1127.3246	1239.4173	1245.2639	1032.1911	732.9419	739.9124	910.1301	907.2821	853.1371	848.9755	(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	4462.0203	3620.4467	3282.2321	2720.3972	2096.2158	1361.2980	833.0313	877.4072	1445.0262	2229.7034	3007.7008	3893.4647	(97)
Space heating kWh	2653.5556	1757.0866	1603.2512	1066.3055	633.1082	0.0000	0.0000	0.0000	0.0000	983.8815	1551.2859	2265.1000	(98a)
Space heating requirement - total per year (kWh/year)												12513.5745	
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	2653.5556	1757.0866	1603.2512	1066.3055	633.1082	0.0000	0.0000	0.0000	0.0000	983.8815	1551.2859	2265.1000	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												12513.5745	
Space heating per m2											(98c) / (4) =	100.1086	(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 %)												418.9169	(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	2653.5556	1757.0866	1603.2512	1066.3055	633.1082	0.0000	0.0000	0.0000	0.0000	983.8815	1551.2859	2265.1000	(98)
Space heating efficiency (main heating system 1)	418.9169	418.9169	418.9169	418.9169	418.9169	0.0000	0.0000	0.0000	0.0000	418.9169	418.9169	418.9169	(210)
Space heating fuel (main heating system)	633.4324	419.4356	382.7134	254.5387	151.1298	0.0000	0.0000	0.0000	0.0000	234.8632	370.3087	540.7039	(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	330.3916	292.0171	309.3461	269.3566	259.4307	231.8998	227.2855	237.2077	240.8465	270.8447	290.8545	326.3951	(64)
Efficiency of water heater												193.3163	(216)
(217)m	193.3163	193.3163	193.3163	193.3163	193.3163	193.3163	193.3163	193.3163	193.3163	193.3163	193.3163	193.3163	(217)
Fuel for water heating, kWh/month	170.9073	151.0567	160.0207	139.3347	134.2001	119.9588	117.5718	122.7044	124.5868	140.1044	150.4552	168.8399	(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	61.1169	55.2023	61.1169	59.1453	61.1169	59.1453	61.1169	61.1169	59.1453	61.1169	59.1453	61.1169	(231)
Lighting	28.4351	22.8117	20.5394	15.0480	11.6235	9.4965	10.6034	13.7827	17.9023	23.4888	26.5306	29.2254	(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												2987.1255	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												193.3163	
Water heating fuel used												1699.7408	(219)

Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4980)		
mechanical ventilation fans (SFP = 1.4980)	719.6017	(230a)
Total electricity for the above, kWh/year	719.6017	(231)
Electricity for lighting (calculated in Appendix L)	229.4873	(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	5635.9554	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2987.1255	16.4900	492.5770	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1699.7408	16.4900	280.2873	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	719.6017	16.4900	118.6623	(249)
Energy for lighting	229.4873	16.4900	37.8425	(250)
Additional standing charges			0.0000	(251)
Total energy cost			929.3690	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.9681	(257)
SAP value		68.0975	
SAP rating (Section 12)		68	(258)
SAP band		D	

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	2987.1255	0.1544	461.2552	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1699.7408	0.1411	239.8312	(264)
Space and water heating			701.0865	(265)
Pumps, fans and electric keep-hot	719.6017	0.1387	99.8176	(267)
Energy for lighting	229.4873	0.1443	33.1221	(268)
Total CO2, kg/year			834.0262	(272)
CO2 emissions per m2			6.6700	(273)
EI value			93.4259	
EI rating			93	(274)
EI band			A	

SAP 10 WORKSHEET FOR Conversion (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	125.0000 (1b)	x	3.1500 (2b)	=	393.7500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 125.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	393.7500	(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		No	
Pressure Test Method		Blower Door	
Measured/design AP50		15.0000	(17)
Infiltration rate		0.7500	(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) = 0.6375 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.5000	4.4000	4.1000	4.1000	3.7000	3.8000	3.7000	3.7000	4.0000	3.9000	4.3000	(22)
Wind factor	1.1500	1.1250	1.1000	1.0250	1.0250	0.9250	0.9500	0.9250	0.9250	1.0000	0.9750	1.0750	(22a)
Adj infilt rate	0.7331	0.7172	0.7013	0.6534	0.6534	0.5897	0.6056	0.5897	0.5897	0.6375	0.6216	0.6853	(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	0.8371	0.8212	0.8053	0.7574	0.7574	0.6937	0.7096	0.6937	0.6937	0.7415	0.7256	0.7893	(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 = 1.40)			26.0500	1.3258	34.5360			(27)
External Wall Existing	96.3900	16.8200	79.5700	1.5500	123.3335	9.0000	716.1300	(29a)
External Wall New	35.7600	9.2300	26.5300	0.1800	4.7754	150.0000	3979.5000	(29a)
Flat Roof	43.2000		43.2000	0.1500	6.4800	9.0000	388.8000	(30)
Total net area of external elements Aum(A, m2)			175.3500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	169.1249			(33)
Party Wall 1			33.3900	0.0000	0.0000	70.0000	2337.3000	(32)
Party Floor 1			125.0000			80.0000	10000.0000	(32d)
Party Ceiling 1			81.8000			80.0000	6544.0000	(32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 23965.7300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 191.7258 (35)
List of Thermal Bridges

		Length	Psi-value	Total	
K1	Element				
E1	Steel lintel with perforated steel base plate	14.1500	1.0000	14.1500	
E3	Sill	14.1500	0.1000	1.4150	
E4	Jamb	36.1200	0.1000	3.6120	
E7	Party floor between dwellings (in blocks of flats)	34.2300	0.2800	9.5844	
E15	Flat roof with parapet	34.2300	0.3000	10.2690	
E16	Corner (normal)	9.1600	0.1800	1.6488	
E18	Party wall between dwellings	3.1500	0.2400	0.7560	
E24	Eaves (insulation at ceiling level - inverted)	6.6800	0.1500	1.0020	
E25	Staggered party wall between dwellings	3.0500	0.2400	0.7320	
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	27.4400	0.0000	0.0000	
E17	Corner (inverted - internal area greater than external area)	3.0500	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 43.1692 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 212.2941 (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	108.7739	106.7031	104.6322	98.4195	98.4195	90.1360	92.2069	90.1360	90.1360	96.3487	94.2778	102.5613	(38)
Heat transfer coeff	321.0680	318.9971	316.9263	310.7136	310.7136	302.4301	304.5010	302.4301	302.4301	308.6427	306.5719	314.8554	(39)

Average = Sum(39)m / 12 = 310.0233

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.5685	2.5520	2.5354	2.4857	2.4857	2.4194	2.4360	2.4194	2.4194	2.4691	2.4526	2.5188	(40)
HLP (average)												2.4802	
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 2.8807 (42)
Hot water usage for mixer showers

99.7154	98.2168	96.0332	91.8552	88.7719	85.3335	83.3791	85.5462	87.9218	91.6136	95.8814	99.3333	(42a)

Hot water usage for baths

32.9572	32.4677	31.7784	30.5076	29.5560	28.5008	27.9308	28.6152	29.3605	30.4896	31.7866	32.8458	(42b)

Hot water usage for other uses

46.4543	44.7651	43.0758	41.3866	39.6973	38.0081	38.0081	39.6973	41.3866	43.0758	44.7651	46.4543	(42c)

Average daily hot water use (litres/day) 164.7219 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	179.1269	175.4496	170.8875	163.7493	158.0252	151.8423	149.3179	153.8587	158.6688	165.1790	172.4330	178.6334	(44)
Energy conte	283.6932	249.8379	262.6477	224.1646	212.7323	186.7078	180.5871	190.5093	195.6545	224.1463	245.6625	279.6967	(45)
Energy content (annual)										Total = Sum(45)m =		2736.0399	
Distribution loss (46)m = 0.15 x (45)m	42.5540	37.4757	39.3972	33.6247	31.9098	28.0062	27.0881	28.5764	29.3482	33.6219	36.8494	41.9545	(46)

Water storage loss:
Store volume 250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.4000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.7560 (55)
Total storage loss

23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(56)

If cylinder contains dedicated solar storage

23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(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

330.3916	292.0171	309.3461	269.3566	259.4307	231.8998	227.2855	237.2077	240.8465	270.8447	290.8545	326.3951	(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

330.3916	292.0171	309.3461	269.3566	259.4307	231.8998	227.2855	237.2077	240.8465	270.8447	290.8545	326.3951	(64)

Total per year (kWh/year) = Sum(64)m = 3285.8759 (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

	131.6867	116.8145	124.6891	110.6883	108.0922	98.2340	97.4039	100.7031	101.2087	111.8874	117.8364	130.3579 (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	172.8441	172.8441	172.8441	172.8441	172.8441	172.8441	172.8441	172.8441	172.8441	172.8441	172.8441	172.8441	(66)

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

	32.4863	28.8540	23.4657	17.7650	13.2796	11.2112	12.1141	15.7463	21.1347	26.8353	31.3208	33.3892 (67)

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

	435.2050	439.7211	428.3407	404.1133	373.5306	344.7871	325.5847	321.0687	332.4490	356.6764	387.2591	416.0026 (68)

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

	55.1651	55.1651	55.1651	55.1651	55.1651	55.1651	55.1651	55.1651	55.1651	55.1651	55.1651	55.1651 (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)

	-115.2294	-115.2294	-115.2294	-115.2294	-115.2294	-115.2294	-115.2294	-115.2294	-115.2294	-115.2294	-115.2294	-115.2294 (71)

Water heating gains (Table 5)

	176.9982	173.8311	167.5928	153.7338	145.2852	136.4360	130.9193	135.3536	140.5677	150.3862	163.6616	175.2122 (72)

Total internal gains

	757.4694	755.1860	732.1791	688.3920	644.8752	605.2142	581.3979	584.9484	606.9312	646.6778	695.0214	737.3838 (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	2.9500	11.5821	0.6000	0.8500	0.7700	12.0757	(74)
Northeast	6.4000	12.4928	0.6000	0.8500	0.7700	28.2581	(75)
Southeast	5.5500	39.1209	0.6000	0.8500	0.7700	76.7371	(77)
Northwest	11.1500	12.4928	0.6000	0.8500	0.7700	49.2308	(81)

Solar gains	166.3017	280.5266	455.5817	704.3163	875.0123	977.3418	919.1965	780.7318	585.2104	359.2220	211.1727	136.3684	(83)
Total gains	923.7710	1035.7125	1187.7608	1392.7083	1519.8875	1582.5560	1500.5944	1365.6802	1192.1416	1005.8999	906.1940	873.7522	(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	20.7344	20.8690	21.0054	21.4253	21.4253	22.0122	21.8625	22.0122	22.0122	21.5691	21.7148	21.1435	
alpha	2.3823	2.3913	2.4004	2.4284	2.4284	2.4675	2.4575	2.4675	2.4675	2.4379	2.4477	2.4096	
util living area	0.9858	0.9806	0.9652	0.9273	0.8464	0.6725	0.4834	0.5440	0.8182	0.9459	0.9786	0.9875	(86)
Living	17.6768	17.9054	18.5361	19.3284	20.1043	20.7074	20.9209	20.8902	20.4365	19.4918	18.5263	17.6891	
Non living	15.3765	15.6711	16.4749	17.4735	18.3828	18.9716	19.0564	19.0629	18.7804	17.7007	16.4910	15.4049	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.3000	17.9054	18.5361	19.3284	20.1043	20.7074	20.9209	20.8902	20.4365	19.4918	18.5263	18.1522	(87)
Th 2	18.9812	18.9907	19.0003	19.0292	19.0292	19.0684	19.0585	19.0684	19.0684	19.0389	19.0487	19.0099	(88)
util rest of house	0.9810	0.9738	0.9516	0.8948	0.7619	0.4709	0.1526	0.2107	0.6754	0.9138	0.9695	0.9832	(89)
MIT 2	17.5441	15.6711	16.4749	17.4735	18.3828	18.9716	19.0564	19.0629	18.7804	17.7007	16.4910	16.0545	(90)
Living area fraction									fLA = Living area / (4) =			0.2012	(91)
MIT	17.8974	16.1206	16.8896	17.8467	18.7291	19.3208	19.4316	19.4306	19.1136	18.0611	16.9005	16.4766	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.8974	16.1206	16.8896	17.8467	18.7291	19.3208	19.4316	19.4306	19.1136	18.0611	16.9005	16.4766	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9773	0.9568	0.9278	0.8653	0.7442	0.5034	0.2248	0.2843	0.6801	0.8877	0.9518	0.9741	(94)
Useful gains	902.8363	990.9962	1102.0079	1205.1237	1131.1683	796.6395	337.3813	388.2803	810.7235	892.9351	862.5453	851.0965	(95)
Ext temp.	5.2000	5.7000	7.7000	10.2000	13.3000	16.3000	18.3000	18.1000	15.5000	11.9000	8.2000	5.2000	(96)
Heat loss rate W	4076.7349	3324.1478	2912.4371	2375.9303	1686.9041	913.5934	344.5650	402.4033	1092.8510	1901.5772	2667.3373	3550.4980	(97)
Space heating kWh	2361.3805	1567.8779	1346.9594	842.9808	413.4674	0.0000	0.0000	0.0000	0.0000	750.4298	1299.4503	2008.3548	(98a)
Space heating requirement - total per year (kWh/year)												10590.9008	
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	2361.3805	1567.8779	1346.9594	842.9808	413.4674	0.0000	0.0000	0.0000	0.0000	750.4298	1299.4503	2008.3548	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												10590.9008	
Space heating per m2											(98c) / (4) =	84.7272	(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 %)	417.9981	(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	2361.3805	1567.8779	1346.9594	842.9808	413.4674	0.0000	0.0000	0.0000	0.0000	750.4298	1299.4503	2008.3548	(98)
Space heating efficiency (main heating system 1)	417.9981	417.9981	417.9981	417.9981	417.9981	0.0000	0.0000	0.0000	0.0000	417.9981	417.9981	417.9981	(210)
Space heating fuel (main heating system)													

	564.9262	375.0921	322.2406	201.6710	98.9161	0.0000	0.0000	0.0000	0.0000	179.5295	310.8747	480.4699 (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												
	330.3916	292.0171	309.3461	269.3566	259.4307	231.8998	227.2855	237.2077	240.8465	270.8447	290.8545	326.3951 (64)
Efficiency of water heater												192.7920 (216)
(217)m	192.7920	192.7920	192.7920	192.7920	192.7920	192.7920	192.7920	192.7920	192.7920	192.7920	192.7920	192.7920 (217)
Fuel for water heating, kWh/month												
	171.3720	151.4674	160.4558	139.7136	134.5650	120.2850	117.8915	123.0381	124.9255	140.4854	150.8644	169.2991 (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	61.1169	55.2023	61.1169	59.1453	61.1169	59.1453	61.1169	61.1169	59.1453	61.1169	59.1453	61.1169 (231)
Lighting	28.4351	22.8117	20.5394	15.0480	11.6235	9.4965	10.6034	13.7827	17.9023	23.4888	26.5306	29.2254 (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	2533.7201 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	192.7920
Water heating fuel used	1704.3629 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4980)	
mechanical ventilation fans (SFP = 1.4980)	719.6017 (230a)
Total electricity for the above, kWh/year	719.6017 (231)
Electricity for lighting (calculated in Appendix L)	229.4873 (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	5187.1720 (238)

10a. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2533.7201	21.5100	545.0032	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1704.3629	21.5100	366.6085	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	719.6017	21.5100	154.7863	(249)
Energy for lighting	229.4873	21.5100	49.3627	(250)
Additional standing charges			0.0000	(251)
Total energy cost			1115.7607	(255)

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	2533.7201	0.1551	392.9711	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1704.3629	0.1411	240.4834	(264)
Space and water heating			633.4545	(265)
Pumps, fans and electric keep-hot	719.6017	0.1387	99.8176	(267)
Energy for lighting	229.4873	0.1443	33.1221	(268)
Total CO2, kg/year			766.3942	(272)

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	2533.7201	1.5742	3988.4804	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1704.3629	1.5217	2593.6004	(278)
Space and water heating			6582.0809	(279)
Pumps, fans and electric keep-hot	719.6017	1.5128	1088.6135	(281)
Energy for lighting	229.4873	1.5338	351.9953	(282)
Total Primary energy kWh/year			8022.6897	(286)

SAP 10 EPC IMPROVEMENTS

231207ac Unit 3 - Be Green

Current energy efficiency rating: D 68
Current environmental impact rating: A 93

N Solar water heating — Not applicable
U Solar photovoltaic panels — Not applicable
V2 Wind turbine — Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: D 68
Potential environmental impact rating: A 93

Fuel prices for cost data on this page from database revision number 533 TEST (30 Nov 2023)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£1116	£1116	£0
Space heating	£700	£700	£0
Water heating	£367	£367	£0
Lighting	£49	£49	£0
Total cost of fuels	£1116	£1116	£0
Total cost of uses	£1116	£1116	£0
Delivered energy	41 kWh/m²	41 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	64 kWh/m²	64 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR Conversion (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	125.0000	(1b)	x 3.1500	(2b) =	393.7500	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.0000					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		393.7500	(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		No	
Pressure Test Method		Blower Door	
Measured/design AP50		15.0000	(17)
Infiltration rate		0.7500	(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) =	0.6375	(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	0.8128	0.7969	0.7809	0.7013	0.6853	0.6056	0.6056	0.5897	0.6375	0.6853	0.7172	0.7491	(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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.9168	0.9009	0.8849	0.8053	0.7893	0.7096	0.7096	0.6937	0.7415	0.7893	0.8212	0.8531	(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	
Windows (Uw = 1.40)			26.0500	1.3258	34.5360			(27)
External Wall Existing	96.3900	16.8200	79.5700	1.5500	123.3335	9.0000	716.1300	(29a)
External Wall New	35.7600	9.2300	26.5300	0.1800	4.7754	150.0000	3979.5000	(29a)
Flat Roof	43.2000		43.2000	0.1500	6.4800	9.0000	388.8000	(30)
Total net area of external elements Aum(A, m2)			175.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		169.1249			(33)
Party Wall 1			33.3900	0.0000	0.0000	70.0000	2337.3000	(32)
Party Floor 1			125.0000			80.0000	10000.0000	(32d)
Party Ceiling 1			81.8000			100.0000	8180.0000	(32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 25601.7300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 204.8138 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	14.1500	1.0000	14.1500
E3 Sill	14.1500	0.1000	1.4150
E4 Jamb	36.1200	0.1000	3.6120
E7 Party floor between dwellings (in blocks of flats)	34.2300	0.2800	9.5844
E15 Flat roof with parapet	34.2300	0.3000	10.2690
E16 Corner (normal)	9.1600	0.1800	1.6488
E18 Party wall between dwellings	3.1500	0.2400	0.7560
E24 Eaves (insulation at ceiling level - inverted)	6.8000	0.1500	1.0020
E25 Staggered party wall between dwellings	3.0500	0.2400	0.7320
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	27.4400	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	3.0500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 43.1692 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 212.2941 (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	119.1283	117.0574	114.9866	104.6322	102.5613	92.2069	92.2069	90.1360	96.3487	102.5613	106.7031	110.8448	(38)
Heat transfer coeff	331.4224	329.3515	327.2807	316.9263	314.8554	304.5010	304.5010	302.4301	308.6427	314.8554	318.9971	323.1389	(39)
Average = Sum(39)m / 12 =												316.4085	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.6514	2.6348	2.6182	2.5354	2.5188	2.4360	2.4360	2.4194	2.4691	2.5188	2.5520	2.5851	(40)
HLP (average)												2.5313	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8807 (42)
Hot water usage for mixer showers

99.7154	98.2168	96.0332	91.8552	88.7719	85.3335	83.3791	85.5462	87.9218	91.6136	95.8814	99.3333	(42a)

Hot water usage for baths

32.9572	32.4677	31.7784	30.5076	29.5560	28.5008	27.9308	28.6152	29.3605	30.4896	31.7866	32.8458	(42b)

Hot water usage for other uses

46.4543	44.7651	43.0758	41.3866	39.6973	38.0081	38.0081	39.6973	41.3866	43.0758	44.7651	46.4543	(42c)

Average daily hot water use (litres/day) 164.7219 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	179.1269	175.4496	170.8875	163.7493	158.0252	151.8423	149.3179	153.8587	158.6688	165.1790	172.4330	178.6334	(44)
Energy conte	283.6932	249.8379	262.6477	224.1646	212.7323	186.7078	180.5871	190.5093	195.6545	224.1463	245.6625	279.6967	(45)
Energy content (annual)										Total = Sum(45)m =		2736.0399	
Distribution loss (46)m = 0.15 x (45)m	42.5540	37.4757	39.3972	33.6247	31.9098	28.0062	27.0881	28.5764	29.3482	33.6219	36.8494	41.9545	(46)

Water storage loss:
Store volume 250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.4000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.7560 (55)
Total storage loss

23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(56)

If cylinder contains dedicated solar storage

23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(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

330.3916	292.0171	309.3461	269.3566	259.4307	231.8998	227.2855	237.2077	240.8465	270.8447	290.8545	326.3951	(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													
330.3916	292.0171	309.3461	269.3566	259.4307	231.8998	227.2855	237.2077	240.8465	270.8447	290.8545	326.3951	(64)
									Total per year (kWh/year) = Sum(64)m =		3285.8759	(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

131.6867	116.8145	124.6891	110.6883	108.0922	98.2340	97.4039	100.7031	101.2087	111.8874	117.8364	130.3579	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	172.8441	172.8441	172.8441	172.8441	172.8441	172.8441	172.8441	172.8441	172.8441	172.8441	172.8441	172.8441	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.4863	28.8540	23.4657	17.7650	13.2796	11.2112	12.1141	15.7463	21.1347	26.8353	31.3208	33.3892	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	435.2050	439.7211	428.3407	404.1133	373.5306	344.7871	325.5847	321.0687	332.4490	356.6764	387.2591	416.0026	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1651	55.1651	55.1651	55.1651	55.1651	55.1651	55.1651	55.1651	55.1651	55.1651	55.1651	55.1651	(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)	-115.2294	-115.2294	-115.2294	-115.2294	-115.2294	-115.2294	-115.2294	-115.2294	-115.2294	-115.2294	-115.2294	-115.2294	(71)
Water heating gains (Table 5)													

	176.9982	173.8311	167.5928	153.7338	145.2852	136.4360	130.9193	135.3536	140.5677	150.3862	163.6616	175.2122	(72)
Total internal gains	757.4694	755.1860	732.1791	688.3920	644.8752	605.2142	581.3979	584.9484	606.9312	646.6778	695.0214	737.3838	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.9500	10.6334	0.6000	0.8500	0.7700	11.0866	(74)
Northeast	6.4000	11.2829	0.6000	0.8500	0.7700	25.5215	(75)
Southeast	5.5500	36.7938	0.6000	0.8500	0.7700	72.1724	(77)
Northwest	11.1500	11.2829	0.6000	0.8500	0.7700	44.4632	(81)

Solar gains	153.2437	286.5792	460.8689	687.7543	877.9354	919.1965	866.3696	717.0199	538.1627	335.1835	188.1815	128.1599	(83)
Total gains	910.7130	1041.7652	1193.0479	1376.1463	1522.8106	1524.4107	1447.7674	1301.9683	1145.0939	981.8613	883.2029	865.5437	(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	21.4578	21.5927	21.7293	22.4393	22.5869	23.3549	23.3549	23.5148	23.0415	22.5869	22.2936	22.0078	
alpha	2.4305	2.4395	2.4486	2.4960	2.5058	2.5570	2.5570	2.5677	2.5361	2.5058	2.4862	2.4672	
util living area	0.9896	0.9848	0.9743	0.9489	0.8963	0.8005	0.6905	0.7431	0.8921	0.9653	0.9854	0.9909	(86)
Living	17.4853	17.7473	18.2675	19.0452	19.7883	20.4276	20.7327	20.6662	20.1341	19.1966	18.2528	17.4953	
Non living	15.0876	15.4255	16.0909	17.0904	17.9974	18.7288	18.9839	18.9574	18.4413	17.3001	16.0943	15.1168	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.2020	17.7473	18.2675	19.0452	19.7883	20.4276	20.7327	20.6662	20.1341	19.1966	18.2528	17.9855	(87)
Th 2	18.9344	18.9437	18.9530	19.0003	19.0099	19.0585	19.0585	19.0684	19.0389	19.0099	18.9907	18.9718	(88)
util rest of house	0.9860	0.9795	0.9646	0.9269	0.8429	0.6761	0.4659	0.5355	0.8107	0.9460	0.9794	0.9878	(89)
MIT 2	17.4008	15.4255	16.0909	17.0904	17.9974	18.7288	18.9839	18.9574	18.4413	17.3001	16.0943	15.8115	(90)
Living area fraction										fLA = Living area / (4) =		0.2012	(91)
MIT	17.7632	15.8927	16.5288	17.4837	18.3577	19.0706	19.3357	19.3012	18.7819	17.6817	16.5286	16.2489	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.7632	15.8927	16.5288	17.4837	18.3577	19.0706	19.3357	19.3012	18.7819	17.6817	16.5286	16.2489	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9832	0.9654	0.9449	0.9006	0.8177	0.6771	0.5063	0.5683	0.7948	0.9240	0.9660	0.9809	(94)
Useful gains	895.4134	1005.7344	1127.3246	1239.4173	1245.2639	1032.1911	732.9419	739.9124	910.1301	907.2821	853.1371	848.9755	(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	4462.0203	3620.4467	3282.2321	2720.3972	2096.2158	1361.2980	833.0313	877.4072	1445.0262	2229.7034	3007.7008	3893.4647	(97)
Space heating kWh	2653.5556	1757.0866	1603.2512	1066.3055	633.1082	0.0000	0.0000	0.0000	0.0000	983.8815	1551.2859	2265.1000	(98a)
Space heating requirement - total per year (kWh/year)												12513.5745	
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	2653.5556	1757.0866	1603.2512	1066.3055	633.1082	0.0000	0.0000	0.0000	0.0000	983.8815	1551.2859	2265.1000	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												12513.5745	
Space heating per m2											(98c) / (4) =	100.1086	(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 %)												418.9169	(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	2653.5556	1757.0866	1603.2512	1066.3055	633.1082	0.0000	0.0000	0.0000	0.0000	983.8815	1551.2859	2265.1000	(98)
Space heating efficiency (main heating system 1)	418.9169	418.9169	418.9169	418.9169	418.9169	0.0000	0.0000	0.0000	0.0000	418.9169	418.9169	418.9169	(210)
Space heating fuel (main heating system)	633.4324	419.4356	382.7134	254.5387	151.1298	0.0000	0.0000	0.0000	0.0000	234.8632	370.3087	540.7039	(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	330.3916	292.0171	309.3461	269.3566	259.4307	231.8998	227.2855	237.2077	240.8465	270.8447	290.8545	326.3951	(64)
Efficiency of water heater												193.3163	(216)
(217)m	193.3163	193.3163	193.3163	193.3163	193.3163	193.3163	193.3163	193.3163	193.3163	193.3163	193.3163	193.3163	(217)
Fuel for water heating, kWh/month	170.9073	151.0567	160.0207	139.3347	134.2001	119.9588	117.5718	122.7044	124.5868	140.1044	150.4552	168.8399	(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	61.1169	55.2023	61.1169	59.1453	61.1169	59.1453	61.1169	61.1169	59.1453	61.1169	59.1453	61.1169	(231)
Lighting	28.4351	22.8117	20.5394	15.0480	11.6235	9.4965	10.6034	13.7827	17.9023	23.4888	26.5306	29.2254	(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	2987.1255	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	193.3163	
Water heating fuel used	1699.7408	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4980)		
mechanical ventilation fans (SFP = 1.4980)	719.6017	(230a)
Total electricity for the above, kWh/year	719.6017	(231)
Electricity for lighting (calculated in Appendix L)	229.4873	(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	5635.9554	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2987.1255	16.4900	492.5770	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1699.7408	16.4900	280.2873	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	719.6017	16.4900	118.6623	(249)
Energy for lighting	229.4873	16.4900	37.8425	(250)
Additional standing charges			0.0000	(251)
Total energy cost			929.3690	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.9681	(257)
SAP value		68.0975	
SAP rating (Section 12)		68	(258)
SAP band		D	

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	2987.1255	0.1544	461.2552	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1699.7408	0.1411	239.8312	(264)
Space and water heating			701.0865	(265)
Pumps, fans and electric keep-hot	719.6017	0.1387	99.8176	(267)
Energy for lighting	229.4873	0.1443	33.1221	(268)
Total CO2, kg/year			834.0262	(272)
CO2 emissions per m2			6.6700	(273)
EI value			93.4259	
EI rating			93	(274)
EI band			A	

SAP 10 WORKSHEET FOR Conversion (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		125.0000 (1b)	x	3.1500 (2b)	=	393.7500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		393.7500	(5)

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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		No	
Pressure Test Method		Blower Door	
Measured/design AP50		15.0000	(17)
Infiltration rate		0.7500	(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) =	0.6375	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.5000	4.4000	4.1000	4.1000	3.7000	3.8000	3.7000	3.7000	4.0000	3.9000	4.3000	(22)
Wind factor	1.1500	1.1250	1.1000	1.0250	1.0250	0.9250	0.9500	0.9250	0.9250	1.0000	0.9750	1.0750	(22a)
Adj infilt rate	0.7331	0.7172	0.7013	0.6534	0.6534	0.5897	0.6056	0.5897	0.5897	0.6375	0.6216	0.6853	(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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.8371	0.8212	0.8053	0.7574	0.7574	0.6937	0.7096	0.6937	0.6937	0.7415	0.7256	0.7893	(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	
Windows (Uw = 1.40)			26.0500	1.3258	34.5360			(27)
External Wall Existing	96.3900	16.8200	79.5700	1.5500	123.3335	9.0000	716.1300	(29a)
External Wall New	35.7600	9.2300	26.5300	0.1800	4.7754	150.0000	3979.5000	(29a)
Flat Roof	43.2000		43.2000	0.1500	6.4800	9.0000	388.8000	(30)
Total net area of external elements Aum(A, m2)			175.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		169.1249			(33)
Party Wall 1			33.3900	0.0000	0.0000	70.0000	2337.3000	(32)
Party Floor 1			125.0000			80.0000	10000.0000	(32d)
Party Ceiling 1			81.8000			80.0000	6544.0000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 23965.7300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	191.7258 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E1 Steel lintel with perforated steel base plate	14.1500	1.0000	14.1500
E3 Sill	14.1500	0.1000	1.4150
E4 Jamb	36.1200	0.1000	3.6120
E7 Party floor between dwellings (in blocks of flats)	34.2300	0.2800	9.5844
E15 Flat roof with parapet	34.2300	0.3000	10.2690
E16 Corner (normal)	9.1600	0.1800	1.6488
E18 Party wall between dwellings	3.1500	0.2400	0.7560
E24 Eaves (insulation at ceiling level - inverted)	6.6800	0.1500	1.0020
E25 Staggered party wall between dwellings	3.0500	0.2400	0.7320
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	27.4400	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	3.0500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	43.1692 (36)
Point Thermal bridges	(36a) = 0.0000
Total fabric heat loss	(33) + (36) + (36a) = 212.2941 (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	108.7739	106.7031	104.6322	98.4195	98.4195	90.1360	92.2069	90.1360	90.1360	96.3487	94.2778	102.5613	(38)
Heat transfer coeff	321.0680	318.9971	316.9263	310.7136	310.7136	302.4301	304.5010	302.4301	302.4301	308.6427	306.5719	314.8554	(39)
Average = Sum(39)m / 12 =												310.0233	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.5685	2.5520	2.5354	2.4857	2.4857	2.4194	2.4360	2.4194	2.4194	2.4691	2.4526	2.5188	(40)
HLP (average)												2.4802	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8807 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
99.7154	98.2168	96.0332	91.8552	88.7719	85.3335	83.3791	85.5462	87.9218	91.6136	95.8814	99.3333	(42a)

Hot water usage for baths

32.9572	32.4677	31.7784	30.5076	29.5560	28.5008	27.9308	28.6152	29.3605	30.4896	31.7866	32.8458	(42b)

Hot water usage for other uses

46.4543	44.7651	43.0758	41.3866	39.6973	38.0081	38.0081	39.6973	41.3866	43.0758	44.7651	46.4543	(42c)

Average daily hot water use (litres/day)	164.7219 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	179.1269	175.4496	170.8875	163.7493	158.0252	151.8423	149.3179	153.8587	158.6688	165.1790	172.4330	178.6334	(44)
Energy conte	283.6932	249.8379	262.6477	224.1646	212.7323	186.7078	180.5871	190.5093	195.6545	224.1463	245.6625	279.6967	(45)
Energy content (annual)										Total = Sum(45)m =		2736.0399	

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

42.5540	37.4757	39.3972	33.6247	31.9098	28.0062	27.0881	28.5764	29.3482	33.6219	36.8494	41.9545	(46)

Water storage loss:	
Store volume	250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.4000 (48)

Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7560	(55)
Total storage loss													
	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(56)
If cylinder contains dedicated solar storage													
	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(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													
	330.3916	292.0171	309.3461	269.3566	259.4307	231.8998	227.2855	237.2077	240.8465	270.8447	290.8545	326.3951	(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													
	330.3916	292.0171	309.3461	269.3566	259.4307	231.8998	227.2855	237.2077	240.8465	270.8447	290.8545	326.3951	(64)
									Total per year (kWh/year) = Sum(64)m =			3285.8759	(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													
	131.6867	116.8145	124.6891	110.6883	108.0922	98.2340	97.4039	100.7031	101.2087	111.8874	117.8364	130.3579	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	172.8441	172.8441	172.8441	172.8441	172.8441	172.8441	172.8441	172.8441	172.8441	172.8441	172.8441	172.8441	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	32.4863	28.8540	23.4657	17.7650	13.2796	11.2112	12.1141	15.7463	21.1347	26.8353	31.3208	33.3892	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	435.2050	439.7211	428.3407	404.1133	373.5306	344.7871	325.5847	321.0687	332.4490	356.6764	387.2591	416.0026	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.1651	55.1651	55.1651	55.1651	55.1651	55.1651	55.1651	55.1651	55.1651	55.1651	55.1651	55.1651	(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)													
	-115.2294	-115.2294	-115.2294	-115.2294	-115.2294	-115.2294	-115.2294	-115.2294	-115.2294	-115.2294	-115.2294	-115.2294	(71)
Water heating gains (Table 5)													
	176.9982	173.8311	167.5928	153.7338	145.2852	136.4360	130.9193	135.3536	140.5677	150.3862	163.6616	175.2122	(72)
Total internal gains													
	757.4694	755.1860	732.1791	688.3920	644.8752	605.2142	581.3979	584.9484	606.9312	646.6778	695.0214	737.3838	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.9500	11.5821	0.6000	0.8500	0.7700	12.0757	(74)
Northeast	6.4000	12.4928	0.6000	0.8500	0.7700	28.2581	(75)
Southeast	5.5500	39.1209	0.6000	0.8500	0.7700	76.7371	(77)
Northwest	11.1500	12.4928	0.6000	0.8500	0.7700	49.2308	(81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	166.3017	280.5266	455.5817	704.3163	875.0123	977.3418	919.1965	780.7318	585.2104	359.2220	211.1727	136.3684	(83)
Total gains	923.7710	1035.7125	1187.7608	1392.7083	1519.8875	1582.5560	1500.5944	1365.6802	1192.1416	1005.8999	906.1940	873.7522	(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	20.7344	20.8690	21.0054	21.4253	21.4253	22.0122	21.8625	22.0122	22.0122	21.5691	21.7148	21.1435	
alpha	2.3823	2.3913	2.4004	2.4284	2.4284	2.4675	2.4575	2.4675	2.4675	2.4379	2.4477	2.4096	
util living area													
	0.9858	0.9806	0.9652	0.9273	0.8464	0.6725	0.4834	0.5440	0.8182	0.9459	0.9786	0.9875	(86)
Living	17.6768	17.9054	18.5361	19.3284	20.1043	20.7074	20.9209	20.8902	20.4365	19.4918	18.5263	17.6891	
Non living	15.3765	15.6711	16.4749	17.4735	18.3828	18.9716	19.0564	19.0629	18.7804	17.7007	16.4910	15.4049	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.3000	17.9054	18.5361	19.3284	20.1043	20.7074	20.9209	20.8902	20.4365	19.4918	18.5263	18.1522	(87)
Th 2	18.9812	18.9907	19.0003	19.0292	19.0292	19.0684	19.0585	19.0684	19.0684	19.0389	19.0487	19.0099	(88)
util rest of house													
	0.9810	0.9738	0.9516	0.8948	0.7619	0.4709	0.1526	0.2107	0.6754	0.9138	0.9695	0.9832	(89)
MIT 2	17.5441	15.6711	16.4749	17.4735	18.3828	18.9716	19.0564	19.0629	18.7804	17.7007	16.4910	16.0545	(90)
Living area fraction										fLA = Living area / (4) =		0.2012	(91)
MIT	17.8974	16.1206	16.8896	17.8467	18.7291	19.3208	19.4316	19.4306	19.1136	18.0611	16.9005	16.4766	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.8974	16.1206	16.8896	17.8467	18.7291	19.3208	19.4316	19.4306	19.1136	18.0611	16.9005	16.4766	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9773	0.9568	0.9278	0.8653	0.7442	0.5034	0.2248	0.2843	0.6801	0.8877	0.9518	0.9741	(94)
Useful gains	902.8363	990.9962	1102.0079	1205.1237	1131.1683	796.6395	337.3813	388.2803	810.7235	892.9351	862.5453	851.0965	(95)
Ext temp.	5.2000	5.7000	7.7000	10.2000	13.3000	16.3000	18.3000	18.1000	15.5000	11.9000	8.2000	5.2000	(96)
Heat loss rate W													
	4076.7349	3324.1478	2912.4371	2375.9303	1686.9041	913.5934	344.5650	402.4033	1092.8510	1901.5772	2667.3373	3550.4980	(97)
Space heating kWh													
	2361.3805	1567.8779	1346.9594	842.9808	413.4674	0.0000	0.0000	0.0000	0.0000	750.4298	1299.4503	2008.3548	(98a)
Space heating requirement - total per year (kWh/year)												10590.9008	
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													
	2361.3805	1567.8779	1346.9594	842.9808	413.4674	0.0000	0.0000	0.0000	0.0000	750.4298	1299.4503	2008.3548	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 10590.9008
Space heating per m2 (98c) / (4) = 84.7272 (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 %) 417.9981 (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													
	2361.3805	1567.8779	1346.9594	842.9808	413.4674	0.0000	0.0000	0.0000	0.0000	750.4298	1299.4503	2008.3548	(98)
Space heating efficiency (main heating system 1)													
	417.9981	417.9981	417.9981	417.9981	417.9981	0.0000	0.0000	0.0000	0.0000	417.9981	417.9981	417.9981	(210)
Space heating fuel (main heating system)													
	564.9262	375.0921	322.2406	201.6710	98.9161	0.0000	0.0000	0.0000	0.0000	179.5295	310.8747	480.4699	(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													
	330.3916	292.0171	309.3461	269.3566	259.4307	231.8998	227.2855	237.2077	240.8465	270.8447	290.8545	326.3951	(64)
Efficiency of water heater												192.7920	(216)
(217)m	192.7920	192.7920	192.7920	192.7920	192.7920	192.7920	192.7920	192.7920	192.7920	192.7920	192.7920	192.7920	(217)
Fuel for water heating, kWh/month													
	171.3720	151.4674	160.4558	139.7136	134.5650	120.2850	117.8915	123.0381	124.9255	140.4854	150.8644	169.2991	(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	61.1169	55.2023	61.1169	59.1453	61.1169	59.1453	61.1169	61.1169	59.1453	61.1169	59.1453	61.1169	(231)
Lighting	28.4351	22.8117	20.5394	15.0480	11.6235	9.4965	10.6034	13.7827	17.9023	23.4888	26.5306	29.2254	(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 2533.7201 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 192.7920
Water heating fuel used 1704.3629 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4980)
mechanical ventilation fans (SFP = 1.4980) 719.6017 (230a)
Total electricity for the above, kWh/year 719.6017 (231)
Electricity for lighting (calculated in Appendix L) 229.4873 (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 5187.1720 (238)

10a. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2533.7201	21.5100	545.0032	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1704.3629	21.5100	366.6085	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	719.6017	21.5100	154.7863	(249)
Energy for lighting	229.4873	21.5100	49.3627	(250)
Additional standing charges			0.0000	(251)
Total energy cost			1115.7607	(255)

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	2533.7201	0.1551	392.9711	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1704.3629	0.1411	240.4834	(264)
Space and water heating			633.4545	(265)
Pumps, fans and electric keep-hot	719.6017	0.1387	99.8176	(267)
Energy for lighting	229.4873	0.1443	33.1221	(268)
Total CO2, kg/year			766.3942	(272)

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	2533.7201	1.5742	3988.4804	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1704.3629	1.5217	2593.6004	(278)
Space and water heating			6582.0809	(279)
Pumps, fans and electric keep-hot	719.6017	1.5128	1088.6135	(281)
Energy for lighting	229.4873	1.5338	351.9953	(282)
Total Primary energy kWh/year			8022.6897	(286)

Predicted Energy Assessment

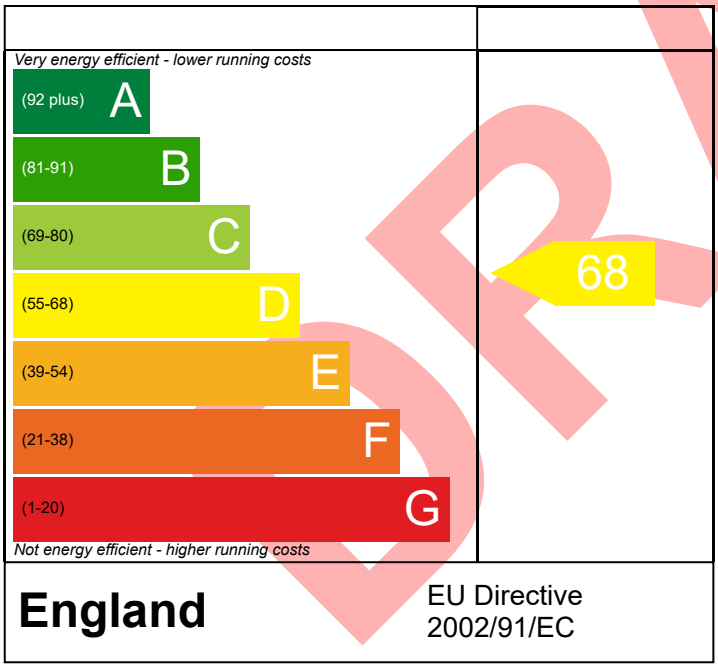
Apartment 3, 26, Rosslyn Hill, London, NW3 1PD

Dwelling type:	Flat, End-Terrace
Date of assessment:	21/12/2023
Produced by:	Anna Sung
Total floor area:	125 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

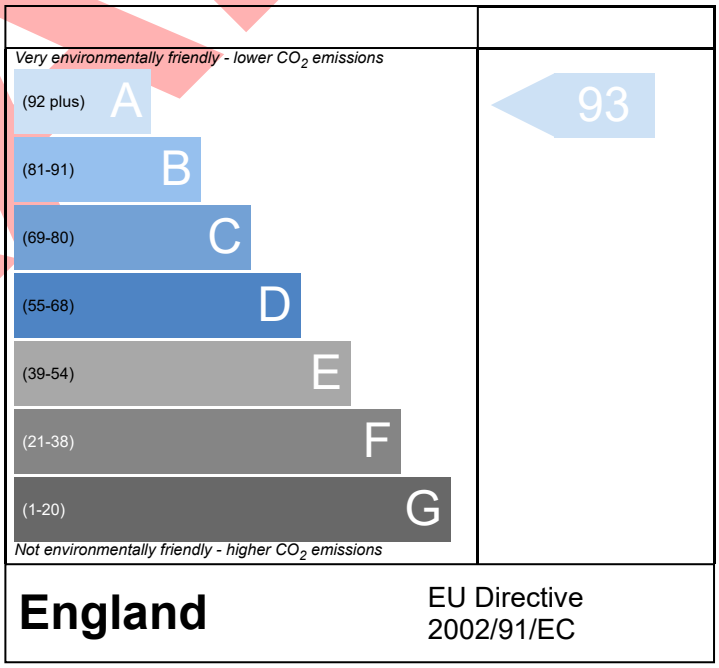
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

Summary for Input Data

elmhurst energy

Property Reference	Apartment 3	**Issued on Date**	21/12/2023
Assessment Reference	231207ac Unit 3 - Be Green	**Prop Type Ref**	Flat
Property	Apartment 3, 26, Rosslyn Hill, London, NW3 1PD		

SAP Rating	68 D	**DER**		**TER**	
Environmental	93 A	**% DER < TER**			N/A
CO_2 Emissions (t/year)	0.77	**DFEE**		**TFEE**	
Compliance Check	See BREL	**% DFEE < TFEE**			
% DPER < TPER		**DPER**		**TPER**	

Assessor Details	Ms. Anna Sung	**Assessor ID**	BK81-0001
Client			

SUMMARY FOR INPUT DATA FOR: Conversion (As Designed)

Orientation	Southwest
Property Tenture	ND
Transaction Type	5
Terrain Type	Suburban
1.0 Property Type	Flat, End-Terrace
Position of Flat	Mid-floor flat
Which Floor	3
2.0 Number of Storeys	1
3.0 Date Built	2023
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown
6.0 Thermal Mass Parameter	Precise calculation
7.0 Electricity Tariff	Standard
Smart electricity meter fitted	No
Smart gas meter fitted	No

7.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground floor:	47.80 m	125.00 m²	3.15 m

8.0 Living Area 25.15 m²

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
External Wall Existing	Solid Wall	Solid wall : plasterboard on dabs, insulation, any outside structure	1.55	9.00	96.39	79.58	0.00	None	16.81	Enter Gross Area
External Wall New	Cavity Wall	Cavity wall : plasterboard on dabs, dense block, filled cavity, any outside structure	0.18	150.00	35.76	26.53	0.00	None	9.23	Enter Gross Area

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)	Shelter Res	Shelter
Party Wall 1	Solid Wall	Single plasterboard on dabs on both sides, dense blocks, cavity or cavity fill	0.00	70.00	33.39		None

10.0 External Roofs

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Code	Shelter Factor	Calculation Type	Openings
Flat Roof	External Flat Roof	Plasterboard, insulated flat roof	0.15	9.00	43.20	43.20	None	0.00	Enter Gross Area	0.00

10.1 Party Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Ceiling 1	Concrete floor slab, carpeted	100.00	81.80

11.1 Party Floors

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)

Party Floor 1	Lowest occupied	Concrete floor slab, carpeted		100.00	125.00

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Windows	Manufacturer	Window	Double Low-E Soft 0.05			0.60		0.85	1.40

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
Bedroom	Windows	External Wall New	North West	5.28	
Living Room (Terrace door)	Windows	External Wall Existing	South East	2.89	
M Bedroom (Terrace door)	Windows	External Wall Existing	South East	2.66	
Living Room + Hallway	Windows	External Wall Existing	North West	5.87	
M Bedroom	Windows	External Wall New	North East	3.95	
M Bedroom (Terrace door)	Windows	External Wall Existing	North	2.95	
Living Room (Terrace door)	Windows	External Wall Existing	North East	2.45	

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	Yes	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E1 Steel lintel with perforated steel base plate	Table K1 - Default	14.15	1.00	1.00	No
E3 Sill	Table K1 - Default	14.15	0.10	0.10	No
E4 Jamb	Table K1 - Default	36.12	0.10	0.10	No
E7 Party floor between dwellings (in blocks of flats)	Table K1 - Default	34.23	0.28	0.28	No
E15 Flat roof with parapet	Table K1 - Default	34.23	0.30	0.30	No
E16 Corner (normal)	Table K1 - Default	9.16	0.18	0.18	No
E18 Party wall between dwellings	Table K1 - Default	3.15	0.24	0.24	No
E24 Eaves (insulation at ceiling level - inverted)	Table K1 - Default	6.68	0.15	0.15	No
E25 Staggered party wall between dwellings	Table K1 - Default	3.05	0.24	0.24	No
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Table K1 - Default	27.44	0.00	0.00	No
E17 Corner (inverted – internal area greater than external area)	Table K1 - Default	3.05	0.00	0.00	No

Y-value	0.25	W/m²K

18.0 Pressure Testing	No	
Test Method	Blower Door	

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Balanced mechanical ventilation with heat recovery
MV Reference Number	500140
Configuration	3
Manufacturer SFP	1.07
Duct Type	Rigid
MVHR Efficiency	88.00
Wet Rooms	3
SFP from Installer Commissioning Certificate	No
MVHR System Location	Inside heated envelope (installed exclusively)
Duct Installation Specification	Level 1

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System	No

22.0 Lighting

No Fixed Lighting	No				
	Name	**Efficacy**	**Power**	**Capacity**	**Count**
	LED	100.00	25	2500	15

24.0 Main Heating 1	Database

Summary for Input Data

elmhurst energy

Description	ASHP	
Percentage of Heat	100.00	%
Database Ref. No.	104457	
Fuel Type	Electricity	
In Winter	418.92	
In Summer	193.32	
Model Name	aroTHERM plus 12kW + AI	
Manufacturer	Vaillant Group UK Ltd	
System Type	Heat Pump	
Controls SAP Code	2207	
Is MHS Pumped	Pump in heated space	
Heating Pump Age	2013 or later	
Heat Emitter	Underfloor	
Underfloor Heating	Yes - Pipes in Wood	
Flow Temperature	Enter value	
Flow Temperature Value	35.00	
25.0 Main Heating 2	None	
26.0 Heat Networks	None	

	Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power Ratio	Electrical	Fuel Factor	Efficiency type
Heat source 1										
Heat source 2										
Heat source 3										
Heat source 4										
Heat source 5										

28.0 Water Heating

Water Heating	Main Heating 1	
SAP Code	901	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	No	
Cold Water Source	From mains	
Bath Count	1	
Immersion Only Heating Hot Water	No	

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To

28.3 Waste Water Heat Recovery System

29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	250.00	L
Loss	1.40	kWh/day
Pipes insulation	Fully insulated primary pipework	
In Airing Cupboard	No	

Summary for Input Data

31.0 Thermal Store	None
34.0 Small-scale Hydro	None

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

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
			0	0
			0	0
			0	0

Thermal Bridging

elmhurst energy

Property Reference	Apartment 3	**Issued on Date**	21/12/2023
Assessment Reference	231207ac Unit 3 - Be Green	**Prop Type Ref**	End-Terrace Flat
Property	Apartment 3, 26, Rosslyn Hill, London, NW3 1PD		

SAP Rating	68 D	**DER**		**TER**	
Environmental	93 A	**% DER < TER**			N/A
CO_2 Emissions (t/year)	0.77	**DFEE**		**TFEE**	
Compliance Check	See BREL	**% DFEE < TFEE**			
% DPER < TPER		**DPER**		**TPER**	

Assessor Details	Ms. Anna Sung	**Assessor ID**	BK81-0001
Client			

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E1 Steel lintel with perforated steel base plate	Table K1 - Default	1.000	14.15	14.15	
External wall	E3 Sill	Table K1 - Default	0.100	14.15	1.42	
External wall	E4 Jamb	Table K1 - Default	0.100	36.12	3.61	
External wall	E7 Party floor between dwellings (in blocks of flats)	Table K1 - Default	0.280	34.23	9.58	
External wall	E15 Flat roof with parapet	Table K1 - Default	0.300	34.23	10.27	
External wall	E16 Corner (normal)	Table K1 - Default	0.180	9.16	1.65	
External wall	E18 Party wall between dwellings	Table K1 - Default	0.240	3.15	0.76	
External wall	E24 Eaves (insulation at ceiling level - inverted)	Table K1 - Default	0.150	6.68	1.00	
External wall	E25 Staggered party wall between dwellings	Table K1 - Default	0.240	3.05	0.73	
Party wall	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Table K1 - Default	0.000	27.44	0.00	
External wall	E17 Corner (inverted – internal area greater than external area)	Table K1 - Default	0.000	3.05	0.00	

Total: 185.41 W/mK:

Y-Value: 0.25 W/m²K:

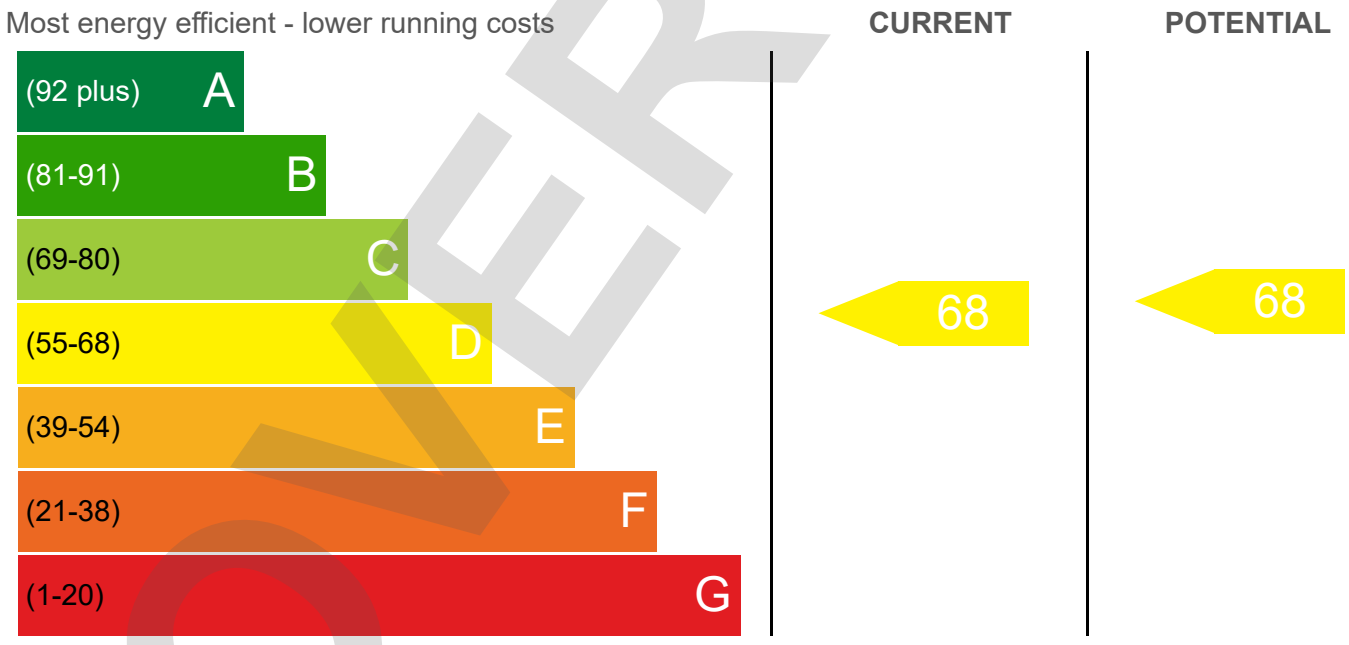
Overview Report

Dwelling Address	Apartment 3, 26, Rosslyn Hill, London, NW3 1PD
Report Date	21/12/2023
Property Type	Flat, End-Terrace
Floor Area [m^2]	125

This document is not an Energy Performance Certificate (EPC) as required by the Energy Performance of Buildings Regulations

Energy Rating

The current energy rating represents the overall energy efficiency of the dwelling. The potential energy rating is the overall energy rating of the dwelling after all of the recommend measures provided on the next page have been installed. A higher score represents a more energy efficient dwelling with lower fuel bills.



Overview Report

Breakdown of property's energy performance

Each feature is assessed as one of the following:

Very Poor | Poor | Average | Good | Very Good

Feature	Description	Energy Performance
Walls	Average thermal transmittance 1.21 W/m²K	Poor
Roof	Average thermal transmittance 0.15 W/m²K	Very Good
Windows	High performance glazing	Good
Main heating	Air source heat pump, underfloor, electric	Very Good
Main heating controls	Time and temperature zone control	Very Good
Secondary heating	None	
Hot water	From main system	Average
Lighting	Excelent lighting efficiency	Very Good
Air tightness	(not tested)	

Primary Energy use

The primary energy use for this property per year is 64 kilowatt hour (kWh) per square metre

Estimated CO_2 emissions of the dwelling

The estimated CO rating provides an indication of the dwelling's impact on the environment in terms of carbon dioxide emissions; the higher the rating the less impact it has on the environment.

The estimated CO emissions for this dwellings is: **0.8** per year

With the recommended measures the potential CO emissions could be: **1** per year

Overview Report

Recommendations

The recommended measures provided below will help to improve the energy efficiency of the dwelling.
To reach the dwelling's potential energy rating all of the recommended measures shown below would need to be installed.
Having these measures installed individually or in any other order may give a different result when compared with the cumulative potential rating.

Recommended measure	Typical Yearly Saving	Potential Rating after measure installed	Cumulative savings (per year)	Cumulative Potential Rating

Estimated energy use and potential savings

Estimated energy cost for this property over a year

£1116

Over a year you could save

£0

The estimated cost and savings show how much the average household would spend in this property for heating, lighting and hot water. It is not based on how energy is used by the people living at the property.

Contacting the assessor and the accreditation scheme

Assessor contact details	
Assessor name	Ms. Anna Sung
Assessor's accreditation number	
Email Address	

Overview Report

Accreditation scheme contact details	
Accreditation scheme	
Telephone	
Email Address	

Assessment details	
Related party disclosure	
Date of assessment	19/12/2023
Date of certificate	19/12/2023
Type of assessment	SAP, existing dwelling

Full SAP Calculation Printout

Property Reference	Apartment A	**Issued on Date**	21/12/2023
Assessment Reference	231207ac Unit A - Be Green	**Prop Type Ref**	Flat
Property	Apartment A, 26, Rosslyn Hill, London, NW3 1PD		

SAP Rating	62 D	**DER**		**TER**	
Environmental	92 A	**% DER < TER**			N/A
CO_2 Emissions (t/year)	1.08	**DFEE**		**TFEE**	
Compliance Check	See BREL	**% DFEE < TFEE**			
% DPER < TPER		**DPER**		**TPER**	

Assessor Details	Ms. Anna Sung	**Assessor ID**	BK81-0001
Client			

SAP 10 WORKSHEET FOR Conversion (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	156.1200	(1b)	x 4.5000	(2b) =	702.5400	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	156.1200					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		702.5400	(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		No
Pressure Test Method		Blower Door
Measured/design AP50		15.0000 (17)
Infiltration rate		0.7500 (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) =	0.6938 (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	0.8845	0.8672	0.8498	0.7631	0.7458	0.6591	0.6591	0.6417	0.6938	0.7458	0.7805	0.8152	(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	0.9885	0.9712	0.9538	0.8671	0.8498	0.7631	0.7631	0.7457	0.7978	0.8498	0.8845	0.9192	(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 = 1.40)			34.2300	1.3258	45.3807			(27)
External Wall LF	155.9400	34.2300	121.7100	1.5500	188.6505	9.0000	1095.3900	(29a)
Flat Roof	31.4800		31.4800	0.1600	5.0368	9.0000	283.3200	(30)
P Roof Rafter	146.3400		146.3400	0.1600	23.4144	9.0000	1317.0600	(30)
Total net area of external elements Aum(A, m2)			333.7600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	262.4824			(33)
Party Wall LF			22.5000	0.0000	0.0000	70.0000	1575.0000	(32)
Party Floor 1			156.0000			0.0000	0.0000	(32d)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 4270.7700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	27.3557 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E1 Steel lintel with perforated steel base plate	29.9600	1.0000	29.9600
E3 Sill	29.9600	0.1000	2.9960

E4 Jamb	68.4300	0.1000	6.8430	
E7 Party floor between dwellings (in blocks of flats)	48.1300	0.2800	13.4764	
E16 Corner (normal)	17.7000	0.1800	3.1860	
E18 Party wall between dwellings	5.6100	0.2400	1.3464	
E24 Eaves (insulation at ceiling level - inverted)	5.6100	0.1500	0.8415	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.7200	0.0000	0.0000	
E17 Corner (inverted - internal area greater than external area)	5.6100	0.0000	0.0000	
E6 Intermediate floor within a dwelling	49.7200	0.1400	6.9608	
E14 Flat roof	21.5500	0.1600	3.4480	
P2 Party wall - Intermediate floor within a dwelling	11.3200	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	5.7200	0.4800	2.7456	
R6 Flat ceiling	24.5900	0.1200	2.9508	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			74.7545	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	337.2369	(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	229.1793	225.1584	221.1374	201.0327	197.0118	176.9070	176.9070	172.8861	184.9489	197.0118	205.0536	213.0955	(38)
Heat transfer coeff	566.4162	562.3952	558.3743	538.2696	534.2486	514.1439	514.1439	510.1230	522.1858	534.2486	542.2905	550.3324	(39)
Average = Sum(39)m / 12 =												537.2643	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	3.6281	3.6023	3.5766	3.4478	3.4220	3.2933	3.2933	3.2675	3.3448	3.4220	3.4735	3.5251	(40)
HLP (average)												3.4414	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9434	(42)
Hot water usage for mixer showers	101.1595	99.6393	97.4240	93.1855	90.0575	86.5693	84.5866	86.7851	89.1951	92.9404	97.2699	100.7719	(42a)
Hot water usage for baths	33.4326	32.9361	32.2369	30.9477	29.9823	28.9119	28.3337	29.0280	29.7840	30.9294	32.2451	33.3196	(42b)
Hot water usage for other uses	47.1296	45.4158	43.7020	41.9882	40.2744	38.5606	38.5606	40.2744	41.9882	43.7020	45.4158	47.1296	(42c)
Average daily hot water use (litres/day)												167.1080	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	181.7216	177.9911	173.3628	166.1213	160.3142	154.0417	151.4808	156.0875	160.9672	167.5717	174.9308	181.2210	(44)
Energy conte	287.8027	253.4569	266.4522	227.4117	215.8137	189.4123	183.2030	193.2689	198.4887	227.3932	249.2211	283.7483	(45)
Energy content (annual)										Total = Sum(45)m =		2775.6726	
Distribution loss (46)m = 0.15 x (45)m	43.1704	38.0185	39.9678	34.1118	32.3721	28.4118	27.4804	28.9903	29.7733	34.1090	37.3832	42.5623	(46)
Water storage loss:													
Store volume												250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7560	(55)
Total storage loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(56)
If cylinder contains dedicated solar storage	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(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	334.5011	295.6361	313.1506	272.6037	262.5121	234.6043	229.9014	239.9673	243.6807	274.0916	294.4131	330.4467	(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	334.5011	295.6361	313.1506	272.6037	262.5121	234.6043	229.9014	239.9673	243.6807	274.0916	294.4131	330.4467	(64)
										Total per year (kWh/year) = Sum(64)m =		3325.5086	(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	133.0531	118.0178	125.9541	111.7680	109.1168	99.1332	98.2737	101.6206	102.1511	112.9670	119.0196	131.7050	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.6024	176.6024	176.6024	176.6024	176.6024	176.6024	176.6024	176.6024	176.6024	176.6024	176.6024	176.6024	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	36.4433	32.3686	26.3239	19.9289	14.8971	12.5767	13.5896	17.6643	23.7090	30.1040	35.1358	37.4561	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	488.2145	493.2807	480.5142	453.3358	419.0280	386.7834	365.2421	360.1760	372.9425	400.1209	434.4287	466.6732	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6036	55.6036	55.6036	55.6036	55.6036	55.6036	55.6036	55.6036	55.6036	55.6036	55.6036	55.6036	(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)	-117.7349	-117.7349	-117.7349	-117.7349	-117.7349	-117.7349	-117.7349	-117.7349	-117.7349	-117.7349	-117.7349	-117.7349	(71)
Water heating gains (Table 5)	178.8348	175.6217	169.2931	155.2333	146.6623	137.6850	132.0883	136.5869	141.8765	151.8373	165.3050	177.0229	(72)
Total internal gains	817.9637	815.7420	790.6022	742.9691	695.0584	651.5162	625.3911	628.8982	652.9990	696.5332	749.3406	795.6233	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.8100	11.2829	0.6000	0.8500	0.7700	35.1319	(75)
Southeast	6.9500	36.7938	0.6000	0.8500	0.7700	90.3781	(77)
Southwest	8.1700	36.7938	0.6000	0.8500	0.7700	106.2430	(79)
Northwest	10.3000	11.2829	0.6000	0.8500	0.7700	41.0736	(81)

Solar gains	272.8267	490.0371	737.7244	1026.7712	1252.9320	1289.1173	1224.0174	1048.3740	836.7318	559.7235	331.3931	230.5000	(83)
Total gains	1090.7903	1305.7791	1528.3267	1769.7403	1947.9904	1940.6335	1849.4085	1677.2722	1489.7308	1256.2568	1080.7336	1026.1233	(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	2.0944	2.1094	2.1246	2.2040	2.2205	2.3074	2.3074	2.3256	2.2718	2.2205	2.1876	2.1557	
alpha	1.1396	1.1406	1.1416	1.1469	1.1480	1.1538	1.1538	1.1550	1.1515	1.1480	1.1458	1.1437	
util living area	0.9238	0.9045	0.8756	0.8260	0.7604	0.6716	0.5892	0.6242	0.7505	0.8536	0.9060	0.9274	(86)
Living	14.4868	14.8910	15.7204	16.9143	18.1593	19.3215	20.0095	19.8941	18.9315	17.3474	15.7323	14.4310	
Non living	12.0140	12.4922	13.4703	14.8832	16.3129	17.6129	18.2821	18.2064	17.2276	15.4201	13.5161	11.9655	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	16	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	15	28	20	0	0	0	0	0	0	0	0	31	
MIT	19.2738	17.6538	17.2608	16.9143	18.1593	19.3215	20.0095	19.8941	18.9315	17.3474	15.7323	17.4015	(87)
Th 2	18.4688	18.4791	18.4894	18.5428	18.5538	18.6105	18.6105	18.6222	18.5875	18.5538	18.5319	18.5104	(88)
util rest of house	0.9099	0.8868	0.8508	0.7870	0.6945	0.5519	0.3826	0.4315	0.6527	0.8125	0.8857	0.9144	(89)
MIT 2	17.0324	15.7256	15.2192	14.8832	16.3129	17.6129	18.2821	18.2064	17.2276	15.4201	13.5161	15.5006	(90)
Living area fraction									fLA = Living area / (4) =			0.3043	(91)
MIT	17.7143	16.3123	15.8404	15.5012	16.8747	18.1327	18.8077	18.7199	17.7460	16.0065	14.1904	16.0789	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.7143	16.3123	15.8404	15.5012	16.8747	18.1327	18.8077	18.7199	17.7460	16.0065	14.1904	16.0789	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9047	0.8660	0.8124	0.7092	0.6261	0.5180	0.4063	0.4428	0.6001	0.7391	0.8203	0.8966	(94)
Useful gains	986.8816	1130.8344	1241.5373	1255.1503	1219.7056	1005.1652	751.3782	742.6304	893.9317	928.5035	886.4984	920.0639	(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	7598.0903	6418.2218	5215.4367	3553.2061	2764.5691	1816.3375	1135.0663	1183.4294	1903.8937	2888.4133	3845.0408	6537.3677	(97)
Space heating kWh	4918.7393	3553.1243	2956.5812	1654.6002	1149.3785	0.0000	0.0000	0.0000	0.0000	1458.1729	2130.1505	4179.2740	(98a)
Space heating requirement - total per year (kWh/year)												22000.0208	
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	4918.7393	3553.1243	2956.5812	1654.6002	1149.3785	0.0000	0.0000	0.0000	0.0000	1458.1729	2130.1505	4179.2740	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												22000.0208	
Space heating per m2											(98c) / (4) =	140.9174	(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 %)												481.5534	(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	4918.7393	3553.1243	2956.5812	1654.6002	1149.3785	0.0000	0.0000	0.0000	0.0000	1458.1729	2130.1505	4179.2740	(98)
Space heating efficiency (main heating system 1)	481.5534	481.5534	481.5534	481.5534	481.5534	0.0000	0.0000	0.0000	0.0000	481.5534	481.5534	481.5534	(210)
Space heating fuel (main heating system)	1021.4317	737.8463	613.9674	343.5964	238.6814	0.0000	0.0000	0.0000	0.0000	302.8061	442.3498	867.8734	(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	334.5011	295.6361	313.1506	272.6037	262.5121	234.6043	229.9014	239.9673	243.6807	274.0916	294.4131	330.4467	(64)
Efficiency of water heater												187.5623	(216)
(217)m	187.5623	187.5623	187.5623	187.5623	187.5623	187.5623	187.5623	187.5623	187.5623	187.5623	187.5623	187.5623	(217)
Fuel for water heating, kWh/month	178.3413	157.6202	166.9582	145.3404	139.9600	125.0807	122.5733	127.9401	129.9199	146.1337	156.9682	176.1797	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	109.0464	98.4936	109.0464	105.5288	109.0464	105.5288	109.0464	109.0464	105.5288	109.0464	105.5288	109.0464	(231)
Lighting	31.8986	25.5902	23.0411	16.8809	13.0393	10.6532	11.8949	15.4614	20.0829	26.3498	29.7621	32.7851	(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												4568.5525	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)

Efficiency of water heater	187.5623	
Water heating fuel used	1773.0156	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4980)		
mechanical ventilation fans (SFP = 1.4980)	1283.9340	(230a)
Total electricity for the above, kWh/year	1283.9340	(231)
Electricity for lighting (calculated in Appendix L)	257.4397	(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	7882.9417	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4568.5525	16.4900	753.3543	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1773.0156	16.4900	292.3703	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	1283.9340	16.4900	211.7207	(249)
Energy for lighting	257.4397	16.4900	42.4518	(250)
Additional standing charges			0.0000	(251)
Total energy cost			1299.8971	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	2.3268	(257)
SAP value		62.2828	
SAP rating (Section 12)		62	(258)
SAP band		D	

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	4568.5525	0.1551	708.5658	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1773.0156	0.1411	250.1804	(264)
Space and water heating			958.7462	(265)
Pumps, fans and electric keep-hot	1283.9340	0.1387	178.0975	(267)
Energy for lighting	257.4397	0.1443	37.1565	(268)
Total CO2, kg/year			1174.0002	(272)
CO2 emissions per m2			7.5200	(273)
EI value			92.1780	
EI rating			92	(274)
EI band			A	

SAP 10 WORKSHEET FOR Conversion (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	156.1200	(1b)	x 4.5000	(2b) =	702.5400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 156.1200						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		702.5400	(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		No
Pressure Test Method		Blower Door

Measured/design AP50	15.0000	(17)
Infiltration rate	0.7500	(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) =	0.6938	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.5000	4.4000	4.1000	4.1000	3.7000	3.8000	3.7000	3.7000	4.0000	3.9000	4.3000	(22)
Wind factor	1.1500	1.1250	1.1000	1.0250	1.0250	0.9250	0.9500	0.9250	0.9250	1.0000	0.9750	1.0750	(22a)
Adj infilt rate	0.7978	0.7805	0.7631	0.7111	0.7111	0.6417	0.6591	0.6417	0.6417	0.6938	0.6764	0.7458	(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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.9018	0.8845	0.8671	0.8151	0.8151	0.7457	0.7631	0.7457	0.7457	0.7978	0.7804	0.8498	(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	
Windows (Uw = 1.40)			34.2300	1.3258	45.3807			(27)
External Wall LF	155.9400	34.2300	121.7100	1.5500	188.6505	9.0000	1095.3900	(29a)
Flat Roof	31.4800		31.4800	0.1600	5.0368	9.0000	283.3200	(30)
P Roof Rafter	146.3400		146.3400	0.1600	23.4144	9.0000	1317.0600	(30)
Total net area of external elements Aum(A, m2)			333.7600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	262.4824			(33)
Party Wall LF			22.5000	0.0000	0.0000	70.0000	1575.0000	(32)
Party Floor 1			156.0000			0.0000	0.0000	(32d)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) =	4270.7700	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	27.3557	(35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E1	Steel lintel with perforated steel base plate	29.9600	1.0000	29.9600
E3	Sill	29.9600	0.1000	2.9960
E4	Jamb	68.4300	0.1000	6.8430
E7	Party floor between dwellings (in blocks of flats)	48.1300	0.2800	13.4764
E16	Corner (normal)	17.7000	0.1800	3.1860
E18	Party wall between dwellings	5.6100	0.2400	1.3464
E24	Eaves (insulation at ceiling level - inverted)	5.6100	0.1500	0.8415
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	5.7200	0.0000	0.0000
E17	Corner (inverted - internal area greater than external area)	5.6100	0.0000	0.0000
E6	Intermediate floor within a dwelling	49.7200	0.1400	6.9608
E14	Flat roof	21.5500	0.1600	3.4480
P2	Party wall - Intermediate floor within a dwelling	11.3200	0.0000	0.0000
P4	Party wall - Roof (insulation at ceiling level)	5.7200	0.4800	2.7456
R6	Flat ceiling	24.5900	0.1200	2.9508

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	74.7545	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	337.2369	(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	209.0746	205.0536	201.0327	188.9699	188.9699	172.8861	176.9070	172.8861	172.8861	184.9489	180.9280	197.0118	(38)
Heat transfer coeff	546.3115	542.2905	538.2696	526.2067	526.2067	510.1230	514.1439	510.1230	510.1230	522.1858	518.1649	534.2486	(39)
Average = Sum(39)m / 12 =												524.8664	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	3.4993	3.4735	3.4478	3.3705	3.3705	3.2675	3.2933	3.2675	3.2675	3.3448	3.3190	3.4220	(40)
HLP (average)												3.3619	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9434	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	101.1595	99.6393	97.4240	93.1855	90.0575	86.5693	84.5866	86.7851	89.1951	92.9404	97.2699	100.7719	(42a)
Hot water usage for baths	33.4326	32.9361	32.2369	30.9477	29.9823	28.9119	28.3337	29.0280	29.7840	30.9294	32.2451	33.3196	(42b)
Hot water usage for other uses	47.1296	45.4158	43.7020	41.9882	40.2744	38.5606	38.5606	40.2744	41.9882	43.7020	45.4158	47.1296	(42c)
Average daily hot water use (litres/day)												167.1080	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	181.7216	177.9911	173.3628	166.1213	160.3142	154.0417	151.4808	156.0875	160.9672	167.5717	174.9308	181.2210	(44)
Energy conte	287.8027	253.4569	266.4522	227.4117	215.8137	189.4123	183.2030	193.2689	198.4887	227.3932	249.2211	283.7483	(45)
Energy content (annual)										Total = Sum(45)m =		2775.6726	
Distribution loss (46)m = 0.15 x (45)m	43.1704	38.0185	39.9678	34.1118	32.3721	28.4118	27.4804	28.9903	29.7733	34.1090	37.3832	42.5623	(46)
Water storage loss:													
Store volume												250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7560	(55)
Total storage loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(56)
If cylinder contains dedicated solar storage	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(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	334.5011	295.6361	313.1506	272.6037	262.5121	234.6043	229.9014	239.9673	243.6807	274.0916	294.4131	330.4467	(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	334.5011	295.6361	313.1506	272.6037	262.5121	234.6043	229.9014	239.9673	243.6807	274.0916	294.4131	330.4467	(64)

Total per year (kWh/year) = Sum(64)m = 3325.5086 (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

133.0531	118.0178	125.9541	111.7680	109.1168	99.1332	98.2737	101.6206	102.1511	112.9670	119.0196	131.7050	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.6024	176.6024	176.6024	176.6024	176.6024	176.6024	176.6024	176.6024	176.6024	176.6024	176.6024	176.6024	(66)

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

36.4433	32.3686	26.3239	19.9289	14.8971	12.5767	13.5896	17.6643	23.7090	30.1040	35.1358	37.4561	(67)

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

488.2145	493.2807	480.5142	453.3358	419.0280	386.7834	365.2421	360.1760	372.9425	400.1209	434.4287	466.6732	(68)

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

55.6036	55.6036	55.6036	55.6036	55.6036	55.6036	55.6036	55.6036	55.6036	55.6036	55.6036	55.6036	(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)

-117.7349	-117.7349	-117.7349	-117.7349	-117.7349	-117.7349	-117.7349	-117.7349	-117.7349	-117.7349	-117.7349	-117.7349	(71)

Water heating gains (Table 5)

178.8348	175.6217	169.2931	155.2333	146.6623	137.6850	132.0883	136.5869	141.8765	151.8373	165.3050	177.0229	(72)

Total internal gains

817.9637	815.7420	790.6022	742.9691	695.0584	651.5162	625.3911	628.8982	652.9990	696.5332	749.3406	795.6233	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.8100	12.4928	0.6000	0.8500	0.7700	38.8990	(75)
Southeast	6.9500	39.1209	0.6000	0.8500	0.7700	96.0942	(77)
Southwest	8.1700	39.1209	0.6000	0.8500	0.7700	112.9626	(79)
Northwest	10.3000	12.4928	0.6000	0.8500	0.7700	45.4778	(81)

Solar gains	293.4335	474.5378	720.6889	1040.6309	1238.7400	1361.3425	1289.1173	1130.7890	899.4443	593.0440	368.3466	243.2256	(83)
Total gains	1111.3972	1290.2799	1511.2912	1783.6000	1933.7985	2012.8587	1914.5084	1759.6873	1552.4433	1289.5772	1117.6871	1038.8489	(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	2.1715	2.1876	2.2040	2.2545	2.2545	2.3256	2.3074	2.3256	2.3256	2.2718	2.2895	2.2205	
alpha	1.1448	1.1458	1.1469	1.1503	1.1503	1.1550	1.1538	1.1550	1.1550	1.1515	1.1526	1.1480	
util living area													
	0.9156	0.8980	0.8626	0.8028	0.7196	0.5825	0.4498	0.4894	0.6871	0.8273	0.8909	0.9200	(86)
Living	14.9273	15.2668	16.2640	17.4868	18.8017	19.9575	20.5547	20.4739	19.5202	17.9325	16.2735	14.9023	
Non living	12.5568	12.9584	14.1324	15.5613	17.0412	18.2286	18.6021	18.5959	17.8614	16.1124	14.1816	12.5418	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	14	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	17	28	15	0	0	0	0	0	0	0	0	31	
MIT	19.1757	17.8591	17.3001	17.4868	18.8017	19.9575	20.5547	20.4739	19.5202	17.9325	16.2735	17.6593	(87)
Th 2	18.5211	18.5319	18.5428	18.5762	18.5762	18.6222	18.6105	18.6222	18.6222	18.5875	18.5990	18.5538	(88)
util rest of house													
	0.8996	0.8786	0.8335	0.7546	0.6296	0.3957	0.0790	0.1366	0.5428	0.7731	0.8662	0.9049	(89)
MIT 2	17.0170	15.9689	15.2852	15.5613	17.0412	18.2286	18.6021	18.5959	17.8614	16.1124	14.1816	15.7894	(90)
Living area fraction											fLA = Living area / (4) =	0.3043	(91)
MIT	17.6738	16.5440	15.8982	16.1471	17.5768	18.7546	19.1962	19.1673	18.3661	16.6662	14.8181	16.3583	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.6738	16.5440	15.8982	16.1471	17.5768	18.7546	19.1962	19.1673	18.3661	16.6662	14.8181	16.3583	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8928	0.8572	0.7862	0.6789	0.5753	0.4099	0.2036	0.2495	0.5199	0.7014	0.7967	0.8862	(94)
Useful gains	992.2896	1106.0392	1188.1690	1210.8834	1112.4558	825.1441	389.8362	439.0424	807.0828	904.5524	890.4060	920.6591	(95)
Ext temp.	5.2000	5.7000	7.7000	10.2000	13.3000	16.3000	18.3000	18.1000	15.5000	11.9000	8.2000	5.2000	(96)
Heat loss rate W													
	6814.5802	5880.6205	4412.8594	3129.4142	2250.4781	1252.1584	460.7761	544.4379	1462.0718	2488.8178	3429.2672	5961.3044	(97)
Space heating kWh													
	4331.7842	3208.5186	2399.1696	1381.3422	846.6886	0.0000	0.0000	0.0000	0.0000	1178.6934	1827.9801	3750.2401	(98a)
Space heating requirement - total per year (kWh/year)												18924.4168	
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													
	4331.7842	3208.5186	2399.1696	1381.3422	846.6886	0.0000	0.0000	0.0000	0.0000	1178.6934	1827.9801	3750.2401	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												18924.4168	
Space heating per m2											(98c) / (4) =	121.2171	(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 %)	480.0251	(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												

	4331.7842	3208.5186	2399.1696	1381.3422	846.6886	0.0000	0.0000	0.0000	0.0000	1178.6934	1827.9801	3750.2401	(98)
Space heating efficiency (main heating system 1)													
	480.0251	480.0251	480.0251	480.0251	480.0251	0.0000	0.0000	0.0000	0.0000	480.0251	480.0251	480.0251	(210)
Space heating fuel (main heating system)													
	902.4079	668.4065	499.8009	287.7646	176.3843	0.0000	0.0000	0.0000	0.0000	245.5483	380.8093	781.2592	(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													
	334.5011	295.6361	313.1506	272.6037	262.5121	234.6043	229.9014	239.9673	243.6807	274.0916	294.4131	330.4467	(64)
Efficiency of water heater												187.9746	(216)
(217)m	187.9746	187.9746	187.9746	187.9746	187.9746	187.9746	187.9746	187.9746	187.9746	187.9746	187.9746	187.9746	(217)
Fuel for water heating, kWh/month													
	177.9501	157.2745	166.5919	145.0215	139.6530	124.8064	122.3045	127.6594	129.6349	145.8131	156.6238	175.7933	(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	109.0464	98.4936	109.0464	105.5288	109.0464	105.5288	109.0464	109.0464	105.5288	109.0464	105.5288	109.0464	(231)
Lighting	31.8986	25.5902	23.0411	16.8809	13.0393	10.6532	11.8949	15.4614	20.0829	26.3498	29.7621	32.7851	(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	3942.3810	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	187.9746	
Water heating fuel used	1769.1264	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4980)		
mechanical ventilation fans (SFP = 1.4980)	1283.9340	(230a)
Total electricity for the above, kWh/year	1283.9340	(231)
Electricity for lighting (calculated in Appendix L)	257.4397	(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	7252.8811	(238)

10a. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3942.3810	21.5100	848.0062	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1769.1264	21.5100	380.5391	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	1283.9340	21.5100	276.1742	(249)
Energy for lighting	257.4397	21.5100	55.3753	(250)
Additional standing charges			0.0000	(251)
Total energy cost			1560.0947	(255)

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	3942.3810	0.1555	613.1822	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1769.1264	0.1411	249.6316	(264)
Space and water heating			862.8137	(265)
Pumps, fans and electric keep-hot	1283.9340	0.1387	178.0975	(267)
Energy for lighting	257.4397	0.1443	37.1565	(268)
Total CO2, kg/year			1078.0677	(272)

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	3942.3810	1.5758	6212.4255	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1769.1264	1.5218	2692.1916	(278)
Space and water heating			8904.6171	(279)
Pumps, fans and electric keep-hot	1283.9340	1.5128	1942.3354	(281)
Energy for lighting	257.4397	1.5338	394.8696	(282)
Total Primary energy kWh/year			11241.8220	(286)

SAP 10 EPC IMPROVEMENTS

231207ac Unit A - Be Green

Current energy efficiency rating: D 62
Current environmental impact rating: A 92

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: D 62
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 533 TEST (30 Nov 2023)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£1560	£1560	£0
Space heating	£1124	£1124	£0
Water heating	£381	£381	£0
Lighting	£55	£55	£0
Total cost of fuels	£1560	£1560	£0
Total cost of uses	£1560	£1560	£0
Delivered energy	46 kWh/m²	46 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.1 tonnes	1.1 tonnes	0.0 tonnes
CO2 emissions per m²	7 kg/m²	7 kg/m²	0 kg/m²
Primary energy	72 kWh/m²	72 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR Conversion (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	156.1200	(1b)	x 4.5000	(2b)	= 702.5400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	156.1200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)		= 702.5400	(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		No
Pressure Test Method		Blower Door
Measured/design AP50		15.0000 (17)
Infiltration rate		0.7500 (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) =	0.6938 (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	0.8845	0.8672	0.8498	0.7631	0.7458	0.6591	0.6591	0.6417	0.6938	0.7458	0.7805	0.8152	(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	0.9885	0.9712	0.9538	0.8671	0.8498	0.7631	0.7631	0.7457	0.7978	0.8498	0.8845	0.9192	(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 = 1.40)			34.2300	1.3258	45.3807			(27)
External Wall LF	155.9400	34.2300	121.7100	1.5500	188.6505	9.0000	1095.3900	(29a)
Flat Roof	31.4800		31.4800	0.1600	5.0368	9.0000	283.3200	(30)
P Roof Rafter	146.3400		146.3400	0.1600	23.4144	9.0000	1317.0600	(30)
Total net area of external elements Aum(A, m2)			333.7600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	262.4824			(33)
Party Wall LF			22.5000	0.0000	0.0000	70.0000	1575.0000	(32)
Party Floor 1			156.0000			0.0000	0.0000	(32d)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 4270.7700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 27.3557 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E1 Steel lintel with perforated steel base plate	29.9600	1.0000	29.9600
E3 Sill	29.9600	0.1000	2.9960
E4 Jamb	68.4300	0.1000	6.8430
E7 Party floor between dwellings (in blocks of flats)	48.1300	0.2800	13.4764
E16 Corner (normal)	17.7000	0.1800	3.1860
E18 Party wall between dwellings	5.6100	0.2400	1.3464
E24 Eaves (insulation at ceiling level - inverted)	5.6100	0.1500	0.8415
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.7200	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	5.6100	0.0000	0.0000
E6 Intermediate floor within a dwelling	49.7200	0.1400	6.9608
E14 Flat roof	21.5500	0.1600	3.4480
P2 Party wall - Intermediate floor within a dwelling	11.3200	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	5.7200	0.4800	2.7456
R6 Flat ceiling	24.5900	0.1200	2.9508

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 74.7545 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 337.2369 (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	229.1793	225.1584	221.1374	201.0327	197.0118	176.9070	176.9070	172.8861	184.9489	197.0118	205.0536	213.0955	(38)
Heat transfer coeff	566.4162	562.3952	558.3743	538.2696	534.2486	514.1439	514.1439	510.1230	522.1858	534.2486	542.2905	550.3324	(39)
Average = Sum(39)m / 12 =												537.2643	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	3.6281	3.6023	3.5766	3.4478	3.4220	3.2933	3.2933	3.2675	3.3448	3.4220	3.4735	3.5251	(40)
HLP (average)												3.4414	
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 2.9434 (42)
Hot water usage for mixer showers

101.1595	99.6393	97.4240	93.1855	90.0575	86.5693	84.5866	86.7851	89.1951	92.9404	97.2699	100.7719	(42a)

Hot water usage for baths

33.4326	32.9361	32.2369	30.9477	29.9823	28.9119	28.3337	29.0280	29.7840	30.9294	32.2451	33.3196	(42b)

Hot water usage for other uses

47.1296	45.4158	43.7020	41.9882	40.2744	38.5606	38.5606	40.2744	41.9882	43.7020	45.4158	47.1296	(42c)

Average daily hot water use (litres/day) 167.1080 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	181.7216	177.9911	173.3628	166.1213	160.3142	154.0417	151.4808	156.0875	160.9672	167.5717	174.9308	181.2210	(44)
Energy conte	287.8027	253.4569	266.4522	227.4117	215.8137	189.4123	183.2030	193.2689	198.4887	227.3932	249.2211	283.7483	(45)
Energy content (annual)											Total = Sum(45)m =	2775.6726	
Distribution loss (46)m = 0.15 x (45)m	43.1704	38.0185	39.9678	34.1118	32.3721	28.4118	27.4804	28.9903	29.7733	34.1090	37.3832	42.5623	(46)
Water storage loss:													
Store volume												250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7560	(55)
Total storage loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(56)
If cylinder contains dedicated solar storage	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(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	334.5011	295.6361	313.1506	272.6037	262.5121	234.6043	229.9014	239.9673	243.6807	274.0916	294.4131	330.4467	(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	334.5011	295.6361	313.1506	272.6037	262.5121	234.6043	229.9014	239.9673	243.6807	274.0916	294.4131	330.4467	(64)
										Total per year (kWh/year) = Sum(64)m =		3325.5086	(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	133.0531	118.0178	125.9541	111.7680	109.1168	99.1332	98.2737	101.6206	102.1511	112.9670	119.0196	131.7050	(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	176.6024	176.6024	176.6024	176.6024	176.6024	176.6024	176.6024	176.6024	176.6024	176.6024	176.6024	176.6024	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	36.4433	32.3686	26.3239	19.9289	14.8971	12.5767	13.5896	17.6643	23.7090	30.1040	35.1358	37.4561	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	488.2145	493.2807	480.5142	453.3358	419.0280	386.7834	365.2421	360.1760	372.9425	400.1209	434.4287	466.6732	(68)

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

	55.6036	55.6036	55.6036	55.6036	55.6036	55.6036	55.6036	55.6036	55.6036	55.6036	55.6036	55.6036 (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)												
	-117.7349	-117.7349	-117.7349	-117.7349	-117.7349	-117.7349	-117.7349	-117.7349	-117.7349	-117.7349	-117.7349	-117.7349 (71)
Water heating gains (Table 5)												
	178.8348	175.6217	169.2931	155.2333	146.6623	137.6850	132.0883	136.5869	141.8765	151.8373	165.3050	177.0229 (72)
Total internal gains												
	817.9637	815.7420	790.6022	742.9691	695.0584	651.5162	625.3911	628.8982	652.9990	696.5332	749.3406	795.6233 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.8100	11.2829	0.6000	0.8500	0.7700	35.1319	(75)
Southeast	6.9500	36.7938	0.6000	0.8500	0.7700	90.3781	(77)
Southwest	8.1700	36.7938	0.6000	0.8500	0.7700	106.2430	(79)
Northwest	10.3000	11.2829	0.6000	0.8500	0.7700	41.0736	(81)

Solar gains	272.8267	490.0371	737.7244	1026.7712	1252.9320	1289.1173	1224.0174	1048.3740	836.7318	559.7235	331.3931	230.5000	(83)
Total gains	1090.7903	1305.7791	1528.3267	1769.7403	1947.9904	1940.6335	1849.4085	1677.2722	1489.7308	1256.2568	1080.7336	1026.1233	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	2.0944	2.1094	2.1246	2.2040	2.2205	2.3074	2.3074	2.3256	2.2718	2.2205	2.1876	2.1557	
alpha	1.1396	1.1406	1.1416	1.1469	1.1480	1.1538	1.1538	1.1550	1.1515	1.1480	1.1458	1.1437	
util living area													
	0.9238	0.9045	0.8756	0.8260	0.7604	0.6716	0.5892	0.6242	0.7505	0.8536	0.9060	0.9274	(86)
Living	14.4868	14.8910	15.7204	16.9143	18.1593	19.3215	20.0095	19.8941	18.9315	17.3474	15.7323	14.4310	
Non living	12.0140	12.4922	13.4703	14.8832	16.3129	17.6129	18.2821	18.2064	17.2276	15.4201	13.5161	11.9655	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	16	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	15	28	20	0	0	0	0	0	0	0	0	31	
MIT	19.2738	17.6538	17.2608	16.9143	18.1593	19.3215	20.0095	19.8941	18.9315	17.3474	15.7323	17.4015	(87)
Th 2	18.4688	18.4791	18.4894	18.5428	18.5538	18.6105	18.6105	18.6222	18.5875	18.5538	18.5319	18.5104	(88)
util rest of house													
	0.9099	0.8868	0.8508	0.7870	0.6945	0.5519	0.3826	0.4315	0.6527	0.8125	0.8857	0.9144	(89)
MIT 2	17.0324	15.7256	15.2192	14.8832	16.3129	17.6129	18.2821	18.2064	17.2276	15.4201	13.5161	15.5006	(90)
Living area fraction										fLA = Living area / (4) =		0.3043	(91)
MIT	17.7143	16.3123	15.8404	15.5012	16.8747	18.1327	18.8077	18.7199	17.7460	16.0065	14.1904	16.0789	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.7143	16.3123	15.8404	15.5012	16.8747	18.1327	18.8077	18.7199	17.7460	16.0065	14.1904	16.0789	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9047	0.8660	0.8124	0.7092	0.6261	0.5180	0.4063	0.4428	0.6001	0.7391	0.8203	0.8966	(94)
Useful gains	986.8816	1130.8344	1241.5373	1255.1503	1219.7056	1005.1652	751.3782	742.6304	893.9317	928.5035	886.4984	920.0639	(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													
	7598.0903	6418.2218	5215.4367	3553.2061	2764.5691	1816.3375	1135.0663	1183.4294	1903.8937	2888.4133	3845.0408	6537.3677	(97)
Space heating kWh													
	4918.7393	3553.1243	2956.5812	1654.6002	1149.3785	0.0000	0.0000	0.0000	0.0000	1458.1729	2130.1505	4179.2740	(98a)
Space heating requirement - total per year (kWh/year)												22000.0208	
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													
	4918.7393	3553.1243	2956.5812	1654.6002	1149.3785	0.0000	0.0000	0.0000	0.0000	1458.1729	2130.1505	4179.2740	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												22000.0208	
Space heating per m2											(98c) / (4) =	140.9174	(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 %)	481.5534 (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													
	4918.7393	3553.1243	2956.5812	1654.6002	1149.3785	0.0000	0.0000	0.0000	0.0000	1458.1729	2130.1505	4179.2740	(98)
Space heating efficiency (main heating system 1)													
	481.5534	481.5534	481.5534	481.5534	481.5534	0.0000	0.0000	0.0000	0.0000	481.5534	481.5534	481.5534	(210)
Space heating fuel (main heating system)													
	1021.4317	737.8463	613.9674	343.5964	238.6814	0.0000	0.0000	0.0000	0.0000	302.8061	442.3498	867.8734	(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													
	334.5011	295.6361	313.1506	272.6037	262.5121	234.6043	229.9014	239.9673	243.6807	274.0916	294.4131	330.4467	(64)
Efficiency of water heater												187.5623	(216)
(217)m	187.5623	187.5623	187.5623	187.5623	187.5623	187.5623	187.5623	187.5623	187.5623	187.5623	187.5623	187.5623	(217)
Fuel for water heating, kWh/month													
	178.3413	157.6202	166.9582	145.3404	139.9600	125.0807	122.5733	127.9401	129.9199	146.1337	156.9682	176.1797	(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	109.0464	98.4936	109.0464	105.5288	109.0464	105.5288	109.0464	109.0464	105.5288	109.0464	105.5288	109.0464	(231)
Lighting	31.8986	25.5902	23.0411	16.8809	13.0393	10.6532	11.8949	15.4614	20.0829	26.3498	29.7621	32.7851	(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	4568.5525	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	187.5623	
Water heating fuel used	1773.0156	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4980)		
mechanical ventilation fans (SFP = 1.4980)	1283.9340	(230a)
Total electricity for the above, kWh/year	1283.9340	(231)
Electricity for lighting (calculated in Appendix L)	257.4397	(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	7882.9417	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4568.5525	16.4900	753.3543	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1773.0156	16.4900	292.3703	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	1283.9340	16.4900	211.7207	(249)
Energy for lighting	257.4397	16.4900	42.4518	(250)
Additional standing charges			0.0000	(251)
Total energy cost			1299.8971	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	2.3268	(257)
SAP value		62.2828	
SAP rating (Section 12)		62	(258)
SAP band		D	

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	4568.5525	0.1551	708.5658	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1773.0156	0.1411	250.1804	(264)
Space and water heating			958.7462	(265)
Pumps, fans and electric keep-hot	1283.9340	0.1387	178.0975	(267)
Energy for lighting	257.4397	0.1443	37.1565	(268)
Total CO2, kg/year			1174.0002	(272)
CO2 emissions per m2			7.5200	(273)
EI value			92.1780	
EI rating			92	(274)
EI band			A	

SAP 10 WORKSHEET FOR Conversion (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		156.1200 (1b)	x	4.5000 (2b)	=	702.5400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	156.1200						(4)

Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 702.5400 (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		No	
Pressure Test Method		Blower Door	
Measured/design AP50		15.0000	(17)
Infiltration rate		0.7500	(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) =	0.6938	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.5000	4.4000	4.1000	4.1000	3.7000	3.8000	3.7000	3.7000	4.0000	3.9000	4.3000	(22)
Wind factor	1.1500	1.1250	1.1000	1.0250	1.0250	0.9250	0.9500	0.9250	0.9250	1.0000	0.9750	1.0750	(22a)
Adj infilt rate	0.7978	0.7805	0.7631	0.7111	0.7111	0.6417	0.6591	0.6417	0.6417	0.6938	0.6764	0.7458	(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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.9018	0.8845	0.8671	0.8151	0.8151	0.7457	0.7631	0.7457	0.7457	0.7978	0.7804	0.8498	(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 = 1.40)			34.2300	1.3258	45.3807			(27)
External Wall LF	155.9400	34.2300	121.7100	1.5500	188.6505	9.0000	1095.3900	(29a)
Flat Roof	31.4800		31.4800	0.1600	5.0368	9.0000	283.3200	(30)
P Roof Rafter	146.3400		146.3400	0.1600	23.4144	9.0000	1317.0600	(30)
Total net area of external elements Aum(A, m2)			333.7600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		262.4824			(33)
Party Wall LF			22.5000	0.0000	0.0000	70.0000	1575.0000	(32)
Party Floor 1			156.0000			0.0000	0.0000	(32d)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	4270.7700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		27.3557 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E1 Steel lintel with perforated steel base plate	29.9600	1.0000	29.9600
E3 Sill	29.9600	0.1000	2.9960
E4 Jamb	68.4300	0.1000	6.8430
E7 Party floor between dwellings (in blocks of flats)	48.1300	0.2800	13.4764
E16 Corner (normal)	17.7000	0.1800	3.1860
E18 Party wall between dwellings	5.6100	0.2400	1.3464
E24 Eaves (insulation at ceiling level - inverted)	5.6100	0.1500	0.8415
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.7200	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	5.6100	0.0000	0.0000
E6 Intermediate floor within a dwelling	49.7200	0.1400	6.9608
E14 Flat roof	21.5500	0.1600	3.4480
P2 Party wall - Intermediate floor within a dwelling	11.3200	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	5.7200	0.4800	2.7456
R6 Flat ceiling	24.5900	0.1200	2.9508

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		74.7545 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	337.2369 (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	209.0746	205.0536	201.0327	188.9699	188.9699	172.8861	176.9070	172.8861	172.8861	184.9489	180.9280	197.0118	(38)
Heat transfer coeff	546.3115	542.2905	538.2696	526.2067	526.2067	510.1230	514.1439	510.1230	510.1230	522.1858	518.1649	534.2486	(39)
Average = Sum(39)m / 12 =												524.8664	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	3.4993	3.4735	3.4478	3.3705	3.3705	3.2675	3.2933	3.2675	3.2675	3.3448	3.3190	3.4220	(40)
HLP (average)												3.3619	
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	2.9434	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
101.1595	99.6393	97.4240	93.1855	90.0575	86.5693	84.5866	86.7851	89.1951	92.9404	97.2699	100.7719	(42a)

Hot water usage for baths

33.4326	32.9361	32.2369	30.9477	29.9823	28.9119	28.3337	29.0280	29.7840	30.9294	32.2451	33.3196	(42b)

Hot water usage for other uses

47.1296	45.4158	43.7020	41.9882	40.2744	38.5606	38.5606	40.2744	41.9882	43.7020	45.4158	47.1296	(42c)

Average daily hot water use (litres/day)	167.1080 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

	181.7216	177.9911	173.3628	166.1213	160.3142	154.0417	151.4808	156.0875	160.9672	167.5717	174.9308	181.2210	(44)
Energy conte	287.8027	253.4569	266.4522	227.4117	215.8137	189.4123	183.2030	193.2689	198.4887	227.3932	249.2211	283.7483	(45)
Energy content (annual)											Total = Sum(45)m =	2775.6726	
Distribution loss (46)m = 0.15 x (45)m													
	43.1704	38.0185	39.9678	34.1118	32.3721	28.4118	27.4804	28.9903	29.7733	34.1090	37.3832	42.5623	(46)
Water storage loss:													
Store volume												250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7560	(55)
Total storage loss													
	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(56)
If cylinder contains dedicated solar storage													
	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(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													
	334.5011	295.6361	313.1506	272.6037	262.5121	234.6043	229.9014	239.9673	243.6807	274.0916	294.4131	330.4467	(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													
	334.5011	295.6361	313.1506	272.6037	262.5121	234.6043	229.9014	239.9673	243.6807	274.0916	294.4131	330.4467	(64)
										Total per year (kWh/year) = Sum(64)m =		3325.5086	(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													
	133.0531	118.0178	125.9541	111.7680	109.1168	99.1332	98.2737	101.6206	102.1511	112.9670	119.0196	131.7050	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.6024	176.6024	176.6024	176.6024	176.6024	176.6024	176.6024	176.6024	176.6024	176.6024	176.6024	176.6024	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	36.4433	32.3686	26.3239	19.9289	14.8971	12.5767	13.5896	17.6643	23.7090	30.1040	35.1358	37.4561	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	488.2145	493.2807	480.5142	453.3358	419.0280	386.7834	365.2421	360.1760	372.9425	400.1209	434.4287	466.6732	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.6036	55.6036	55.6036	55.6036	55.6036	55.6036	55.6036	55.6036	55.6036	55.6036	55.6036	55.6036	(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)													
	-117.7349	-117.7349	-117.7349	-117.7349	-117.7349	-117.7349	-117.7349	-117.7349	-117.7349	-117.7349	-117.7349	-117.7349	(71)
Water heating gains (Table 5)													
	178.8348	175.6217	169.2931	155.2333	146.6623	137.6850	132.0883	136.5869	141.8765	151.8373	165.3050	177.0229	(72)
Total internal gains													
	817.9637	815.7420	790.6022	742.9691	695.0584	651.5162	625.3911	628.8982	652.9990	696.5332	749.3406	795.6233	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.8100	12.4928	0.6000	0.8500	0.7700	38.8990	(75)
Southeast	6.9500	39.1209	0.6000	0.8500	0.7700	96.0942	(77)
Southwest	8.1700	39.1209	0.6000	0.8500	0.7700	112.9626	(79)
Northwest	10.3000	12.4928	0.6000	0.8500	0.7700	45.4778	(81)

Solar gains	293.4335	474.5378	720.6889	1040.6309	1238.7400	1361.3425	1289.1173	1130.7890	899.4443	593.0440	368.3466	243.2256	(83)
Total gains	1111.3972	1290.2799	1511.2912	1783.6000	1933.7985	2012.8587	1914.5084	1759.6873	1552.4433	1289.5772	1117.6871	1038.8489	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	2.1715	2.1876	2.2040	2.2545	2.2545	2.3256	2.3074	2.3256	2.3256	2.2718	2.2895	2.2205	
alpha	1.1448	1.1458	1.1469	1.1503	1.1503	1.1550	1.1538	1.1550	1.1550	1.1515	1.1526	1.1480	
util living area													
	0.9156	0.8980	0.8626	0.8028	0.7196	0.5825	0.4498	0.4894	0.6871	0.8273	0.8909	0.9200	(86)
Living	14.9273	15.2668	16.2640	17.4868	18.8017	19.9575	20.5547	20.4739	19.5202	17.9325	16.2735	14.9023	
Non living	12.5568	12.9584	14.1324	15.5613	17.0412	18.2286	18.6021	18.5959	17.8614	16.1124	14.1816	12.5418	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	14	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	17	28	15	0	0	0	0	0	0	0	0	31	
MIT	19.1757	17.8591	17.3001	17.4868	18.8017	19.9575	20.5547	20.4739	19.5202	17.9325	16.2735	17.6593	(87)
Th 2	18.5211	18.5319	18.5428	18.5762	18.5762	18.6222	18.6105	18.6222	18.6222	18.5875	18.5990	18.5538	(88)
util rest of house													
	0.8996	0.8786	0.8335	0.7546	0.6296	0.3957	0.0790	0.1366	0.5428	0.7731	0.8662	0.9049	(89)
MIT 2	17.0170	15.9689	15.2852	15.5613	17.0412	18.2286	18.6021	18.5959	17.8614	16.1124	14.1816	15.7894	(90)
Living area fraction										fLA = Living area / (4) =		0.3043	(91)
MIT	17.6738	16.5440	15.8982	16.1471	17.5768	18.7546	19.1962	19.1673	18.3661	16.6662	14.8181	16.3583	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.6738	16.5440	15.8982	16.1471	17.5768	18.7546	19.1962	19.1673	18.3661	16.6662	14.8181	16.3583	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8928	0.8572	0.7862	0.6789	0.5753	0.4099	0.2036	0.2495	0.5199	0.7014	0.7967	0.8862	(94)
Useful gains	992.2896	1106.0392	1188.1690	1210.8834	1112.4558	825.1441	389.8362	439.0424	807.0828	904.5524	890.4060	920.6591	(95)
Ext temp.	5.2000	5.7000	7.7000	10.2000	13.3000	16.3000	18.3000	18.1000	15.5000	11.9000	8.2000	5.2000	(96)
Heat loss rate W													
	6814.5802	5880.6205	4412.8594	3129.4142	2250.4781	1252.1584	460.7761	544.4379	1462.0718	2488.8178	3429.2672	5961.3044	(97)

Space heating kWh

4331.7842	3208.5186	2399.1696	1381.3422	846.6886	0.0000	0.0000	0.0000	0.0000	1178.6934	1827.9801	3750.2401	(98a)

Space heating requirement - total per year (kWh/year) 18924.4168

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

4331.7842	3208.5186	2399.1696	1381.3422	846.6886	0.0000	0.0000	0.0000	0.0000	1178.6934	1827.9801	3750.2401	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 18924.4168

Space heating per m2 (98c) / (4) = 121.2171 (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 %) 480.0251 (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													
	4331.7842	3208.5186	2399.1696	1381.3422	846.6886	0.0000	0.0000	0.0000	0.0000	1178.6934	1827.9801	3750.2401	(98)
Space heating efficiency (main heating system 1)													
	480.0251	480.0251	480.0251	480.0251	480.0251	0.0000	0.0000	0.0000	0.0000	480.0251	480.0251	480.0251	(210)
Space heating fuel (main heating system)													
	902.4079	668.4065	499.8009	287.7646	176.3843	0.0000	0.0000	0.0000	0.0000	245.5483	380.8093	781.2592	(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													
	334.5011	295.6361	313.1506	272.6037	262.5121	234.6043	229.9014	239.9673	243.6807	274.0916	294.4131	330.4467	(64)
Efficiency of water heater												187.9746	(216)
(217)m	187.9746	187.9746	187.9746	187.9746	187.9746	187.9746	187.9746	187.9746	187.9746	187.9746	187.9746	187.9746	(217)
Fuel for water heating, kWh/month													
	177.9501	157.2745	166.5919	145.0215	139.6530	124.8064	122.3045	127.6594	129.6349	145.8131	156.6238	175.7933	(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	109.0464	98.4936	109.0464	105.5288	109.0464	105.5288	109.0464	109.0464	105.5288	109.0464	105.5288	109.0464	(231)
Lighting	31.8986	25.5902	23.0411	16.8809	13.0393	10.6532	11.8949	15.4614	20.0829	26.3498	29.7621	32.7851	(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 3942.3810 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 187.9746

Water heating fuel used 1769.1264 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4980)

mechanical ventilation fans (SFP = 1.4980) 1283.9340 (230a)

Total electricity for the above, kWh/year 1283.9340 (231)

Electricity for lighting (calculated in Appendix L) 257.4397 (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 7252.8811 (238)

10a. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3942.3810	21.5100	848.0062	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1769.1264	21.5100	380.5391	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	1283.9340	21.5100	276.1742	(249)
Energy for lighting	257.4397	21.5100	55.3753	(250)
Additional standing charges			0.0000	(251)
Total energy cost			1560.0947	(255)

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	3942.3810	0.1555	613.1822	(261)

Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1769.1264	0.1411	249.6316	(264)
Space and water heating			862.8137	(265)
Pumps, fans and electric keep-hot	1283.9340	0.1387	178.0975	(267)
Energy for lighting	257.4397	0.1443	37.1565	(268)
Total CO2, kg/year			1078.0677	(272)

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	3942.3810	1.5758	6212.4255	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1769.1264	1.5218	2692.1916	(278)
Space and water heating			8904.6171	(279)
Pumps, fans and electric keep-hot	1283.9340	1.5128	1942.3354	(281)
Energy for lighting	257.4397	1.5338	394.8696	(282)
Total Primary energy kWh/year			11241.8220	(286)

Predicted Energy Assessment

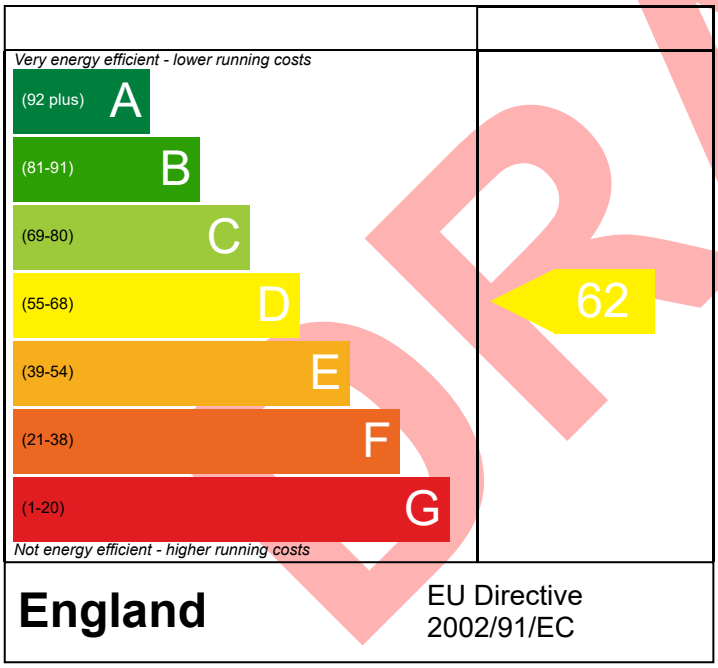
Apartment A, 26, Rosslyn Hill, London, NW3 1PD

Dwelling type:	Flat, Semi-Detached
Date of assessment:	21/12/2023
Produced by:	Anna Sung
Total floor area:	156.12 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

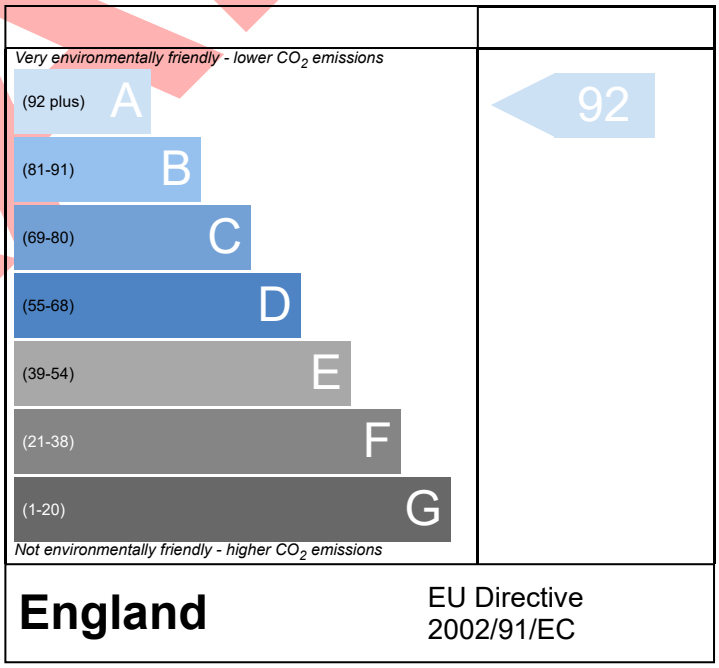
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

Summary for Input Data

elmhurst energy

Property Reference	Apartment A	**Issued on Date**	21/12/2023
Assessment Reference	231207ac Unit A - Be Green	**Prop Type Ref**	Flat
Property	Apartment A, 26, Rosslyn Hill, London, NW3 1PD		

SAP Rating	62 D	**DER**		**TER**	
Environmental	92 A	**% DER < TER**			N/A
CO_2 Emissions (t/year)	1.08	**DFEE**		**TFEE**	
Compliance Check	See BREL	**% DFEE < TFEE**			
% DPER < TPER		**DPER**		**TPER**	

Assessor Details	Ms. Anna Sung	**Assessor ID**	BK81-0001
Client			

SUMMARY FOR INPUT DATA FOR: Conversion (As Designed)

Orientation	Southwest
Property Tenture	ND
Transaction Type	5
Terrain Type	Suburban
1.0 Property Type	Flat, Semi-Detached
Position of Flat	Top-floor flat
Which Floor	4
2.0 Number of Storeys	1
3.0 Date Built	2023
4.0 Sheltered Sides	1
5.0 Sunlight/Shade	Average or unknown
6.0 Thermal Mass Parameter	Precise calculation
7.0 Electricity Tariff	Standard
Smart electricity meter fitted	No
Smart gas meter fitted	No

7.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground floor:	54.38 m	156.12 m²	4.50 m

8.0 Living Area 47.50 m²

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
External Wall LF	Solid Wall	Solid wall : plasterboard on dabs, insulation, any outside structure	1.55	9.00	155.94	121.71	0.00	None	34.23	Enter Gross Area

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)	Shelter Res	Shelter
Party Wall LF	Solid Wall	Single plasterboard on dabs on both sides, dense blocks, cavity or cavity fill	0.00	70.00	22.50		None

10.0 External Roofs

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Code	Shelter Factor	Calculation Type	Openings
Flat Roof	External Flat Roof	Plasterboard, insulated flat roof	0.16	9.00	31.48	31.48	None	0.00	Enter Gross Area	0.00
P Roof Rafter	External Slope Roof	Plasterboard, insulated slope	0.16	9.00	146.34	146.34	None	0.00	Enter Gross Area	0.00

11.1 Party Floors

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Lowest occupied	Other	0.00	156.00

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)

Windows	Manufacturer	Window	Double Low-E Soft 0.05	0.60	0.85	1.40

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
Living, Dining, Kitchen, M Bedroom	Windows	External Wall LF	North West	10.30	
M Bedroom, Ensuite, Bedroom	Windows	External Wall LF	South West	8.17	
Living, Kitchen, Dining	Windows	External Wall LF	South East	6.95	
Hallway	Windows	External Wall LF	North East	8.81	

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	Yes	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E1 Steel lintel with perforated steel base plate	Table K1 - Default	29.96	1.00	1.00	No
E3 Sill	Table K1 - Default	29.96	0.10	0.10	No
E4 Jamb	Table K1 - Default	68.43	0.10	0.10	No
E7 Party floor between dwellings (in blocks of flats)	Table K1 - Default	48.13	0.28	0.28	No
E16 Corner (normal)	Table K1 - Default	17.70	0.18	0.18	No
E18 Party wall between dwellings	Table K1 - Default	5.61	0.24	0.24	No
E24 Eaves (insulation at ceiling level - inverted)	Table K1 - Default	5.61	0.15	0.15	No
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Table K1 - Default	5.72	0.00	0.00	No
E17 Corner (inverted – internal area greater than external area)	Table K1 - Default	5.61	0.00	0.00	No
E6 Intermediate floor within a dwelling	Table K1 - Default	49.72	0.14	0.14	No
E14 Flat roof	Table K1 - Default	21.55	0.16	0.16	No
P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	11.32	0.00	0.00	No
P4 Party wall - Roof (insulation at ceiling level)	Table K1 - Default	5.72	0.48	0.48	No
R6 Flat ceiling	Table K1 - Default	24.59	0.12	0.12	No

Y-value	0.22	W/m²K
18.0 Pressure Testing	No	
Test Method	Blower Door	

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present	Yes	
Approved Installation	No	
Mechanical Ventilation data Type	Database	
Type	Balanced mechanical ventilation with heat recovery	
MV Reference Number	500140	
Configuration	3	
Manufacturer SFP	1.07	
Duct Type	Rigid	
MVHR Efficiency	88.00	
Wet Rooms	3	
SFP from Installer Commissioning Certificate	No	
MVHR System Location	Inside heated envelope (installed exclusively)	
Duct Installation Specification	Level 1	

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System	No	

22.0 Lighting

No Fixed Lighting	No	

Name	Efficacy	Power	Capacity	Count
LED	100.00	25	2500	15

24.0 Main Heating 1	Database	
Description	Vaillant aroTHERM plus 12kW	
Percentage of Heat	100.00	%

Summary for Input Data

Database Ref. No.	104457	
Fuel Type	Electricity	
In Winter	481.55	
In Summer	187.56	
Model Name	aroTHERM plus 12kW + AI	
Manufacturer	Vaillant Group UK Ltd	
System Type	Heat Pump	
Controls SAP Code	2207	
Is MHS Pumped	Pump in heated space	
Heating Pump Age	2013 or later	
Heat Emitter	Underfloor	
Underfloor Heating	Yes - Pipes in Wood	
Flow Temperature	Enter value	
Flow Temperature Value	35.00	

25.0 Main Heating 2 — None

26.0 Heat Networks — None

	Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power Ratio	Electrical	Fuel Factor	Efficiency type
Heat source 1										
Heat source 2										
Heat source 3										
Heat source 4										
Heat source 5										

28.0 Water Heating

Water Heating	Main Heating 1	
SAP Code	901	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	No	
Cold Water Source	From mains	
Bath Count	1	
Immersion Only Heating Hot Water	No	

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To

28.3 Waste Water Heat Recovery System

29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	250.00	L
Loss	1.40	kWh/day
Pipes insulation	Fully insulated primary pipework	
In Airing Cupboard	No	

31.0 Thermal Store — None

Summary for Input Data

34.0 Small-scale Hydro None

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

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
			0	0
			0	0
			0	0

Thermal Bridging

elmhurst energy

Property Reference	Apartment A	**Issued on Date**	21/12/2023
Assessment Reference	231207ac Unit A - Be Green	**Prop Type Ref**	Semi-Detached Flat
Property	Apartment A, 26, Rosslyn Hill, London, NW3 1PD		

SAP Rating	62 D	**DER**		**TER**	
Environmental	92 A	**% DER < TER**			N/A
CO_2 Emissions (t/year)	1.08	**DFEE**		**TFEE**	
Compliance Check	See BREL	**% DFEE < TFEE**			
% DPER < TPER		**DPER**		**TPER**	

Assessor Details	Ms. Anna Sung	**Assessor ID**	BK81-0001
Client			

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E1 Steel lintel with perforated steel base plate	Table K1 - Default	1.000	29.96	29.96	
External wall	E3 Sill	Table K1 - Default	0.100	29.96	3.00	
External wall	E4 Jamb	Table K1 - Default	0.100	68.43	6.84	
External wall	E7 Party floor between dwellings (in blocks of flats)	Table K1 - Default	0.280	48.13	13.48	
External wall	E16 Corner (normal)	Table K1 - Default	0.180	17.70	3.19	
External wall	E18 Party wall between dwellings	Table K1 - Default	0.240	5.61	1.35	
External wall	E24 Eaves (insulation at ceiling level - inverted)	Table K1 - Default	0.150	5.61	0.84	
Party wall	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Table K1 - Default	0.000	5.72	0.00	
External wall	E17 Corner (inverted – internal area greater than external area)	Table K1 - Default	0.000	5.61	0.00	
External wall	E6 Intermediate floor within a dwelling	Table K1 - Default	0.140	49.72	6.96	
External wall	E14 Flat roof	Table K1 - Default	0.160	21.55	3.45	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	11.32	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Table K1 - Default	0.480	5.72	2.75	
External roof	R6 Flat ceiling	Table K1 - Default	0.120	24.59	2.95	

Total: 329.63 W/mK:

Y-Value: 0.22 W/m²K:

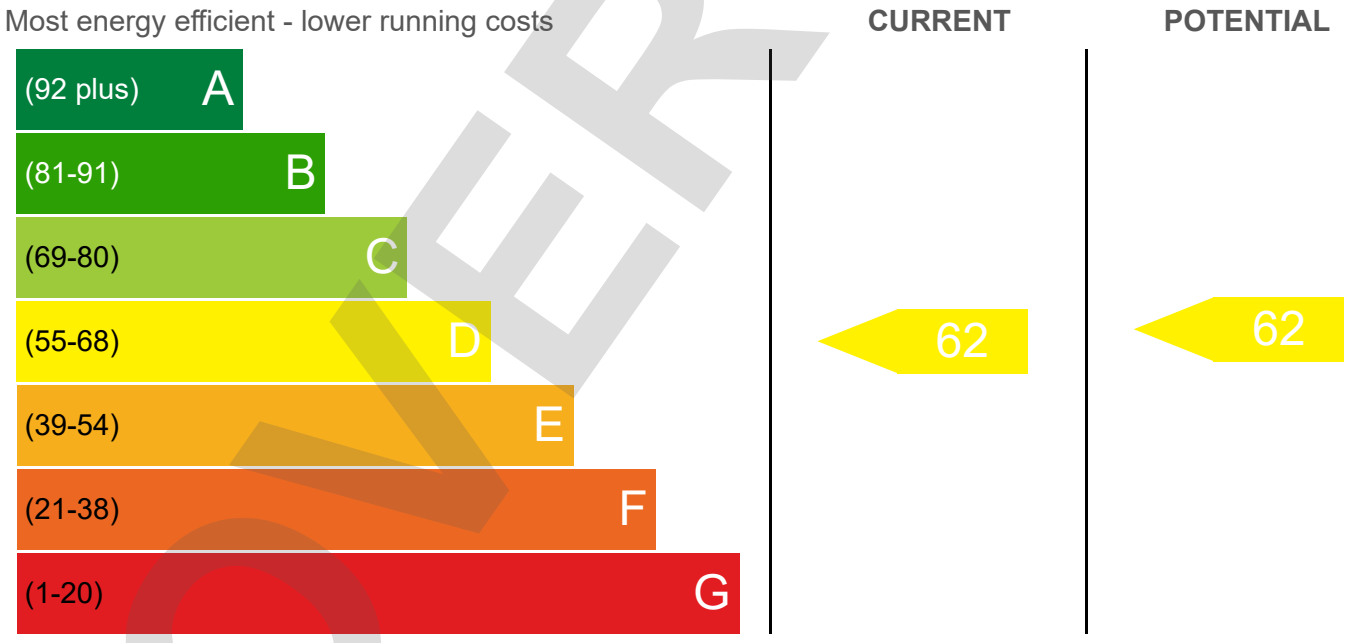
Overview Report

Dwelling Address	Apartment A, 26, Rosslyn Hill, London, NW3 1PD
Report Date	21/12/2023
Property Type	Flat, Semi-Detached
Floor Area [m^2]	156

This document is not an Energy Performance Certificate (EPC) as required by the Energy Performance of Buildings Regulations

Energy Rating

The current energy rating represents the overall energy efficiency of the dwelling. The potential energy rating is the overall energy rating of the dwelling after all of the recommend measures provided on the next page have been installed. A higher score represents a more energy efficient dwelling with lower fuel bills.



Overview Report

Breakdown of property's energy performance

Each feature is assessed as one of the following:

Very Poor | Poor | Average | Good | Very Good

Feature	Description	Energy Performance
Walls	Average thermal transmittance 1.55 W/m²K	Poor
Roof	Average thermal transmittance 0.16 W/m²K	Very Good
Windows	High performance glazing	Good
Main heating	Air source heat pump, underfloor, electric	Very Good
Main heating controls	Time and temperature zone control	Very Good
Secondary heating	None	
Hot water	From main system	Average
Lighting	Excelent lighting efficiency	Very Good
Air tightness	(not tested)	

Primary Energy use

The primary energy use for this property per year is 72 kilowatt hour (kWh) per square metre

Estimated CO_2 emissions of the dwelling

The estimated CO rating provides an indication of the dwelling's impact on the environment in terms of carbon dioxide emissions; the higher the rating the less impact it has on the environment.

The estimated CO emissions for this dwellings is: **1.1** per year

With the recommended measures the potential CO emissions could be: **1** per year

Overview Report

Recommendations

The recommended measures provided below will help to improve the energy efficiency of the dwelling.
To reach the dwelling's potential energy rating all of the recommended measures shown below would need to be installed.
Having these measures installed individually or in any other order may give a different result when compared with the cumulative potential rating.

Recommended measure	Typical Yearly Saving	Potential Rating after measure installed	Cumulative savings (per year)	Cumulative Potential Rating

Estimated energy use and potential savings

Estimated energy cost for this property over a year

£1560

Over a year you could save

£0

The estimated cost and savings show how much the average household would spend in this property for heating, lighting and hot water. It is not based on how energy is used by the people living at the property.

Contacting the assessor and the accreditation scheme

Assessor contact details	
Assessor name	Ms. Anna Sung
Assessor's accreditation number	
Email Address	

Overview Report

Accreditation scheme contact details	
Accreditation scheme	
Telephone	
Email Address	

Assessment details	
Related party disclosure	
Date of assessment	19/12/2023
Date of certificate	19/12/2023
Type of assessment	SAP, existing dwelling

Full SAP Calculation Printout

Property Reference	Apartment B	**Issued on Date**	21/12/2023
Assessment Reference	231207ac Unit B - Be Green	**Prop Type Ref**	Flat
Property	Apartment B, 26, Rosslyn Hill, London, NW3 1PD		

SAP Rating	63 D	**DER**		**TER**	
Environmental	92 A	**% DER < TER**			N/A
CO_2 Emissions (t/year)	1.16	**DFEE**		**TFEE**	
Compliance Check	See BREL	**% DFEE < TFEE**			
% DPER < TPER		**DPER**		**TPER**	

Assessor Details	Ms. Anna Sung	**Assessor ID**	BK81-0001
Client			

SAP 10 WORKSHEET FOR Conversion (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		174.0000 (1b)	x	4.5000 (2b)	=	783.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	174.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	783.0000	(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		No	
Pressure Test Method		Blower Door	
Measured/design AP50		15.0000	(17)
Infiltration rate		0.7500	(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) =	0.6938	(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	0.8845	0.8672	0.8498	0.7631	0.7458	0.6591	0.6591	0.6417	0.6938	0.7458	0.7805	0.8152	(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	0.9885	0.9712	0.9538	0.8671	0.8498	0.7631	0.7631	0.7457	0.7978	0.8498	0.8845	0.9192	(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 = 1.40)			30.3900	1.3258	40.2898			(27)
External Wall LF Existing	147.0500	30.3900	116.6600	1.5500	180.8230	9.0000	1049.9400	(29a)
External Wall New	36.4500		36.4500	0.1800	6.5610	110.0000	4009.5000	(29a)
Flat Roof	108.0000		108.0000	0.1500	16.2000	9.0000	972.0000	(30)
P Roof Rafter	65.5000		65.5000	0.3500	22.9250	9.0000	589.5000	(30)
Total net area of external elements Aum(A, m2)			357.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		266.7988			(33)
Party Wall LF			22.5000	0.0000	0.0000	20.0000	450.0000	(32)
Party Floor 1			174.0000			0.0000	0.0000	(32d)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	7070.9400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		40.6376 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E1 Steel lintel with perforated steel base plate	27.6000	1.0000	27.6000

E3 Sill	27.6000	0.1000	2.7600	
E4 Jamb	49.7300	0.1000	4.9730	
E7 Party floor between dwellings (in blocks of flats)	59.4000	0.2800	16.6320	
E16 Corner (normal)	18.5100	0.1800	3.3318	
E18 Party wall between dwellings	5.5800	0.2400	1.3392	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	2.6200	0.0000	0.0000	
E17 Corner (inverted - internal area greater than external area)	5.5800	0.0000	0.0000	
E6 Intermediate floor within a dwelling	31.1100	0.1400	4.3554	
E14 Flat roof	17.1500	0.1600	2.7440	
P2 Party wall - Intermediate floor within a dwelling	21.9200	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	2.6200	0.4800	1.2576	
R6 Flat ceiling	13.9500	0.1200	1.6740	
E15 Flat roof with parapet	28.3100	0.3000	8.4930	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 75.1600 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 341.9588 (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	255.4266	250.9451	246.4637	224.0564	219.5750	197.1677	197.1677	192.6863	206.1306	219.5750	228.5379	237.5008	(38)
Heat transfer coeff	597.3854	592.9039	588.4225	566.0152	561.5338	539.1265	539.1265	534.6450	548.0894	561.5338	570.4967	579.4596	(39)
Average = Sum(39)m / 12 =												564.8948	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	3.4332	3.4075	3.3817	3.2530	3.2272	3.0984	3.0984	3.0727	3.1499	3.2272	3.2787	3.3302	(40)
HLP (average)												3.2465	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9679 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	130.7137	128.7493	125.8868	120.4100	116.3683	111.8609	109.2989	112.1398	115.2538	120.0933	125.6878	130.2129	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	47.3940	45.6706	43.9471	42.2237	40.5003	38.7769	38.7769	40.5003	42.2237	43.9471	45.6706	47.3940	(42c)
Average daily hot water use (litres/day)												163.5991	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	178.1077	174.4199	169.8340	162.6337	156.8686	150.6378	148.0758	152.6401	157.4775	164.0405	171.3583	177.6068	(44)
Energy conte	282.0790	248.3716	261.0285	222.6375	211.1752	185.2267	179.0849	189.0003	194.1855	222.6014	244.1314	278.0894	(45)
Energy content (annual)										Total = Sum(45)m =		2717.6113	
Distribution loss (46)m = 0.15 x (45)m	42.3119	37.2557	39.1543	33.3956	31.6763	27.7840	26.8627	28.3500	29.1278	33.3902	36.6197	41.7134	(46)

Water storage loss:
Store volume 250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.4000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.7560 (55)

Total storage loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(56)
If cylinder contains dedicated solar storage	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(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	328.7774	290.5508	307.7269	267.8295	257.8736	230.4187	225.7833	235.6987	239.3775	269.2998	289.3234	324.7878	(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	328.7774	290.5508	307.7269	267.8295	257.8736	230.4187	225.7833	235.6987	239.3775	269.2998	289.3234	324.7878	(64)
										Total per year (kWh/year) = Sum(64)m =		3267.4473	(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	131.1500	116.3269	124.1507	110.1806	107.5745	97.7415	96.9044	100.2013	100.7203	111.3737	117.3273	129.8234	(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	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	38.5851	34.2710	27.8710	21.1002	15.7726	13.3159	14.3883	18.7025	25.1024	31.8733	37.2008	39.6575	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	515.8319	521.1846	507.6960	478.9801	442.7316	408.6631	385.9032	380.5505	394.0391	422.7550	459.0035	493.0720	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	(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)	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	(71)
Water heating gains (Table 5)	176.2769	173.1055	166.8692	153.0285	144.5894	135.7521	130.2479	134.6792	139.8893	149.6958	162.9546	174.4939	(72)
Total internal gains	845.8272	843.6944	817.5695	768.2422	718.2269	672.8644	645.6727	649.0654	674.1642	719.4573	774.2922	822.3568	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.7400	11.2829	0.6000	0.8500	0.7700	42.8282	(75)
Southeast	6.9500	36.7938	0.6000	0.8500	0.7700	90.3781	(77)
Southwest	6.1300	36.7938	0.6000	0.8500	0.7700	79.7148	(79)

Northwest			6.5700		11.2829		0.6000		0.8500		0.7700	26.1994	(81)
Solar gains	239.1205	430.2388	649.5729	906.9323	1109.0137	1141.9779	1083.9329	926.9054	737.7095	491.9262	290.5867	201.9355	(83)
Total gains	1084.9477	1273.9333	1467.1424	1675.1745	1827.2405	1814.8423	1729.6056	1575.9708	1411.8736	1211.3835	1064.8789	1024.2923	(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	3.2879	3.3128	3.3380	3.4701	3.4978	3.6432	3.6432	3.6737	3.5836	3.4978	3.4429	3.3896	
alpha	1.2192	1.2209	1.2225	1.2313	1.2332	1.2429	1.2429	1.2449	1.2389	1.2332	1.2295	1.2260	
util living area	0.9400	0.9250	0.9018	0.8606	0.8031	0.7206	0.6397	0.6733	0.7922	0.8826	0.9258	0.9430	(86)
Living	14.6418	15.0188	15.8107	16.9668	18.1788	19.3292	20.0130	19.9014	18.9542	17.4155	15.8578	14.5983	
Non living	12.1744	12.6243	13.5659	14.9482	16.3575	17.6669	18.3494	18.2721	17.2828	15.5020	13.6499	12.1399	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	21	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	10	28	30	0	0	0	0	0	0	0	0	31	
MIT	19.8737	17.7154	18.0747	16.9668	18.1788	19.3292	20.0130	19.9014	18.9542	17.4155	15.8578	17.4839	(87)
Th 2	18.5490	18.5601	18.5713	18.6289	18.6407	18.7016	18.7016	18.7141	18.6769	18.6407	18.6171	18.5940	(88)
util rest of house	0.9285	0.9104	0.8811	0.8271	0.7442	0.6082	0.4371	0.4872	0.7037	0.8475	0.9090	0.9323	(89)
MIT 2	17.6053	15.8361	16.1870	14.9482	16.3575	17.6669	18.3494	18.2721	17.2828	15.5020	13.6499	15.6325	(90)
Living area fraction										fLA = Living area / (4) =		0.3339	(91)
MIT	18.3627	16.4636	16.8173	15.6223	16.9656	18.2220	18.9049	18.8161	17.8409	16.1409	14.3871	16.2507	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3627	16.4636	16.8173	15.6223	16.9656	18.2220	18.9049	18.8161	17.8409	16.1409	14.3871	16.2507	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9274	0.8931	0.8605	0.7572	0.6796	0.5744	0.4623	0.4992	0.6536	0.7828	0.8536	0.9177	(94)
Useful gains	1006.1991	1137.7949	1262.4073	1268.5210	1241.8339	1042.3700	799.6667	786.7139	922.8297	948.2302	908.9693	940.0278	(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	8400.8717	6856.0879	6070.9152	3804.8975	2956.8386	1952.6952	1242.6159	1291.7805	2050.3639	3111.4180	4157.2838	6982.8918	(97)
Space heating kWh	5501.6364	3842.6929	3577.5299	1826.1911	1275.9635	0.0000	0.0000	0.0000	0.0000	1609.4117	2338.7865	4495.8909	(98a)
Space heating requirement - total per year (kWh/year)												24468.1028	
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	5501.6364	3842.6929	3577.5299	1826.1911	1275.9635	0.0000	0.0000	0.0000	0.0000	1609.4117	2338.7865	4495.8909	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												24468.1028	
Space heating per m2											(98c) / (4) =	140.6213	(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 %)												484.7494	(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	5501.6364	3842.6929	3577.5299	1826.1911	1275.9635	0.0000	0.0000	0.0000	0.0000	1609.4117	2338.7865	4495.8909	(98)
Space heating efficiency (main heating system 1)	484.7494	484.7494	484.7494	484.7494	484.7494	0.0000	0.0000	0.0000	0.0000	484.7494	484.7494	484.7494	(210)
Space heating fuel (main heating system)	1134.9444	792.7174	738.0164	376.7289	263.2213	0.0000	0.0000	0.0000	0.0000	332.0090	482.4733	927.4670	(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	328.7774	290.5508	307.7269	267.8295	257.8736	230.4187	225.7833	235.6987	239.3775	269.2998	289.3234	324.7878	(64)
Efficiency of water heater												186.7142	(216)
(217)m	186.7142	186.7142	186.7142	186.7142	186.7142	186.7142	186.7142	186.7142	186.7142	186.7142	186.7142	186.7142	(217)
Fuel for water heating, kWh/month	176.0859	155.6126	164.8117	143.4436	138.1114	123.4072	120.9245	126.2350	128.2053	144.2310	154.9552	173.9492	(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	121.5352	109.7738	121.5352	117.6148	121.5352	117.6148	121.5352	121.5352	117.6148	121.5352	117.6148	121.5352	(231)
Lighting	33.7733	27.0942	24.3953	17.8731	13.8057	11.2794	12.5940	16.3702	21.2632	27.8985	31.5113	34.7120	(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												5047.5777	(211)
Space heating fuel - main system 2												0.0000	(213)

Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	186.7142	
Water heating fuel used	1749.9728	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4980)		
mechanical ventilation fans (SFP = 1.4980)	1430.9795	(230a)
Total electricity for the above, kWh/year	1430.9795	(231)
Electricity for lighting (calculated in Appendix L)	272.5702	(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	8501.1002	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5047.5777	16.4900	832.3456	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1749.9728	16.4900	288.5705	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	1430.9795	16.4900	235.9685	(249)
Energy for lighting	272.5702	16.4900	44.9468	(250)
Additional standing charges			0.0000	(251)
Total energy cost			1401.8314	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	2.3044	(257)
SAP value		62.6460	
SAP rating (Section 12)		63	(258)
SAP band		D	

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	5047.5777	0.1550	782.5485	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1749.9728	0.1411	246.9376	(264)
Space and water heating			1029.4861	(265)
Pumps, fans and electric keep-hot	1430.9795	0.1387	198.4945	(267)
Energy for lighting	272.5702	0.1443	39.3403	(268)
Total CO2, kg/year			1267.3209	(272)
CO2 emissions per m2			7.2800	(273)
EI value			92.2456	
EI rating			92	(274)
EI band			A	

SAP 10 WORKSHEET FOR Conversion (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	174.0000 (1b)	x	4.5000 (2b)	=	783.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 174.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		783.0000	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 = 0.0000	(6a)
Number of open flues	0 * 20 = 0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000	(6d)
Number of flues attached to other heater	0 * 35 = 0.0000	(6e)
Number of blocked chimneys	0 * 20 = 0.0000	(6f)
Number of intermittent extract fans	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	No	

Pressure Test Method	Blower Door	
Measured/design AP50	15.0000	(17)
Infiltration rate	0.7500	(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) =	0.6938	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.5000	4.4000	4.1000	4.1000	3.7000	3.8000	3.7000	3.7000	4.0000	3.9000	4.3000	(22)
Wind factor	1.1500	1.1250	1.1000	1.0250	1.0250	0.9250	0.9500	0.9250	0.9250	1.0000	0.9750	1.0750	(22a)
Adj infilt rate	0.7978	0.7805	0.7631	0.7111	0.7111	0.6417	0.6591	0.6417	0.6417	0.6938	0.6764	0.7458	(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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.9018	0.8845	0.8671	0.8151	0.8151	0.7457	0.7631	0.7457	0.7457	0.7978	0.7804	0.8498	(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	
Windows (Uw = 1.40)			30.3900	1.3258	40.2898			(27)
External Wall LF Existing	147.0500	30.3900	116.6600	1.5500	180.8230	9.0000	1049.9400	(29a)
External Wall New	36.4500		36.4500	0.1800	6.5610	110.0000	4009.5000	(29a)
Flat Roof	108.0000		108.0000	0.1500	16.2000	9.0000	972.0000	(30)
P Roof Rafter	65.5000		65.5000	0.3500	22.9250	9.0000	589.5000	(30)
Total net area of external elements Aum(A, m2)			357.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	266.7988			(33)
Party Wall LF			22.5000	0.0000	0.0000	20.0000	450.0000	(32)
Party Floor 1			174.0000			0.0000	0.0000	(32d)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) =	7070.9400	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	40.6376	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E1 Steel lintel with perforated steel base plate	27.6000	1.0000	27.6000
E3 Sill	27.6000	0.1000	2.7600
E4 Jamb	49.7300	0.1000	4.9730
E7 Party floor between dwellings (in blocks of flats)	59.4000	0.2800	16.6320
E16 Corner (normal)	18.5100	0.1800	3.3318
E18 Party wall between dwellings	5.5800	0.2400	1.3392
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	2.6200	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	5.5800	0.0000	0.0000
E6 Intermediate floor within a dwelling	31.1100	0.1400	4.3554
E14 Flat roof	17.1500	0.1600	2.7440
P2 Party wall - Intermediate floor within a dwelling	21.9200	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.6200	0.4800	1.2576
R6 Flat ceiling	13.9500	0.1200	1.6740
E15 Flat roof with parapet	28.3100	0.3000	8.4930

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	75.1600	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	341.9588	(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	233.0193	228.5379	224.0564	210.6121	210.6121	192.6863	197.1677	192.6863	192.6863	206.1306	201.6492	219.5750	(38)
Heat transfer coeff	574.9781	570.4967	566.0152	552.5709	552.5709	534.6450	539.1265	534.6450	534.6450	548.0894	543.6079	561.5338	(39)
Average = Sum(39)m / 12 =												551.0770	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	3.3045	3.2787	3.2530	3.1757	3.1757	3.0727	3.0984	3.0727	3.0727	3.1499	3.1242	3.2272	(40)
HLP (average)												3.1671	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9679	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
130.7137	128.7493	125.8868	120.4100	116.3683	111.8609	109.2989	112.1398	115.2538	120.0933	125.6878	130.2129	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

47.3940	45.6706	43.9471	42.2237	40.5003	38.7769	38.7769	40.5003	42.2237	43.9471	45.6706	47.3940	(42c)

Average daily hot water use (litres/day)	163.5991	(43)

Daily hot water use

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
178.1077	174.4199	169.8340	162.6337	156.8686	150.6378	148.0758	152.6401	157.4775	164.0405	171.3583	177.6068	(44)
282.0790	248.3716	261.0285	222.6375	211.1752	185.2267	179.0849	189.0003	194.1855	222.6014	244.1314	278.0894	(45)
Energy content (annual) Total = Sum(45)m =												2717.6113	
Distribution loss (46)m = 0.15 x (45)m													
42.3119	37.2557	39.1543	33.3956	31.6763	27.7840	26.8627	28.3500	29.1278	33.3902	36.6197	41.7134	(46)

Water storage loss:		
Store volume	250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.4000	(48)
Temperature factor from Table 2b	0.5400	(49)
Enter (49) or (54) in (55)	0.7560	(55)

Total storage loss

23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(56)

If cylinder contains dedicated solar storage

23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(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)

Total heat required for water heating calculated for each month

328.7774	290.5508	307.7269	267.8295	257.8736	230.4187	225.7833	235.6987	239.3775	269.2998	289.3234	324.7878	(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)

Output from w/h

	328.7774	290.5508	307.7269	267.8295	257.8736	230.4187	225.7833	235.6987	239.3775	269.2998	289.3234	324.7878 (64)
Total per year (kWh/year) = Sum(64)m =												3267.4473 (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

	131.1500	116.3269	124.1507	110.1806	107.5745	97.7415	96.9044	100.2013	100.7203	111.3737	117.3273	129.8234 (65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.5851	34.2710	27.8710	21.1002	15.7726	13.3159	14.3883	18.7025	25.1024	31.8733	37.2008	39.6575	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	515.8319	521.1846	507.6960	478.9801	442.7316	408.6631	385.9032	380.5505	394.0391	422.7550	459.0035	493.0720	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	(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)													
	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	(71)
Water heating gains (Table 5)													
	176.2769	173.1055	166.8692	153.0285	144.5894	135.7521	130.2479	134.6792	139.8893	149.6958	162.9546	174.4939	(72)
Total internal gains													
	845.8272	843.6944	817.5695	768.2422	718.2269	672.8644	645.6727	649.0654	674.1642	719.4573	774.2922	822.3568	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.7400	12.4928	0.6000	0.8500	0.7700	47.4205	(75)
Southeast	6.9500	39.1209	0.6000	0.8500	0.7700	96.0942	(77)
Southwest	6.1300	39.1209	0.6000	0.8500	0.7700	84.7565	(79)
Northwest	6.5700	12.4928	0.6000	0.8500	0.7700	29.0087	(81)

Solar gains	257.2799	416.8252	634.9071	919.6142	1096.8660	1206.3470	1141.9779	1000.2107	793.4136	521.4707	323.1218	213.1599	(83)
Total gains	1103.1071	1260.5196	1452.4766	1687.8563	1815.0929	1879.2113	1787.6506	1649.2762	1467.5778	1240.9281	1097.4141	1035.5167	(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	3.4160	3.4429	3.4701	3.5546	3.5546	3.6737	3.6432	3.6737	3.6737	3.5836	3.6132	3.4978	
alpha	1.2277	1.2295	1.2313	1.2370	1.2370	1.2449	1.2429	1.2449	1.2449	1.2389	1.2409	1.2332	
util living area													
	0.9334	0.9197	0.8908	0.8401	0.7652	0.6335	0.4970	0.5374	0.7330	0.8597	0.9135	0.9370	(86)
Living	15.0776	15.3947	16.3500	17.5311	18.8149	19.9610	20.5577	20.4782	19.5349	17.9883	16.3909	15.0630	
Non living	12.7146	13.0934	14.2278	15.6235	17.0893	18.2956	18.6886	18.6800	17.9223	16.1871	14.3108	12.7115	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	19	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	12	28	25	0	0	0	0	0	0	0	0	31	
MIT	19.7407	17.9209	18.0400	17.5311	18.8149	19.9610	20.5577	20.4782	19.5349	17.9883	16.3909	17.7383	(87)
Th 2	18.6055	18.6171	18.6289	18.6647	18.6647	18.7141	18.7016	18.7141	18.7141	18.6769	18.6892	18.6407	(88)
util rest of house													
	0.9202	0.9036	0.8662	0.7982	0.6828	0.4503	0.1133	0.1771	0.5979	0.8127	0.8928	0.9246	(89)
MIT 2	17.5592	16.0828	16.1487	15.6235	17.0893	18.2956	18.6886	18.6800	17.9223	16.1871	14.3108	15.9206	(90)
Living area fraction									fLA = Living area / (4) =			0.3339	(91)
MIT	18.2876	16.6965	16.7802	16.2604	17.6655	18.8517	19.3127	19.2804	18.4608	16.7885	15.0054	16.5276	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2876	16.6965	16.7802	16.2604	17.6655	18.8517	19.3127	19.2804	18.4608	16.7885	15.0054	16.5276	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9181	0.8857	0.8391	0.7289	0.6301	0.4655	0.2532	0.3019	0.5755	0.7482	0.8334	0.9092	(94)
Useful gains	1012.7336	1116.4709	1218.7090	1230.3505	1143.6567	874.8552	452.6167	497.8531	844.5276	928.4384	914.5407	941.4574	(95)
Ext temp.	5.2000	5.7000	7.7000	10.2000	13.3000	16.3000	18.3000	18.1000	15.5000	11.9000	8.2000	5.2000	(96)
Heat loss rate W													
	7525.1031	6273.4948	5139.5316	3348.8280	2412.2378	1364.2599	545.9783	631.1056	1582.9593	2679.3478	3699.4480	6360.8031	(97)
Space heating kWh													
	4845.2030	3465.5200	2917.0920	1525.3038	943.8243	0.0000	0.0000	0.0000	0.0000	1302.6766	2005.1332	4031.9932	(98a)
Space heating requirement - total per year (kWh/year)												21036.7462	
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													
	4845.2030	3465.5200	2917.0920	1525.3038	943.8243	0.0000	0.0000	0.0000	0.0000	1302.6766	2005.1332	4031.9932	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												21036.7462	
Space heating per m2											(98c) / (4) =	120.9008	(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 %)	483.1859	(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													
	4845.2030	3465.5200	2917.0920	1525.3038	943.8243	0.0000	0.0000	0.0000	0.0000	1302.6766	2005.1332	4031.9932	(98)
Space heating efficiency (main heating system 1)													
	483.1859	483.1859	483.1859	483.1859	483.1859	0.0000	0.0000	0.0000	0.0000	483.1859	483.1859	483.1859	(210)
Space heating fuel (main heating system)													
	1002.7617	717.2229	603.7204	315.6764	195.3336	0.0000	0.0000	0.0000	0.0000	269.6015	414.9817	834.4600	(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													
	328.7774	290.5508	307.7269	267.8295	257.8736	230.4187	225.7833	235.6987	239.3775	269.2998	289.3234	324.7878	(64)
Efficiency of water heater												187.1267	(216)
(217)m	187.1267	187.1267	187.1267	187.1267	187.1267	187.1267	187.1267	187.1267	187.1267	187.1267	187.1267	187.1267	(217)
Fuel for water heating, kWh/month													
	175.6977	155.2695	164.4484	143.1273	137.8069	123.1351	120.6580	125.9567	127.9227	143.9130	154.6136	173.5657	(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	121.5352	109.7738	121.5352	117.6148	121.5352	117.6148	121.5352	121.5352	117.6148	121.5352	117.6148	121.5352	(231)
Lighting	33.7733	27.0942	24.3953	17.8731	13.8057	11.2794	12.5940	16.3702	21.2632	27.8985	31.5113	34.7120	(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	4353.7583	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	187.1267	
Water heating fuel used	1746.1148	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4980)		
mechanical ventilation fans (SFP = 1.4980)	1430.9795	(230a)
Total electricity for the above, kWh/year	1430.9795	(231)
Electricity for lighting (calculated in Appendix L)	272.5702	(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	7803.4228	(238)

10a. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4353.7583	21.5100	936.4934	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1746.1148	21.5100	375.5893	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	1430.9795	21.5100	307.8037	(249)
Energy for lighting	272.5702	21.5100	58.6298	(250)
Additional standing charges			0.0000	(251)
Total energy cost			1678.5162	(255)

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	4353.7583	0.1555	676.8458	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1746.1148	0.1411	246.3932	(264)
Space and water heating			923.2390	(265)
Pumps, fans and electric keep-hot	1430.9795	0.1387	198.4945	(267)
Energy for lighting	272.5702	0.1443	39.3403	(268)
Total CO2, kg/year			1161.0738	(272)

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	4353.7583	1.5755	6859.5361	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1746.1148	1.5218	2657.2058	(278)
Space and water heating			9516.7419	(279)
Pumps, fans and electric keep-hot	1430.9795	1.5128	2164.7858	(281)
Energy for lighting	272.5702	1.5338	418.0772	(282)
Total Primary energy kWh/year			12099.6049	(286)

SAP 10 EPC IMPROVEMENTS

231207ac Unit B - Be Green

Current energy efficiency rating: D 63
Current environmental impact rating: A 92

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: D 63
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 533 TEST (30 Nov 2023)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£1679	£1679	£0
Space heating	£1244	£1244	£0
Water heating	£376	£376	£0
Lighting	£59	£59	£0
Total cost of fuels	£1679	£1679	£0
Total cost of uses	£1679	£1679	£0
Delivered energy	45 kWh/m²	45 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.2 tonnes	1.2 tonnes	0.0 tonnes
CO2 emissions per m²	7 kg/m²	7 kg/m²	0 kg/m²
Primary energy	70 kWh/m²	70 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR Conversion (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	174.0000	(1b)	x 4.5000	(2b) =	783.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	174.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		783.0000	(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		No
Pressure Test Method		Blower Door
Measured/design AP50		15.0000 (17)
Infiltration rate		0.7500 (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) =		0.6938 (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	0.8845	0.8672	0.8498	0.7631	0.7458	0.6591	0.6591	0.6417	0.6938	0.7458	0.7805	0.8152	(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	0.9885	0.9712	0.9538	0.8671	0.8498	0.7631	0.7631	0.7457	0.7978	0.8498	0.8845	0.9192	(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	
Windows (Uw = 1.40)			30.3900	1.3258	40.2898			(27)
External Wall LF Existing	147.0500	30.3900	116.6600	1.5500	180.8230	9.0000	1049.9400	(29a)
External Wall New	36.4500		36.4500	0.1800	6.5610	110.0000	4009.5000	(29a)
Flat Roof	108.0000		108.0000	0.1500	16.2000	9.0000	972.0000	(30)
P Roof Rafter	65.5000		65.5000	0.3500	22.9250	9.0000	589.5000	(30)
Total net area of external elements Aum(A, m2)			357.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	266.7988			(33)
Party Wall LF			22.5000	0.0000	0.0000	20.0000	450.0000	(32)
Party Floor 1			174.0000			0.0000	0.0000	(32d)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	7070.9400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		40.6376 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E1 Steel lintel with perforated steel base plate	27.6000	1.0000	27.6000
E3 Sill	27.6000	0.1000	2.7600
E4 Jamb	49.7300	0.1000	4.9730
E7 Party floor between dwellings (in blocks of flats)	59.4000	0.2800	16.6320
E16 Corner (normal)	18.5100	0.1800	3.3318
E18 Party wall between dwellings	5.5800	0.2400	1.3392
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	2.6200	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	5.5800	0.0000	0.0000
E6 Intermediate floor within a dwelling	31.1100	0.1400	4.3554
E14 Flat roof	17.1500	0.1600	2.7440
P2 Party wall - Intermediate floor within a dwelling	21.9200	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.6200	0.4800	1.2576
R6 Flat ceiling	13.9500	0.1200	1.6740
E15 Flat roof with parapet	28.3100	0.3000	8.4930

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		75.1600 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	341.9588 (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	255.4266	250.9451	246.4637	224.0564	219.5750	197.1677	197.1677	192.6863	206.1306	219.5750	228.5379	237.5008	(38)
Heat transfer coeff	597.3854	592.9039	588.4225	566.0152	561.5338	539.1265	539.1265	534.6450	548.0894	561.5338	570.4967	579.4596	(39)
Average = Sum(39)m / 12 =												564.8948	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	3.4332	3.4075	3.3817	3.2530	3.2272	3.0984	3.0984	3.0727	3.1499	3.2272	3.2787	3.3302	(40)
HLP (average)												3.2465	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9679	(42)
Hot water usage for mixer showers	130.7137	128.7493	125.8868	120.4100	116.3683	111.8609	109.2989	112.1398	115.2538	120.0933	125.6878	130.2129	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	47.3940	45.6706	43.9471	42.2237	40.5003	38.7769	38.7769	40.5003	42.2237	43.9471	45.6706	47.3940	(42c)
Average daily hot water use (litres/day)												163.5991	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	178.1077	174.4199	169.8340	162.6337	156.8686	150.6378	148.0758	152.6401	157.4775	164.0405	171.3583	177.6068	(44)
Energy conte	282.0790	248.3716	261.0285	222.6375	211.1752	185.2267	179.0849	189.0003	194.1855	222.6014	244.1314	278.0894	(45)
Energy content (annual)										Total = Sum(45)m =		2717.6113	
Distribution loss (46)m = 0.15 x (45)m	42.3119	37.2557	39.1543	33.3956	31.6763	27.7840	26.8627	28.3500	29.1278	33.3902	36.6197	41.7134	(46)
Water storage loss:													
Store volume												250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7560	(55)
Total storage loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(56)
If cylinder contains dedicated solar storage	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(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	328.7774	290.5508	307.7269	267.8295	257.8736	230.4187	225.7833	235.6987	239.3775	269.2998	289.3234	324.7878	(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	328.7774	290.5508	307.7269	267.8295	257.8736	230.4187	225.7833	235.6987	239.3775	269.2998	289.3234	324.7878	(64)
										Total per year (kWh/year) = Sum(64)m =		3267.4473	(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	131.1500	116.3269	124.1507	110.1806	107.5745	97.7415	96.9044	100.2013	100.7203	111.3737	117.3273	129.8234	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	(66)

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

	38.5851	34.2710	27.8710	21.1002	15.7726	13.3159	14.3883	18.7025	25.1024	31.8733	37.2008	39.6575	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	515.8319	521.1846	507.6960	478.9801	442.7316	408.6631	385.9032	380.5505	394.0391	422.7550	459.0035	493.0720	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	(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)													
	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	(71)
Water heating gains (Table 5)													
	176.2769	173.1055	166.8692	153.0285	144.5894	135.7521	130.2479	134.6792	139.8893	149.6958	162.9546	174.4939	(72)
Total internal gains													
	845.8272	843.6944	817.5695	768.2422	718.2269	672.8644	645.6727	649.0654	674.1642	719.4573	774.2922	822.3568	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.7400	11.2829	0.6000	0.8500	0.7700	42.8282	(75)
Southeast	6.9500	36.7938	0.6000	0.8500	0.7700	90.3781	(77)
Southwest	6.1300	36.7938	0.6000	0.8500	0.7700	79.7148	(79)
Northwest	6.5700	11.2829	0.6000	0.8500	0.7700	26.1994	(81)

Solar gains	239.1205	430.2388	649.5729	906.9323	1109.0137	1141.9779	1083.9329	926.9054	737.7095	491.9262	290.5867	201.9355	(83)
Total gains	1084.9477	1273.9333	1467.1424	1675.1745	1827.2405	1814.8423	1729.6056	1575.9708	1411.8736	1211.3835	1064.8789	1024.2923	(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	3.2879	3.3128	3.3380	3.4701	3.4978	3.6432	3.6432	3.6737	3.5836	3.4978	3.4429	3.3896	
alpha	1.2192	1.2209	1.2225	1.2313	1.2332	1.2429	1.2429	1.2449	1.2389	1.2332	1.2295	1.2260	
util living area	0.9400	0.9250	0.9018	0.8606	0.8031	0.7206	0.6397	0.6733	0.7922	0.8826	0.9258	0.9430	(86)
Living	14.6418	15.0188	15.8107	16.9668	18.1788	19.3292	20.0130	19.9014	18.9542	17.4155	15.8578	14.5983	
Non living	12.1744	12.6243	13.5659	14.9482	16.3575	17.6669	18.3494	18.2721	17.2828	15.5020	13.6499	12.1399	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	21	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	10	28	30	0	0	0	0	0	0	0	0	31	
MIT	19.8737	17.7154	18.0747	16.9668	18.1788	19.3292	20.0130	19.9014	18.9542	17.4155	15.8578	17.4839	(87)
Th 2	18.5490	18.5601	18.5713	18.6289	18.6407	18.7016	18.7016	18.7141	18.6769	18.6407	18.6171	18.5940	(88)
util rest of house	0.9285	0.9104	0.8811	0.8271	0.7442	0.6082	0.4371	0.4872	0.7037	0.8475	0.9090	0.9323	(89)
MIT 2	17.6053	15.8361	16.1870	14.9482	16.3575	17.6669	18.3494	18.2721	17.2828	15.5020	13.6499	15.6325	(90)
Living area fraction										fLA = Living area / (4) =		0.3339	(91)
MIT	18.3627	16.4636	16.8173	15.6223	16.9656	18.2220	18.9049	18.8161	17.8409	16.1409	14.3871	16.2507	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3627	16.4636	16.8173	15.6223	16.9656	18.2220	18.9049	18.8161	17.8409	16.1409	14.3871	16.2507	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9274	0.8931	0.8605	0.7572	0.6796	0.5744	0.4623	0.4992	0.6536	0.7828	0.8536	0.9177	(94)
Useful gains	1006.1991	1137.7949	1262.4073	1268.5210	1241.8339	1042.3700	799.6667	786.7139	922.8297	948.2302	908.9693	940.0278	(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	8400.8717	6856.0879	6070.9152	3804.8975	2956.8386	1952.6952	1242.6159	1291.7805	2050.3639	3111.4180	4157.2838	6982.8918	(97)
Space heating kWh	5501.6364	3842.6929	3577.5299	1826.1911	1275.9635	0.0000	0.0000	0.0000	0.0000	1609.4117	2338.7865	4495.8909	(98a)
Space heating requirement - total per year (kWh/year)												24468.1028	
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	5501.6364	3842.6929	3577.5299	1826.1911	1275.9635	0.0000	0.0000	0.0000	0.0000	1609.4117	2338.7865	4495.8909	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												24468.1028	
Space heating per m2											(98c) / (4) =	140.6213	(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 %)	484.7494	(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	5501.6364	3842.6929	3577.5299	1826.1911	1275.9635	0.0000	0.0000	0.0000	0.0000	1609.4117	2338.7865	4495.8909	(98)
Space heating efficiency (main heating system 1)	484.7494	484.7494	484.7494	484.7494	484.7494	0.0000	0.0000	0.0000	0.0000	484.7494	484.7494	484.7494	(210)
Space heating fuel (main heating system)	1134.9444	792.7174	738.0164	376.7289	263.2213	0.0000	0.0000	0.0000	0.0000	332.0090	482.4733	927.4670	(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	328.7774	290.5508	307.7269	267.8295	257.8736	230.4187	225.7833	235.6987	239.3775	269.2998	289.3234	324.7878	(64)
Efficiency of water heater												186.7142	(216)

(217)m	186.7142	186.7142	186.7142	186.7142	186.7142	186.7142	186.7142	186.7142	186.7142	186.7142	186.7142	186.7142	(217)
Fuel for water heating, kWh/month													
	176.0859	155.6126	164.8117	143.4436	138.1114	123.4072	120.9245	126.2350	128.2053	144.2310	154.9552	173.9492	(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	121.5352	109.7738	121.5352	117.6148	121.5352	117.6148	121.5352	121.5352	117.6148	121.5352	117.6148	121.5352	(231)
Lighting	33.7733	27.0942	24.3953	17.8731	13.8057	11.2794	12.5940	16.3702	21.2632	27.8985	31.5113	34.7120	(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	5047.5777	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	186.7142	
Water heating fuel used	1749.9728	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4980)		
mechanical ventilation fans (SFP = 1.4980)	1430.9795	(230a)
Total electricity for the above, kWh/year	1430.9795	(231)
Electricity for lighting (calculated in Appendix L)	272.5702	(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	8501.1002	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5047.5777	16.4900	832.3456	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1749.9728	16.4900	288.5705	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	1430.9795	16.4900	235.9685	(249)
Energy for lighting	272.5702	16.4900	44.9468	(250)
Additional standing charges			0.0000	(251)
Total energy cost			1401.8314	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	2.3044	(257)
SAP value		62.6460	
SAP rating (Section 12)		63	(258)
SAP band		D	

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	5047.5777	0.1550	782.5485	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1749.9728	0.1411	246.9376	(264)
Space and water heating			1029.4861	(265)
Pumps, fans and electric keep-hot	1430.9795	0.1387	198.4945	(267)
Energy for lighting	272.5702	0.1443	39.3403	(268)
Total CO2, kg/year			1267.3209	(272)
CO2 emissions per m2			7.2800	(273)
EI value			92.2456	
EI rating			92	(274)
EI band			A	

SAP 10 WORKSHEET FOR Conversion (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area	Storey height	Volume	

		(m2)		(m)		(m3)
Ground floor		174.0000 (1b)	x	4.5000 (2b)	=	783.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	174.0000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	783.0000 (5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	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		No	
Pressure Test Method		Blower Door	
Measured/design AP50		15.0000	(17)
Infiltration rate		0.7500	(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) =	0.6938	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.5000	4.4000	4.1000	4.1000	3.7000	3.8000	3.7000	3.7000	4.0000	3.9000	4.3000	(22)
Wind factor	1.1500	1.1250	1.1000	1.0250	1.0250	0.9250	0.9500	0.9250	0.9250	1.0000	0.9750	1.0750	(22a)
Adj infilt rate	0.7978	0.7805	0.7631	0.7111	0.7111	0.6417	0.6591	0.6417	0.6417	0.6938	0.6764	0.7458	(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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.9018	0.8845	0.8671	0.8151	0.8151	0.7457	0.7631	0.7457	0.7457	0.7978	0.7804	0.8498	(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	
Windows (Uw = 1.40)			30.3900	1.3258	40.2898			(27)
External Wall LF Existing	147.0500	30.3900	116.6600	1.5500	180.8230	9.0000	1049.9400	(29a)
External Wall New	36.4500		36.4500	0.1800	6.5610	110.0000	4009.5000	(29a)
Flat Roof	108.0000		108.0000	0.1500	16.2000	9.0000	972.0000	(30)
P Roof Rafter	65.5000		65.5000	0.3500	22.9250	9.0000	589.5000	(30)
Total net area of external elements Aum(A, m2)			357.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		266.7988			(33)
Party Wall LF			22.5000	0.0000	0.0000	20.0000	450.0000	(32)
Party Floor 1			174.0000			0.0000	0.0000	(32d)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	7070.9400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		40.6376 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E1 Steel lintel with perforated steel base plate	27.6000	1.0000	27.6000
E3 Sill	27.6000	0.1000	2.7600
E4 Jamb	49.7300	0.1000	4.9730
E7 Party floor between dwellings (in blocks of flats)	59.4000	0.2800	16.6320
E16 Corner (normal)	18.5100	0.1800	3.3318
E18 Party wall between dwellings	5.5800	0.2400	1.3392
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	2.6200	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	5.5800	0.0000	0.0000
E6 Intermediate floor within a dwelling	31.1100	0.1400	4.3554
E14 Flat roof	17.1500	0.1600	2.7440
P2 Party wall - Intermediate floor within a dwelling	21.9200	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.6200	0.4800	1.2576
R6 Flat ceiling	13.9500	0.1200	1.6740
E15 Flat roof with parapet	28.3100	0.3000	8.4930

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		75.1600 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	341.9588 (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	233.0193	228.5379	224.0564	210.6121	210.6121	192.6863	197.1677	192.6863	192.6863	206.1306	201.6492	219.5750	(38)
Heat transfer coeff	574.9781	570.4967	566.0152	552.5709	552.5709	534.6450	539.1265	534.6450	534.6450	548.0894	543.6079	561.5338	(39)
Average = Sum(39)m / 12 =												551.0770	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	3.3045	3.2787	3.2530	3.1757	3.1757	3.0727	3.0984	3.0727	3.0727	3.1499	3.1242	3.2272	(40)
HLP (average)												3.1671	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9679 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
130.7137	128.7493	125.8868	120.4100	116.3683	111.8609	109.2989	112.1398	115.2538	120.0933	125.6878	130.2129	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

47.3940	45.6706	43.9471	42.2237	40.5003	38.7769	38.7769	40.5003	42.2237	43.9471	45.6706	47.3940	(42c)

Average daily hot water use (litres/day) 163.5991 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	178.1077	174.4199	169.8340	162.6337	156.8686	150.6378	148.0758	152.6401	157.4775	164.0405	171.3583	177.6068	(44)
Energy conte	282.0790	248.3716	261.0285	222.6375	211.1752	185.2267	179.0849	189.0003	194.1855	222.6014	244.1314	278.0894	(45)
Energy content (annual)										Total = Sum(45)m =		2717.6113	
Distribution loss (46)m = 0.15 x (45)m	42.3119	37.2557	39.1543	33.3956	31.6763	27.7840	26.8627	28.3500	29.1278	33.3902	36.6197	41.7134	(46)
Water storage loss:													
Store volume												250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7560	(55)
Total storage loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(56)
If cylinder contains dedicated solar storage	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(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	328.7774	290.5508	307.7269	267.8295	257.8736	230.4187	225.7833	235.6987	239.3775	269.2998	289.3234	324.7878	(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	328.7774	290.5508	307.7269	267.8295	257.8736	230.4187	225.7833	235.6987	239.3775	269.2998	289.3234	324.7878	(64)
										Total per year (kWh/year) = Sum(64)m =		3267.4473	(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	131.1500	116.3269	124.1507	110.1806	107.5745	97.7415	96.9044	100.2013	100.7203	111.3737	117.3273	129.8234	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	38.5851	34.2710	27.8710	21.1002	15.7726	13.3159	14.3883	18.7025	25.1024	31.8733	37.2008	39.6575	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	515.8319	521.1846	507.6960	478.9801	442.7316	408.6631	385.9032	380.5505	394.0391	422.7550	459.0035	493.0720	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	(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)	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	(71)
Water heating gains (Table 5)	176.2769	173.1055	166.8692	153.0285	144.5894	135.7521	130.2479	134.6792	139.8893	149.6958	162.9546	174.4939	(72)
Total internal gains	845.8272	843.6944	817.5695	768.2422	718.2269	672.8644	645.6727	649.0654	674.1642	719.4573	774.2922	822.3568	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.7400	12.4928	0.6000	0.8500	0.7700	47.4205	(75)
Southeast	6.9500	39.1209	0.6000	0.8500	0.7700	96.0942	(77)
Southwest	6.1300	39.1209	0.6000	0.8500	0.7700	84.7565	(79)
Northwest	6.5700	12.4928	0.6000	0.8500	0.7700	29.0087	(81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	257.2799	416.8252	634.9071	919.6142	1096.8660	1206.3470	1141.9779	1000.2107	793.4136	521.4707	323.1218	213.1599	(83)
Total gains	1103.1071	1260.5196	1452.4766	1687.8563	1815.0929	1879.2113	1787.6506	1649.2762	1467.5778	1240.9281	1097.4141	1035.5167	(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	3.4160	3.4429	3.4701	3.5546	3.5546	3.6737	3.6432	3.6737	3.6737	3.5836	3.6132	3.4978	
alpha	1.2277	1.2295	1.2313	1.2370	1.2370	1.2449	1.2429	1.2449	1.2449	1.2389	1.2409	1.2332	
util living area	0.9334	0.9197	0.8908	0.8401	0.7652	0.6335	0.4970	0.5374	0.7330	0.8597	0.9135	0.9370	(86)
Living	15.0776	15.3947	16.3500	17.5311	18.8149	19.9610	20.5577	20.4782	19.5349	17.9883	16.3909	15.0630	
Non living	12.7146	13.0934	14.2278	15.6235	17.0893	18.2956	18.6886	18.6800	17.9223	16.1871	14.3108	12.7115	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	19	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	12	28	25	0	0	0	0	0	0	0	0	31	
MIT	19.7407	17.9209	18.0400	17.5311	18.8149	19.9610	20.5577	20.4782	19.5349	17.9883	16.3909	17.7383	(87)
Th 2	18.6055	18.6171	18.6289	18.6647	18.6647	18.7141	18.7016	18.7141	18.7141	18.6769	18.6892	18.6407	(88)
util rest of house	0.9202	0.9036	0.8662	0.7982	0.6828	0.4503	0.1133	0.1771	0.5979	0.8127	0.8928	0.9246	(89)
MIT 2	17.5592	16.0828	16.1487	15.6235	17.0893	18.2956	18.6886	18.6800	17.9223	16.1871	14.3108	15.9206	(90)
Living area fraction										fLA = Living area / (4) =		0.3339	(91)
MIT	18.2876	16.6965	16.7802	16.2604	17.6655	18.8517	19.3127	19.2804	18.4608	16.7885	15.0054	16.5276	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2876	16.6965	16.7802	16.2604	17.6655	18.8517	19.3127	19.2804	18.4608	16.7885	15.0054	16.5276	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9181	0.8857	0.8391	0.7289	0.6301	0.4655	0.2532	0.3019	0.5755	0.7482	0.8334	0.9092	(94)

Useful gains	1012.7336	1116.4709	1218.7090	1230.3505	1143.6567	874.8552	452.6167	497.8531	844.5276	928.4384	914.5407	941.4574	(95)
Ext temp.	5.2000	5.7000	7.7000	10.2000	13.3000	16.3000	18.3000	18.1000	15.5000	11.9000	8.2000	5.2000	(96)
Heat loss rate W													
	7525.1031	6273.4948	5139.5316	3348.8280	2412.2378	1364.2599	545.9783	631.1056	1582.9593	2679.3478	3699.4480	6360.8031	(97)
Space heating kWh													
	4845.2030	3465.5200	2917.0920	1525.3038	943.8243	0.0000	0.0000	0.0000	0.0000	1302.6766	2005.1332	4031.9932	(98a)
Space heating requirement - total per year (kWh/year)												21036.7462	
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													
	4845.2030	3465.5200	2917.0920	1525.3038	943.8243	0.0000	0.0000	0.0000	0.0000	1302.6766	2005.1332	4031.9932	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												21036.7462	
Space heating per m2											(98c) / (4) =	120.9008	(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 %)												483.1859	(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													
	4845.2030	3465.5200	2917.0920	1525.3038	943.8243	0.0000	0.0000	0.0000	0.0000	1302.6766	2005.1332	4031.9932	(98)
Space heating efficiency (main heating system 1)													
	483.1859	483.1859	483.1859	483.1859	483.1859	0.0000	0.0000	0.0000	0.0000	483.1859	483.1859	483.1859	(210)
Space heating fuel (main heating system)													
	1002.7617	717.2229	603.7204	315.6764	195.3336	0.0000	0.0000	0.0000	0.0000	269.6015	414.9817	834.4600	(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													
	328.7774	290.5508	307.7269	267.8295	257.8736	230.4187	225.7833	235.6987	239.3775	269.2998	289.3234	324.7878	(64)
Efficiency of water heater												187.1267	(216)
(217)m	187.1267	187.1267	187.1267	187.1267	187.1267	187.1267	187.1267	187.1267	187.1267	187.1267	187.1267	187.1267	(217)
Fuel for water heating, kWh/month													
	175.6977	155.2695	164.4484	143.1273	137.8069	123.1351	120.6580	125.9567	127.9227	143.9130	154.6136	173.5657	(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	121.5352	109.7738	121.5352	117.6148	121.5352	117.6148	121.5352	121.5352	117.6148	121.5352	117.6148	121.5352	(231)
Lighting	33.7733	27.0942	24.3953	17.8731	13.8057	11.2794	12.5940	16.3702	21.2632	27.8985	31.5113	34.7120	(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												4353.7583	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												187.1267	
Water heating fuel used												1746.1148	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4980)													
mechanical ventilation fans (SFP = 1.4980)												1430.9795	(230a)
Total electricity for the above, kWh/year												1430.9795	(231)
Electricity for lighting (calculated in Appendix L)												272.5702	(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												7803.4228	(238)

10a. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4353.7583	21.5100	936.4934	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1746.1148	21.5100	375.5893	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	1430.9795	21.5100	307.8037	(249)
Energy for lighting	272.5702	21.5100	58.6298	(250)
Additional standing charges			0.0000	(251)
Total energy cost			1678.5162	(255)

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	4353.7583	0.1555	676.8458	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1746.1148	0.1411	246.3932	(264)
Space and water heating			923.2390	(265)
Pumps, fans and electric keep-hot	1430.9795	0.1387	198.4945	(267)
Energy for lighting	272.5702	0.1443	39.3403	(268)
Total CO2, kg/year			1161.0738	(272)

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	4353.7583	1.5755	6859.5361	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1746.1148	1.5218	2657.2058	(278)
Space and water heating			9516.7419	(279)
Pumps, fans and electric keep-hot	1430.9795	1.5128	2164.7858	(281)
Energy for lighting	272.5702	1.5338	418.0772	(282)
Total Primary energy kWh/year			12099.6049	(286)

Predicted Energy Assessment

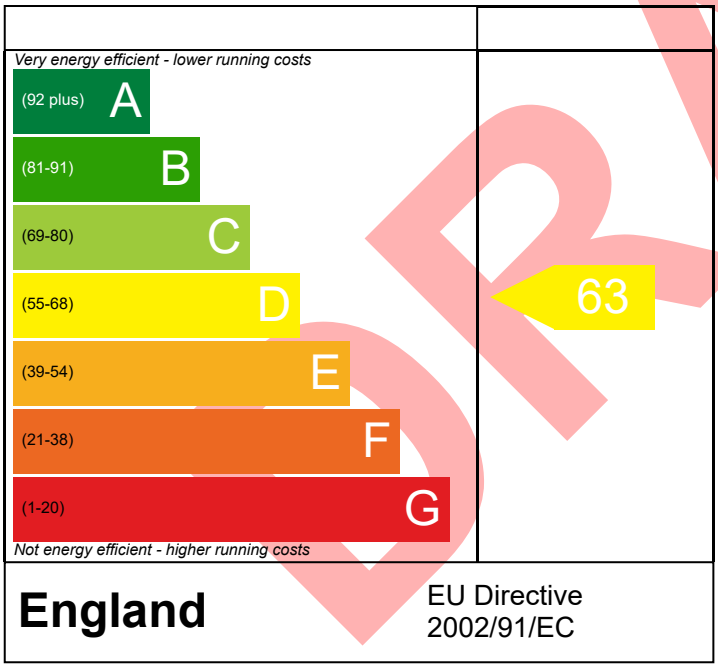
Apartment B, 26, Rosslyn Hill, London, NW3 1PD

Dwelling type:	Flat, Semi-Detached
Date of assessment:	21/12/2023
Produced by:	Anna Sung
Total floor area:	174 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

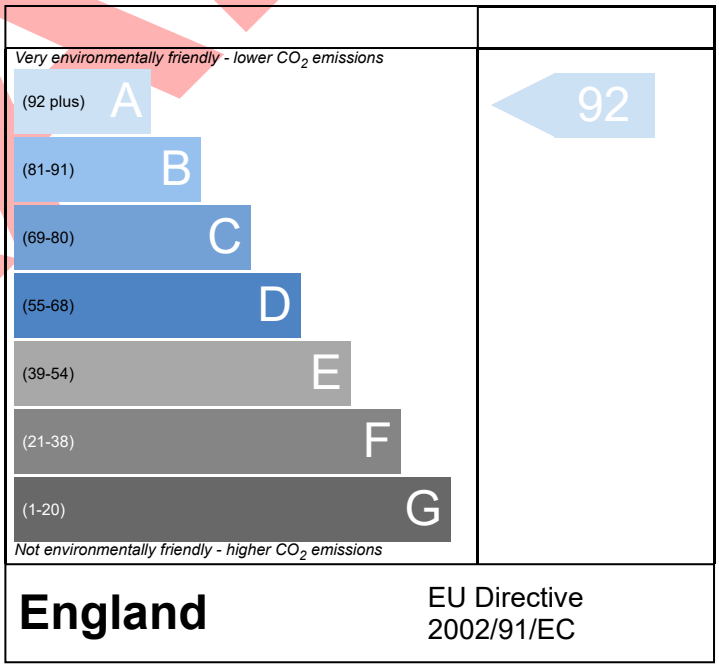
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

Summary for Input Data

Property Reference	Apartment B	**Issued on Date**	21/12/2023
Assessment Reference	231207ac Unit B - Be Green	**Prop Type Ref**	Flat
Property	Apartment B, 26, Rosslyn Hill, London, NW3 1PD		

SAP Rating	63 D	**DER**		**TER**	
Environmental	92 A	**% DER < TER**			N/A
CO_2 Emissions (t/year)	1.16	**DFEE**		**TFEE**	
Compliance Check	See BREL	**% DFEE < TFEE**			
% DPER < TPER		**DPER**		**TPER**	

Assessor Details	Ms. Anna Sung	**Assessor ID**	BK81-0001
Client			

SUMMARY FOR INPUT DATA FOR: Conversion (As Designed)

Orientation	Southwest
Property Tenture	ND
Transaction Type	5
Terrain Type	Suburban
1.0 Property Type	Flat, Semi-Detached
Position of Flat	Top-floor flat
Which Floor	4
2.0 Number of Storeys	1
3.0 Date Built	2023
4.0 Sheltered Sides	1
5.0 Sunlight/Shade	Average or unknown
6.0 Thermal Mass Parameter	Precise calculation
7.0 Electricity Tariff	Standard
Smart electricity meter fitted	No
Smart gas meter fitted	No

7.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground floor:	51.66 m	174.00 m²	4.50 m

8.0 Living Area 58.10 m²

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
External Wall LF Existing	Solid Wall	Solid wall : plasterboard on dabs, insulation, any outside structure	1.55	9.00	147.04	116.66	0.00	None	30.38	Enter Nett Area
External Wall New	Cavity Wall	Cavity wall; plasterboard on dabs or battens, lightweight aggregate block, filled cavity, any outside structure	0.18	110.00	36.45	36.45	0.00	None	0.00	Enter Gross Area

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)	Shelter Res	Shelter
Party Wall LF	Solid Wall	Double plasterboard on both sides, twin timber f rame with/without sheathing board	0.00	20.00	22.50		None

10.0 External Roofs

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Code	Shelter Factor	Calculation Type	Openings
Flat Roof	External Flat Roof	Plasterboard, insulated flat roof	0.15	9.00	108.00	108.00	None	0.00	Enter Gross Area	0.00
P Roof Rafter	External Slope Roof	Other	0.35	9.00	65.50	65.50	None	0.00	Enter Gross Area	0.00

11.1 Party Floors

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Lowest occupied	Other	0.00	174.00

12.0 Opening Types

Summary for Input Data

elmhurst energy

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Windows	Manufacturer	Window	Double Low-E Soft 0.05			0.60		0.85	1.40

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
Front bedrooms	Windows	External Wall LF Existing	South West	6.13	
Dining	Windows	External Wall LF Existing	North West	2.42	
Living	Windows	External Wall LF Existing	North West	4.15	
Living	Windows	External Wall LF Existing	North East	6.47	
Kitchen	Windows	External Wall LF Existing	North East	4.27	
Dining	Windows	External Wall LF Existing	South East	6.95	

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	Yes	

17.0 Thermal Bridging	Calculate Bridges

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E1 Steel lintel with perforated steel base plate	Table K1 - Default	27.60	1.00	1.00	No
E3 Sill	Table K1 - Default	27.60	0.10	0.10	No
E4 Jamb	Table K1 - Default	49.73	0.10	0.10	No
E7 Party floor between dwellings (in blocks of flats)	Table K1 - Default	59.40	0.28	0.28	No
E16 Corner (normal)	Table K1 - Default	18.51	0.18	0.18	No
E18 Party wall between dwellings	Table K1 - Default	5.58	0.24	0.24	No
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Table K1 - Default	2.62	0.00	0.00	No
E17 Corner (inverted – internal area greater than external area)	Table K1 - Default	5.58	0.00	0.00	No
E6 Intermediate floor within a dwelling	Table K1 - Default	31.11	0.14	0.14	No
E14 Flat roof	Table K1 - Default	17.15	0.16	0.16	No
P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	21.92	0.00	0.00	No
P4 Party wall - Roof (insulation at ceiling level)	Table K1 - Default	2.62	0.48	0.48	No
R6 Flat ceiling	Table K1 - Default	13.95	0.12	0.12	No
E15 Flat roof with parapet	Table K1 - Default	28.31	0.30	0.30	No

Y-value	0.21	W/m²K

18.0 Pressure Testing	No	
Test Method	Blower Door	

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Balanced mechanical ventilation with heat recovery
MV Reference Number	500140
Configuration	3
Manufacturer SFP	1.07
Duct Type	Rigid
MVHR Efficiency	88.00
Wet Rooms	3
SFP from Installer Commissioning Certificate	No
MVHR System Location	Inside heated envelope (installed exclusively)
Duct Installation Specification	Level 1

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System	No

22.0 Lighting

No Fixed Lighting	No				
	Name	**Efficacy**	**Power**	**Capacity**	**Count**
	LED	100.00	25	2500	15

24.0 Main Heating 1	Database
Description	Vaillant aroTHERM plus 12kW

Summary for Input Data

Percentage of Heat	100.00	%
Database Ref. No.	104457	
Fuel Type	Electricity	
In Winter	484.75	
In Summer	186.71	
Model Name	aroTHERM plus 12kW + AI	
Manufacturer	Vaillant Group UK Ltd	
System Type	Heat Pump	
Controls SAP Code	2207	
Is MHS Pumped	Pump in heated space	
Heating Pump Age	2013 or later	
Heat Emitter	Underfloor	
Underfloor Heating	Yes - Pipes in Wood	
Flow Temperature	Enter value	
Flow Temperature Value	35.00	

25.0 Main Heating 2 — None

26.0 Heat Networks — None

	Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power Ratio	Electrical	Fuel Factor	Efficiency type
Heat source 1										
Heat source 2										
Heat source 3										
Heat source 4										
Heat source 5										

28.0 Water Heating

Water Heating	Main Heating 1	
SAP Code	901	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	No	
Cold Water Source	From mains	
Bath Count	0	
Immersion Only Heating Hot Water	No	

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To

28.3 Waste Water Heat Recovery System

29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	250.00	L
Loss	1.40	kWh/day
Pipes insulation	Fully insulated primary pipework	
In Airing Cupboard	No	

Summary for Input Data

31.0 Thermal Store	None
34.0 Small-scale Hydro	None

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

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
			0	0
			0	0
			0	0

Thermal Bridging

elmhurst energy

Property Reference	Apartment B	**Issued on Date**	21/12/2023
Assessment Reference	231207ac Unit B - Be Green	**Prop Type Ref**	Semi-Detached Flat
Property	Apartment B, 26, Rosslyn Hill, London, NW3 1PD		

SAP Rating	63 D	**DER**		**TER**	
Environmental	92 A	**% DER < TER**			N/A
CO_2 Emissions (t/year)	1.16	**DFEE**		**TFEE**	
Compliance Check	See BREL	**% DFEE < TFEE**			
% DPER < TPER		**DPER**		**TPER**	

Assessor Details	Ms. Anna Sung	**Assessor ID**	BK81-0001
Client			

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E1 Steel lintel with perforated steel base plate	Table K1 - Default	1.000	27.60	27.60	
External wall	E3 Sill	Table K1 - Default	0.100	27.60	2.76	
External wall	E4 Jamb	Table K1 - Default	0.100	49.73	4.97	
External wall	E7 Party floor between dwellings (in blocks of flats)	Table K1 - Default	0.280	59.40	16.63	
External wall	E16 Corner (normal)	Table K1 - Default	0.180	18.51	3.33	
External wall	E18 Party wall between dwellings	Table K1 - Default	0.240	5.58	1.34	
Party wall	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Table K1 - Default	0.000	2.62	0.00	
External wall	E17 Corner (inverted – internal area greater than external area)	Table K1 - Default	0.000	5.58	0.00	
External wall	E6 Intermediate floor within a dwelling	Table K1 - Default	0.140	31.11	4.36	
External wall	E14 Flat roof	Table K1 - Default	0.160	17.15	2.74	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	21.92	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Table K1 - Default	0.480	2.62	1.26	
External roof	R6 Flat ceiling	Table K1 - Default	0.120	13.95	1.67	
External wall	E15 Flat roof with parapet	Table K1 - Default	0.300	28.31	8.49	

Total: 311.68 W/mK:

Y-Value: 0.21 W/m²K:

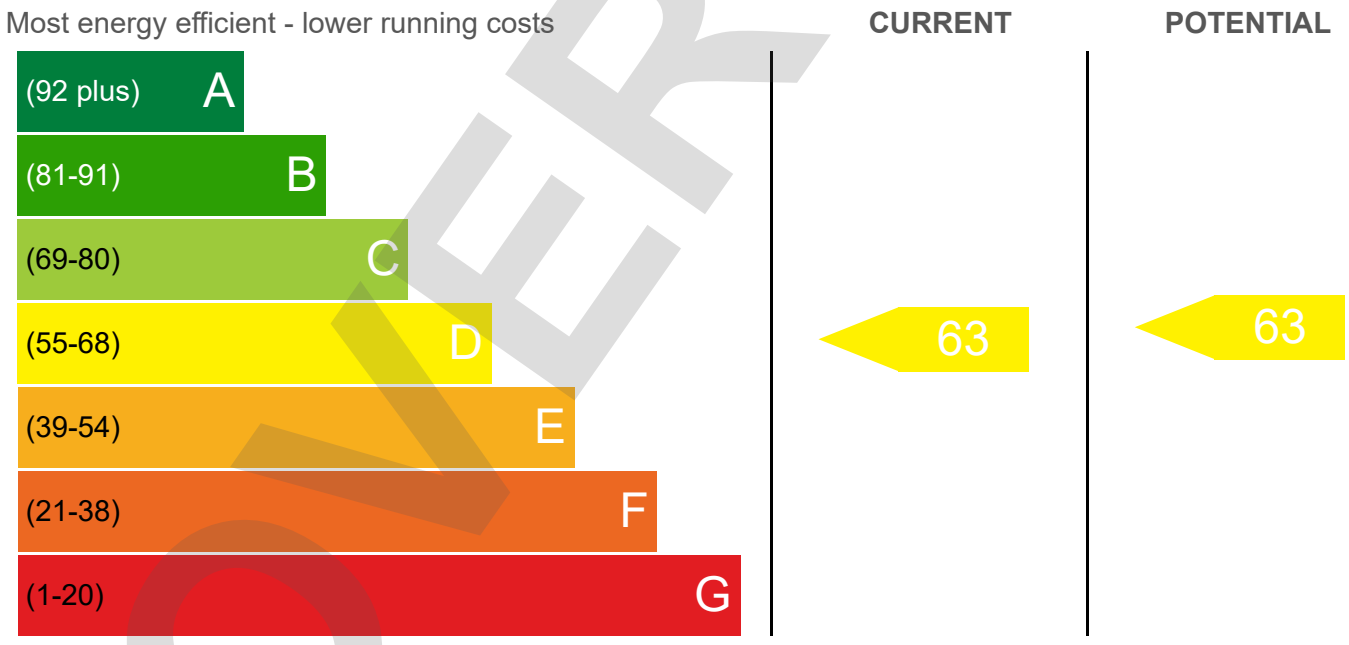
Overview Report

Dwelling Address	Apartment B, 26, Rosslyn Hill, London, NW3 1PD
Report Date	21/12/2023
Property Type	Flat, Semi-Detached
Floor Area [m^2]	174

This document is not an Energy Performance Certificate (EPC) as required by the Energy Performance of Buildings Regulations

Energy Rating

The current energy rating represents the overall energy efficiency of the dwelling. The potential energy rating is the overall energy rating of the dwelling after all of the recommend measures provided on the next page have been installed. A higher score represents a more energy efficient dwelling with lower fuel bills.



Overview Report

Breakdown of property's energy performance

Each feature is assessed as one of the following:

Very Poor | Poor | Average | Good | Very Good

Feature	Description	Energy Performance
Walls	Average thermal transmittance 1.22 W/m²K	Poor
Roof	Average thermal transmittance 0.23 W/m²K	Good
Windows	High performance glazing	Good
Main heating	Air source heat pump, underfloor, electric	Very Good
Main heating controls	Time and temperature zone control	Very Good
Secondary heating	None	
Hot water	From main system	Average
Lighting	Excelent lighting efficiency	Very Good
Air tightness	(not tested)	

Primary Energy use

The primary energy use for this property per year is 70 kilowatt hour (kWh) per square metre

Estimated CO_2 emissions of the dwelling

The estimated CO rating provides an indication of the dwelling's impact on the environment in terms of carbon dioxide emissions; the higher the rating the less impact it has on the environment.

The estimated CO emissions for this dwellings is: **1.2** per year

With the recommended measures the potential CO emissions could be: **1** per year

Overview Report

Recommendations

The recommended measures provided below will help to improve the energy efficiency of the dwelling.
To reach the dwelling's potential energy rating all of the recommended measures shown below would need to be installed.
Having these measures installed individually or in any other order may give a different result when compared with the cumulative potential rating.

Recommended measure	Typical Yearly Saving	Potential Rating after measure installed	Cumulative savings (per year)	Cumulative Potential Rating

Estimated energy use and potential savings

Estimated energy cost for this property over a year

£1679

Over a year you could save

£0

The estimated cost and savings show how much the average household would spend in this property for heating, lighting and hot water. It is not based on how energy is used by the people living at the property.

Contacting the assessor and the accreditation scheme

Assessor contact details	
Assessor name	Ms. Anna Sung
Assessor's accreditation number	
Email Address	

Overview Report

Accreditation scheme contact details	
Accreditation scheme	
Telephone	
Email Address	

Assessment details	
Related party disclosure	
Date of assessment	19/12/2023
Date of certificate	19/12/2023
Type of assessment	SAP, existing dwelling

Appendix B. Non-domestic BRUKL Report

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Hamstead police station BE GREEN

As designed

Date: Wed Nov 29 07:10:16 2023

Administrative information

Building Details

Address: Former Hampstead Police Station, 26 Rosslyn Hill, London, NW3 1PD

Certifier details

Name: PDA

Telephone number:

Address: 282 Chase Road, Southgate, N14 6HA

Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.d.0

Interface to calculation engine: Energy Simulator

Interface to calculation engine version: 10.10.1.151

BRUKL compliance module version: v6.1.d.0

Foundation area [m^2]: 350

The CO_2 emission and primary energy rates of the building must not exceed the targets

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

Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	3.92	
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	9.37	
Target primary energy rate (TPER), $kWh/m^2.annum$	41.66	
Building primary energy rate (BPER), $kWh/m^2.annum$	99.78	
Do the building's emission and primary energy rates exceed the targets?	BER > TER	BPER > TPER

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

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	1.32	1.5	Wall 1
Floors	0.18	0.37	1.75	Internal Floor 3
Pitched roofs	0.16	0.18	0.18	Exposed Roof 5
Flat roofs	0.18	0.15	0.15	Exposed Roof 1
Windows** and roof windows	1.6	1.41	1.5	Rooflight 1
Rooflights***	2.2	-	-	No external rooflights
Personnel doors^	1.6	-	-	No external personnel doors
Vehicle access & similar large doors	1.3	-	-	No external vehicle access doors
High usage entrance doors	3	2.14	2.14	Door 1 (High Usage Entrance Door)

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]

$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]

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

** Display windows and similar glazing are excluded from the U-value check.

*** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m^2K

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

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	10

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	>0.95

1- Zone 1 - Offices VRF+MVHR

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	4	6	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

2- Zone 2 - EPH+TEF

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	1	-	-	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

3- Zone 3 - EPH+NatVent

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	1	-	-	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

1- POU

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

Zone-level mechanical ventilation, exhaust, and terminal units

ID	**System type in the Approved Documents**
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter
NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.	

Zone name	**SFP [W/(l/s)]**									**HR efficiency**	
ID of system type	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	**Zone**	**Standard**
OFF 5	-	-	-	-	1.6	-	-	-	-	0.85	N/A
OFF 4	-	-	-	-	1.6	-	-	-	-	0.85	N/A
OFF 4, Extension 2	-	-	-	-	1.6	-	-	-	-	0.85	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
ANNEX OFF	-	-	-	-	1.6	-	-	-	-	0.85	N/A
ANNEX ENTRANCE LOBBY	-	-	-	-	1.6	-	-	-	-	0.85	N/A
OFF4, EXTENSION	-	-	-	-	1.6	-	-	-	-	0.85	N/A
OFF 6	-	-	-	-	1.6	-	-	-	-	0.85	N/A
OFF3, A	-	-	-	-	1.6	-	-	-	-	0.85	N/A
OFF 3, B	-	-	-	-	1.6	-	-	-	-	0.85	N/A
OFF 3, C	-	-	-	-	1.6	-	-	-	-	0.85	N/A
OFF 3, D	-	-	-	-	1.6	-	-	-	-	0.85	N/A
OFF 4	-	-	-	-	1.6	-	-	-	-	0.85	N/A
OFFICE	-	-	-	-	1.6	-	-	-	-	0.85	N/A
MEETING ROOM	-	-	-	-	1.6	-	-	-	-	0.85	N/A
OFFICE REAR 4	-	-	-	-	1.6	-	-	-	-	0.85	N/A
GF ANNX OFFA	-	-	-	-	1.6	-	-	-	-	0.85	N/A
OFF3, E	-	-	-	-	1.6	-	-	-	-	0.85	N/A
OFFICE ENTRANCE	-	-	-	-	1.6	-	-	-	-	0.85	N/A
BOARDROOM	-	-	-	-	1.6	-	-	-	-	0.85	N/A
OFFICE 1 RECEPTION	-	-	-	-	1.6	-	-	-	-	0.85	N/A
OFFICE 1 KITCHEN	-	-	-	-	1.6	-	-	-	-	0.85	N/A
BREAKOUT	-	-	-	-	1.6	-	-	-	-	0.85	N/A
OFFICE REAR 1	-	-	-	-	1.6	-	-	-	-	0.85	N/A
OFFICE REAR 2	-	-	-	-	1.6	-	-	-	-	0.85	N/A
OFFICE REAR 3	-	-	-	-	1.6	-	-	-	-	0.85	N/A
ANNX OFF	-	-	-	-	1.6	-	-	-	-	0.85	N/A
GF ANNEX MTRM	-	-	-	-	1.6	-	-	-	-	0.85	N/A
FF ANNX MTRM	-	-	-	-	1.6	-	-	-	-	0.85	N/A
OFF WCs	0.3	-	-	-	-	-	-	-	-	-	N/A
ANNEX TOILETS	0.3	-	-	-	-	-	-	-	-	-	N/A
OFF SHOWERS	0.3	-	-	-	-	-	-	-	-	-	N/A
OFF 6 TOILETS	0.3	-	-	-	-	-	-	-	-	-	N/A
OFF3 WCs	0.3	-	-	-	-	-	-	-	-	-	N/A
ANNEX WC	0.3	-	-	-	-	-	-	-	-	-	N/A
OFF DDA WC	0.3	-	-	-	-	-	-	-	-	-	N/A
REAR OFFICE TOILET	0.3	-	-	-	-	-	-	-	-	-	N/A
ANNX Tpoint	0.3	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
LGF Office Waste store	120	-	-
LGF OFFICE BIKE STORE	120	-	-
LGF Plantrm	120	-	-
ANNEX PLANT	120	-	-
LGF OFFICE CLNR STORE	120	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
LGF OFFICE STORE	120	-	-
OFF 5	120	-	-
OFF 4	120	-	-
OFF 4, Extension 2	120	-	-
ANNEX OFF	120	-	-
ANNEX ENTRANCE LOBBY	120	15	9
OFF4, EXTENSION	120	-	-
OFF 6	120	-	-
OFF3, A	120	-	-
OFF 3, B	120	-	-
OFF 3, C	120	-	-
OFF 3, D	120	-	-
OFF 4	120	-	-
OFFICE	120	-	-
MEETING ROOM	120	-	-
OFFICE REAR 4	120	-	-
GF ANNX OFFA	120	-	-
OFF3, E	120	-	-
OFFICE ENTRANCE	120	-	-
BOARDROOM	120	-	-
OFFICE 1 RECEPTION	120	-	-
OFFICE 1 KITCHEN	120	-	-
BREAKOUT	120	-	-
OFFICE REAR 1	120	-	-
OFFICE REAR 2	120	-	-
OFFICE REAR 3	120	-	-
ANNX OFF	120	-	-
GF ANNEX MTRM	120	-	-
FF ANNX MTRM	120	-	-
OFF WCs	120	-	-
ANNEX TOILETS	120	-	-
OFF SHOWERS	120	-	-
OFF 6 TOILETS	120	-	-
OFF3 WCs	120	-	-
ANNEX WC	120	-	-
OFF DDA WC	120	-	-
REAR OFFICE TOILET	120	-	-
ANNX Tpoint	120	-	-
ANNEX STAIRS	120	-	-
OFF3 CIRR	120	-	-
OFFICE REAR CORRIDOR	120	-	-
ANNX Stairs	120	-	-
GF ANNEX STAIRS	120	-	-

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

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
LGF Office Waste store	NO (-87.5%)	NO
OFF 5	NO (-49.1%)	NO
OFF 4	YES (+94.2%)	NO
OFF 4, Extension 2	YES (+12.9%)	NO
ANNEX OFF	NO (-8.8%)	NO
ANNEX ENTRANCE LOBBY	YES (+16.2%)	NO
OFF4, EXTENSION	NO (-64%)	NO
OFF 6	YES (+7.2%)	NO
OFF3, A	NO (-42.9%)	NO
OFF 3, B	YES (+14.4%)	NO
OFF 3, C	YES (+4.5%)	NO
OFF 3, D	NO (-58.8%)	NO
OFF 4	YES (+97.1%)	NO
OFFICE	N/A	N/A
MEETING ROOM	NO (-13.3%)	NO
OFFICE REAR 4	YES (+21.9%)	NO
GF ANNX OFFA	NO (-10%)	NO
OFF3, E	N/A	N/A
OFFICE ENTRANCE	N/A	N/A
BOARDROOM	NO (-11.2%)	NO
OFFICE 1 RECEPTION	N/A	N/A
OFFICE 1 KITCHEN	N/A	N/A
BREAKOUT	YES (+77.6%)	NO
OFFICE REAR 1	YES (+18.6%)	NO
OFFICE REAR 2	NO (-31.1%)	NO
OFFICE REAR 3	N/A	N/A
ANNX OFF	YES (+19.8%)	NO
GF ANNEX MTRM	NO (-24.9%)	NO
FF ANNX MTRM	YES (+41.6%)	NO
OFF WCs	N/A	N/A

Regulation 25A: Consideration of high efficiency alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	1122.4	1122.4
External area [m^2]	2742.6	2742.6
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	10	3
Average conductance [W/K]	2648.69	931.45
Average U-value [W/m^2K]	0.97	0.34
Alpha value* [%]	9.98	22.82

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

Building Use

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

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	33.17	10.04
Cooling	7.22	5.01
Auxiliary	5.69	2.32
Lighting	17.65	10.82
Hot water	3.06	3.06
Equipment*	44.68	44.68
TOTAL**	**66.79**	**31.25**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	3.3
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*0*	*3.3*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	420.47	206.97
Primary energy [kWh/m^2]	99.78	41.66
Total emissions [kg/m^2]	9.37	3.92

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] No Heating or Cooling										
	Actual	283.2	490.8	0	0	0	0	0	0	0
	Notional	73.9	436.1	0	0	0	0	0	----	----
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	234.2	145.7	17.5	9.5	6.9	3.73	4.26	4	6
	Notional	74.8	104.5	7.9	6.6	2.3	2.64	4.4	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	415.9	30	144.4	0	5.3	0.8	0	1	0
	Notional	106.9	34.8	22.2	0	7.1	1.34	0	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	342.5	35	118.9	0	0	0.8	0	1	0
	Notional	158.8	36.2	32.9	0	0	1.34	0	----	----

Key to terms

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