

2026

re:shape

Energy Strategy Report

Ashley Park



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1 Executive Summary

This Energy Assessment report has been prepared by Meinhardt (UK) Ltd on behalf of Re: shape T Ltd (the “Applicant”) to accompany the application to the London Borough of Haringey (the “Local Planning Authority”) for full planning permission at Former Ashley House site, Ashley Road, Tottenham Hale, London Borough of Haringey, N17 9LZ (the “Site”).

The report demonstrates how the Proposed Development responds to the energy and carbon requirements of the London Plan 2021, the Greater London Authority's Energy Assessment Guidance (2022) and the Haringey Local Plan. It sets out the carbon emissions of the development at each stage of the energy hierarchy, the heating and cooling strategy, the renewable energy provision, the residual carbon offset, and the assessment of overheating risk.

The application is referable to the Mayor of London. The GLA Carbon Emissions Reporting Spreadsheet accompanies this report and should be read alongside it.

The planning history of the site, including the extant consents at Ashley House and Ashley Park, is set out in the Planning Statement. This report should be read alongside the Planning Statement, Sustainability Statement, Whole Life-Carbon Assessment, Circular Economy Statement and the Noise Assessment prepared by Trium Acoustics.

The strategy follows the London Plan energy hierarchy of Be Lean, Be Clean, Be Green and Be Seen.

Be Lean. A fabric-first approach reduces demand before any consideration of supply. Measures include external wall U-values of 0.14 W/m²K, floor and roof U-values of 0.10 W/m²K, triple glazing at 0.80 W/m²K for the residential elements, air permeability of 3 m³/(h.m²) against the Part L limiting value of 8, a target thermal bridging y-value of 0.08 W/m²K, mechanical ventilation with heat recovery at up to 90% efficiency, LED lighting throughout, smart metering to each dwelling and a central Building Management System for landlord plant.

Be Clean. There is no existing heat network within reach of the site. A proposed network is identified nearby on the London Heat Map and the network operator, Energetik, has been engaged regarding feasibility, timescales and alignment with the delivery programme. The Proposed Development will be served by central air source heat pumps to each block, distributing heat for space heating and hot water via a site-wide network, with each dwelling served by a dual plate heat interface unit. The system has been designed to permit connection to a future district heat network, and the Applicant will accept an obligation securing that connection should a network become available.

Be Green. Air source heat pumps provide 100% of space heating and hot water demand. These are supplemented by 63 roof-mounted photovoltaic panels providing 28.5 kWp. Biomass boilers, solar thermal, ground source heat pumps and wind turbines have each been appraised and are not proposed, for the reasons set out at Section 8.

Be Seen. The Applicant commits to monitoring and reporting energy performance in accordance with the GLA's Be Seen guidance. The planning-stage submission will be made via the GLA Be Seen portal at the point of application.

1.1 Carbon Reduction Policy and Targets

National Policy

The United Kingdom (UK) Government has made a commitment to bring all greenhouse gas emissions in the UK to net zero by 2050. Further commitments have been made to reducing economy-wide greenhouse gas emissions by at least 68% by 2030 and by 78% by 2035, compared to 1990 levels.

Building Regulations

The current Building Regulations Part L Conservation of Fuel and Power (Part L 2021) and Part O Overheating (Part O 2021) were introduced in June 2022.

Further consultation is expected on the new Future Homes Standard and Future Buildings Standard which are intended to be published in Autumn 2025.

London Plan (2021)

Major development should be net zero-carbon, with a minimum on-site reduction of at least 35 per cent beyond Building Regulations Part L 2013 requirements.

Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent reduction through energy efficiency measures.

Where the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, either through a cash in lieu contribution to the borough's carbon offset fund, or off-site provided that an alternative proposal is identified, and delivery is certain.

Carbon emissions from any other part of the development i.e. unregulated emissions, should be calculated and minimised.

Energy Assessment Guidance (2022)

Updated planning guidance was published by the Greater London Authority (GLA) in June 2022 which explains how London Plan policies apply now that Part L 2021 has taken effect.

Major developments are required to achieve a 35 per cent minimum improvement over Building Regulations Part L 2021 requirements. Residential developments should be able to exceed this so should aim to achieve at least a 50 per cent improvement over Part L 2021.

Haringey Local Plan

SP4 policy reference

Target: 100% reduction in regulated CO2 emissions compared to Part L 2021 Minimum On-site: 35% improvement via the energy hierarchy

Renewables: Minimum 20% reduction from "Be Green" (on-site renewables)

1.2 Carbon Reduction Strategy

The energy strategy for the proposed development follows the London Plan's energy hierarchy approach of 'Be Lean', 'Be Clean', 'Be Green', and 'Be Seen' as detailed in policy SI2.

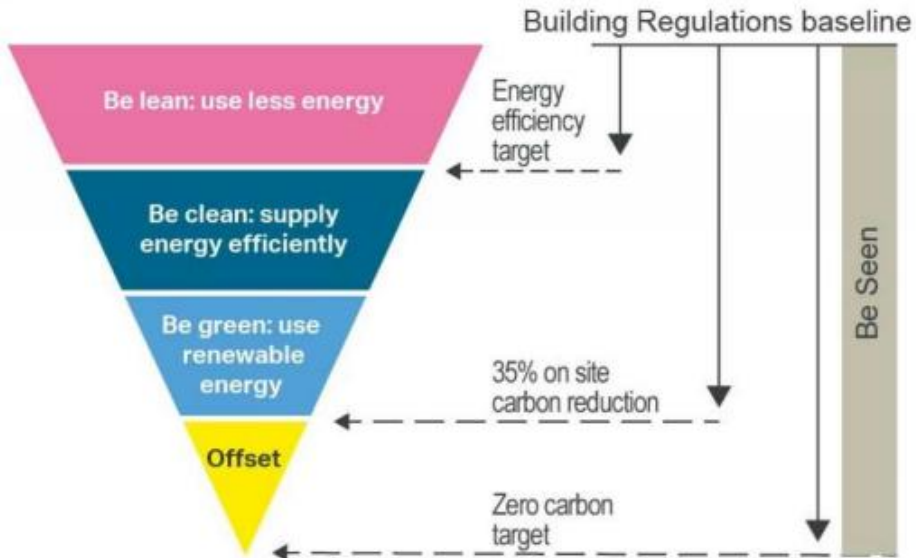


Figure 1: The energy hierarchy and associated targets

The proposed development has been assessed using Elmhurst “Design SAP10” modelling software which is based on the UK Government Standard Assessment Procedure (SAP) version 10.2.

1.3 Carbon Reductions

Domestic Carbon Emissions and Savings

The expected carbon dioxide emissions at each stage of the hierarchy are shown in the graph below for the residential element of the Proposed Development.

The graph demonstrates that the residential element of the Proposed Development achieves an overall on-site reduction of 72% in regulated carbon dioxide emissions over Part L 2021, exceeding the GLA minimum target of 35% and the benchmark target of 50%.

Energy demand has been significantly reduced, exceeding the GLA target of 10%, achieving a reduction of 12% in regulated carbon emissions over Part L 2021 at the ‘Be Lean’ stage of the hierarchy, through passive design and energy efficiency measures alone.

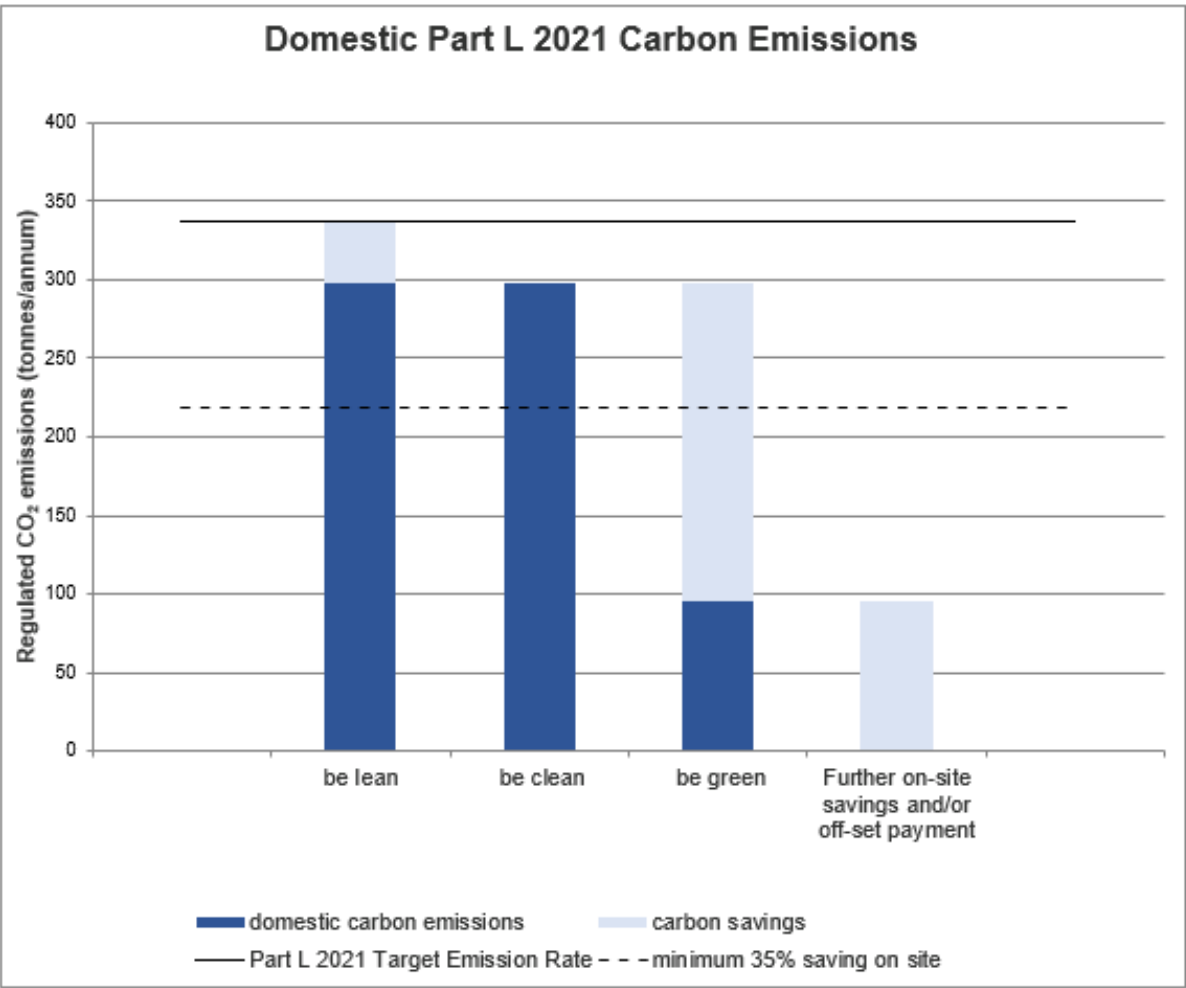


Figure 2: Domestic energy hierarchy and targets

The tables below detail the carbon dioxide emissions and savings expected at each stage of the energy hierarchy for the residential element of the Proposed Development.

	Carbon dioxide emissions for domestic buildings (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2021	337.2	188.0
Be Lean	297.0	167.3
Be Clean	297.1	167.3
Be Green	95.6	167.3

Table 1: Domestic carbon dioxide emissions after each stage of the energy hierarchy

	Regulated domestic carbon dioxide savings	
	Tonnes CO ₂ per annum	%
Be lean	40.2	12%
Be clean	0.0	0%
Be green	201.4	60%
Cumulative on site savings	241.6	72%
Carbon shortfall	95.6	-
	Tonnes CO ₂	
Cumulative savings for off-set payment	2,867	
Cash-in-lieu contribution	£272,394	

Table 2: Regulated domestic carbon dioxide savings from each stage of the energy hierarchy

Non-Domestic Carbon Emissions and Savings

The expected carbon dioxide emissions at each stage of the hierarchy are shown in the graph below for the non-residential element of the Proposed Development.

The graph demonstrates that the non-residential element of the Proposed Development achieves an overall on-site reduction of 53% in regulated carbon dioxide emissions over Part L 2021, exceeding the GLA minimum target of 35%.

Energy demand has been significantly reduced, significantly exceeding the GLA target of 15%, achieving a reduction of 27% in regulated carbon emissions over Part L 2021 at the ‘Be Lean’ stage of the hierarchy, through passive design and energy efficiency measures alone.

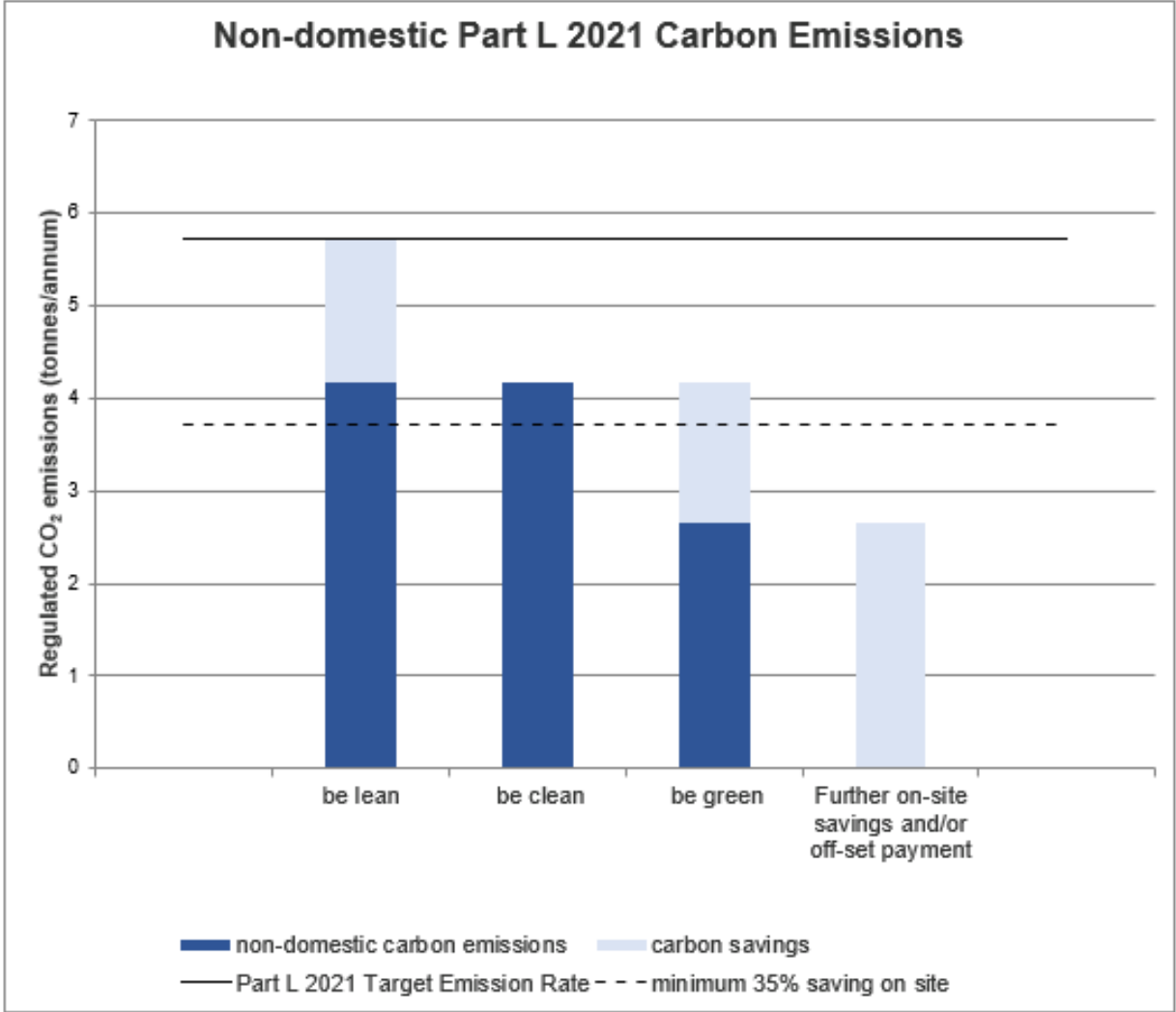


Figure 3: Non-domestic energy hierarchy and targets

The tables below detail the carbon dioxide emissions and savings expected at each stage of the energy hierarchy for the non-residential element of the Proposed Development.

	Carbon dioxide emissions for non-domestic buildings (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2021	5.7	1.3
Be Lean	4.2	1.0
Be Clean	4.2	1.0
Be Green	2.7	1.0

Table 3: Non-domestic carbon dioxide emissions after each stage of the energy hierarchy

	Regulated non-domestic carbon dioxide savings	
	Tonnes CO ₂ per annum	%
Be lean	1.5	27%
Be clean	0.0	0%
Be green	1.5	27%
Cumulative on site savings	3.1	53%
Carbon shortfall	2.7	-
	Tonnes CO ₂	
Cumulative savings for off-set payment	80	
Cash-in-lieu contribution	£ 7,587	

Table 4: Regulated non-domestic carbon dioxide savings from each stage of the energy hierarchy

Total Carbon Emissions and Savings

The table below details the overall carbon dioxide emissions and savings expected at each stage of the energy hierarchy for the Proposed Development.

	Total regulated emissions (Tonnes CO ₂ /year)	CO ₂ savings (Tonnes CO ₂ /year)	Percentage saving (%)
Part L 2021 baseline	342.9		
Be Lean	301.2	41.8	12%
Be Clean	301.2	0.0	0%
Be Green	98.2	202.9	59%
Cumulative on site savings	-	244.7	71%
		CO ₂ savings off-set (Tonnes CO ₂)	
Off-set		2,947.2	-

Table 5: Total regulated carbon dioxide emissions and savings for the Proposed Development

1.4 Demand Reduction (Be Lean)

Energy demand will be significantly reduced beyond Part L requirements, achieving an overall saving of 41,800 kg CO₂ per year in regulated carbon dioxide emissions through passive design and energy efficiency measures alone.

The reduction will be achieved by a combination of measures, which shall include the following. Please refer to Section 6 for further details.

- Significantly improved fabric 'U' values, including triple glazing
- Minimised thermal bridging
- Improved air tightness
- Optimised g-value of the glazing – to provide a balance between minimising heat gain in summer (to reduce overheating), maximising useful heat gain in winter (to reduce heating energy) and maximising natural daylight (to reduce lighting energy)
- Site-wide heating system
- High efficiency ventilation systems
- Minimised heat loss from hot water systems
- Low energy lighting
- Controls systems to monitor and operate the plant and equipment as efficiently as possible.
- Smart meters.

Fabric Energy Efficiency

The table below details the total Part L residential Fabric Energy Efficiency Standard (FEES).

	Part L Fabric Energy Efficiency Standard (FEES)		
	Target Fabric Energy Efficiency (kWh/m ²)	Design Fabric Energy Efficiency (kWh/m ²)	Improvement (%)
Proposed development total	23.86	21.08	12%

Table 6: Part L residential Fabric Energy Efficiency Standard (FEES)

Energy Use Intensity (EUI) and Space Heating Demand

The table below details the Energy Use Intensity (EUI) and space heating demand for the residential and non-residential elements of the Detailed Component.

Building type	EUI (kWh/m ² /yr)		Space heating demand (kWh/m ² /yr)		Methodology used
	GLA Target	Actual	GLA Target	Actual	
Residential	35	31.5	15	7	Space heating and regulated from SAP. Unregulated from HES.
Building type	EUI (kWh/m ² /yr)		Space heating demand (kWh/m ² /yr)		Methodology used
	Net Zero Target	Actual	GLA Target	Actual	
Commercial	70	65	15	6	CIBSE TM54
Shared Living	70	64	15	12.65	CIBSE TM54

Table 7: EUI and space heating demand for the Proposed Development

1.5 Heating Infrastructure (Be Clean)

Existing and Planned Heat Networks

As shown in the extract from the London Heat Map below, there are no existing heat networks in the vicinity of the site. However, a proposed heat network is identified nearby.

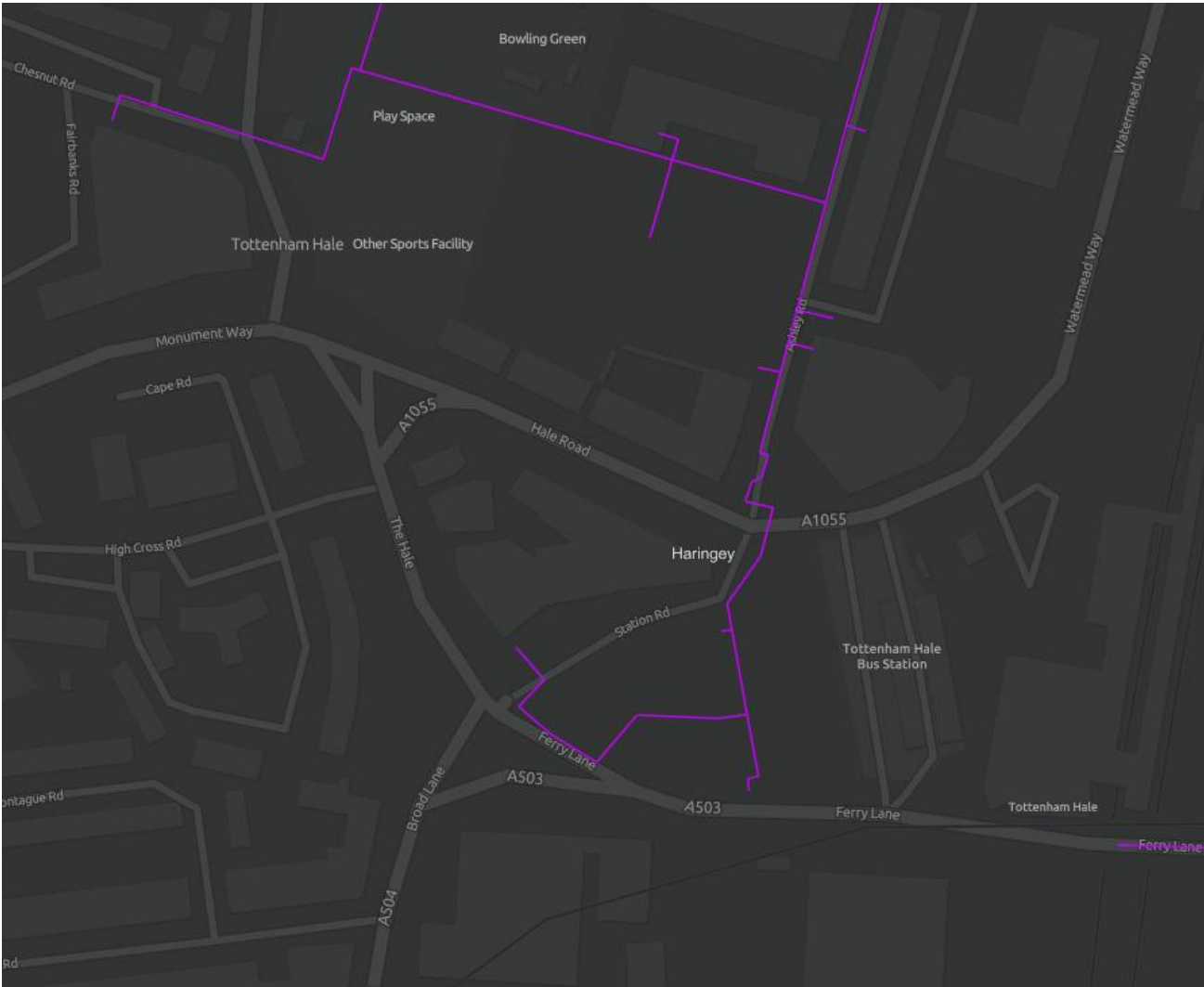


Figure 4: Extract from London Heat Map

Proposed Heat Supply Hierarchy

London Plan Policy SI 3 requires that the heat source for the heating system is selected in accordance with the heating hierarchy shown below:-

- connect to local existing or planned heat networks
- use zero-emission or local secondary heat sources (in conjunction with heat pump, if required)
- use low-emission combined heat and power (only where there is a case for it to enable the delivery of an area-wide heat network, meet the development's electricity demand and provide demand response to the local electricity network)
- use ultra-low nitrogen oxides (NOx) gas boilers

As described above, it is not feasible to connect to an existing or proposed heat network.

It is proposed to install a central air source heat pumps on each block that are specifically designed to operate at the expected operating temperatures to maximise efficiency.

The network will be distributed throughout the proposed development to provide heat for space heating and domestic hot water in all residential dwellings. Each residential dwelling will be served via a dual plate heat interface unit.

The heat system has been designed with the capability to connect to a future district heat network should one become available.

The heat system will be designed to minimise heat losses including measures such as minimising pipework lengths and installing high level of insulation (in excess of British Standards).

The carbon reductions generated by the heat pumps are included at the Be Green stage of the hierarchy.

1.6 Renewable Energy Systems (Be Green)

An assessment of the feasibility of including on-site renewable energy has been carried out, and the results are shown in Section 8.

As stated above, heat pumps are proposed as the main heat source for the proposed development and the carbon reductions generated by the central heat pumps are included at the Be Green stage of the hierarchy.

It is proposed to install a total of 63 No. photovoltaic panels on the roofs of the two residential blocks with a total peak output of 28.5 kW (based on 445W, 1.83m², 24.1% efficient panels).

The heat pumps and PV panels will provide an overall saving of 201.4 kg CO₂ per year in regulated carbon dioxide emissions.

1.7 Energy Monitoring (Be Seen)

The Applicant confirms a commitment to monitor and report its energy performance post-construction in accordance with the 'Be Seen' guidance.

A 'planning stage' submission will be made via the GLA 'Be Seen' web-form after any planning consultation comments are resolved.

1.8 Carbon Offset

The remaining regulated carbon dioxide emissions (to 100%) over 30 years for the proposed development (241.6 Tonnes CO₂ per annum) will off-set through a cash in lieu contribution of £272,394 (based on £95/Tonne) to the local planning authority, to be ring fenced to secure delivery of carbon dioxide savings elsewhere.

1.9 Unregulated Energy

The energy demand and associated carbon dioxide emissions from unregulated uses, i.e. those not covered by the Building Regulations assessments (e.g. cooking, appliances, equipment) have been estimated using the following:-

- Residential – UK Government Household Electrical Survey (2014).
- Non-residential – CIBSE Guide F.

An assessment has been carried out to determine how unregulated energy and carbon dioxide emissions can be reduced through the use of energy efficient appliances and equipment, controls, good management practice, etc.

It is expected that a 11% reduction in unregulated carbon dioxide emissions could be achieved over the baseline. Refer to Section 9.

1.10 Overheating and Cooling

The proposed development has been assessed in accordance with the cooling hierarchy detailed in policy SI 4 of the London Plan, the latest GLA Energy Assessment Guidance and Building Regulations Part O 2021, in order to reduce overheating and minimise the use of air conditioning. Refer to Section 10.

The assessment includes dynamic thermal modelling of the proposed development, using IES modelling software, to assess the risk of overheating. The results are summarised below.

1.10.1 Residential

The residential assessment includes dynamic thermal modelling of a representative sample of dwellings to assess the risk of overheating, using IES modelling software, in accordance with the guidance and data sets in the Chartered Institute of Building Services Engineers (CIBSE) Technical Memoranda 49 “Design Summer Years for London” (TM49), CIBSE Technical Memoranda 59 “Design methodology for the assessment of overheating risk in homes” (TM59) and Building Regulations Part O 2021, using the current 2020s design summer year (DSY 1) and the more extreme design summer years (DSY 2 and DSY 3) weather data.

Natural Ventilation via Fully Open Windows

All residential dwellings tested have been modelled with natural ventilation via fully open windows/doors and increased mechanical ventilation to demonstrate that passive measures have been maximised and the façade design has been optimised.

Please refer to Section 10 and Appendix A.6 for the results.

The GLA energy assessment guidance expects that the CIBSE compliance criteria is met for the DSY1 weather scenario. It is acknowledged that meeting the CIBSE compliance criteria is challenging for the DSY 2 & 3 weather files, although it is expected that in the majority of cases a significant proportion of spaces will be able to achieve compliance.

The results demonstrate the following:-

- The CIBSE compliance criteria are met in all rooms modelled (for the 2020s DSY1 weather scenario) without blinds through the use of natural ventilation via fully open windows/doors and increased mechanical ventilation.
- The CIBSE compliance criteria are met in a some of the rooms modelled (for the 2020s DSY2 and 3 weather scenarios) without blinds through the use of natural ventilation via fully open windows/doors and increased mechanical ventilation.
- With fully open windows the risk of overheating has been reduced as far as practical, with all available passive measures explored, as detailed in Sections 6 and 10 of this report.

Closed and Partially Open Bedroom Windows

The Noise Assessment carried out by Trium Acoustics demonstrates that if the windows are fully open some of the bedrooms are subject to background noise levels at night that exceed the limit prescribed in Building Regulations Part O 2021.

Their report includes zoning plans which detail the maximum window opening area for each part of the building to achieve the Part O noise criteria.

Additional modelling has been carried out for the sampled apartments with the bedroom windows fully closed, at night to reflect the maximum window areas on the zoning plans, and with the increased mechanical ventilation in operation. The results are summarised below:-

Please refer to Section 10 and Appendix A.6 for the results.

These results demonstrate the following:-

- The CIBSE compliance criteria cannot be met in all rooms modelled (for the 2020s DSY1 weather scenario) without blinds with closed or partially closed bedroom windows (at night) and increased mechanical ventilation.
- The CIBSE compliance criteria cannot be met in a significant proportion of the rooms modelled (for the 2020s DSY2 and 3 weather scenarios) without blinds with closed or partially closed bedroom windows(at night) and increased mechanical ventilation.

In the apartments affected by higher external noise levels, where the occupants may choose to keep their bedroom windows closed at night, an alternative method of reducing the risk of overheating is proposed with the installation of a MVHR cooling module. Refer to Section 10

Mitigation Measures

The proposed overheating mitigation measures are summarised below:-

- In residential dwellings the use of natural ventilation via openable windows/doors and increased mechanical ventilation will generally sufficiently reduce the risk of overheating.
- During extreme summer weather, residents will be encouraged to use additional measures to reduce the risk of overheating, including the following:-
 - Using portable fans to increase airflow
 - Minimising internal heat gains
 - Keeping windows open as long as possible
- Guidance will be provided to residents on reducing the overheating risk in their home in line with the cooling hierarchy.
- In the apartments affected by higher external noise levels, where the occupants may choose to keep their bedroom windows closed at night, an alternative method of reducing the risk of overheating is proposed with the installation of a MVHR cooling module. The cooling module would have the following features:-
 - It would only ‘temper’ the supply air, reducing the temperature by a few degrees.
 - It would have limited cooling capacity due to the size of the heat pump in the cooling module and the low air volume of the residential ventilation system.
 - It would not ‘control’ space temperature – it would only be used if required by the occupant and would be designed to operate when external temperature exceeds 26 °C at night and 28°C during the day to achieve compliance with the CIBSE overheating criteria.
 - No additional fan would be required in the apartment.

1.11 Cost to Occupants

The applicant has considered and minimised the energy costs to the occupants and is committed to protecting the consumers from high energy prices.

The proposed passive design and energy efficiency measures detailed in this report will achieve significant reductions in both regulated and unregulated energy demand.

Targets have been set for space heating demand and operational energy use across the proposed development. These will be monitored during design and post construction, with the aim of reducing energy usage even further.

The photovoltaic panels (PV) on the roof of each block will generate a significant amount of electricity, thereby giving much more protection against rising energy costs in the future.

The site heat network operator is not known at this point, but the applicant would aim to select one who is Heat Trust registered.

2 Introduction

2.1 This Application

This Energy Assessment report has been prepared by Meinhardt (UK) Ltd on behalf of Re: shape T Ltd (the “Applicant”) to accompany the application to the London Borough of Haringey (the “Local Planning Authority”) for full planning permission at Former Ashley House site, Ashley Road, Tottenham Hale, London Borough of Haringey, N17 9LZ (the “Site”).

2.2 This Energy Assessment

The purpose of this Energy Assessment report is to demonstrate that the design of the Proposed Development has been developed and will continue to develop in accordance with the relevant local, regional, and national planning policies in terms of energy performance.

2.3 Other Documents

This report should be read in conjunction with the other documents which form part of the planning application.

3 Overview

3.1 Site Description

The existing site comprises a vacant brownfield land, with the previous existing buildings having been demolished in August 2023.

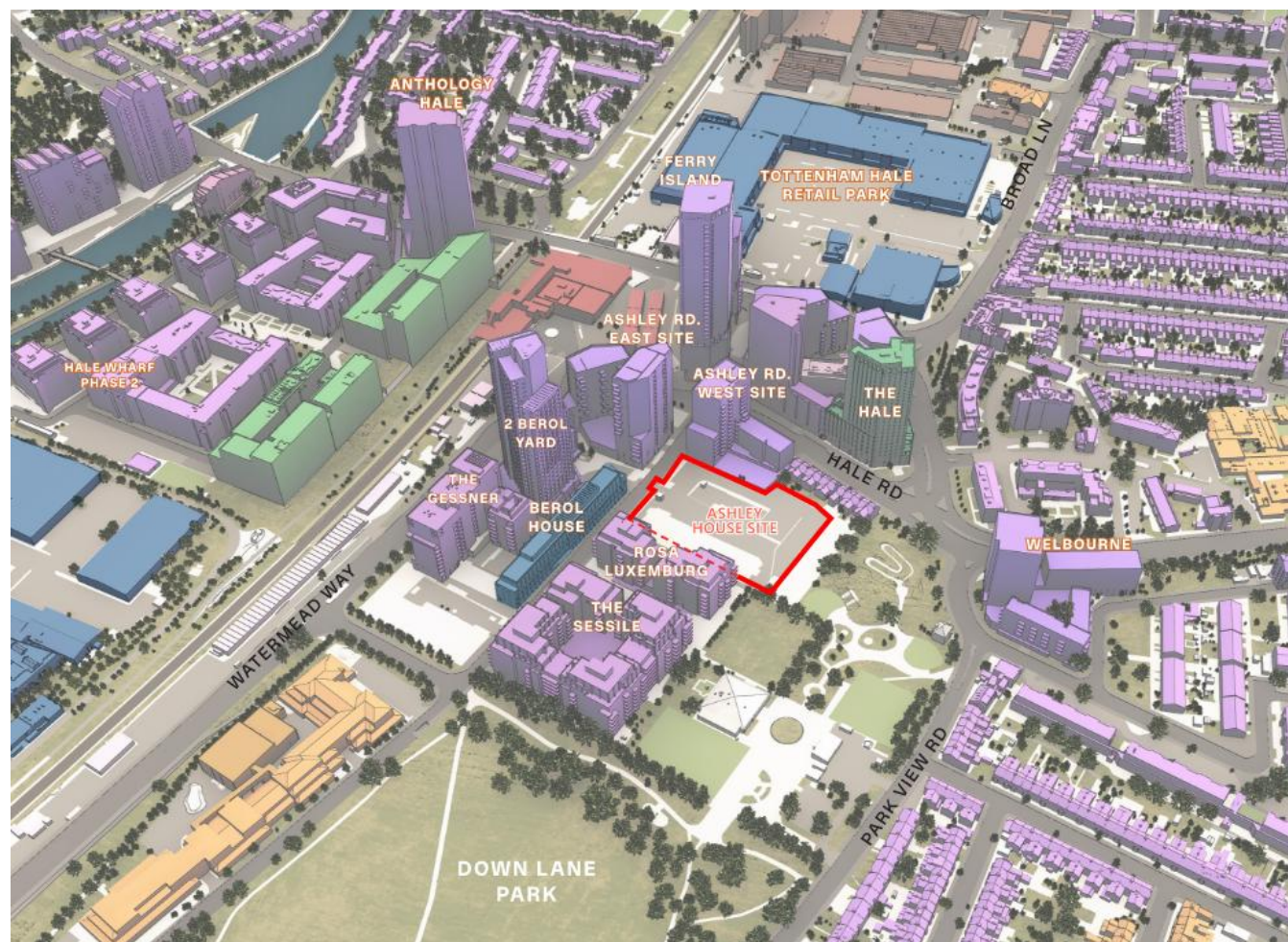


Figure 5: Site plan

3.2 Site Surroundings

The site is located to the west of Ashley Road, south of the Rosa Luxemburg residential building, east of Down Lane Park and north of a number of residential properties along Hale Road. Berol House, a locally listed building, sits on the opposite side of Ashley Road and is currently vacant. The site is located approximately 200m northwest of Tottenham Hale underground and railway station. The surroundings comprise a mix of uses, including a range of recent developments providing ground and lower floor commercial units, with residential development.

3.3 Proposed Development

The proposal is for redevelopment of the site and the erection of two linear buildings running east to west, located to the north and south of the site, with a central route through the site.

Full planning permission for a phased mixed-use development comprising: (i) enabling works and operations; (ii) residential development (Use Class C3) including affordable housing; (iii) shared living accommodation (Sui

Generis), (iv) commercial and community floorspace (Use Classes E and F2); and (v) site-wide and/or phase-specific access, servicing, public realm, blue-badge parking, cycle parking, open space, hard and soft landscaping, utilities, plant and all other associated works.

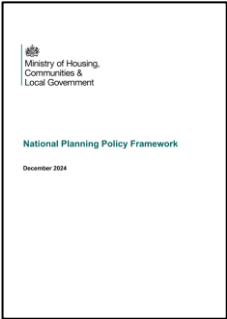


Figure 6: Ground floor plan view of the proposed development

4 Planning Policy

4.1 National

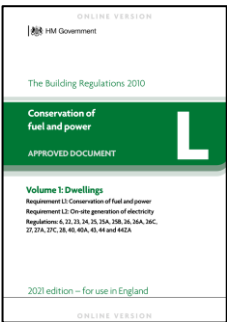
4.1.1 National Planning Policy Framework (2024)



The National Planning Policy Framework (NPPF) set out the Government's planning policies for England and how these should be applied. It provides a framework within which locally-prepared plans can provide for housing and other development in a sustainable manner.

The current version was issued in December 2024.

4.1.2 Building Regulations



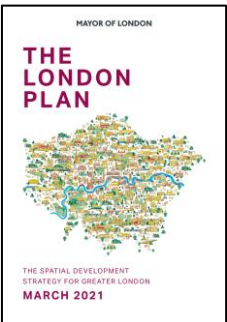
The Building Regulations set out the statutory standards that developments are to meet. These standards cover measures including energy efficiency, water efficiency, sound resistance and ventilation.

Part L of the Building Regulations covers energy efficiency requirements.

The current version of Part L was issued in 2021 (with minor amendments in 2023).

4.2 Regional

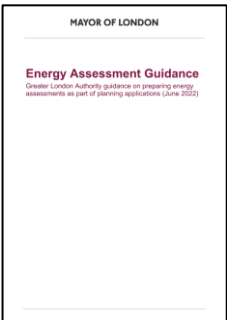
4.2.1 The London Plan (2021)



The London Plan 2021 is the Spatial Development Strategy for Greater London. It sets out a framework for how London will develop over the next 20-25 years and the Mayor's vision for Good Growth.

The Plan is part of the statutory development plan for London, meaning that the policies in the Plan should inform decisions on planning applications across the capital. Borough's Local Plans must be in 'general conformity' with the London Plan, ensuring that the planning system for London operates in a joined-up way and reflects the overall strategy for how London can develop sustainably.

4.2.2 Energy Assessment Guidance (2022)

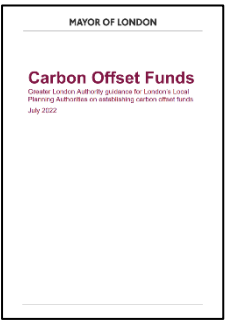


This guidance document explains how to prepare an energy assessment to accompany strategic planning applications referred to the Mayor.

The purpose of an energy assessment is to demonstrate that the proposed climate change mitigation measures comply with London Plan energy policies, including the energy hierarchy.

An updated version was published in June 2022 which explains how London Plan policies apply now that Part L 2021 has taken effect.

4.2.3 Carbon Offset Funds (2022)



This guidance document provides further detail for London's LPAs on setting up carbon offset funds and identifying suitable projects to best utilise that funding. It aims to encourage a consistent approach across London but one that allows for flexibility according to an LPA's local context and priorities

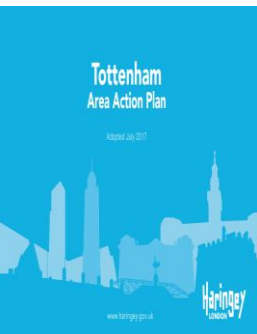
4.3 Local

4.3.1 Haringey Local Plan (2017)



The 2017 Local Plan is the adopted strategic planning framework for Haringey. It includes Strategic Policies, Development Management Policies, Site Allocations and the Tottenham Area Action Plan.

4.3.2 Tottenham Hale AAP (2017)



The Tottenham Area Action Plan (AAP) 2017 was adopted by Haringey Council on 24 July 2017 and provides the planning framework for regeneration and development within Tottenham, including Tottenham Hale.

5 Establishing Energy Demand and Emissions

5.1 Carbon Reduction Targets

5.1.1 National Policy

The UK Government has made a commitment to bring all greenhouse gas emissions in the UK to net zero by 2050. Further commitments have been made to reducing economy-wide greenhouse gas emissions by at least 68% by 2030 and by 78% by 2035, compared to 1990 levels.

5.1.2 Building Regulations

The current Building Regulations Part L Conservation of Fuel and Power (Part L 2021) and Part O Overheating (Part O 2021) were introduced in June 2022.

Further consultation is expected on the new Future Homes Standard and Future Buildings Standard (Approved Document L 2026) was published on 24 March 2026 and is therefore finalised, though not yet legally in force. It comes into effect for standard new-build applications from 24 March 2027 (24 September 2027 for higher-risk buildings), with full mandatory compliance from 24 March 2028 following a 12-month transition period. Applications submitted before 24 March 2027 may still be built to Part L 2021 standards, provided construction commences before the March 2028 deadline.

5.1.3 London Plan (2021)

Major development should be net zero-carbon, with a minimum on-site reduction of at least 35 per cent beyond Building Regulations Part L 2013 requirements.

Residential development should achieve 10 per cent reduction through energy efficiency measures.

Where the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, either through a cash in lieu contribution to the borough's carbon offset fund, or off-site provided that an alternative proposal is identified and delivery is certain.

Carbon emissions from any other part of the development i.e. unregulated emissions, should be calculated and minimised.

5.1.4 Energy Assessment Guidance (2022)

Updated planning guidance has been published by the GLA (in June 2022) which explains how London Plan policies apply now that Part L 2021 has taken effect.

Residential developments are expected to be able to exceed the 35 per cent minimum improvement over Building Regulations Part L 2021 requirements and should aim to achieve at least a 50 per cent improvement.

5.2 Residential

5.2.1 Methodology

Building Regulations Part L1 2021 SAP calculations have been undertaken, using Elmhurst Design SAP10.2 software for a sample of residential dwellings in each block.

The calculations include apartments at the lowest level, intermediate and top floors.

Samples of the results of the residential SAP calculations worksheets are provided in Appendix A.1 for the 'Be Lean' stage of the hierarchy and in Appendix A.2 and for the 'Be Green' stage.

5.2.2 Baseline Emissions

In accordance with GLA Energy Assessment Guidance 2022 Section 6.8, to determine the CO₂ emissions baseline the Target Emission Rate (TER) has been used from the final proposed building specification ie the 'Be Green' stage of the hierarchy.

As the final proposed building specification includes heat pumps, SAP 10.2 calculates the TER using a gas fired boiler with an efficiency of 89.5% for space heating and hot water.

Under SAP 10.2 the TER includes an area of photovoltaic panels in accordance with the dwelling floor area and the number of storeys in the block (for flats).

The GLA Carbon Emissions Reporting spreadsheet also includes the carbon savings generated by the notional PV panels for the actual building, at both the 'Be Lean' and 'Be Clean' stages of the hierarchy (but not at the 'Be Green' stage) to ensure that passive design and energy efficiency savings are suitably demonstrated.

5.3 Non-Residential

5.3.1 Methodology

Building Regulations Part L2 2021 modelling has been undertaken for the non-residential areas using IES thermal modelling software which uses the SBEM methodology in line with the relevant National Calculation Methodology (NCM) guidance. The modelling includes the community space and residential lobbies.

The BRUKL output sheets are provided in Appendix A.3 for the 'Be Lean' stage of the hierarchy and in Appendix A.4 and for the 'Be Green' stage.

5.3.2 Baseline Emissions

In accordance with GLA Energy Assessment Guidance 2022 Section 6.8, to determine the CO₂ emissions baseline the Target Emission Rate (TER) has been used from the final proposed building specification ie the 'Be Green' stage of the hierarchy.

As the final proposed building specification includes heat pumps, the current version of SBEM for Part L 2021 now calculates the TER using a heat pump with a seasonal efficiency of 2.64 for space heating and 2.86 for hot water.

This is a significant change from the previous assessment methodology against Part L 2013 which calculated the baseline TER using a gas fired boiler. The current Part L 2021 SBEM methodology results in a significantly lower Target Emission Rate making it extremely challenging to achieve the GLA carbon reduction targets.

Under the current version of SBEM the TER normally includes an area of photovoltaic panels in accordance with the building area and arrangement, but for this development it is proposed to supply 100% of the space heating and hot water demand from heat pumps so the area of PV in the TER is reduced to zero.

Where applicable, the GLA Carbon Emissions Reporting spreadsheet also includes the carbon savings generated by the notional PV panels for the actual building, at both the 'Be Lean' and 'Be Clean' stages of the hierarchy (but not at the 'Be Green' stage).

6 Demand Reduction (Be Lean)

Energy demand will be significantly reduced beyond Part L requirements, achieving an overall saving of 41,800 kg CO2 per year in regulated carbon dioxide emissions through passive design and energy efficiency measures alone.

The demand reduction will be achieved by a combination of the measures including those detailed below:-

6.1 Building Fabric Insulation

The thermal performance of the building fabric will be significantly improved over Part L 2021 minimum requirements as below:-

Fabric Element	Residential 'U' Value (W/m² K)	Non-Residential 'U' Value (W/m² K)
External Walls	0.14	0.14
Floor	0.1	0.1
Roof	0.1	0.1
Glazing	0.8	1.2
Party Wall	0.0	0.0

Table 8: Proposed fabric 'U' values

6.2 Cold Bridging

Thermal bridging will be minimised to reduce the loss of heat and to prevent the development of cold spots which can lead to mould.

At this early stage of design, detailed construction joint details are not available, so a target y-value has been set as detailed below.

At the appropriate stages of design and construction, the thermal bridges will be demonstrated to the Building Control Body in accordance with the requirements of Building Regulations Part L 2021.

Residential

A target y-value of 0.08 W/m² K has been used for the residential.

This target has been validated by calculating the y-value for a small sample of apartments using the measured junction lengths and psi-values from other similar junctions and reputable sources.

Non-Residential

IES VE software calculates thermal bridge heat losses for the actual building using default y-values that are 25% of the construction element 'U' values, in accordance with the NCM Modelling Guide.

The target improved y-values have been set at 10% of the construction element 'U' values, in accordance with the notional building in the NCM Modelling Guide.

6.3 Air Tightness

The target air permeability has been set at 3 m³/(h m²) in the residential dwellings and non-residential areas, as compared to the Part L minimum requirement of 8 m³/(h m²) to reduce heat loss in winter.

6.4 Natural Daylight

Natural daylight has been maximised wherever possible in the residential accommodation by arranging the living rooms and bedrooms as shallow spaces on the perimeter, by providing dual aspect glazing where possible, and by ensuring ceiling voids are as small as possible (particularly at the perimeter) to maintain the maximum floor to ceiling heights.

6.5 Solar Gain

The size and g-value of the glazing has been optimised using the SAP calculations and the dynamic thermal modelling for the overheating assessment, in order to provide a balance between minimising summer heat gain to prevent overheating, maximising winter heat gain to reduce heating loads, and maximising natural daylight to reduce lighting energy.

This has resulted in the g-value of the glazing being set at 0.4 for the residential and 0.35 for the non-residential.

6.6 Shading

Projecting balconies will provide a shading effect to the residential apartments to minimise peak solar gain.

6.7 Heating Systems

In Section 7.9 entitled "Heating and hot water assumptions" the GLA Energy Assessment Guidance 2022 states "For the purposes of demonstrating CO2 emission improvements in the 'be lean' stage of the energy hierarchy, applicants should use the notional building system type and performance values specified in the Part L 2021 baseline as determined by the final proposed building specification".

Residential

In SAP 10.2 where heat pumps are proposed as the final specification, the notional building uses a gas fired boiler with an efficiency of 89.5% for space heating and hot water, so this has also been assumed for the actual building at 'Be Lean' stage.

Non-Residential

In SBEM where heat pumps are proposed as the final specification, the notional building uses a heat pump with a seasonal efficiency of 2.64 for space heating and 2.86 for hot water, so this has also been assumed for the non-residential spaces at 'Be Lean' stage.

Pipework Heat Losses

The site heating systems will be designed to minimise heat losses in accordance with the recommendations of CIBSE "Heat Networks Code of Practice for the UK" (CP1) including measures such as minimising pipework lengths and installing high level of insulation (in excess of British Standards).

In SAP 10.2 an overall distribution loss factor of 15% has been used for the communal heating system losses.

6.8 Cooling

Residential

The use of natural ventilation via openable windows/doors and increased mechanical ventilation will generally sufficiently reduce the risk of overheating, so active mechanical cooling is not proposed for the residential dwellings.

Where the occupants may choose to keep their windows closed at night due to higher external noise levels, an alternative method of reducing the risk of overheating will be available through the use of the MVHR cooling module, which is not considered to be active cooling. Please refer to the section 10 for further details.

Commercial

For the commercial areas active cooling is proposed via water-to-refrigerant heat pump (VRF) systems which will allow rejected heat from the space cooling to be recovered and utilised by the water-to-water heat pumps to help meet the residential heating loads.

Part L 2021 requires a minimum seasonal efficiency ratio of 5.0 for VRF heat pump systems operating in cooling mode, so this has also been assumed for the commercial spaces at 'Be Lean' stage.

6.9 Ventilation Systems

Residential

Ventilation to the residential apartments to provide fresh air and extract moisture/pollutants in accordance with Building Regulations Part F will be via individual Mechanical Ventilation with Heat Recovery (MVHR) units. Each unit will achieve a Specific Fan Power of up to 0.52 W/(l/s) and a heat recovery efficiency of up to 90%, depending on the number of wet rooms.

The internal communal corridors shall have a dual-purpose mechanical extract system that can operate to assist the natural ventilation when necessary in maintaining air movement in corridors and prevent stagnant air and odour build up in winter.

Non-Residential

It is expected that the non-residential areas will be provided with local commercial MVHR units that will achieve a Specific Fan Power of less than 0.9 W/(l/s) and a heat recovery efficiency of at least 90%.

6.10 Lighting

Energy efficient LED lighting will be used throughout the proposed development.

6.11 Smart Controls / Metering

It is expected that residential apartments will be provided with an individual, programmable, zoned, control system, together with smart energy meters.

This will allow the display of energy use within individual units, assisting occupants to understand the way in which they consume energy and how much it costs, and encouraging them to turn off non-essential equipment or run some equipment at a lower capacity during times of peak demand.

A central Building Management System (BMS) will be provided to operate the 'Landlord' plant and systems in the most energy efficient manner.

6.12 Appliances

Where appliances are provided by the developer, they will be of an energy efficient type, which generally generate less heat and can help minimise the build-up of heat within the buildings. Where appliances are not provided by the developer, owners/tenants will be encouraged to supply energy efficient equipment through the provision of advice in the Building User Guide provided at handover.

7 Heating Infrastructure (Be Clean)

7.1 Existing and Planned Heat Networks

As shown in the extract from the London Heat Map below, there are no existing heat networks in the vicinity of the site. However, a proposed heat network is identified nearby.

Energetik has been contacted, and we are awaiting their response regarding feasibility, timescales, and alignment with the proposed delivery programme.

As described above, it is not feasible to connect to an existing heat network

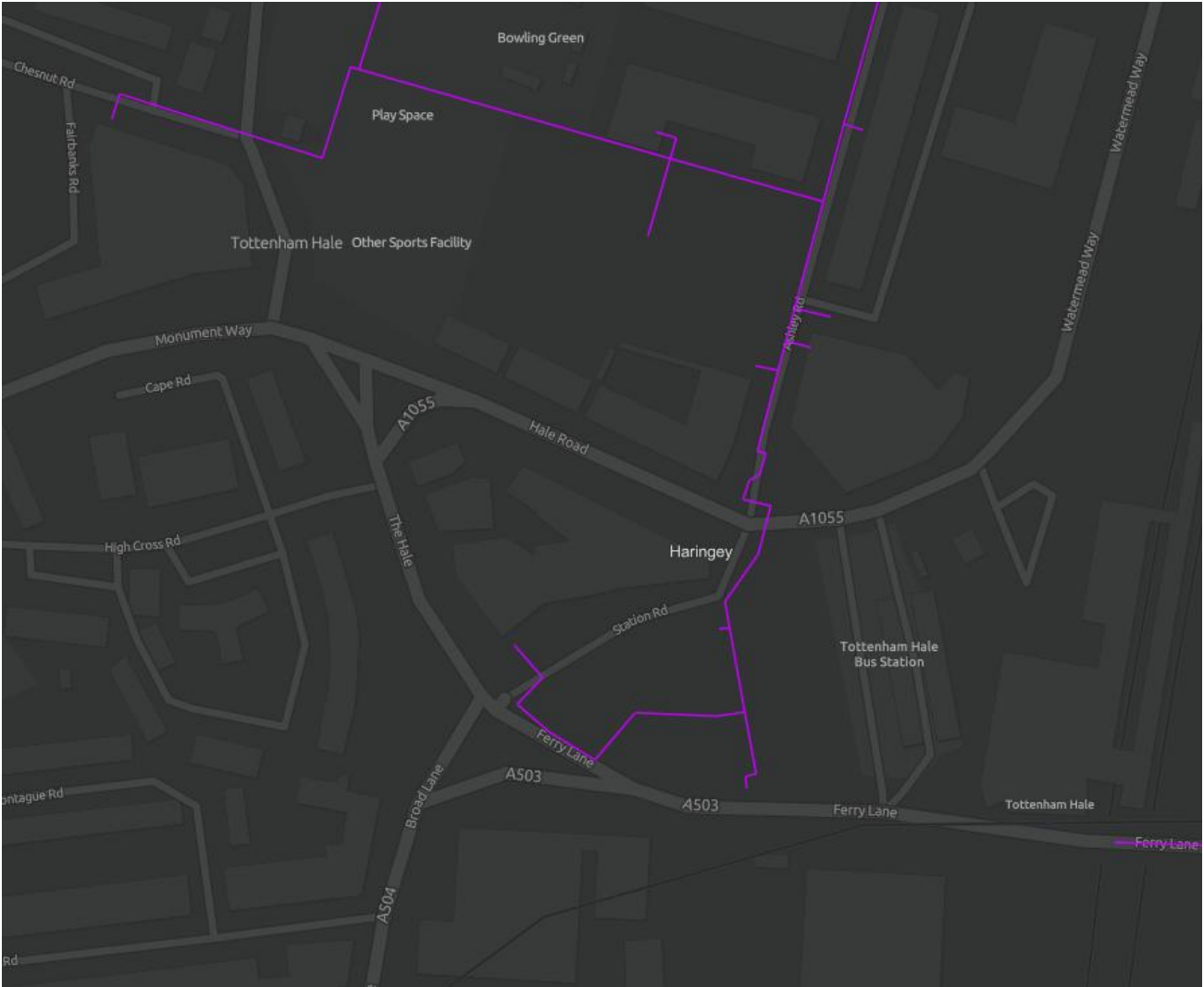


Figure 7: Extract from London Heat Map

7.2 Proposed Heat Supply Hierarchy

Proposed Heat Supply Hierarchy

London Plan Policy SI 3 requires that the heat source for the communal heating system is selected in accordance with the heating hierarchy shown below;-

- connect to local existing or planned heat networks
- use zero-emission or local secondary heat sources (in conjunction with heat pump, if required)
- use low-emission combined heat and power (only where there is a case for it to enable the delivery of an area-wide heat network, meet the development's electricity demand and provide demand response to the local electricity network)
- use ultra-low nitrogen oxides (NOx) gas boilers

As described above, it is not feasible to connect to an existing heat network.

It is proposed to install a central air source heat pumps on each block that are specifically designed to operate at the expected operating temperatures to maximise efficiency.

The network will be distributed throughout the proposed development to provide heat for space heating and domestic hot water in all residential dwellings. Each residential dwelling will be served via a dual plate heat interface unit.

The heat system has been designed with the capability to connect to a future district heat network should one become available.

The heat system will be designed to minimise heat losses including measures such as minimising pipework lengths and installing high level of insulation (in excess of British Standards).

The carbon reductions generated by the heat pumps are included at the Be Green stage of the hierarchy

8 Renewable Energy (Be Green)

An appraisal of potential on-site renewable energy systems has been undertaken for the proposed development with the following technologies considered:

- Biomass boilers;
- Photovoltaics (PVs);
- Solar thermal;
- Ground source heat pumps;
- Air source heat pumps; and
- Wind Turbines.

8.1 Biomass Boilers

Biomass boilers could provide a proportion of the space heating and hot water load but would compete with the heat pumps serving the base load of the proposed development.

Biomass boilers are better operating as the lead heat source (and not as top up) as they are not suited to operating with variable load.

Biomass boilers would also adversely impact on local air quality due to their emissions, and vehicular delivery of fuel would be required resulting in increased traffic movements.

Biomass boilers are therefore not planned for the proposed development.

8.2 Photovoltaics (PVs)

An assessment has been carried out and it has been determined that photovoltaic panels are appropriate for the proposed development.

It is proposed to install a total of 63 No. photovoltaic panels on the roofs of the two residential blocks with a total peak output of 28.5 kW (based on 445W, 1.85m², 24.1% efficient panels).

The PV panels will provide a saving of 3,566 4kg CO₂ per year in regulated carbon dioxide emissions.

Photovoltaics are therefore planned for the proposed development.

8.3 Solar Thermal

A solar thermal system could provide a proportion of the hot water load but would compete with the site heat network serving the base load of the proposed development. Greater carbon reductions are achieved by installing photovoltaics in the roof space available.

Solar thermal is therefore not planned for the proposed development.

8.4 Ground Source Heat Pumps

There is no cooling provision, resulting in a poor balance between heating and cooling demand, which would adversely impact on the potential yield from any ground source system.

Ground source heat pumps are therefore not planned for the proposed development.

8.5 Air / Water Source Heat Pumps

As stated above, heat pumps are proposed as the main heat source for the proposed development and the carbon reductions generated by the central heat pumps are included at the Be Green stage of the hierarchy.

The heat pumps will provide a saving of approximately 211.034 kg CO₂ per year in regulated carbon dioxide emissions.

Air source heat pumps are therefore planned for the proposed development.

8.6 Wind Turbines

Wind turbines would be a complimentary technology to the proposed site heat network. However, they would have significant architectural and townscape implications, together with potential noise.

Wind turbines are therefore not planned for the proposed development.

9 Unregulated Energy

This section outlines how non-regulated energy and carbon dioxide emissions will be reduced through the use of energy efficient appliances and equipment, controls, good management practice, etc.

9.1 Baseline

The energy demand and associated carbon dioxide emissions from unregulated uses, i.e. those not covered by the Building Regulations assessments (e.g. cooking, appliances, equipment) have been estimated using the following:-

- Residential – UK Government Household Electrical Survey (2014).
- Non-residential – CIBSE Guide F.

The table below details the breakdown of baseline residential unregulated energy demand and associated CO₂ emissions for the Proposed Development.

Energy Use	Total Energy Demand (kWh/year)	Total Carbon Dioxide Emissions (kg CO ₂ /year)
Cold appliances	263,693	35,862
Laundry, dishwashing and cleaning	355,440	48,340
Cooking	280,700	38,175
Audio visual	307,880	41,872
Computer	134,720	18,322
Other equipment	40,273	5,477
Total (Unregulated)	1,382,706	188,048

Table 9: Baseline residential unregulated energy demand and CO₂ emissions

The table below details the breakdown of baseline non-residential unregulated energy demand and associated CO₂ emissions for the Proposed Development.

Energy Use	Total Energy Demand (kWh/year)	Total Carbon Dioxide Emissions (kg CO ₂ /year)
Cooking	0	0
Appliances/equipment	9,830	1,337
Total (Unregulated)	9,830	1,337

Table 10: Baseline non-residential unregulated energy demand and CO₂ emissions

9.2 Demand Reduction (Be Lean)

An assessment has been carried out to determine how unregulated energy and carbon dioxide emissions can be reduced through the use of energy efficient appliances and equipment, controls, good management practice, etc.

The table below details the breakdown of residential unregulated energy demand and associated CO₂ emissions following demand reduction for the Proposed Development.

Energy Use	Total Energy Demand (kWh/year)	Total Carbon Dioxide Emissions (kg CO ₂ /year)
Cold appliances	204,362	27,793
Laundry, dishwashing and cleaning	322,050	43,799
Cooking	249,739	33,964
Audio visual	279,235	37,976
Computer	134,720	18,322
Other equipment	40,273	5,477
Total (Unregulated)	1,230,377	167,331

Table 11: Residential unregulated energy demand and CO₂ emissions after demand reduction

The table below details the breakdown of non-residential unregulated energy demand and associated CO₂ emissions following demand reduction for the Proposed Development.

Energy Use	Total Energy Demand (kWh/year)	Total Carbon Dioxide Emissions (kg CO ₂ /year)
Cooking	0	0
Appliances/equipment	8,043	1,094
Total (Unregulated)	8,043	1,094

Table 12: Non-residential unregulated energy demand and CO₂ emissions after demand reduction

It is expected that a 11% reduction in unregulated carbon dioxide emissions could be achieved over the baseline.

It is expected that the energy demand reduction will be achieved by a combination of measures including those detailed below.

9.2.1 Residential Cooking

The baseline energy demand and associated carbon dioxide emissions are assumed to be based on the use of appliances with a good standard of energy efficiency commonly available in the commercial market, such as 'A' rated electric ovens and electric hobs with an energy consumption of less than 210Wh/kg.

More efficient appliances are easily available, and provision of 'A+' rated oven and electric hobs with an energy consumption of less than 195Wh/kg will be encouraged.

9.2.2 Residential Appliances/Equipment

The baseline energy demand and associated carbon dioxide emissions are assumed to be based on the use of appliances with a good standard of energy efficiency commonly available in the commercial market, such as 'F' rated fridge/freezers, 'E' rated washer/dryers, 'E' rated dishwashers and 'G' rated televisions.

More efficient appliances are easily available, and purchasers/tenants will be encouraged to reduce energy demand by providing an 'E' rated fridge/freezer, an 'D' rated washing machine, an 'D' rated dishwasher and an 'F' rated television.

Further reductions in unregulated energy can be achieved by owners/tenants of residential properties as detailed below. The potential savings are difficult to quantify as they are operational items. A reduction has not been included in this assessment, but owners/tenants will be encouraged to operate appliances as suggested.

Washing Machine and Dryer

Wash full loads rather than just a few items.

Use a temperature setting of 30°C or even 20°C where possible.

Reduce dryer use by using an outdoor line in summer and a drying rack in winter.

Use tumble dryer balls to reduce drying time.

Dishwasher

Fill the dishwasher before using.

Use the economy setting if available.

Kettle

Only boil the amount you need each time.

Oven

Limit the number of times the oven door is opened while cooking.

Hob

Use the smallest pot possible each time.

Use a lid.

Use stacked steamers.

General Appliances

Do not leave appliances on standby.

9.2.3 Non-residential Equipment/Small Power

The users of the community space will be encouraged to reduce energy demand and associated carbon dioxide emissions to achieve the CIBSE good practice benchmarks.

It is expected that the energy demand reduction will be achieved by a combination of measures including those detailed below.

- Energy efficient sound systems to be used.
- Encourage users to switch off equipment when not in use.
- Energy efficient equipment to be used.

10 Overheating and Cooling

10.1 Cooling Hierarchy

The proposed development has been assessed in accordance with the cooling hierarchy detailed in policy SI 4 of the London Plan, the latest GLA Energy Assessment Guidance 2022 and Building Regulations Part O 2021, in order to reduce overheating and minimise the use of air conditioning.

Reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure

The heat entering the building will be reduced by a combination of measures including the following: -

- Significantly improved fabric 'U' values
- Improved air tightness
- Optimisation of glazing g-value
- Optimisation of glazing area
- External shading via projecting balconies
- Internal blinds
- Green roofs

Minimise internal heat generation through energy efficient design

Internal heat generation will be minimised by a combination of measures including the following: -

- Minimising cold bridging
- Minimising heat loss from heating and hot water systems through reducing pipe lengths, pipework arrangements and high levels of insulation
- Low energy lighting
- Energy efficient appliances

Manage the heat within the building through exposed internal thermal mass and high ceilings

- Floor to floor heights have been maximised in the proposed development.
- Purge ventilation can be achieved in residential dwellings through open windows
- Building structure is concrete providing thermal mass to absorb excess heat

Provide passive ventilation

Passive ventilation will be maximised by a combination of measures including the following: -

- Residential dwellings are designed with shallow floorplates
- Dual aspect dwellings where possible
- All residential dwellings are provided with natural ventilation via openable windows

Mechanical ventilation

Mechanical ventilation will assist in mitigating through the following measures:-

- Mechanical ventilation with high efficiency heat recovery (MVHR) will provide fresh air and extract moisture/pollutants in accordance with Building Regulations Part F.

- MVHR will have a bypass for summer mode operation
- MVHR will have a boost mode to increase ventilation rate and assist in reducing the risk of overheating when needed
- Dynamic modelling demonstrates that the risk of overheating is suitably reduced in residential dwellings through the use of natural ventilation via open windows and mechanical ventilation

Active Cooling Systems

- The use of active cooling has been negated through the incorporation of the above passive measures

10.2 Early Stage Overheating Risk Tool

As requested in the Energy Assessment Guidance, the Good Homes Alliance (GHA) Early Stage Overheating Risk Tool has been completed and is provided in Appendix A.5.

10.3 Overheating Risk Assessment Methodology

The residential assessment includes dynamic thermal modelling on a representative sample of dwellings to assess the risk of overheating, using IES modelling software, in accordance with the guidance and data sets in CIBSE TM49 and TM59 guidance.

The Chartered Institution of Building Services Engineers (CIBSE) has produced guidance on assessing and mitigating overheating risk in new developments. TM 59 Design Methodology for the Assessment of Overheating Risk in Homes should be used for residential developments.

For compliance with CIBSE TM 59, the modelled apartments must pass both of the following two criteria:

- a) For living rooms, kitchens and bedrooms: the number of hours during which ΔT is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3% of occupied hours.
- b) For bedrooms only: to guarantee comfort during the sleeping hours the operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26°C for more than 1% of annual hours. (Note: 1% of the annual hours between 22:00 and 07:00 for bedrooms is 32 hours, so 33 or more hours above 26°C will be recorded as a fail).

Both (a) and (b) above must be passed for all relevant rooms.

All residential dwellings tested have been modelled with natural ventilation via fully open windows/doors and increased mechanical ventilation to demonstrate that passive measures have been maximised and the façade design has been optimised.

Building Regulations Part O 2021 requires the modelling to assume that bedroom windows are closed at night if the average 8 hour ambient noise level exceeds 40 dB.

The Noise Assessment carried out by Trium Acoustics demonstrates that if the windows are fully open some of the bedrooms are subject to background noise levels at night that exceed the limit prescribed in Building Regulations Part O 2021.

Their report includes zoning plans which detail the maximum window opening area for each part of the building to achieve the Part O noise criteria.

Additional modelling has been carried out for the sampled apartments with the bedroom windows fully closed at night to reflect the maximum window areas on the zoning plans, and with the increased mechanical ventilation in operation.

10.4 Weather Data

The weather file used for the assessment is as per TM59: DSY1 (Design Summer Year) for the site location, for the 2020s, high emissions, 50% percentile scenario.

The London Heathrow weather data set has been used which is the most representative for the site location.

It is expected that the CIBSE compliance criteria are met for the DSY1 weather scenario.

Additional testing has been undertaken for the residential apartments using the 2020 versions of the following more extreme design weather years;-

- DSY2 – 2003: a year with a very intense single warm spell.
- DSY3 – 1976: a year with a prolonged period of sustained warmth.

It is acknowledged in the GLA Energy Assessment Guidance 2022 that meeting the CIBSE compliance criteria is challenging for the DSY 2 & 3 weather files, and compliance is therefore not expected.

10.5 Summary of Overheating Modelling Results

Refer to Appendix A.4 for the full overheating modelling results.

Natural Ventilation via Fully Open Windows

All residential dwellings tested have been modelled with natural ventilation via fully open windows/doors and increased mechanical ventilation to demonstrate that passive measures have been maximised and the façade design has been optimised. The results are summarised below;-

Weather file	DSY1		DSY2		DSY3	
Test criteria	Criteria a	Criteria b	Criteria a	Criteria b	Criteria a	Criteria b
Rooms pass	137	101	134	18	120	30
Rooms pass (%)	100%	100%	98%	18%	88%	30%

Table 13: Summary of dynamic overheating modelling results with windows fully open

The GLA energy assessment guidance expects that the CIBSE compliance criteria is met for the DSY1 weather scenario. It is acknowledged that meeting the CIBSE compliance criteria is challenging for the DSY 2 & 3 weather files, although it is expected that in the majority of cases a significant proportion of spaces will be able to achieve compliance.

The results demonstrate the following;-

- The CIBSE compliance criteria are met in all rooms modelled (for the 2020s DSY1 weather scenario) without blinds through the use of natural ventilation via fully open windows/doors and increased mechanical ventilation.
- The CIBSE compliance criteria are met in a some of the rooms modelled (for the 2020s DSY2 and 3 weather scenarios) without blinds through the use of natural ventilation via fully open windows/doors and increased mechanical ventilation.
- With fully open windows the risk of overheating has been reduced as far as practical, with all available passive measures explored.

Closed Bedroom Windows

Additional modelling has been carried out for the sampled apartments with the bedroom windows fully closed at night to reflect the maximum window areas on the zoning plans, and with the increased mechanical ventilation in operation.

Windows	Bedroom windows closed at night	
Weather file	DSY1	
Test criteria	Criteria a	Criteria b
Rooms pass	137	0
Rooms pass (%)	100%	0%

Table 14: Summary of dynamic overheating modelling results with bedroom windows closed

These results demonstrate the following;-

- The CIBSE compliance criteria cannot be met in all rooms modelled (for the 2020s DSY1 weather scenario) without blinds with closed or partially closed bedroom windows (at night) and increased mechanical ventilation.
- The CIBSE compliance criteria cannot be met in a significant proportion of the rooms modelled (for the 2020s DSY2 and 3 weather scenarios) without blinds with closed bedroom windows(at night) and increased mechanical ventilation.

In the apartments affected by higher external noise levels, where the occupants may choose to keep their bedroom windows closed at night, an alternative method of reducing the risk of overheating is proposed with the installation of a MVHR cooling module.

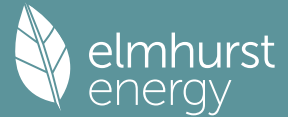
Mitigation Measures

The proposed overheating mitigation measures are summarised below;-

- In residential dwellings the use of natural ventilation via openable windows/doors and increased mechanical ventilation will generally sufficiently reduce the risk of overheating.
- During extreme summer weather, residents will be encouraged to use additional measures to reduce the risk of overheating, including the following;-
 - Using portable fans to increase airflow
 - Minimising internal heat gains
 - Keeping windows open as long as possible
- Guidance will be provided to residents on reducing the overheating risk in their home in line with the cooling hierarchy.
- In the apartments affected by higher external noise levels, where the occupants may choose to keep their bedroom windows closed at night, an alternative method of reducing the risk of overheating is proposed with the installation of a MVHR cooling module. The cooling module would have the following features;-
 - It would only ‘temper’ the supply air, reducing the temperature by a few degrees.
 - It would have limited cooling capacity due to the size of the heat pump in the cooling module and the low air volume of the residential ventilation system.
 - It would not ‘control’ space temperature – it would only be used if required by the occupant and would be designed to operate when external temperature exceeds 26 °C at night and 28°C during the day to achieve compliance with the CIBSE overheating criteria.
 - No additional fan would be required in the apartment.

Appendix A.1 – SAP Calculations (Be Lean)

Full SAP Calculation Printout



Plot Reference	1B 2P NW 2F O				Issued on Date	27/08/2026	
Assessment Reference	00001			Plot Type Ref			
Plot Address					SAP Version	10.2	
SAP Rating	85 B	DER	12.48	TER	10.78		
Environmental	91 B	% DER < TER				-15.77	
CO ₂ Emissions (t/year)	0.7	DFEE	18.97	TFEE	24.28		
Compliance Check	See BREL	% DFEE < TFEE				21.89	
% DPER < TPER	-26.05	DPER	70.80	TPER	56.17		
Assessor Details	Mr. Richard Denteh				Assessor ID	U148-0001	
Client							

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	57.7300 (1b)	2.8000 (2b)	161.6440 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.7300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	161.6440 (5)

2. Ventilation rate

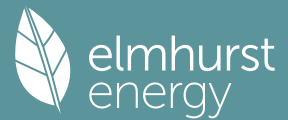
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.1500 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												72.0000 (23c)
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Opening Type 1			13.9500	0.8687	12.1187		(27)
External Wall 1 LG	26.3200	13.9500	12.3700	0.1400	1.7318	190.0000	2350.2997 (29a)
Total net area of external elements Aum(A, m ²)			26.3200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	13.8505	(33)
Main dwelling							
Party Wall 1			24.1000	0.0000	0.0000	180.0000	4338.0001 (32)
Party Floor 1			57.7300			40.0000	2309.2000 (32a)
Party Ceiling 1			57.7300			30.0000	1731.9000 (32b)
Heat capacity Cm = Sum (A x k)							(28)...(30) + (32) + (32a)...(32e) = 10729.3998 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							185.8548 (35)
List of Thermal Bridges							
K1 Element					Length	Psi-value	Total
E2 Other lintels (including other steel lintels)					6.3000	0.0100	0.0630
E3 Sill					6.3000	0.0200	0.1260

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E4 Jamb									13.0000	0.0150	0.1950	
E7 Party floor between dwellings (in blocks of flats)									9.4000	0.0450	0.4230	
E17 Corner (inverted - internal area greater than external area)									2.8000	-0.0980	-0.2744	
E16 Corner (normal)									5.6000	0.0450	0.2520	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												0.7846 (36)
Point Thermal bridges												0.0000
Total fabric heat loss										(33) + (36) + (36a) =		14.6351 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	16.1394	15.9694	15.7994	14.9492	14.7792	13.9291	13.9291	13.7590	14.2691	14.7792	15.1193	15.4593 (38)
Average = Sum(39)m / 12 =	30.7746	30.6045	30.4345	29.5844	29.4143	28.5642	28.5642	28.3942	28.9042	29.4143	29.7544	30.0945 (39)
												29.5419
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.5331	0.5301	0.5272	0.5125	0.5095	0.4948	0.4948	0.4918	0.5007	0.5095	0.5154	0.5213 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												1.9168 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	64.9416	63.9771	62.6189	60.1147	58.2395	56.1603	55.0372	56.3859	57.8543	60.0792	62.6350	64.7220 (42b)
Hot water usage for other uses	34.2597	33.0139	31.7681	30.5223	29.2765	28.0307	28.0307	29.2765	30.5223	31.7681	33.0139	34.2597 (42c)
Average daily hot water use (litres/day)												91.3563 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	99.2013	96.9910	94.3870	90.6370	87.5160	84.1910	83.0679	85.6624	88.3767	91.8473	95.6489	98.9818 (44)
Energy content (annual)	157.1106	138.1139	145.0694	124.0775	117.8134	103.5226	100.4634	106.0679	108.9773	124.6359	136.2695	154.9815 (45)
Distribution loss (46)m = 0.15 x (45)m	23.5666	20.7171	21.7604	18.6116	17.6720	15.5284	15.0695	15.9102	16.3466	18.6954	20.4404	23.2472 (46)
Water storage loss (or HIU loss):												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1100 (48)
Temperature factor from Table 2b												0.7800 (49)
Enter (49) or (54) in (55)												1.6458 (55)
Total storage loss	51.0198	46.0824	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	49.3740	51.0198	49.3740	51.0198 (56)
If cylinder contains dedicated solar storage	51.0198	46.0824	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	49.3740	51.0198	49.3740	51.0198 (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												
	231.3928	205.2075	219.3516	195.9635	192.0956	175.4086	174.7456	180.3501	180.8633	198.9181	208.1555	229.2637 (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	231.3928	205.2075	219.3516	195.9635	192.0956	175.4086	174.7456	180.3501	180.8633	198.9181	208.1555	229.2637 (64)
Total per year (kWh/year)												2391.7161 (64)
Electric shower(s)												2392 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
	111.6650	99.5978	107.6613	98.7646	98.5987	91.9301	92.8298	94.6933	93.7437	100.8672	102.8184	110.9571 (65)

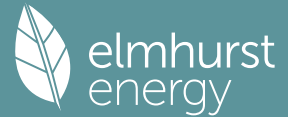
5. Internal gains (see Table 5 and 5a)												

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	84.5194	93.5751	84.5194	87.3367	84.5194	87.3367	84.5194	84.5194	87.3367	84.5194	87.3367	84.5194 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	167.1878	168.9227	164.5509	155.2437	143.4951	132.4530	125.0763	123.3414	127.7132	137.0204	148.7690	159.8111 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839 (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)												
	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712 (71)
Water heating gains (Table 5)												
	150.0874	148.2110	144.7061	137.1730	132.5252	127.6807	124.7713	127.2760	130.1996	135.5742	142.8033	149.1359 (72)
Total internal gains												
	453.5464	462.4605	445.5281	431.5052	412.2914	399.2221	386.1187	386.8885	397.0013	408.8657	430.6608	445.2181 (73)

6. Solar gains													
[Jan]				Area	Solar flux	g		FF	Access			Gains	
				m2	Table 6a	Specific data		Specific data	factor			W	
					W/m2	or Table 6b		or Table 6c	Table 6d				
Northeast				10.2000	11.2829	0.4000		0.7000	0.7700			22.3313 (75)	
Southwest				3.7500	36.7938	0.4000		0.7000	0.7700			26.7730 (79)	
Solar gains	49.1043	91.0604	144.2951	211.8128	267.3909	278.7161	263.1943	219.7035	167.3568	105.9534	60.1665	41.1490 (83)	
Total gains	502.6507	553.5208	589.8232	643.3180	679.6822	677.9382	649.3130	606.5920	564.3581	514.8191	490.8272	486.3671 (84)	

7. Mean internal temperature (heating season)

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Temperature during heating periods in the living area from Table 9, Th1 (C)											
Utilisation factor for gains for living area, nil,m (see Table 9a)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
tau	96.8458	97.3839	97.9279	100.7420	101.3244	104.3400	104.3400	104.9648	103.1125	101.3244	100.1663
alpha	7.4564	7.4923	7.5285	7.7161	7.7550	7.9560	7.9560	7.9977	7.8742	7.7550	7.6778
util living area	0.8913	0.8250	0.7250	0.5537	0.4023	0.2697	0.1936	0.2153	0.3533	0.5899	0.7966
											0.9001 (86)
MIT	20.8212	20.9021	20.9629	20.9953	20.9996	21.0000	21.0000	21.0000	20.9999	20.9940	20.9384
Th 2	20.4906	20.4933	20.4960	20.5094	20.5121	20.5256	20.5256	20.5283	20.5202	20.5121	20.5067
util rest of house											20.8156 (87)
											20.5013 (88)
MIT 2	0.8778	0.8075	0.7037	0.5319	0.3812	0.2497	0.1727	0.1932	0.3288	0.5633	0.7756
Living area fraction	20.2922	20.3880	20.4580	20.5050	20.5118	20.5256	20.5256	20.5283	20.5201	20.5067	20.4431
MIT	20.5359	20.6248	20.6906	20.7308	20.7365	20.7441	20.7441	20.7456	20.7411	20.7311	20.6712
Temperature adjustment											0.0000
adjusted MIT	20.5359	20.6248	20.6906	20.7308	20.7365	20.7441	20.7441	20.7456	20.7411	20.7311	20.6712
											20.5352 (93)

8. Space heating requirement											

Utilisation	0.8791	0.8122	0.7120	0.5418	0.3909	0.2589	0.1823	0.2034	0.3401	0.5753	0.7828
Useful gains	441.8761	449.5678	419.9799	348.5435	265.6907	175.4985	118.3731	123.3885	191.9305	296.1765	384.1990
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000
Heat loss rate W	499.6526	481.2508	431.8831	350.0070	265.8022	175.5013	118.3732	123.3888	191.9565	298.0003	403.8037
Space heating kWh	42.9857	21.2910	8.8560	1.0537	0.0829	0.0000	0.0000	0.0000	0.0000	1.3569	14.1154
Space heating requirement - total per year (kWh/year)											44.2667 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Solar heating contribution - total per year (kWh/year)											0.0000 (98b)
Space heating kWh	42.9857	21.2910	8.8560	1.0537	0.0829	0.0000	0.0000	0.0000	0.0000	1.3569	14.1154
Space heating requirement after solar contribution - total per year (kWh/year)											44.2667 (98c)
Space heating per m2										(98c) / (4) =	2.3213 (99)

9b. Energy requirements											

Fraction of space heat from secondary/supplementary system (Table 11)											0.0000 (301)
Fraction of space heat from community system											1.0000 (302)
Fraction of heat from community Boilers-Space and Water											1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating											1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating											1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system											1.1500 (306)
Efficiency of secondary/supplementary heating system, %											0.0000 (208)
Space heating:											
Space heating requirement	42.9857	21.2910	8.8560	1.0537	0.0829	0.0000	0.0000	0.0000	0.0000	1.3569	14.1154
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.15											44.2667 (98)
307a	49.4336	24.4846	10.1844	1.2118	0.0954	0.0000	0.0000	0.0000	0.0000	1.5604	16.2327
Space heating requirement	49.4336	24.4846	10.1844	1.2118	0.0954	0.0000	0.0000	0.0000	0.0000	1.5604	16.2327
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)											50.9067 (307)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
											0.0000 (308)
Water heating											
Annual water heating requirement	231.3928	205.2075	219.3516	195.9635	192.0956	175.4086	174.7456	180.3501	180.8633	198.9181	208.1555
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.15											229.2637 (64)
310a	266.1018	235.9887	252.2543	225.3580	220.9100	201.7199	200.9575	207.4026	207.9927	228.7559	239.3788
Water heating fuel	266.1018	235.9887	252.2543	225.3580	220.9100	201.7199	200.9575	207.4026	207.9927	228.7559	239.3788
Cooling System Energy Efficiency Ratio											263.6533 (310)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pumps and Fa	9.5804	8.6533	9.5804	9.2714	9.5804	9.2714	9.5804	9.5804	9.2714	9.5804	9.2714
Lighting	16.5842	13.3045	11.9792	8.7765	6.7792	5.5387	6.1842	8.0385	10.4412	13.6994	15.4735
Electricity generated by PVs (Appendix M) (negative quantity)											17.0452 (332)
(333a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity generated by wind turbines (Appendix M) (negative quantity)											0.0000 (333a)
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)											0.0000 (334a)
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity generated by PVs (Appendix M) (negative quantity)											0.0000 (335a)
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity generated by wind turbines (Appendix M) (negative quantity)											0.0000 (333b)
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)											0.0000 (334b)
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Annual totals kWh/year											
Space heating fuel - community heating											154.1095 (307)
Space heating fuel - secondary											0.0000 (309)
Water heating fuel - community heating											2750.4735 (310)
Efficiency of water heater											0.0000 (311)
Electricity used for heat distribution											1.5411 (313)
Space cooling fuel											0.0000 (321)
Electricity for pumps and fans:											
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)											
mechanical ventilation fans (SFP = 0.5720)											112.8016 (330a)
Total electricity for the above, kWh/year											112.8016 (331)
Electricity for lighting (calculated in Appendix L)											133.8444 (332)
Energy saving/generation technologies (Appendices M ,N and Q)											
PV generation											0.0000 (333)
Wind generation											0.0000 (334)
Hydro-electric generation (Appendix N)											0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)											0.0000 (335)
Appendix Q - special features											
Energy saved or generated											-0.0000 (336)
Energy used											0.0000 (337)
Total delivered energy for all uses											3151.2290 (338)

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			89.5000 (367)
Space and Water heating from Boilers	3245.3441	0.2100	36.1598 (367)
Electrical energy for heat distribution (space & water)	1.5411	0.0000	4.1114 (372)
Overall CO2 factor for heat network			0.2361 (386)
Total CO2 associated with community systems			685.6337 (373)
Space and water heating			685.6337 (376)
Pumps, fans and electric keep-hot	112.8016	0.1387	15.6470 (378)
Energy for lighting	133.8444	0.1443	19.3179 (379)
Total CO2, kg/year			720.5986 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			12.4800 (384)

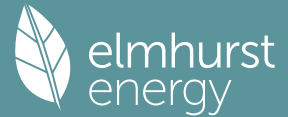
	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year
Efficiency of heat source Boilers			89.5000 (467a)
Space and Water heating from Boilers	3245.3441	1.1300	194.5740 (467)
Electrical energy for heat distribution (space & water)	1.5411	0.0000	44.2487 (472)
Overall CO ₂ factor for heat network			1.2778 (486)
Total CO ₂ associated with community systems			3711.4876 (473)
Space and water heating			3711.4876 (476)
Pumps, fans and electric keep-hot	112.8016	1.5128	170.6463 (478)
Energy for lighting	133.8444	1.5338	205.2950 (479)
Total Primary energy kWh/year			4087.4289 (483)
Dwelling Primary energy Rate (DPER)			70.8000 (484)

		Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling				
Ground floor		57.7300 (1b)	x 2.8000 (2b)	= 161.6440 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.7300			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)		= 161.6440 (5)

		m3 per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000
Pressure test	Air changes per hour / (5) =	0.1237 (8)
Pressure Test Method	Yes	
Measured/design AP50	Blower Door	5.0000 (17)
Infiltration rate		0.3737 (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) =	0.3177 (21)

[illegible]

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List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	6.3000	0.0500	0.3150
E3 Sill	6.3000	0.0500	0.3150
E4 Jamb	13.0000	0.0500	0.6500
E7 Party floor between dwellings (in blocks of flats)	9.4000	0.0700	0.6580
E17 Corner (inverted - internal area greater than external area)	2.8000	-0.0900	-0.2520
E16 Corner (normal)	5.6000	0.0900	0.5040
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			2.1900 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	20.3899 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	31.0466	30.8767	30.7102	29.9280	29.7816	29.1003	29.1003	28.9742	29.3628	29.7816	30.0777	30.3872 (38)
Heat transfer coeff	51.4365	51.2666	51.1001	50.3179	50.1715	49.4902	49.4902	49.3641	49.7526	50.1715	50.4676	50.7771 (39)
Average = Sum(39)m / 12 =												50.3172
HLP	0.8910	0.8880	0.8852	0.8716	0.8691	0.8573	0.8573	0.8551	0.8618	0.8691	0.8742	0.8796 (40)
HLP (average)												0.8716
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9168 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths												64.9416 (42b)
Hot water usage for other uses												34.2597 (42c)
Average daily hot water use (litres/day)												91.3563 (43)
Daily hot water use	99.2013	96.9910	94.3870	90.6370	87.5160	84.1910	83.0679	85.6624	88.3767	91.8473	95.6489	98.9818 (44)
Energy conte	157.1106	138.1139	145.0694	124.0775	117.8134	103.5226	100.4634	106.0679	108.9773	124.6359	136.2695	154.9815 (45)
Energy content (annual)										Total = Sum(45)m =		1517.1031
Distribution loss (46)m = 0.15 x (45)m												23.5666 (46)
Water storage loss (or HIU loss):												300.0000 (47)
Store volume												2.1127 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												1.1409 (55)
Enter (49) or (54) in (55)												
Total storage loss	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664 (56)
If cylinder contains dedicated solar storage	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664 (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	215.7395	191.0690	203.6982	180.8151	176.4422	160.2602	159.0922	164.6967	165.7148	183.2648	193.0070	213.6103 (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	215.7395	191.0690	203.6982	180.8151	176.4422	160.2602	159.0922	164.6967	165.7148	183.2648	193.0070	213.6103 (64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2207.4100 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	99.1423	88.2869	95.1386	86.6458	86.0760	79.8113	80.3071	82.1706	81.6250	88.3445	90.6996	98.4344 (65)

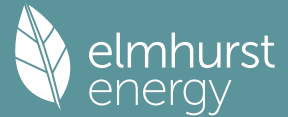
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	84.3271	93.3621	84.3271	87.1380	84.3271	87.1380	84.3271	84.3271	87.1380	84.3271	87.1380	84.3271 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	167.1878	168.9227	164.5509	155.2437	143.4951	132.4530	125.0763	123.3414	127.7132	137.0204	148.7690	159.8111 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712 (71)
Water heating gains (Table 5)	133.2558	131.3794	127.8745	120.3414	115.6936	110.8491	107.9397	110.4444	113.3680	118.7426	125.9717	132.3043 (72)
Total internal gains	439.5224	448.4159	431.5041	417.4748	398.2674	382.1918	369.0947	369.8645	379.9709	394.8418	416.6304	431.1942 (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					10.2000	11.2829		0.6300	0.7000	0.7700		35.1718 (75)
Southwest					3.7500	36.7938		0.6300	0.7000	0.7700		42.1675 (79)
Solar gains	77.3393	143.4201	227.2648	333.6051	421.1406	438.9779	414.5311	346.0331	263.5869	166.8766	94.7622	64.8097 (83)
Total gains	516.8618	591.8360	658.7689	751.0799	819.4080	821.1696	783.6258	715.8976	643.5579	561.7183	511.3926	496.0038 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	57.9431	58.1351	58.3246	59.2312	59.4040	60.2218	60.2218	60.3757	59.9041	59.4040	59.0555	58.6955
alpha	4.8629	4.8757	4.8883	4.9487	4.9603	5.0148	5.0148	5.0250	4.9936	4.9603	4.9370	4.9130
util living area	0.9645	0.9349	0.8750	0.7345	0.5539	0.3837	0.2776	0.3165	0.5224	0.8001	0.9328	0.9696 (86)
MIT	20.1075	20.3258	20.5921	20.8577	20.9683	20.9959	20.9994	20.9988	20.9823	20.8199	20.4420	20.0761 (87)
Th 2	20.1752	20.1777	20.1801	20.1917	20.1939	20.2040	20.2040	20.2058	20.2001	20.1939	20.1895	20.1849 (88)
util rest of house	0.9574	0.9228	0.8538	0.6993	0.5101	0.3368	0.2275	0.2622	0.4657	0.7622	0.9183	0.9634 (89)
MIT 2	19.1530	19.4239	19.7456	20.0547	20.1678	20.2014	20.2037	20.2053	20.1879	20.0239	19.5803	19.1214 (90)
Living area fraction									fLA = Living area / (4) =			0.4606 (91)
MIT	19.5927	19.8393	20.1355	20.4245	20.5365	20.5674	20.5702	20.5708	20.5538	20.3905	19.9772	19.5612 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5927	19.8393	20.1355	20.4245	20.5365	20.5674	20.5702	20.5708	20.5538	20.3905	19.9772	19.5612 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9514	0.9171	0.8526	0.7098	0.5289	0.3583	0.2506	0.2872	0.4910	0.7719	0.9140	0.9577 (94)
Useful gains	491.7212	542.7858	561.6532	533.1031	433.4191	294.2025	196.3421	205.6069	316.0179	433.6173	467.4109	475.0285 (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	786.6010	765.8879	696.7750	579.8901	443.3411	295.3256	196.4851	205.8867	321.0931	491.2061	649.8788	779.9948 (97)
Space heating kWh	219.3905	149.9246	100.5306	33.6866	7.3820	0.0000	0.0000	0.0000	0.0000	42.8461	131.3769	226.8950 (98a)
Space heating requirement - total per year (kWh/year)												912.0323
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	219.3905	149.9246	100.5306	33.6866	7.3820	0.0000	0.0000	0.0000	0.0000	42.8461	131.3769	226.8950 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												912.0323
Space heating per m2										(98c) / (4) =		15.7982 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	219.3905	149.9246	100.5306	33.6866	7.3820	0.0000	0.0000	0.0000	0.0000	42.8461	131.3769	226.8950 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	237.6929	162.4319	108.9172	36.4969	7.9978	0.0000	0.0000	0.0000	0.0000	46.4205	142.3368	245.8234 (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	215.7395	191.0690	203.6982	180.8151	176.4422	160.2602	159.0922	164.6967	165.7148	183.2648	193.0070	213.6103 (64)
Efficiency of water heater (217)m	84.0975	83.5218	82.5652	81.0907	80.1261	79.8000	79.8000	79.8000	79.8000	81.3626	83.2158	79.8000 (216)
Fuel for water heating, kWh/month	256.5351	228.7653	246.7120	222.9788	220.2056	200.8273	199.3637	206.3869	207.6627	225.2445	231.9355	84.1953 (217)
Space cooling fuel requirement												253.7081 (219)
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	17.5215	14.0564	12.6562	9.2725	7.1623	5.8517	6.5337	8.4928	11.0313	14.4736	16.3480	18.0085 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-27.3468	-38.7335	-55.9529	-63.2655	-68.5602	-64.1585	-63.3996	-59.6987	-53.1975	-44.4805	-30.1408	-23.6246 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-14.9173	-31.4386	-62.5781	-94.1073	-124.5277	-125.1189	-123.6135	-104.5946	-76.5964	-44.9628	-19.9214	-11.7892 (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												988.1174 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												79.8000
Water heating fuel used												2700.3254 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												86.0000 (231)
Electricity for lighting (calculated in Appendix L)												141.4085 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1426.7249 (233)

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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	2489.1264 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	988.1174	0.2100	207.5047 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2700.3254	0.2100	567.0683 (264)
Space and water heating			774.5730 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	141.4085	0.1443	20.4096 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-592.5590	0.1345	-79.6767
PV Unit electricity exported	-834.1659	0.1259	-104.9928
Total			-184.6695 (269)
Total CO2, kg/year			622.2423 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.7800 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	988.1174	1.1300	1116.5726 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2700.3254	1.1300	3051.3677 (278)
Space and water heating			4167.9404 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	141.4085	1.5338	216.8971 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-592.5590	1.4969	-887.0265
PV Unit electricity exported	-834.1659	0.4620	-385.3952
Total			-1272.4217 (283)
Total Primary energy kWh/year			3242.5166 (286)
Target Primary Energy Rate (TPER)			56.1700 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

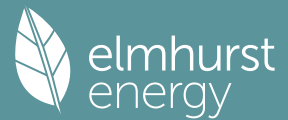
	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling	57.7300 (1b)	x 2.8000 (2b)	= 161.6440 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.7300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 161.6440 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 20.0000 / (5) = 0.1237 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.2737 (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) = 0.2327 (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	0.2967	0.2908	0.2850	0.2559	0.2501	0.2210	0.2210	0.2152	0.2327	0.2501	0.2618	0.2734 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5440	0.5423	0.5406	0.5328	0.5313	0.5244	0.5244	0.5232	0.5271	0.5313	0.5343	0.5374 (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	
Main dwelling								
Opening Type 1			13.9500	0.8687	12.1187			(27)
External Wall 1 LG	26.3200	13.9500	12.3700	0.1400	1.7318	190.0000	2350.2997	(29a)
Total net area of external elements Aum(A, m2)			26.3200					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	13.8505		(33)
Main dwelling								
Party Wall 1			24.1000	0.0000	0.0000	180.0000	4338.0001	(32)
Party Floor 1			57.7300			40.0000	2309.2000	(32d)
Party Ceiling 1			57.7300			30.0000	1731.9000	(32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 10729.3998 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 185.8548 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	6.3000	0.0100	0.0630	
E3 Sill	6.3000	0.0200	0.1260	
E4 Jamb	13.0000	0.0150	0.1950	
E7 Party floor between dwellings (in blocks of flats)	9.4000	0.0450	0.4230	
E17 Corner (inverted - internal area greater than external area)	2.8000	-0.0980	-0.2744	
E16 Corner (normal)	5.6000	0.0450	0.2520	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 0.7846 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 14.6351 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	29.0184	28.9273	28.8379	28.4183	28.3398	27.9743	27.9743	27.9067	28.1151	28.3398	28.4986	28.6647	(38)
Heat transfer coeff	43.6535	43.5624	43.4731	43.0534	42.9749	42.6095	42.6095	42.5418	42.7502	42.9749	43.1338	43.2998	(39)
Average = Sum(39)m / 12 =												43.0531	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7562	0.7546	0.7530	0.7458	0.7444	0.7381	0.7381	0.7369	0.7405	0.7444	0.7472	0.7500	(40)
HLP (average)												0.7458	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

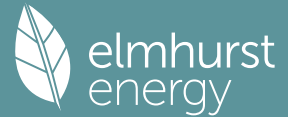
4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.9168 (42)
Hot water usage for mixer showers													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths													
24.3589	23.9971	23.4877	22.5483	21.8450	21.0651	20.6438	21.1497	21.7005	22.5350	23.4937	24.2765	24.2765	(42b)
Hot water usage for other uses													
34.2597	33.0139	31.7681	30.5223	29.2765	28.0307	28.0307	29.2765	30.5223	31.7681	33.0139	34.2597	34.2597	(42c)
Average daily hot water use (litres/day)												53.7297	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	58.6186	57.0110	55.2558	53.0707	51.1215	49.0958	48.6745	50.4262	52.2228	54.3032	56.5076	58.5363	(44)
Energy conte	92.8375	81.1829	84.9261	72.6511	68.8194	60.3690	58.8676	62.4382	64.3960	73.6889	80.5055	91.6536	(45)
Energy content (annual)										Total = Sum(45)m =		892.3358	
Distribution loss (46)m = 0.15 x (45)m													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage 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	(56)
If cylinder contains dedicated solar storage													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
78.9119	69.0055	72.1872	61.7534	58.4965	51.3137	50.0375	53.0725	54.7366	62.6355	68.4297	77.9056	77.9056	(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	78.9119	69.0055	72.1872	61.7534	58.4965	51.3137	50.0375	53.0725	54.7366	62.6355	68.4297	77.9056	(64)
12Total per year (kWh/year)								Total per year (kWh/year) = Sum(64)m =				758.4854	(64)
Electric shower(s)	45.1331	40.2139	43.9121	41.9048	42.6911	40.7232	42.0806	42.6911	41.9048	43.9121	43.0864	45.1331	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												513.3862	(64a)
Heat gains from water heating, kWh/month	31.0112	27.3049	29.0248	25.9145	25.2969	23.0092	23.0295	23.9409	24.1603	26.6369	27.8790	30.7597	(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	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
84.5194	93.5751	84.5194	87.3367	84.5194	87.3367	84.5194	84.5194	87.3367	84.5194	87.3367	84.5194	84.5194	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
167.1878	168.9227	164.5509	155.2437	143.4951	132.4530	125.0763	123.3414	127.7132	137.0204	148.7690	159.8111	159.8111	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	(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)													
-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	(71)
Water heating gains (Table 5)													
41.6818	40.6322	39.0118	35.9924	34.0012	31.9572	30.9537	32.1786	33.5560	35.8023	38.7208	41.3436	41.3436	(72)
Total internal gains	345.1408	354.8818	339.8338	330.3246	313.7674	303.4987	292.3010	291.7911	300.3577	309.0938	326.5783	337.4258	(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		
Northeast				10.2000	11.2829	0.4000	0.7000	0.7700		22.3313 (75)		
Southwest				3.7500	36.7938	0.4000	0.7000	0.7700		26.7730 (79)		
Solar gains	49.1043	91.0604	144.2951	211.8128	267.3909	278.7161	263.1943	219.7035	167.3568	105.9534	60.1665	41.1490 (83)
Total gains	394.2451	445.9421	484.1290	542.1374	581.1583	582.2148	555.4954	511.4947	467.7145	415.0472	386.7448	378.5748 (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	68.2737	68.4165	68.5571	69.2253	69.3518	69.9466	69.9466	70.0579	69.7163	69.3518	69.0964	68.8315
alpha	5.5516	5.5611	5.5705	5.6150	5.6235	5.6631	5.6631	5.6705	5.6478	5.6235	5.6064	5.5888
util living area	0.9846	0.9691	0.9352	0.8314	0.6592	0.4650	0.3370	0.3816	0.6126	0.8786	0.9678	0.9874 (86)
MIT	20.1276	20.3106	20.5451	20.8198	20.9574	20.9949	20.9993	20.9987	20.9783	20.7888	20.4221	20.0934 (87)
Th 2	20.2915	20.2929	20.2942	20.3006	20.3018	20.3073	20.3073	20.3083	20.3052	20.3018	20.2994	20.2968 (88)
util rest of house	0.9813	0.9628	0.9225	0.8036	0.6169	0.4160	0.2842	0.3247	0.5570	0.8509	0.9602	0.9846 (89)
MIT 2	19.4949	19.6752	19.9021	20.1590	20.2732	20.3047	20.3071	20.3079	20.2929	20.1381	19.7914	19.4656 (90)
Living area fraction	19.7863	19.9679	20.1983	20.4634	20.5883	20.6226	20.6259	20.6260	20.6086	20.4378	20.0819	19.7548 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7863	19.9679	20.1983	20.4634	20.5883	20.6226	20.6259	20.6260	20.6086	20.4378	20.0819	19.7548 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9785	0.9594	0.9206	0.8104	0.6346	0.4384	0.3085	0.3509	0.5817	0.8567	0.9575	0.9821 (94)
Useful gains	385.7647	427.8516	445.6977	439.3602	368.7968	255.2271	171.3895	179.4724	272.0476	355.5888	370.2966	371.7967 (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	676.0314	656.3930	595.5063	497.8433	381.9762	256.6198	171.5423	179.7829	278.2430	422.7781	559.9595	673.5188 (97)
Space heating kWh	215.9584	153.5798	111.4576	42.1079	9.8055	0.0000	0.0000	0.0000	0.0000	49.9888	136.5572	224.4812 (98a)
Space heating requirement - total per year (kWh/year)												943.9365
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	215.9584	153.5798	111.4576	42.1079	9.8055	0.0000	0.0000	0.0000	0.0000	49.9888	136.5572	224.4812 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												943.9365
Space heating per m ²												(98c) / (4) = 16.3509 (99)

8c. Space cooling requirement

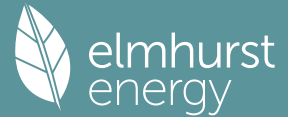
Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	400.5289	315.3100	323.3175	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9742	0.9892	0.9822	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	390.1834	311.9059	317.5784	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	649.5686	620.0081	570.2062	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	186.7573	229.2281	187.9551	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	46.6893	57.3070	46.9888	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												150.9851 (107)
Energy for space heating												16.3509 (99)
Energy for space cooling												2.6154 (108)
Total												18.9662 (109)
Fabric Energy Efficiency (DFEE)												19.0 (109)

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

1. Overall dwelling characteristics

Main dwelling	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	57.7300 (1b)	x 2.8000 (2b)	= 161.6440 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.7300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	161.6440 (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												2 * 10 = 20.0000 (7a)
Number of passive vents												0 * 10 = 0.0000 (7b)
Number of flueless gas fires												0 * 40 = 0.0000 (7c)
												Air changes per hour
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											20.0000 / (5) = 0.1237 (8)
Pressure test												Yes
Pressure Test Method												Blower Door
Measured/design AP50												5.0000 (17)
Infiltration rate												0.3737 (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) = 0.3177 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
	0.4050	0.3971	0.3891	0.3494	0.3415	0.3018	0.3018	0.2938	0.3177	0.3415	0.3574	0.3733	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													0.0000 (23c)
Effective ac	0.5820	0.5788	0.5757	0.5611	0.5583	0.5455	0.5455	0.5432	0.5505	0.5583	0.5639	0.5697	(25)

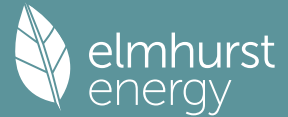
3. Heat losses and heat loss parameter

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						
Main dwelling													
TER Opening Type			13.9500	1.1450	15.9733			(27)					
External Wall 1 LG	26.3200	13.9500	12.3700	0.1800	2.2266			(29a)					
Total net area of external elements Aum(A, m2)			26.3200					(31)					
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =				18.1999			(33)					
Main dwelling													
Party Wall 1			24.1000	0.0000	0.0000			(32)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								185.8548 (35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value	Total							
E2 Other lintels (including other steel lintels)				6.3000	0.0500	0.3150							
E3 Sill				6.3000	0.0500	0.3150							
E4 Jamb				13.0000	0.0500	0.6500							
E7 Party floor between dwellings (in blocks of flats)				9.4000	0.0700	0.6580							
E17 Corner (inverted - internal area greater than external area)				2.8000	-0.0900	-0.2520							
E16 Corner (normal)				5.6000	0.0900	0.5040							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							2.1900	(36)					
Point Thermal bridges							(36a) =	0.0000					
Total fabric heat loss							(33) + (36) + (36a) =	20.3899 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	31.0466	30.8767	30.7102	29.9280	29.7816	29.1003	29.1003	28.9742	29.3628	29.7816	30.0777	30.3872	(38)
Average = Sum(39)m / 12 =	51.4365	51.2666	51.1001	50.3179	50.1715	49.4902	49.4902	49.3641	49.7526	50.1715	50.4676	50.7771	(39)
													50.3172
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.8910	0.8880	0.8852	0.8716	0.8691	0.8573	0.8573	0.8551	0.8618	0.8691	0.8742	0.8796	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.9168 (42)
Hot water usage for mixer showers													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths													
	24.3589	23.9971	23.4877	22.5483	21.8450	21.0651	20.6438	21.1497	21.7005	22.5350	23.4937	24.2765	(42b)
Hot water usage for other uses													
	34.2597	33.0139	31.7681	30.5223	29.2765	28.0307	28.0307	29.2765	30.5223	31.7681	33.0139	34.2597	(42c)
Average daily hot water use (litres/day)													53.7297 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	58.6186	57.0110	55.2558	53.0707	51.1215	49.0958	48.6745	50.4262	52.2228	54.3032	56.5076	58.5363	(44)
Energy content (annual)	92.8375	81.1829	84.9261	72.6511	68.8194	60.3690	58.8676	62.4382	64.3960	73.6889	80.5055	91.6536	(45)
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 892.3358
Water storage loss (or HIU 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	(46)
Total storage 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	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	78.9119	69.0055	72.1872	61.7534	58.4965	51.3137	50.0375	53.0725	54.7366	62.6355	68.4297	77.9056	(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)

Full SAP Calculation Printout



Output from w/h	78.9119	69.0055	72.1872	61.7534	58.4965	51.3137	50.0375	53.0725	54.7366	62.6355	68.4297	77.9056 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											758.4854 (64)
Electric shower(s)	45.1331	40.2139	43.9121	41.9048	42.6911	40.7232	42.0806	42.6911	41.9048	43.9121	43.0864	45.1331 (64a)
Heat gains from water heating, kWh/month	31.0112	27.3049	29.0248	25.9145	25.2969	23.0092	23.0295	23.9409	24.1603	26.6369	27.8790	30.7597 (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	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	84.3271	93.3621	84.3271	87.1380	84.3271	87.1380	84.3271	84.3271	87.1380	84.3271	87.1380	84.3271 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	167.1878	168.9227	164.5509	155.2437	143.4951	132.4530	125.0763	123.3414	127.7132	137.0204	148.7690	159.8111 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839 (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)	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712 (71)
Water heating gains (Table 5)	41.6818	40.6322	39.0118	35.9924	34.0012	31.9572	30.9537	32.1786	33.5560	35.8023	38.7208	41.3436 (72)
Total internal gains	344.9484	354.6688	339.6415	330.1258	313.5750	303.2999	292.1087	291.5988	300.1589	308.9015	326.3795	337.2335 (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					10.2000	11.2829	0.6300	0.7000			0.7700	35.1718 (75)	
Southwest					3.7500	36.7938	0.6300	0.7000			0.7700	42.1675 (79)	
Solar gains	77.3393	143.4201	227.2648	333.6051	421.1406	438.9779	414.5311	346.0331	263.5869	166.8766	94.7622	64.8097 (83)	
Total gains	422.2877	498.0889	566.9063	663.7309	734.7157	742.2778	706.6398	637.6318	563.7458	475.7780	421.1417	402.0431 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	57.9431	58.1351	58.3246	59.2312	59.4040	60.2218	60.2218	60.3757	59.9041	59.4040	59.0555	58.6955
alpha	4.8629	4.8757	4.8883	4.9487	4.9603	5.0148	5.0148	5.0250	4.9936	4.9603	4.9370	4.9130
util living area	0.9837	0.9644	0.9200	0.7941	0.6089	0.4233	0.3076	0.3548	0.5879	0.8682	0.9662	0.9867 (86)
MIT	19.9017	20.1451	20.4560	20.7965	20.9522	20.9936	20.9990	20.9980	20.9704	20.7294	20.2676	19.8670 (87)
Th 2	20.1752	20.1777	20.1801	20.1917	20.1939	20.2040	20.2040	20.2058	20.2001	20.1939	20.1895	20.1849 (88)
util rest of house	0.9800	0.9569	0.9042	0.7614	0.5630	0.3720	0.2522	0.2942	0.5268	0.8370	0.9578	0.9837 (89)
MIT 2	19.1781	19.4180	19.7179	20.0354	20.1628	20.2009	20.2036	20.2051	20.1838	19.9870	19.5500	19.1517 (90)
Living area fraction	19.5114	19.7529	20.0579	20.3860	20.5264	20.5660	20.5700	20.5703	20.5461	20.3289	19.8806	19.4812 (92)
Temperature adjustment	19.5114	19.7529	20.0579	20.3860	20.5264	20.5660	20.5700	20.5703	20.5461	20.3289	19.8806	19.4812 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9764	0.9524	0.9016	0.7696	0.5823	0.3954	0.2777	0.3221	0.5537	0.8427	0.9540	0.9805 (94)
Ext temp.	412.3327	474.3817	511.1354	510.8227	427.8209	293.5050	196.2429	205.3871	312.1509	400.9344	401.7841	394.2222 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	782.4208	761.4585	692.8086	577.9506	442.8333	295.2586	196.4743	205.8630	320.7103	488.1154	645.0034	775.9324 (97)
Space heating requirement - total per year (kWh/year)	275.3455	192.9156	135.1649	48.3321	11.1693	0.0000	0.0000	0.0000	0.0000	64.8627	175.1180	283.9924 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Space heating contribution - total per year (kWh/year)	275.3455	192.9156	135.1649	48.3321	11.1693	0.0000	0.0000	0.0000	0.0000	64.8627	175.1180	283.9924 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	275.3455	192.9156	135.1649	48.3321	11.1693	0.0000	0.0000	0.0000	0.0000	64.8627	175.1180	283.9924 (98c)
Space heating per m2	(98c) / (4) =											20.5595 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	465.2081	366.2276	375.1668	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9759	0.9889	0.9813	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	454.0084	362.1786	368.1555	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	836.8707	796.8770	717.8405	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	275.6608	323.4157	260.1656	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fc = cooled area / (4) =											1.0000 (105)
Intermittency factor (Table 10b)												

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Space cooling kWh	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling requirement	0.0000	0.0000	0.0000	0.0000	0.0000	68.9152	80.8539	65.0414	0.0000	0.0000	0.0000	0.0000 (107)
Energy for space heating												214.8105 (107)
Energy for space cooling												20.5595 (99)
Total												3.7210 (108)
Fabric Energy Efficiency (TFEE)												24.2805 (109)
												24.3 (109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling	57.7300	2.8000	161.6440
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.7300		161.6440
Dwelling volume			

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.1500 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												72.0000 (23c)
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898 (25)

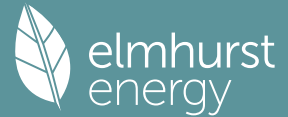
3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Opening Type 1			13.9500	0.8687	12.1187		(27)
External Wall 1 LG	26.3200	13.9500	12.3700	0.1400	1.7318	190.0000	2350.2997 (29a)
Total net area of external elements Aum(A, m ²)			26.3200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		13.8505		(33)
Main dwelling							
Party Wall 1			24.1000	0.0000	0.0000	180.0000	4338.0001 (32)
Party Floor 1			57.7300			40.0000	2309.2000 (32d)
Party Ceiling 1			57.7300			30.0000	1731.9000 (32b)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 10729.3998 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							185.8548 (35)
List of Thermal Bridges							
K1 Element					Length	Psi-value	Total
E2 Other lintels (including other steel lintels)					6.3000	0.0100	0.0630
E3 Sill					6.3000	0.0200	0.1260
E4 Jamb					13.0000	0.0150	0.1950
E7 Party floor between dwellings (in blocks of flats)					9.4000	0.0450	0.4230
E17 Corner (inverted - internal area greater than external area)					2.8000	-0.0980	-0.2744
E16 Corner (normal)					5.6000	0.0450	0.2520
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							0.7846 (36)
Point Thermal bridges							(36a) = 0.0000
Total fabric heat loss							(33) + (36) + (36a) = 14.6351 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	16.1394	15.9694	15.7994	14.9492	14.7792	13.9291	13.9291	13.7590	14.2691	14.7792	15.1193	15.4593 (38)
Average = Sum(39)m / 12 =	30.7746	30.6045	30.4345	29.5844	29.4143	28.5642	28.5642	28.3942	28.9042	29.4143	29.7544	30.0945 (39)
												29.5419

7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	96.8458	97.3839	97.9279	100.7420	101.3244	104.3400	104.3400	104.9648	103.1125	101.3244	100.1663	99.0345
alpha	7.4564	7.4923	7.5285	7.7161	7.7550	7.9560	7.9560	7.9977	7.8742	7.7550	7.6778	7.6023
util living area	0.8457	0.7848	0.6806	0.5263	0.3859	0.2621	0.1880	0.2083	0.3396	0.5551	0.7514	0.8572 (86)
MIT	20.8779	20.9299	20.9753	20.9966	20.9997	21.0000	21.0000	21.0000	20.9999	20.9960	20.9583	20.8723 (87)
Th 2	20.4906	20.4933	20.4960	20.5094	20.5121	20.5256	20.5256	20.5283	20.5202	20.5121	20.5067	20.5013 (88)
util rest of house	0.8297	0.7662	0.6595	0.5054	0.3657	0.2427	0.1677	0.1870	0.3160	0.5298	0.7297	0.8420 (89)
MIT 2	20.3574	20.4188	20.4710	20.5063	20.5119	20.5256	20.5256	20.5283	20.5202	20.5085	20.4642	20.3614 (90)
Living area fraction									fIA = Living area / (4) =			0.4606 (91)
MIT	20.5971	20.6542	20.7033	20.7321	20.7366	20.7441	20.7441	20.7456	20.7411	20.7331	20.6918	20.5967 (92)

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Temperature adjustment												0.0000
adjusted MIT	20.5971	20.6542	20.7033	20.7321	20.7366	20.7441	20.7441	20.7456	20.7411	20.7331	20.6918	20.5967 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8331	0.7722	0.6682	0.5149	0.3750	0.2517	0.1771	0.1968	0.3268	0.5413	0.7379	0.8450	(94)
Useful gains	461.9057	459.4190	424.3441	349.0100	265.7220	175.4991	118.3731	123.3886	191.9377	296.8489	391.1328	452.1036	(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	501.5377	482.1511	432.2690	350.0465	265.8048	175.5014	118.3732	123.3888	191.9571	298.0571	404.4152	493.4512	(97)
Space heating kWh	29.4862	15.2759	5.8962	0.7463	0.0616	0.0000	0.0000	0.0000	0.0000	0.8989	9.5634	30.7626	(98a)
Space heating requirement - total per year (kWh/year)												92.6911	
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	29.4862	15.2759	5.8962	0.7463	0.0616	0.0000	0.0000	0.0000	0.0000	0.8989	9.5634	30.7626	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												92.6911	
Space heating per m2											(98c) / (4) =	1.6056	(99)

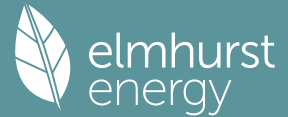
9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(301)
Fraction of space heat from community system												1.0000	(302)
Fraction of heat from community Boilers-Space and Water												1.0000	(303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000	(305)
Factor for charging method (Table 4c(3)) for water heating												1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system												1.1500	(306)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating:													
Space heating requirement	29.4862	15.2759	5.8962	0.7463	0.0616	0.0000	0.0000	0.0000	0.0000	0.8989	9.5634	30.7626	(98)
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.15													
307a	33.9091	17.5673	6.7806	0.8582	0.0709	0.0000	0.0000	0.0000	0.0000	1.0337	10.9979	35.3770	
Space heating requirement	33.9091	17.5673	6.7806	0.8582	0.0709	0.0000	0.0000	0.0000	0.0000	1.0337	10.9979	35.3770	(307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(309)
Water heating													
Annual water heating requirement	231.3928	205.2075	219.3516	195.9635	192.0956	175.4086	174.7456	180.3501	180.8633	198.9181	208.1555	229.2637	(64)
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.15													
310a	266.1018	235.9887	252.2543	225.3580	220.9100	201.7199	200.9575	207.4026	207.9927	228.7559	239.3788	263.6533	
Water heating fuel	266.1018	235.9887	252.2543	225.3580	220.9100	201.7199	200.9575	207.4026	207.9927	228.7559	239.3788	263.6533	(310)
Cooling System Energy Efficiency Ratio												0.0000	(314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(315)
Pumps and Fa	9.5804	8.6533	9.5804	9.2714	9.5804	9.2714	9.5804	9.5804	9.2714	9.5804	9.2714	9.5804	(331)
Lighting	16.5842	13.3045	11.9792	8.7765	6.7792	5.5387	6.1842	8.0385	10.4412	13.6994	15.4735	17.0452	(332)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335b)
Annual totals kWh/year													
Space heating fuel - community heating												106.5947	(307)
Space heating fuel - secondary												0.0000	(309)
Water heating fuel - community heating												2750.4735	(310)
Efficiency of water heater												0.0000	(311)
Electricity used for heat distribution												1.0659	(313)
Space cooling fuel												0.0000	(321)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)													
mechanical ventilation fans (SFP = 0.5720)												112.8016	(330a)
Total electricity for the above, kWh/year												112.8016	(331)
Electricity for lighting (calculated in Appendix L)												133.8444	(332)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(333)
Wind generation												0.0000	(334)
Hydro-electric generation (Appendix N)												0.0000	(335a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(335)
Appendix Q - special features													
Energy saved or generated												-0.0000	(336)
Energy used												0.0000	(337)
Total delivered energy for all uses												3103.7142	(338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	106.5947	4.4400	4.7328	(340a)
Space heating total			4.7328	(340)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	2750.4735	4.4400	122.1210	(342a)
Water heating total			122.1210	(342)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(347a)
Pumps, fans and electric keep-hot	112.8016	16.4900	18.6010	(349)
Energy for lighting	133.8444	16.4900	22.0709	(350)

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Additional standing charges
Total energy cost

92.0000 (351)
259.5258 (355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):

Energy cost factor (ECF)

$$[(255) \times (256)] / [(4) + 45.0] =$$

0.3600 (356)

0.9095 (357)

SAP value

85.2576

SAP rating (Section 12)

85 (358)

SAP band

B

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			89.5000 (367)
Space and Water heating from Boilers	3192.2550	0.2100	25.0111 (367)
Electrical energy for heat distribution (space & water)	1.0659	0.0000	4.0354 (372)
Overall CO2 factor for heat network			0.2360 (386)
Total CO2 associated with community systems			674.4089 (373)
Space and water heating			674.4089 (376)
Pumps, fans and electric keep-hot	112.8016	0.1387	15.6470 (378)
Energy for lighting	133.8444	0.1443	19.3179 (379)
Total CO2, kg/year			709.3738 (383)
CO2 emissions per m2			12.2900 (384)
EI value			90.7470 (384a)
EI rating			91 (385)
EI band			B

SAP 10 WORKSHEET FOR New Build (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)
Main dwelling	57.7300 (1b)	x 2.8000 (2b)	= 161.6440 (1b) - (3b)
Ground floor			(4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.7300		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	161.6440 (5)

2. Ventilation rate

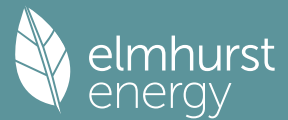
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.1339	0.1275	0.1275	0.1179	0.1179	0.1052	0.1084	0.1020	0.1052	0.1116	0.1116	0.1211 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												72.0000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2739	0.2675	0.2675	0.2579	0.2579	0.2452	0.2484	0.2420	0.2452	0.2516	0.2516	0.2611 (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
Main dwelling							
Opening Type 1			13.9500	0.8687	12.1187		(27)
External Wall 1 LG	26.3200	13.9500	12.3700	0.1400	1.7318	190.0000	2350.2997 (29a)
Total net area of external elements Aum(A, m2)			26.3200				(31)

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Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	13.8505	(33)
Main dwelling			
Party Wall 1	24.1000	0.0000	0.0000
Party Floor 1	57.7300		180.0000
Party Ceiling 1	57.7300		30.0000
			4338.0001 (32)
			2309.2000 (32d)
			1731.9000 (32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10729.3998	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		185.8548	(35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	6.3000	0.0100	0.0630
E2 Other lintels (including other steel lintels)	6.3000	0.0200	0.1260
E3 Sill	13.0000	0.0150	0.1950
E4 Jamb	9.4000	0.0450	0.4230
E7 Party floor between dwellings (in blocks of flats)	2.8000	-0.0980	-0.2744
E17 Corner (inverted - internal area greater than external area)	5.6000	0.0450	0.2520
E16 Corner (normal)			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			0.7846 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 14.6351 (37)

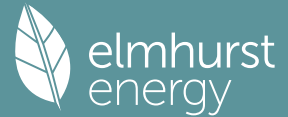
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	14.6092	14.2691	14.2691	13.7590	13.7590	13.0789	13.2489	12.9089	13.0789	13.4190	13.4190	13.9291
Average = Sum(39)m / 12 =	29.2443	28.9042	28.9042	28.3942	28.3942	27.7140	27.8841	27.5440	27.7140	28.0541	28.0541	28.5642
												28.2808
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.5066	0.5007	0.5007	0.4918	0.4918	0.4801	0.4830	0.4771	0.4801	0.4860	0.4860	0.4948
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												1.9168 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	64.9416	63.9771	62.6189	60.1147	58.2395	56.1603	55.0372	56.3859	57.8543	60.0792	62.6350	64.7220 (42b)
Hot water usage for other uses	34.2597	33.0139	31.7681	30.5223	29.2765	28.0307	28.0307	29.2765	30.5223	31.7681	33.0139	34.2597 (42c)
Average daily hot water use (litres/day)												91.3563 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	99.2013	96.9910	94.3870	90.6370	87.5160	84.1910	83.0679	85.6624	88.3767	91.8473	95.6489	98.9818 (44)
Energy content (annual)	157.1106	138.1139	145.0694	124.0775	117.8134	103.5226	100.4634	106.0679	108.9773	124.6359	136.2695	154.9815 (45)
Distribution loss (46)m = 0.15 x (45)m	23.5666	20.7171	21.7604	18.6116	17.6720	15.5284	15.0695	15.9102	16.3466	18.6954	20.4404	23.2472 (46)
Water storage loss (or HIU loss):												300.0000 (47)
Store volume												2.1100 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.7800 (49)
Temperature factor from Table 2b												1.6458 (55)
Enter (49) or (54) in (55)												
Total storage loss	51.0198	46.0824	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	49.3740	51.0198	49.3740	51.0198 (56)
If cylinder contains dedicated solar storage	51.0198	46.0824	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	49.3740	51.0198	49.3740	51.0198 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	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	231.3928	205.2075	219.3516	195.9635	192.0956	175.4086	174.7456	180.3501	180.8633	198.9181	208.1555	229.2637 (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	231.3928	205.2075	219.3516	195.9635	192.0956	175.4086	174.7456	180.3501	180.8633	198.9181	208.1555	229.2637 (64)
												2391.7161 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	111.6650	99.5978	107.6613	98.7646	98.5987	91.9301	92.8298	94.6933	93.7437	100.8672	102.8184	110.9571 (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	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.9471	16.8286	13.6859	10.3611	7.7451	6.5387	7.0653	9.1838	12.3264	15.6512	18.2673	19.4737 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	249.5341	252.1235	245.5983	231.7070	214.1718	197.6911	186.6810	184.0916	190.6168	204.5081	222.0433	238.5240 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175 (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)	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712 (71)
Water heating gains (Table 5)	150.0874	148.2110	144.7061	137.1730	132.5252	127.6807	124.7713	127.2760	130.1996	135.5742	142.8033	149.1359 (72)
Total internal gains	505.3216	503.9161	490.7434	465.9942	441.1950	418.6635	405.2706	407.3044	419.8959	442.4865	469.8670	493.8866 (73)

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

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Southeast		10.2000		12.9236		0.4000		0.7000		0.7700		25.5784 (75)		
Southwest		3.7500		40.4699		0.4000		0.7000		0.7700		29.4479 (79)		

Solar gains	55.0263	92.2221	145.2135	220.5808	271.5272	302.8017	282.8968	241.4580	182.9325	114.8358	69.1572	45.6134 (83)		
Total gains	560.3480	596.1382	635.9569	686.5750	712.7222	721.4652	688.1675	648.7624	602.8284	557.3223	539.0242	539.5000 (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	101.9135	103.1125	103.1125	104.9648	104.9648	107.5407	106.8850	108.2046	107.5407	106.2372	106.2372	104.3400		
alpha	7.7942	7.8742	7.8742	7.9977	7.9977	8.1694	8.1257	8.2136	8.1694	8.0825	8.0825	7.9560		
util living area	0.7889	0.7262	0.6127	0.4586	0.3187	0.1921	0.1256	0.1359	0.2666	0.4726	0.6670	0.7988 (86)		
MIT	20.9374	20.9666	20.9906	20.9991	21.0000	21.0000	21.0000	21.0000	21.0000	20.9991	20.9858	20.9364 (87)		
Th 2	20.5148	20.5202	20.5202	20.5283	20.5283	20.5391	20.5364	20.5419	20.5391	20.5337	20.5337	20.5256 (88)		
util rest of house	0.7706	0.7068	0.5922	0.4392	0.2999	0.1744	0.1068	0.1164	0.2455	0.4493	0.6450	0.7810 (89)		
MIT 2	20.4483	20.4855	20.5109	20.5275	20.5283	20.5391	20.5364	20.5419	20.5391	20.5330	20.5198	20.4579 (90)		
Living area fraction	fLA = Living area / (4) =													
MIT	20.6736	20.7071	20.7319	20.7447	20.7455	20.7514	20.7499	20.7529	20.7514	20.7477	20.7344	20.6783 (92)		
Temperature adjustment	0.0000													
adjusted MIT	20.6736	20.7071	20.7319	20.7447	20.7455	20.7514	20.7499	20.7529	20.7514	20.7477	20.7344	20.6783 (93)		

8. Space heating requirement														

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.7767	0.7145	0.6013	0.4481	0.3086	0.1825	0.1155	0.1254	0.2552	0.4600	0.6545	0.7868 (94)		
Useful gains	435.2268	425.9148	382.3735	307.6473	219.9153	131.6807	79.4682	81.3339	153.8502	256.3667	352.8113	424.4893 (95)		
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)		
Heat loss rate W	455.4386	436.6596	385.3474	307.9260	219.9278	131.6808	79.4682	81.3339	153.8519	256.6294	357.2535	444.9803 (97)		
Space heating kWh	15.0375	7.2205	2.2126	0.2007	0.0093	0.0000	0.0000	0.0000	0.0000	0.1955	3.1983	15.2453 (98a)		
Space heating requirement - total per year (kWh/year)													43.3197	
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	15.0375	7.2205	2.2126	0.2007	0.0093	0.0000	0.0000	0.0000	0.0000	0.1955	3.1983	15.2453 (98c)		
Space heating requirement after solar contribution - total per year (kWh/year)													43.3197	
Space heating per m2											(98c) / (4) =			0.7504 (99)

9b. Energy requirements														

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (301)		
Fraction of space heat from community system												1.0000 (302)		
Fraction of heat from community Boilers-Space and Water												1.0000 (303a)		
Factor for control and charging method (Table 4c(3)) for space heating												1.0000 (305)		
Factor for charging method (Table 4c(3)) for water heating												1.0000 (305a)		
Distribution loss factor (Table 12c) for community heating system												1.1500 (306)		
Efficiency of secondary/supplementary heating system, %												0.0000 (208)		
Space heating:														
Space heating requirement	15.0375	7.2205	2.2126	0.2007	0.0093	0.0000	0.0000	0.0000	0.0000	0.1955	3.1983	15.2453 (98)		
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.15														
307a	17.2932	8.3036	2.5444	0.2308	0.0107	0.0000	0.0000	0.0000	0.0000	0.2248	3.6781	17.5321		
Space heating requirement	17.2932	8.3036	2.5444	0.2308	0.0107	0.0000	0.0000	0.0000	0.0000	0.2248	3.6781	17.5321 (307)		
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)													0.0000 (308)	
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)		
Water heating														
Annual water heating requirement	231.3928	205.2075	219.3516	195.9635	192.0956	175.4086	174.7456	180.3501	180.8633	198.9181	208.1555	229.2637 (64)		
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.15														
310a	266.1018	235.9887	252.2543	225.3580	220.9100	201.7199	200.9575	207.4026	207.9927	228.7559	239.3788	263.6533		
Water heating fuel	266.1018	235.9887	252.2543	225.3580	220.9100	201.7199	200.9575	207.4026	207.9927	228.7559	239.3788	263.6533 (310)		
Cooling System Energy Efficiency Ratio	0.0000 (314)													
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)		
Pumps and Fa	9.5804	8.6533	9.5804	9.2714	9.5804	9.2714	9.5804	9.5804	9.2714	9.5804	9.2714	9.5804 (331)		
Lighting	16.5842	13.3045	11.9792	8.7765	6.7792	5.5387	6.1842	8.0385	10.4412	13.6994	15.4735	17.0452 (332)		
Electricity generated by PVs (Appendix M) (negative quantity)														
(333a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333a)		
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)		
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)		
Electricity generated by PVs (Appendix M) (negative quantity)														
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)		
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)		
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)		
Annual totals kWh/year														
Space heating fuel - community heating													49.8176 (307)	
Space heating fuel - secondary													0.0000 (309)	
Water heating fuel - community heating													2750.4735 (310)	
Efficiency of water heater													0.0000 (311)	
Electricity used for heat distribution													0.4982 (313)	
Space cooling fuel													0.0000 (321)	
Electricity for pumps and fans:														
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)														
mechanical ventilation fans (SFP = 0.5720)												112.8016 (330a)		
Total electricity for the above, kWh/year												112.8016 (331)		
Electricity for lighting (calculated in Appendix L)												133.8444 (332)		

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

PV generation	0.0000 (333)
Wind generation	0.0000 (334)
Hydro-electric generation (Appendix N)	0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (335)
Appendix Q - special features	
Energy saved or generated	-0.0000 (336)
Energy used	0.0000 (337)
Total delivered energy for all uses	3046.9371 (338)

10b. Fuel costs - using BEDF prices (597)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating from Boilers	49.8176	7.3200	3.6467 (340a)
Space heating total			3.6467 (340)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	0.0000	0.0000	0.0000 (341)
Water heating from Boilers	2750.4735	7.3200	201.3347 (342a)
Water heating total			201.3347 (342)
Energy for instantaneous electric shower(s)	0.0000	27.6700	0.0000 (347a)
Pumps, fans and electric keep-hot	112.8016	27.6700	31.2122 (349)
Energy for lighting	133.8444	27.6700	37.0347 (350)
Additional standing charges			108.0000 (351)
Total energy cost			381.2283 (355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			89.5000 (367)
Space and Water heating from Boilers	3128.8169	0.2100	11.6891 (367)
Electrical energy for heat distribution (space & water)	0.4982	0.0000	3.9448 (372)
Overall CO2 factor for heat network			0.2360 (386)
Total CO2 associated with community systems			660.9963 (373)
Space and water heating			660.9963 (376)
Pumps, fans and electric keep-hot	112.8016	0.1387	15.6470 (378)
Energy for lighting	133.8444	0.1443	19.3179 (379)
Total CO2, kg/year			695.9612 (383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Boilers			89.5000 (467a)
Space and Water heating from Boilers	3128.8169	1.1300	62.8982 (467)
Electrical energy for heat distribution (space & water)	0.4982	0.0000	42.5890 (472)
Overall CO2 factor for heat network			1.2778 (486)
Total CO2 associated with community systems			3578.1521 (473)
Space and water heating			3578.1521 (476)
Pumps, fans and electric keep-hot	112.8016	1.5128	170.6463 (478)
Energy for lighting	133.8444	1.5338	205.2950 (479)
Total Primary energy kWh/year			3954.0934 (483)

SAP 10 EPC IMPROVEMENTS

00001

Current energy efficiency rating:	B 85
Current environmental impact rating:	B 91

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

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

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

Potential energy efficiency rating:	B 85
Potential environmental impact rating:	B 91

Fuel prices for cost data on this page from database revision number 597 TEST (31 Jul 2026)
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	£68	£68	£0
Community scheme	£313	£313	£0
Space heating	£143	£143	£0
Water heating	£201	£201	£0
Lighting	£37	£37	£0
Total cost of fuels	£381	£381	£0
Total cost of uses	£381	£381	£0
Delivered energy	53 kWh/m²	53 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.7 tonnes	0.0 tonnes

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CO2 emissions per m² 12 kg/m² 12 kg/m² 0 kg/m²
 Primary energy 68 kWh/m² 68 kWh/m² 0 kWh/m²

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling	57.7300 (1b)	x 2.8000 (2b)	= 161.6440 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.7300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 161.6440 (5)

2. Ventilation rate

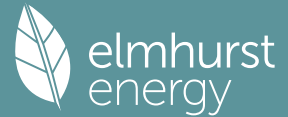
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.1500 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												72.0000 (23c)
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898 (25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K					
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K					
Opening Type 1			13.9500	0.8687	12.1187			(27)				
External Wall 1 LG	26.3200	13.9500	12.3700	0.1400	1.7318	190.0000	2350.2997	(29a)				
Total net area of external elements Aum(A, m2)			26.3200					(31)				
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		13.8505			(33)				
Main dwelling												
Party Wall 1			24.1000	0.0000	0.0000	180.0000	4338.0001	(32)				
Party Floor 1			57.7300			40.0000	2309.2000	(32d)				
Party Ceiling 1			57.7300			30.0000	1731.9000	(32b)				
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10729.3998	(34)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							185.8548	(35)				
List of Thermal Bridges												
K1 Element				Length	Psi-value	Total						
E2 Other lintels (including other steel lintels)				6.3000	0.0100	0.0630						
E3 Sill				6.3000	0.0200	0.1260						
E4 Jamb				13.0000	0.0150	0.1950						
E7 Party floor between dwellings (in blocks of flats)				9.4000	0.0450	0.4230						
E17 Corner (inverted - internal area greater than external area)				2.8000	-0.0980	-0.2744						
E16 Corner (normal)				5.6000	0.0450	0.2520						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								0.7846 (36)				
Point Thermal bridges						(36a) =	0.0000					
Total fabric heat loss						(33) + (36) + (36a) =	14.6351	(37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	16.1394	15.9694	15.7994	14.9492	14.7792	13.9291	13.9291	13.7590	14.2691	14.7792	15.1193	15.4593 (38)
Average = Sum(39)m / 12 =	30.7746	30.6045	30.4345	29.5844	29.4143	28.5642	28.5642	28.3942	28.9042	29.4143	29.7544	30.0945 (39)
												29.5419
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.5331	0.5301	0.5272	0.5125	0.5095	0.4948	0.4948	0.4918	0.5007	0.5095	0.5154	0.5213 (40)
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												1.9168 (42)
Hot water usage for mixer showers												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths												
64.9416	63.9771	62.6189	60.1147	58.2395	56.1603	55.0372	56.3859	57.8543	60.0792	62.6350	64.7220	(42b)
Hot water usage for other uses												
34.2597	33.0139	31.7681	30.5223	29.2765	28.0307	28.0307	29.2765	30.5223	31.7681	33.0139	34.2597	(42c)
Average daily hot water use (litres/day)												91.3563 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
99.2013	96.9910	94.3870	90.6370	87.5160	84.1910	83.0679	85.6624	88.3767	91.8473	95.6489	98.9818	(44)
Energy content	157.1106	138.1139	145.0694	124.0775	117.8134	103.5226	100.4634	106.0679	108.9773	124.6359	136.2695	154.9815 (45)
Energy content (annual)												
	Total = Sum(45)m =											1517.1031
Distribution loss (46)m = 0.15 x (45)m												
23.5666	20.7171	21.7604	18.6116	17.6720	15.5284	15.0695	15.9102	16.3466	18.6954	20.4404	23.2472	(46)
Water storage loss (or HIU loss):												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1100 (48)
Temperature factor from Table 2b												0.7800 (49)
Enter (49) or (54) in (55)												1.6458 (55)
Total storage loss												
51.0198	46.0824	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	49.3740	51.0198	49.3740	51.0198	(56)
If cylinder contains dedicated solar storage												
51.0198	46.0824	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	49.3740	51.0198	49.3740	51.0198	(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	(61)
Total heat required for water heating calculated for each month												
231.3928	205.2075	219.3516	195.9635	192.0956	175.4086	174.7456	180.3501	180.8633	198.9181	208.1555	229.2637 (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												
231.3928	205.2075	219.3516	195.9635	192.0956	175.4086	174.7456	180.3501	180.8633	198.9181	208.1555	229.2637 (64)	
Electric shower(s)												
Total per year (kWh/year) = Sum(64)m =												2391.7161 (64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
111.6650	99.5978	107.6613	98.7646	98.5987	91.9301	92.8298	94.6933	93.7437	100.8672	102.8184	110.9571 (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	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.9471	16.8286	13.6859	10.3611	7.7451	6.5387	7.0653	9.1838	12.3264	15.6512	18.2673	19.4737 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	249.5341	252.1235	245.5983	231.7070	214.1718	197.6911	186.6810	184.0916	190.6168	204.5081	222.0433	238.5240 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175 (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)	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712 (71)
Water heating gains (Table 5)	150.0874	148.2110	144.7061	137.1730	132.5252	127.6807	124.7713	127.2760	130.1996	135.5742	142.8033	149.1359 (72)
Total internal gains	505.3216	503.9161	490.7434	465.9942	441.1950	418.6635	405.2706	407.3044	419.8959	442.4865	469.8670	493.8866 (73)

6. Solar gains

[Jan]				Area	Solar flux	g		FF	Access		Gains	
				m2	Table 6a	Specific data		Specific data	factor		W	
					W/m2	or Table 6b		or Table 6c	Table 6d			
Northeast				10.2000	11.2829	0.4000		0.7000	0.7700		22.3313 (75)	
Southwest				3.7500	36.7938	0.4000		0.7000	0.7700		26.7730 (79)	
Solar gains	49.1043	91.0604	144.2951	211.8128	267.3909	278.7161	263.1943	219.7035	167.3568	105.9534	60.1665	41.1490 (83)
Total gains	554.4260	594.9765	635.0385	677.8070	708.5859	697.3796	668.4650	627.0080	587.2526	548.4399	530.0335	535.0356 (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	96.8458	97.3839	97.9279	100.7420	101.3244	104.3400	104.3400	104.9648	103.1125	101.3244	100.1663	99.0345
alpha	7.4564	7.4923	7.5285	7.7161	7.7550	7.9560	7.9560	7.9977	7.8742	7.7550	7.6778	7.6023
util living area	0.8457	0.7848	0.6806	0.5263	0.3859	0.2621	0.1880	0.2083	0.3396	0.5551	0.7514	0.8572 (86)
MIT	20.8779	20.9299	20.9753	20.9966	20.9997	21.0000	21.0000	21.0000	20.9999	20.9960	20.9583	20.8723 (87)
Th 2	20.4906	20.4933	20.4960	20.5094	20.5121	20.5256	20.5256	20.5283	20.5202	20.5121	20.5067	20.5013 (88)
util rest of house	0.8297	0.7662	0.6595	0.5054	0.3657	0.2427	0.1677	0.1870	0.3160	0.5298	0.7297	0.8420 (89)
MIT 2	20.3574	20.4188	20.4710	20.5063	20.5119	20.5256	20.5256	20.5283	20.5202	20.5085	20.4642	20.3614 (90)
Living area fraction	20.5971	20.6542	20.7033	20.7321	20.7366	20.7441	20.7441	20.7456	fLA = Living area / (4) = 20.7411	20.7331	20.6918	0.4606 (91)
MIT	20.5971	20.6542	20.7033	20.7321	20.7366	20.7441	20.7441	20.7456	20.7411	20.7331	20.6918	20.5967 (92)
Temperature adjustment												0.0000
adjusted MIT	20.5971	20.6542	20.7033	20.7321	20.7366	20.7441	20.7441	20.7456	20.7411	20.7331	20.6918	20.5967 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8331	0.7722	0.6682	0.5149	0.3750	0.2517	0.1771	0.1968	0.3268	0.5413	0.7379	0.8450	(94)
Useful gains	461.9057	459.4190	424.3441	349.0100	265.7220	175.4991	118.3731	123.3886	191.9377	296.8489	391.1328	452.1036	(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	501.5377	482.1511	432.2690	350.0465	265.8048	175.5014	118.3732	123.3888	191.9571	298.0571	404.4152	493.4512	(97)
Space heating kWh	29.4862	15.2759	5.8962	0.7463	0.0616	0.0000	0.0000	0.0000	0.0000	0.8989	9.5634	30.7626	(98a)
Space heating requirement - total per year (kWh/year)												92.6911	
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	29.4862	15.2759	5.8962	0.7463	0.0616	0.0000	0.0000	0.0000	0.0000	0.8989	9.5634	30.7626	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												92.6911	
Space heating per m2											(98c) / (4) =	1.6056	(99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(301)
Fraction of space heat from community system												1.0000	(302)
Fraction of heat from community Boilers-Space and Water												1.0000	(303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000	(305)
Factor for charging method (Table 4c(3)) for water heating												1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system												1.1500	(306)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating:													
Space heating requirement	29.4862	15.2759	5.8962	0.7463	0.0616	0.0000	0.0000	0.0000	0.0000	0.8989	9.5634	30.7626	(98)
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.15													
307a	33.9091	17.5673	6.7806	0.8582	0.0709	0.0000	0.0000	0.0000	0.0000	1.0337	10.9979	35.3770	
Space heating requirement	33.9091	17.5673	6.7806	0.8582	0.0709	0.0000	0.0000	0.0000	0.0000	1.0337	10.9979	35.3770	(307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(309)
Water heating													
Annual water heating requirement	231.3928	205.2075	219.3516	195.9635	192.0956	175.4086	174.7456	180.3501	180.8633	198.9181	208.1555	229.2637	(64)
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.15													
310a	266.1018	235.9887	252.2543	225.3580	220.9100	201.7199	200.9575	207.4026	207.9927	228.7559	239.3788	263.6533	
Water heating fuel	266.1018	235.9887	252.2543	225.3580	220.9100	201.7199	200.9575	207.4026	207.9927	228.7559	239.3788	263.6533	(310)
Cooling System Energy Efficiency Ratio												0.0000	(314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(315)
Pumps and Fa	9.5804	8.6533	9.5804	9.2714	9.5804	9.2714	9.5804	9.5804	9.2714	9.5804	9.2714	9.5804	(331)
Lighting	16.5842	13.3045	11.9792	8.7765	6.7792	5.5387	6.1842	8.0385	10.4412	13.6994	15.4735	17.0452	(332)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335b)
Annual totals kWh/year													
Space heating fuel - community heating												106.5947	(307)
Space heating fuel - secondary												0.0000	(309)
Water heating fuel - community heating												2750.4735	(310)
Efficiency of water heater												0.0000	(311)
Electricity used for heat distribution												1.0659	(313)
Space cooling fuel												0.0000	(321)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)													
mechanical ventilation fans (SFP = 0.5720)												112.8016	(330a)
Total electricity for the above, kWh/year												112.8016	(331)
Electricity for lighting (calculated in Appendix L)												133.8444	(332)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(333)
Wind generation												0.0000	(334)
Hydro-electric generation (Appendix N)												0.0000	(335a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(335)
Appendix Q - special features													
Energy saved or generated												-0.0000	(336)
Energy used												0.0000	(337)
Total delivered energy for all uses												3103.7142	(338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	106.5947	4.4400	4.7328	(340a)
Space heating total			4.7328	(340)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	2750.4735	4.4400	122.1210	(342a)
Water heating total			122.1210	(342)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(347a)
Pumps, fans and electric keep-hot	112.8016	16.4900	18.6010	(349)
Energy for lighting	133.8444	16.4900	22.0709	(350)
Additional standing charges			92.0000	(351)
Total energy cost			259.5258	(355)

Full SAP Calculation Printout



11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):		0.3600 (356)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.9095 (357)
SAP value		85.2576
SAP rating (Section 12)		85 (358)
SAP band		B

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Efficiency of heat source Boilers			89.5000 (367)
Space and Water heating from Boilers	3192.2550	0.2100	25.0111 (367)
Electrical energy for heat distribution (space & water)	1.0659	0.0000	4.0354 (372)
Overall CO ₂ factor for heat network			0.2360 (386)
Total CO ₂ associated with community systems			674.4089 (373)
Space and water heating			674.4089 (376)
Pumps, fans and electric keep-hot	112.8016	0.1387	15.6470 (378)
Energy for lighting	133.8444	0.1443	19.3179 (379)
Total CO ₂ , kg/year			709.3738 (383)
CO ₂ emissions per m ²			12.2900 (384)
EI value			90.7470 (384a)
EI rating			91 (385)
EI band			B

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	57.7300 (1b)	x 2.8000 (2b)	= 161.6440 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.7300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	161.6440 (5)

2. Ventilation rate

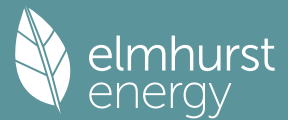
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.1500 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.1339	0.1275	0.1275	0.1179	0.1179	0.1052	0.1084	0.1020	0.1052	0.1116	0.1116	0.1211 (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) =												72.0000 (23c)
Effective ac	0.2739	0.2675	0.2675	0.2579	0.2579	0.2452	0.2484	0.2420	0.2452	0.2516	0.2516	0.2611 (25)

3. Heat losses and heat loss parameter

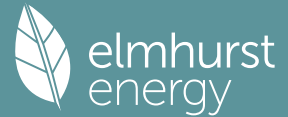
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Opening Type 1			13.9500	0.8687	12.1187		(27)
External Wall 1 LG	26.3200	13.9500	12.3700	0.1400	1.7318	190.0000	2350.2997 (29a)
Total net area of external elements A _{um} (A, m ²)			26.3200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		13.8505		(33)
Main dwelling							
Party Wall 1			24.1000	0.0000	0.0000	180.0000	4338.0001 (32)
Party Floor 1			57.7300			40.0000	2309.2000 (32d)
Party Ceiling 1			57.7300			30.0000	1731.9000 (32b)

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Heat capacity Cm = Sum(A x k)											
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K											
List of Thermal Bridges											
K1 Element											
E2 Other lintels (including other steel lintels)											
E3 Sill											
E4 Jamb											
E7 Party floor between dwellings (in blocks of flats)											
E17 Corner (inverted - internal area greater than external area)											
E16 Corner (normal)											
Thermal bridges (Sum(L x Psi) calculated using Appendix K)											
Point Thermal Bridges											
Total fabric heat loss											
(28)...(30) + (32) + (32a)...(32e) = 10729.3998 (34)											
185.8548 (35)											
Length											
Psi-value											
Total											
6.3000 0.0100 0.0630											
6.3000 0.0200 0.1260											
13.0000 0.0150 0.1950											
9.4000 0.0450 0.4230											
2.8000 -0.0980 -0.2744											
5.6000 0.0450 0.2520											
Thermal bridges (Sum(L x Psi) calculated using Appendix K)											
Point Thermal Bridges											
Total fabric heat loss											
(33) + (36) + (36a) = 14.6351 (37)											
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)											
(38)m											
Heat transfer coeff											
Average = Sum(39)m / 12 =											
HLP											
HLP (average)											
Days in mont											
4. Water heating energy requirements (kWh/year)											
Assumed occupancy											
Hot water usage for mixer showers											
Hot water usage for baths											
Hot water usage for other uses											
Average daily hot water use (litres/day)											
Daily hot water use											
Energy conte											
Energy content (annual)											
Distribution loss (46)m = 0.15 x (45)m											
Water storage loss (or HIU loss):											
Store volume											
a) If manufacturer declared loss factor is known (kWh/day):											
Temperature factor from Table 2b											
Enter (49) or (54) in (55)											
Total storage loss											
If cylinder contains dedicated solar storage											
Primary loss											
Combi loss											
Total heat required for water heating calculated for each month											
WWHRS											
PV diverter											
Solar input											
FGHRS											
Output from w/h											
Electric shower(s)											
Heat gains from water heating, kWh/month											
5. Internal gains (see Table 5 and 5a)											
Metabolic gains (Table 5), Watts											
(66)m											
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5											
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5											
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5											
Pumps, fans											
Losses e.g. evaporation (negative values) (Table 5)											
Water heating gains (Table 5)											
Total internal gains											
6. Solar gains											
[Jan]											
Area											
Solar flux											
Specific data											
Specific data											
Access factor											
Gains											
Northeast											
Southwest											
Solar gains											

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Total gains 560.3480 596.1382 635.9569 686.5750 712.7222 721.4652 688.1675 648.7624 602.8284 557.3223 539.0242 539.5000 (84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	101.9135	103.1125	103.1125	104.9648	104.9648	107.5407	106.8850	108.2046	107.5407	106.2372	106.2372	104.3400
alpha	7.7942	7.8742	7.8742	7.9977	7.9977	8.1694	8.1257	8.2136	8.1694	8.0825	8.0825	7.9560
util living area	0.7889	0.7262	0.6127	0.4586	0.3187	0.1921	0.1256	0.1359	0.2666	0.4726	0.6670	0.7988 (86)
MIT	20.9374	20.9666	20.9906	20.9991	21.0000	21.0000	21.0000	21.0000	21.0000	20.9991	20.9858	20.9364 (87)
Th 2	20.5148	20.5202	20.5202	20.5283	20.5283	20.5391	20.5364	20.5419	20.5391	20.5337	20.5337	20.5256 (88)
util rest of house	0.7706	0.7068	0.5922	0.4392	0.2999	0.1744	0.1068	0.1164	0.2455	0.4493	0.6450	0.7810 (89)
MIT 2	20.4483	20.4855	20.5109	20.5275	20.5283	20.5391	20.5364	20.5419	20.5391	20.5330	20.5198	20.4579 (90)
Living area fraction	fLA = Living area / (4) = 0.4606 (91)											
MIT	20.6736	20.7071	20.7319	20.7447	20.7455	20.7514	20.7499	20.7529	20.7514	20.7477	20.7344	20.6783 (92)
Temperature adjustment	0.0000											
adjusted MIT	20.6736	20.7071	20.7319	20.7447	20.7455	20.7514	20.7499	20.7529	20.7514	20.7477	20.7344	20.6783 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.7767	0.7145	0.6013	0.4481	0.3086	0.1825	0.1155	0.1254	0.2552	0.4600	0.6545	0.7868 (94)
Useful gains	435.2268	425.9148	382.3735	307.6473	219.9153	131.6807	79.4682	81.3339	153.8502	256.3667	352.8113	424.4893 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	455.4386	436.6596	385.3474	307.9260	219.9278	131.6808	79.4682	81.3339	153.8519	256.6294	357.2535	444.9803 (97)
Space heating kWh	15.0375	7.2205	2.2126	0.2007	0.0093	0.0000	0.0000	0.0000	0.0000	0.1955	3.1983	15.2453 (98a)
Space heating requirement - total per year (kWh/year)												43.3197
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	15.0375	7.2205	2.2126	0.2007	0.0093	0.0000	0.0000	0.0000	0.0000	0.1955	3.1983	15.2453 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												43.3197
Space heating per m2												(98c) / (4) = 0.7504 (99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)
Fraction of space heat from community system
Fraction of heat from community Boilers-Space and Water
Factor for control and charging method (Table 4c(3)) for space heating
Factor for charging method (Table 4c(3)) for water heating
Distribution loss factor (Table 12c) for community heating system
Efficiency of secondary/supplementary heating system, %

Space heating:												
Space heating requirement	15.0375	7.2205	2.2126	0.2007	0.0093	0.0000	0.0000	0.0000	0.0000	0.1955	3.1983	15.2453 (98)
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.15												
307a	17.2932	8.3036	2.5444	0.2308	0.0107	0.0000	0.0000	0.0000	0.0000	0.2248	3.6781	17.5321
Space heating requirement	17.2932	8.3036	2.5444	0.2308	0.0107	0.0000	0.0000	0.0000	0.0000	0.2248	3.6781	17.5321 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)

Water heating

Annual water heating requirement	231.3928	205.2075	219.3516	195.9635	192.0956	175.4086	174.7456	180.3501	180.8633	198.9181	208.1555	229.2637 (64)
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.15												
310a	266.1018	235.9887	252.2543	225.3580	220.9100	201.7199	200.9575	207.4026	207.9927	228.7559	239.3788	263.6533
Water heating fuel	266.1018	235.9887	252.2543	225.3580	220.9100	201.7199	200.9575	207.4026	207.9927	228.7559	239.3788	263.6533 (310)
Cooling System Energy Efficiency Ratio	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	9.5804	8.6533	9.5804	9.2714	9.5804	9.2714	9.5804	9.5804	9.2714	9.5804	9.2714	9.5804 (331)
Lighting	16.5842	13.3045	11.9792	8.7765	6.7792	5.5387	6.1842	8.0385	10.4412	13.6994	15.4735	17.0452 (332)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year												
Space heating fuel - community heating												49.8176 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												2750.4735 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												0.4982 (313)
Space cooling fuel												0.0000 (321)

Electricity for pumps and fans:

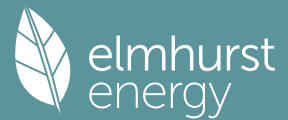
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)
mechanical ventilation fans (SFP = 0.5720)

Total electricity for the above, kWh/year	112.8016 (330a)
Electricity for lighting (calculated in Appendix L)	112.8016 (331)
	133.8444 (332)

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

PV generation	0.0000 (333)
Wind generation	0.0000 (334)
Hydro-electric generation (Appendix N)	0.0000 (335a)

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Plot Reference	3B 5P NW				Issued on Date	27/08/2026	
Assessment Reference	00001			Plot Type Ref			
Plot Address					SAP Version	10.2	
SAP Rating	87 B	DER	9.80	TER	10.37		
Environmental	92 A	% DER < TER				5.50	
CO ₂ Emissions (t/year)	0.8	DFEE	19.13	TFEE	23.14		
Compliance Check	See BREL	% DFEE < TFEE				17.31	
% DPER < TPER	-1.45	DPER	56.04	TPER	55.24		
Assessor Details	Mr. Richard Denteh				Assessor ID	U148-0001	
Client							

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	86.5500 (1b)	2.8000 (2b)	242.3400 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.5500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	242.3400 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.1500 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1275 (21)

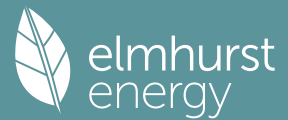
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												72.0000 (23c)
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Opening Type 1			21.7000	0.8687	18.8514		(27)
External Wall 1 LG	40.3200	21.7000	18.6200	0.1400	2.6068	190.0000	3537.7997 (29a)
Total net area of external elements Aum(A, m ²)			40.3200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.4582		(33)
Main dwelling							
Party Wall 1			67.4800	0.0000	0.0000	180.0000	12146.4006 (32)
Party Floor 1			86.5500			40.0000	3462.0000 (32a)
Party Ceiling 1			86.5500			30.0000	2596.5000 (32b)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	21742.7003 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							251.2155 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				8.8000	0.0100	0.0880	
E3 Sill				8.8000	0.0200	0.1760	

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Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	126.2484	126.9247	127.6083	131.1398	131.8697	135.6445	135.6445	136.4256	134.1090	131.8697	130.4180	128.9978
alpha	9.4166	9.4616	9.5072	9.7427	9.7913	10.0430	10.0430	10.0950	9.9406	9.7913	9.6945	9.5999
util living area	0.9549	0.8872	0.7758	0.5920	0.4335	0.2933	0.2100	0.2313	0.3744	0.6341	0.8742	0.9632 (86)
MIT	20.8106	20.9151	20.9756	20.9980	20.9999	21.0000	21.0000	21.0000	21.0000	20.9971	20.9403	20.7964 (87)
Th 2	20.4727	20.4754	20.4781	20.4915	20.4942	20.5076	20.5076	20.5103	20.5022	20.4942	20.4888	20.4834 (88)
util rest of house	0.9457	0.8701	0.7522	0.5675	0.4100	0.2707	0.1865	0.2067	0.3474	0.6042	0.8535	0.9553 (89)
MIT 2	20.2631	20.3867	20.4545	20.4898	20.4941	20.5076	20.5076	20.5103	20.5022	20.4918	20.4290	20.2560 (90)
Living area fraction									fLA = Living area /	(4) =		0.3447 (91)
MIT	20.4518	20.5688	20.6341	20.6650	20.6684	20.6773	20.6773	20.6791	20.6738	20.6659	20.6053	20.4422 (92)
Temperature adjustment												0.0000
adjusted MIT	20.4518	20.5688	20.6341	20.6650	20.6684	20.6773	20.6773	20.6791	20.6738	20.6659	20.6053	20.4422 (93)
8. Space heating requirement												
Utilisation	0.9453	0.8733	0.7594	0.5759	0.4181	0.2785	0.1946	0.2151	0.3567	0.6144	0.8584	0.9547 (94)
Useful gains	655.3762	693.7216	654.4888	540.7515	410.7074	270.5948	181.5444	189.4372	296.0452	459.4619	589.8767	634.1418 (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	772.6924	745.5900	668.9595	541.8351	410.7543	270.5953	181.5444	189.4373	296.0520	461.0205	625.4266	760.4568 (97)
Space heating kWh	87.2832	34.8555	10.7662	0.7802	0.0348	0.0000	0.0000	0.0000	0.0000	1.1596	25.5959	93.9783 (98a)
Space heating requirement - total per year (kWh/year)												254.4538
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	87.2832	34.8555	10.7662	0.7802	0.0348	0.0000	0.0000	0.0000	0.0000	1.1596	25.5959	93.9783 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												254.4538
Space heating per m2										(98c) / (4) =		2.9400 (99)
9b. Energy requirements												
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (301)
Fraction of space heat from community system												1.0000 (302)
Fraction of heat from community Boilers-Space and Water												1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system												1.1500 (306)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating:												
Space heating requirement	87.2832	34.8555	10.7662	0.7802	0.0348	0.0000	0.0000	0.0000	0.0000	1.1596	25.5959	93.9783 (98)
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.15												
307a	100.3757	40.0839	12.3811	0.8972	0.0401	0.0000	0.0000	0.0000	0.0000	1.3335	29.4353	108.0751
Space heating requirement	100.3757	40.0839	12.3811	0.8972	0.0401	0.0000	0.0000	0.0000	0.0000	1.3335	29.4353	108.0751 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating												
Annual water heating requirement	262.3286	232.4027	247.9163	220.3949	215.2936	195.7927	194.5273	201.2353	202.3213	223.4595	234.9875	259.7802 (64)
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.15												
310a	301.6779	267.2632	285.1038	253.4541	247.5876	225.1616	223.7064	231.4206	232.6695	256.9784	270.2356	298.7473
Water heating fuel	301.6779	267.2632	285.1038	253.4541	247.5876	225.1616	223.7064	231.4206	232.6695	256.9784	270.2356	298.7473 (310)
Cooling System Energy Efficiency Ratio												0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	14.3632	12.9732	14.3632	13.8998	14.3632	13.8998	14.3632	14.3632	13.8998	14.3632	13.8998	14.3632 (331)
Lighting	21.5615	17.2974	15.5744	11.4105	8.8138	7.2009	8.0402	10.4510	13.5748	17.8109	20.1173	22.1607 (332)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year												
Space heating fuel - community heating												292.6219 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												3094.0058 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												2.9262 (313)
Space cooling fuel												0.0000 (321)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)												
mechanical ventilation fans (SFP = 0.5720)												169.1145 (330a)
Total electricity for the above, kWh/year												169.1145 (331)
Electricity for lighting (calculated in Appendix L)												174.0133 (332)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (333)
Wind generation												0.0000 (334)
Hydro-electric generation (Appendix N)												0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (335)
Appendix Q - special features												
Energy saved or generated												-0.0000 (336)
Energy used												0.0000 (337)
Total delivered energy for all uses												3729.7556 (338)

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12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			89.5000 (367)
Space and Water heating from Boilers	3783.9416	0.2100	68.6599 (367)
Electrical energy for heat distribution (space & water)	2.9262	0.0000	4.8213 (372)
Overall CO2 factor for heat network			0.2361 (386)
Total CO2 associated with community systems			799.4491 (373)
Space and water heating			799.4491 (376)
Pumps, fans and electric keep-hot	169.1145	0.1387	23.4583 (378)
Energy for lighting	174.0133	0.1443	25.1155 (379)
Total CO2, kg/year			848.0228 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			9.8000 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Boilers			89.5000 (467a)
Space and Water heating from Boilers	3783.9416	1.1300	369.4556 (467)
Electrical energy for heat distribution (space & water)	2.9262	0.0000	51.6948 (472)
Overall CO2 factor for heat network			1.2778 (486)
Total CO2 associated with community systems			4327.5488 (473)
Space and water heating			4327.5488 (476)
Pumps, fans and electric keep-hot	169.1145	1.5128	255.8365 (478)
Energy for lighting	174.0133	1.5338	266.9074 (479)
Total Primary energy kWh/year			4850.2927 (483)
Dwelling Primary energy Rate (DPER)			56.0400 (484)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling	86.5500 (1b)	x 2.8000 (2b)	= 242.3400 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.5500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 242.3400 (5)

2. Ventilation rate

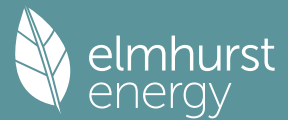
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 30.0000 / (5) = 0.1238 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3738 (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) = 0.3177 (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	0.4051	0.3972	0.3892	0.3495	0.3416	0.3018	0.3018	0.2939	0.3177	0.3416	0.3574	0.3733 (22b)
Effective ac	0.5821	0.5789	0.5757	0.5611	0.5583	0.5456	0.5456	0.5432	0.5505	0.5583	0.5639	0.5697 (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
Main dwelling							
TER Opening Type			21.6400	1.1450	24.7786		(27)
External Wall 1 LG	40.3200	21.6400	18.6800	0.1800	3.3624		(29a)
Total net area of external elements Aum(A, m2)			40.3200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		28.1410		(33)
Main dwelling							
Party Wall 1			67.4800	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							251.2155 (35)

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List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	8.8000	0.0500	0.4400
E3 Sill	8.8000	0.0500	0.4400
E4 Jamb	25.0000	0.0500	1.2500
E7 Party floor between dwellings (in blocks of flats)	14.4000	0.0700	1.0080
E18 Party wall between dwellings	11.2000	0.0600	0.6720
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			3.8100 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	31.9510 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	46.5480	46.2932	46.0434	44.8703	44.6508	43.6291	43.6291	43.4399	44.0226	44.6508	45.0948	45.5590 (38)
Average = Sum(39)m / 12 =	78.4990	78.2442	77.9945	76.8213	76.6019	75.5801	75.5801	75.3909	75.9737	76.6019	77.0459	77.5101 (39)
												76.8203
HLP	0.9070	0.9040	0.9011	0.8876	0.8851	0.8733	0.8733	0.8711	0.8778	0.8851	0.8902	0.8956 (40)
HLP (average)												0.8876
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5755 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	77.7288	76.5745	74.9488	71.9515	69.7071	67.2185	65.8742	67.4885	69.2461	71.9090	74.9681	77.4661 (42b)
Hot water usage for other uses	41.0056	39.5145	38.0234	36.5323	35.0412	33.5501	33.5501	35.0412	36.5323	38.0234	39.5145	41.0056 (42c)
Average daily hot water use (litres/day)												109.3447 (43)
Daily hot water use	118.7345	116.0890	112.9722	108.4838	104.7483	100.7685	99.4243	102.5297	105.7784	109.9324	114.4826	118.4717 (44)
Energy conte	188.0464	165.3091	173.6341	148.5089	141.0114	123.9067	120.2451	126.9531	130.4353	149.1773	163.1015	185.4980 (45)
Energy content (annual)										Total = Sum(45)m =		1815.8269
Distribution loss (46)m = 0.15 x (45)m	28.2070	24.7964	26.0451	22.2763	21.1517	18.5860	18.0368	19.0430	19.5653	22.3766	24.4652	27.8247 (46)
Water storage loss (or HIU loss):												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1127 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.1409 (55)
Total storage loss	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664 (56)
If cylinder contains dedicated solar storage	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	246.6752	218.2642	232.2629	205.2465	199.6402	180.6442	178.8739	185.5819	187.1729	207.8061	219.8390	244.1268 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	246.6752	218.2642	232.2629	205.2465	199.6402	180.6442	178.8739	185.5819	187.1729	207.8061	219.8390	244.1268 (64)
12Total per year (kWh/year)								Total per year (kWh/year) = Sum(64)m =				2506.1339 (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	109.4285	97.3293	104.6364	94.7693	93.7893	86.5890	86.8845	89.1150	88.7598	96.5045	99.6213	108.5811 (65)

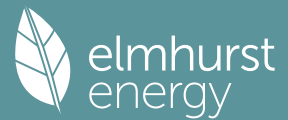
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	117.3127	129.8819	117.3127	121.2231	117.3127	121.2231	117.3127	117.3127	121.2231	117.3127	121.2231	117.3127 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	232.5856	234.9991	228.9171	215.9693	199.6251	184.2638	174.0015	171.5880	177.6699	190.6177	206.9620	222.3233 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197 (71)
Water heating gains (Table 5)	147.0813	144.8353	140.6403	131.6240	126.0609	120.2625	116.7803	119.7782	123.2775	129.7103	138.3629	145.9424 (72)
Total internal gains	561.6120	574.3487	551.5025	533.4488	507.6311	487.3818	469.7269	470.3112	483.8030	502.2732	531.1804	550.2108 (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				7.4800	11.2829		0.6300		0.7000		0.7700	25.7926 (75)
Southeast				11.9700	36.7938		0.6300		0.7000		0.7700	134.5987 (77)
Southwest				2.1900	36.7938		0.6300		0.7000		0.7700	24.6258 (79)
Solar gains	185.0172	323.7200	465.6841	615.1480	723.8321	733.9117	701.1962	617.7718	517.0760	363.9153	223.1682	157.3266 (83)
Total gains	746.6292	898.0688	1017.1866	1148.5969	1231.4632	1221.2935	1170.9231	1088.0831	1000.8789	866.1884	754.3486	707.5374 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	76.9390	77.1896	77.4368	78.6193	78.8446	79.9104	79.9104	80.1110	79.4965	78.8446	78.3902	77.9207
alpha	6.1293	6.1460	6.1625	6.2413	6.2563	6.3274	6.3274	6.3407	6.2998	6.2563	6.2260	6.1947
util living area	0.9861	0.9606	0.9016	0.7567	0.5704	0.3954	0.2839	0.3186	0.5195	0.8236	0.9638	0.9894 (86)
MIT	20.2582	20.4873	20.7237	20.9218	20.9871	20.9989	20.9999	20.9998	20.9944	20.8921	20.5547	20.2212 (87)
Th 2	20.1616	20.1641	20.1665	20.1781	20.1802	20.1903	20.1903	20.1922	20.1864	20.1802	20.1758	20.1713 (88)
util rest of house	0.9821	0.9505	0.8797	0.7177	0.5229	0.3457	0.2317	0.2627	0.4601	0.7817	0.9527	0.9864 (89)
MIT 2	19.3138	19.5995	19.8828	20.1081	20.1708	20.1897	20.1903	20.1921	20.1832	20.0858	19.6960	19.2749 (90)
Living area fraction	19.6393	19.9055	20.1726	20.3885	20.4521	20.4686	20.4693	20.4705	20.4628	20.3637	19.9920	19.6010 (92)
MIT	19.6393	19.9055	20.1726	20.3885	20.4521	20.4686	20.4693	20.4705	20.4628	20.3637	19.9920	19.6010 (93)
Temperature adjustment												0.0000
adjusted MIT	19.6393	19.9055	20.1726	20.3885	20.4521	20.4686	20.4693	20.4705	20.4628	20.3637	19.9920	19.6010 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9790	0.9469	0.8799	0.7280	0.5388	0.3628	0.2497	0.2820	0.4804	0.7917	0.9497	0.9837 (94)
Useful gains	730.9535	850.3794	894.9792	836.2044	663.5408	443.0858	292.4087	306.8040	480.8420	685.7240	716.4401	695.9850 (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	1204.1220	1174.0920	1066.3896	882.5644	670.4294	443.5513	292.4425	306.8760	483.4053	747.9154	993.2717	1193.7346 (97)
Space heating kWh	352.0373	217.5349	127.5294	33.3792	5.1251	0.0000	0.0000	0.0000	0.0000	46.2704	199.3188	370.3256 (98a)
Space heating requirement - total per year (kWh/year)												1351.5208
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	352.0373	217.5349	127.5294	33.3792	5.1251	0.0000	0.0000	0.0000	0.0000	46.2704	199.3188	370.3256 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1351.5208
Space heating per m2										(98c) / (4) =		15.6155 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	352.0373	217.5349	127.5294	33.3792	5.1251	0.0000	0.0000	0.0000	0.0000	46.2704	199.3188	370.3256 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	381.4056	235.6824	138.1683	36.1639	5.5526	0.0000	0.0000	0.0000	0.0000	50.1305	215.9467	401.2195 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	246.6752	218.2642	232.2629	205.2465	199.6402	180.6442	178.8739	185.5819	187.1729	207.8061	219.8390	244.1268 (64)
Efficiency of water heater (217)m	84.8569	84.0523	82.7736	80.9476	80.0029	79.8000	79.8000	79.8000	79.8000	81.3006	83.8407	79.8000 (216)
Fuel for water heating, kWh/month	290.6954	259.6767	280.6003	253.5547	249.5410	226.3712	224.1527	232.5588	234.5525	255.6022	262.2104	287.2365 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	24.3753	19.5547	17.6069	12.8996	9.9640	8.1407	9.0895	11.8149	15.3463	20.1352	22.7427	25.0527 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-16.2649	-24.5487	-37.7432	-45.4833	-51.7567	-49.3008	-48.6912	-44.6026	-37.9045	-29.3615	-18.4433	-13.8791 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-4.8561	-10.5192	-21.4915	-33.1622	-44.7371	-45.2887	-44.7668	-37.5013	-26.9588	-15.3369	-6.5747	-3.8186 (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												1464.2695 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												79.8000
Water heating fuel used												3056.7525 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												86.0000 (231)
Electricity for lighting (calculated in Appendix L)												196.7223 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-712.9918 (233)

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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	4090.7526	(238)

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	1464.2695	0.2100	307.4966 (261)
Total CO ₂ associated with community systems			0.0000 (373)
Water heating (other fuel)	3056.7525	0.2100	641.9180 (264)
Space and water heating			949.4146 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	196.7223	0.1443	28.3931 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-417.9799	0.1332	-55.6707
PV Unit electricity exported	-295.0119	0.1251	-36.9085
Total			-92.5792 (269)
Total CO ₂ , kg/year			897.1578 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.3700 (273)

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

	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year
Space heating - main system 1	1464.2695	1.1300	1654.6246 (275)
Total CO ₂ associated with community systems			0.0000 (473)
Water heating (other fuel)	3056.7525	1.1300	3454.1303 (278)
Space and water heating			5108.7549 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	196.7223	1.5338	301.7393 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-417.9799	1.4922	-623.6962
PV Unit electricity exported	-295.0119	0.4592	-135.4680
Total			-759.1642 (283)
Total Primary energy kWh/year			4781.4308 (286)
Target Primary Energy Rate (TPER)			55.2400 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling	86.5500	2.8000	242.3400
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.5500		
Dwelling volume			242.3400

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1238 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.2738 (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) = 0.2327 (21)
Wind speed	Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 4.7000 (22)
Wind factor	Jan 1.2750 Feb 1.2500 Mar 1.2250 Apr 1.1000 May 1.0750 Jun 0.9500 Jul 0.9500 Aug 0.9250 Sep 1.0000 Oct 1.0750 Nov 1.1250 Dec 1.1750 (22a)
Adj infilt rate	0.2967 0.2909 0.2851 0.2560 0.2502 0.2211 0.2211 0.2153 0.2327 0.2502 0.2618 0.2735 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0.0000 (23c)
Effective ac	0.5440 0.5423 0.5406 0.5328 0.5313 0.5244 0.5244 0.5232 0.5271 0.5313 0.5343 0.5374 (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						
Main dwelling													
Opening Type 1			21.7000	0.8687	18.8514			(27)					
External Wall 1 LG	40.3200	21.7000	18.6200	0.1400	2.6068	190.0000	3537.7997	(29a)					
Total net area of external elements Aum(A, m2)			40.3200					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.4582			(33)					
Main dwelling													
Party Wall 1			67.4800	0.0000	0.0000	180.0000	12146.4006	(32)					
Party Floor 1			86.5500			40.0000	3462.0000	(32d)					
Party Ceiling 1			86.5500			30.0000	2596.5000	(32b)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =		21742.7003 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								251.2155 (35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value	Total							
E2 Other lintels (including other steel lintels)				8.8000	0.0100	0.0880							
E3 Sill				8.8000	0.0200	0.1760							
E4 Jamb				25.0000	0.0150	0.3750							
E7 Party floor between dwellings (in blocks of flats)				14.4000	0.0700	1.0080							
E18 Party wall between dwellings				11.2000	0.0480	0.5376							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								2.1846 (36)					
Point Thermal Bridges						(36a) =	0.0000						
Total fabric heat loss						(33) + (36) + (36a) =	23.6428	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 43.5067	Feb 43.3700	Mar 42.2360	Apr 42.6066	May 42.4888	Jun 41.9406	Jul 41.9406	Aug 41.8391	Sep 42.1518	Oct 42.4888	Nov 42.7270	Dec 42.9761	(38)
Heat transfer coeff	67.1494	67.0127	66.8787	66.2493	66.1316	65.5834	65.5834	65.4819	65.7945	66.1316	66.3698	66.6188	(39)
Average = Sum(39)m / 12 =												66.2487	
HLP	Jan 0.7758	Feb 0.7743	Mar 0.7727	Apr 0.7654	May 0.7641	Jun 0.7578	Jul 0.7578	Aug 0.7566	Sep 0.7602	Oct 0.7641	Nov 0.7668	Dec 0.7697	(40)
HLP (average)												0.7654	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.5755 (42)
Hot water usage for mixer showers													0.0000 (42a)
Hot water usage for baths	29.1084	28.6761	28.0673	26.9449	26.1044	25.1724	24.6690	25.2735	25.9317	26.9290	28.0746	29.0100	(42b)
Hot water usage for other uses	41.0056	39.5145	38.0234	36.5323	35.0412	33.5501	33.5501	35.0412	36.5323	38.0234	39.5145	41.0056	(42c)
Average daily hot water use (litres/day)													64.2659 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	70.1140	68.1906	66.0907	63.4772	61.1456	58.7225	58.2191	60.3147	62.4640	64.9524	67.5891	70.0156	(44)
Energy content (annual)	111.0435	97.1025	101.5790	86.8971	82.3137	72.2061	70.4109	74.6822	77.0244	88.1398	96.2930	109.6276	(45)
Distribution loss (46)m = 0.15 x (45)m													1067.3198
Water storage loss (or HIU loss):													
Total storage 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	(46)
If cylinder contains dedicated solar storage													
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
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	(59)
Total heat required for water heating calculated for each month													
WWHRS	94.3870	82.5372	86.3422	73.8625	69.9666	61.3752	59.8493	63.4799	65.4707	74.9188	81.8491	93.1834	(62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
Output from w/h	94.3870	82.5372	86.3422	73.8625	69.9666	61.3752	59.8493	63.4799	65.4707	74.9188	81.8491	93.1834	(64)
12Total per year (kWh/year)													907.2219 (64)
Electric shower(s)	53.9780	48.0948	52.5177	50.1170	51.0575	48.7039	50.3273	51.0575	50.1170	52.5177	51.5302	53.9780	(64a)
Heat gains from water heating, kWh/month	37.0912	32.6580	34.7150	30.9949	30.2560	27.5198	27.5442	28.6343	28.8969	31.8591	33.3448	36.7904	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	117.3640	129.9388	117.3640	121.2762	117.3640	121.2762	117.3640	117.3640	121.2762	117.3640	121.2762	117.3640	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	232.5856	234.9991	228.9171	215.9693	199.6251	184.2638	174.0015	171.5880	177.6699	190.6177	206.9620	222.3233	(68)
Pumps, fans	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	(69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Water heating gains (Table 5)	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	(71)
Total internal gains	49.8538	48.5982	46.6599	43.0484	40.6667	38.2219	37.0217	38.4870	40.1346	42.8214	46.3122	49.4494	(72)
	461.4358	475.1685	454.5735	441.9263	419.2882	405.3942	390.0196	389.0714	400.7131	412.4356	436.1828	450.7691	(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	
Northeast				7.5000	11.2829	0.4000	0.7000		0.7700		16.4201 (75)	
Southeast				12.0000	36.7938	0.4000	0.7000		0.7700		85.6737 (77)	
Southwest				2.2000	36.7938	0.4000	0.7000		0.7700		15.7068 (79)	
Solar gains	117.8006	206.1121	296.4986	391.6586	460.8542	467.2707	446.4416	393.3282	329.2186	231.7039	142.0912	100.1701 (83)
Total gains	579.2364	681.2806	751.0721	833.5849	880.1424	872.6649	836.4612	782.3996	729.9317	644.1394	578.2740	550.9392 (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	89.9433	90.1268	90.3074	91.1653	91.3276	92.0910	92.0910	92.2338	91.7955	91.3276	90.9998	90.6596
alpha	6.9962	7.0085	7.0205	7.0777	7.0885	7.1394	7.1394	7.1489	7.1197	7.0885	7.0667	7.0440
util living area	0.9952	0.9849	0.9570	0.8584	0.6812	0.4796	0.3449	0.3847	0.6138	0.9031	0.9859	0.9965 (86)
MIT	20.2787	20.4599	20.6676	20.8859	20.9795	20.9984	20.9999	20.9997	20.9921	20.8593	20.5327	20.2444 (87)
Th 2	20.2743	20.2757	20.2770	20.2834	20.2846	20.2901	20.2901	20.2911	20.2880	20.2846	20.2822	20.2797 (88)
util rest of house	0.9938	0.9806	0.9454	0.8282	0.6345	0.4271	0.2893	0.3256	0.5539	0.8738	0.9812	0.9955 (89)
MIT 2	19.6164	19.7960	19.9971	20.1988	20.2723	20.2894	20.2901	20.2910	20.2842	20.1816	19.8744	19.5869 (90)
Living area fraction	19.8447	20.0248	20.2282	20.4356	20.5160	20.5338	20.5347	20.5353	20.5282	20.4152	20.1013	19.8135 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8447	20.0248	20.2282	20.4356	20.5160	20.5338	20.5347	20.5353	20.5282	20.4152	20.1013	19.8135 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9927	0.9789	0.9445	0.8350	0.6499	0.4452	0.3085	0.3460	0.5744	0.8797	0.9797	0.9946 (94)
Useful gains	575.0116	666.8830	709.3780	696.0414	572.0030	388.4819	258.0109	270.6972	419.2407	566.6492	566.5346	547.9741 (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	1043.8154	1013.5557	918.1234	764.2251	583.0170	389.1586	258.0512	270.7871	422.9383	649.0948	862.8924	1040.1523 (97)
Space heating kWh	348.7901	232.9640	155.3066	49.0923	8.1943	0.0000	0.0000	0.0000	0.0000	61.3395	213.3776	366.1806 (98a)
Space heating requirement - total per year (kWh/year)												1435.2451
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	348.7901	232.9640	155.3066	49.0923	8.1943	0.0000	0.0000	0.0000	0.0000	61.3395	213.3776	366.1806 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1435.2451
Space heating per m2										(98c) / (4) =		16.5828 (99)

8c. Space cooling requirement

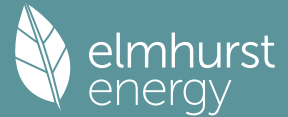
Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	616.4836	485.3169	497.6621	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9857	0.9955	0.9922	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	607.6405	483.1324	493.7798	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	974.2102	934.1745	873.2838	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	263.9301	335.5753	282.3510	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	65.9825	83.8938	70.5877	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												220.4641 (107)
Energy for space heating												16.5828 (99)
Energy for space cooling												2.5472 (108)
Total												19.1301 (109)
Fabric Energy Efficiency (DFEE)												19.1 (109)

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

1. Overall dwelling characteristics

Main dwelling	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	86.5500 (1b)	x 2.8000 (2b)	= 242.3400 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.5500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	242.3400 (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										3 * 10 =	30.0000 (7a)	
Number of passive vents										0 * 10 =	0.0000 (7b)	
Number of flueless gas fires										0 * 40 =	0.0000 (7c)	
										Air changes per hour		
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =									30.0000 / (5) =	0.1238 (8)	
Pressure test											Yes	
Pressure Test Method											Blower Door	
Measured/design AP50											5.0000 (17)	
Infiltration rate											0.3738 (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) = 0.3177 (21)	

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4051	0.3972	0.3892	0.3495	0.3416	0.3018	0.3018	0.2939	0.3177	0.3416	0.3574	0.3733	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													0.0000 (23c)
Effective ac	0.5821	0.5789	0.5757	0.5611	0.5583	0.5456	0.5456	0.5432	0.5505	0.5583	0.5639	0.5697	(25)

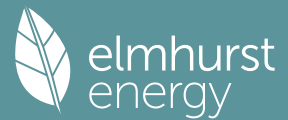
3. Heat losses and heat loss parameter

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						
Main dwelling													
TER Opening Type			21.6400	1.1450	24.7786			(27)					
External Wall 1 LG	40.3200	21.6400	18.6800	0.1800	3.3624			(29a)					
Total net area of external elements Aum(A, m2)			40.3200					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		28.1410			(33)					
Main dwelling													
Party Wall 1			67.4800	0.0000	0.0000			(32)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							251.2155	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value	Total							
E2 Other lintels (including other steel lintels)				8.8000	0.0500	0.4400							
E3 Sill				8.8000	0.0500	0.4400							
E4 Jamb				25.0000	0.0500	1.2500							
E7 Party floor between dwellings (in blocks of flats)				14.4000	0.0700	1.0080							
E18 Party wall between dwellings				11.2000	0.0600	0.6720							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.8100	(36)					
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss						(33) + (36) + (36a) =	31.9510	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	46.5480	46.2932	46.0434	44.8703	44.6508	43.6291	43.6291	43.4399	44.0226	44.6508	45.0948	45.5590	(38)
Average = Sum(39)m / 12 =	78.4990	78.2442	77.9945	76.8213	76.6019	75.5801	75.5801	75.3909	75.9737	76.6019	77.0459	77.5101	(39)
												76.8203	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9070	0.9040	0.9011	0.8876	0.8851	0.8733	0.8733	0.8711	0.8778	0.8851	0.8902	0.8956	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.5755 (42)
Hot water usage for mixer showers													0.0000 (42a)
Hot water usage for baths	29.1084	28.6761	28.0673	26.9449	26.1044	25.1724	24.6690	25.2735	25.9317	26.9290	28.0746	29.0100	(42b)
Hot water usage for other uses	41.0056	39.5145	38.0234	36.5323	35.0412	33.5501	33.5501	35.0412	36.5323	38.0234	39.5145	41.0056	(42c)
Average daily hot water use (litres/day)													64.2659 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	70.1140	68.1906	66.0907	63.4772	61.1456	58.7225	58.2191	60.3147	62.4640	64.9524	67.5891	70.0156	(44)
Energy content (annual)	111.0435	97.1025	101.5790	86.8971	82.3137	72.2061	70.4109	74.6822	77.0244	88.1398	96.2930	109.6276	(45)
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 1067.3198
Water storage loss (or HIU 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	(46)
Total storage 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	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	94.3870	82.5372	86.3422	73.8625	69.9666	61.3752	59.8493	63.4799	65.4707	74.9188	81.8491	93.1834	(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													

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	94.3870	82.5372	86.3422	73.8625	69.9666	61.3752	59.8493	63.4799	65.4707	74.9188	81.8491	93.1834 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											907.2219 (64)
Electric shower(s)	53.9780	48.0948	52.5177	50.1170	51.0575	48.7039	50.3273	51.0575	50.1170	52.5177	51.5302	53.9780 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											613.9966 (64a)
Heat gains from water heating, kWh/month	37.0912	32.6580	34.7150	30.9949	30.2560	27.5198	27.5442	28.6343	28.8969	31.8591	33.3448	36.7904 (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	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	117.3127	129.8819	117.3127	121.2231	117.3127	121.2231	117.3127	117.3127	121.2231	117.3127	121.2231	117.3127 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	232.5856	234.9991	228.9171	215.9693	199.6251	184.2638	174.0015	171.5880	177.6699	190.6177	206.9620	222.3233 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775 (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)	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197 (71)
Water heating gains (Table 5)	49.8538	48.5982	46.6599	43.0484	40.6667	38.2219	37.0217	38.4870	40.1346	42.8214	46.3122	49.4494 (72)
Total internal gains	461.3845	475.1116	454.5221	441.8733	419.2369	405.3412	389.9683	389.0201	400.6601	412.3842	436.1298	450.7178 (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					7.4800	11.2829		0.6300	0.7000	0.7700		25.7926 (75)				
Southeast					11.9700	36.7938		0.6300	0.7000	0.7700		134.5987 (77)				
Southwest					2.1900	36.7938		0.6300	0.7000	0.7700		24.6258 (79)				
Solar gains					185.0172	323.7200	465.6841	615.1480	723.8321	733.9117	701.1962	617.7718	517.0760	363.9153	223.1682	157.3266 (83)
Total gains					646.4017	798.8317	920.2062	1057.0213	1143.0690	1139.2529	1091.1645	1006.7919	917.7361	776.2995	659.2979	608.0444 (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	76.9390	77.1896	77.4368	78.6193	78.8446	79.9104	79.9104	80.1110	79.4965	78.8446	78.3902	77.9207
alpha	6.1293	6.1460	6.1625	6.2413	6.2563	6.3274	6.3274	6.3407	6.2998	6.2563	6.2260	6.1947
util living area	0.9933	0.9768	0.9322	0.8009	0.6106	0.4235	0.3047	0.3442	0.5639	0.8731	0.9807	0.9952 (86)
MIT	20.1367	20.3809	20.6471	20.8925	20.9813	20.9984	20.9998	20.9997	20.9913	20.8459	20.4505	20.0984 (87)
Th 2	20.1616	20.1641	20.1665	20.1781	20.1802	20.1903	20.1903	20.1922	20.1864	20.1802	20.1758	20.1713 (88)
util rest of house	0.9913	0.9704	0.9151	0.7637	0.5610	0.3704	0.2487	0.2839	0.5005	0.8368	0.9741	0.9937 (89)
MIT 2	19.3815	19.6227	19.8773	20.1014	20.1694	20.1896	20.1903	20.1921	20.1824	20.0710	19.7030	19.3516 (90)
Living area fraction	19.6418	19.8840	20.1427	20.3740	20.4493	20.4684	20.4693	20.4704	20.4612	20.3381	19.9606	19.6090 (92)
MIT	19.6418	19.8840	20.1427	20.3740	20.4493	20.4684	20.4693	20.4704	20.4612	20.3381	19.9606	19.6090 (93)
Temperature adjustment	19.6418	19.8840	20.1427	20.3740	20.4493	20.4684	20.4693	20.4704	20.4612	20.3381	19.9606	19.6090 (93)
adjusted MIT	19.6418	19.8840	20.1427	20.3740	20.4493	20.4684	20.4693	20.4704	20.4612	20.3381	19.9606	19.6090 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	639.7161	773.0909	841.6030	817.0435	660.1782	442.8400	292.3892	306.7578	479.2202	655.5191	640.8662	603.4519 (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	1204.3152	1172.4146	1064.0513	881.4516	670.2103	443.5332	292.4407	306.8719	483.2836	745.9560	990.8563	1194.3496 (97)
Space heating kWh	420.0617	268.3455	165.5015	46.3738	7.4639	0.0000	0.0000	0.0000	0.0000	67.2850	251.9928	439.6279 (98a)
Space heating requirement - total per year (kWh/year)	420.0617	268.3455	165.5015	46.3738	7.4639	0.0000	0.0000	0.0000	0.0000	67.2850	251.9928	1666.6522
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Space heating kWh	420.0617	268.3455	165.5015	46.3738	7.4639	0.0000	0.0000	0.0000	0.0000	67.2850	251.9928	439.6279 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	420.0617	268.3455	165.5015	46.3738	7.4639	0.0000	0.0000	0.0000	0.0000	67.2850	251.9928	1666.6522
Space heating per m2	(98c) / (4) =											19.2565 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	710.4530	559.2928	572.9708	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9894	0.9963	0.9935	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	702.9078	557.2216	569.2367	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1285.8641	1231.9348	1135.6143	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	419.7285	501.9866	421.3849	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fc = cooled area / (4) =											1.0000 (105)
Intermittency factor (Table 10b)												

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Space cooling kWh	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling requirement	0.0000	0.0000	0.0000	0.0000	0.0000	104.9321	125.4966	105.3462	0.0000	0.0000	0.0000	0.0000 (107)
Energy for space heating												335.7750 (107)
Energy for space cooling												19.2565 (99)
Total												3.8795 (108)
Fabric Energy Efficiency (TFEE)												23.1361 (109)
												23.1 (109)

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

1. Overall dwelling characteristics

Main dwelling	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	86.5500 (1b)	2.8000 (2b)	242.3400 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.5500		242.3400 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 242.3400 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.1500 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1275 (21)

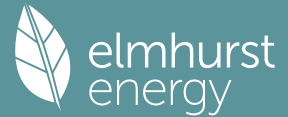
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infiltr rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												72.0000 (23c)
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Opening Type 1			21.7000	0.8687	18.8514		(27)
External Wall 1 LG	40.3200	21.7000	18.6200	0.1400	2.6068	190.0000	3537.7997 (29a)
Total net area of external elements Aum(A, m ²)			40.3200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.4582		(33)
Main dwelling							
Party Wall 1			67.4800	0.0000	0.0000	180.0000	12146.4006 (32)
Party Floor 1			86.5500			40.0000	3462.0000 (32d)
Party Ceiling 1			86.5500			30.0000	2596.5000 (32b)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 21742.7003 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							251.2155 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				8.8000	0.0100	0.0880	
E3 Sill				8.8000	0.0200	0.1760	
E4 Jamb				25.0000	0.0150	0.3750	
E7 Party floor between dwellings (in blocks of flats)				14.4000	0.0700	1.0080	
E18 Party wall between dwellings				11.2000	0.0480	0.5376	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							2.1846 (36)
Point Thermal Bridges							0.0000
Total fabric heat loss							(33) + (36) + (36a) = 23.6428 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	24.1966	23.9417	23.6868	22.4122	22.1573	20.8827	20.8827	20.6278	21.3926	22.1573	22.6671	23.1769 (38)
Average = Sum(39)m / 12 =	47.8393	47.5844	47.3295	46.0550	45.8000	44.5255	44.5255	44.2706	45.0353	45.8000	46.3099	46.8197 (39)
	45.9912											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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HLP	0.5527	0.5498	0.5468	0.5321	0.5292	0.5144	0.5144	0.5115	0.5203	0.5292	0.5351	0.5410 (40)
HLP (average)												0.5314
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5755 (42)
Hot water usage for mixer showers												0.0000 (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	77.7288	76.5745	74.9488	71.9515	69.7071	67.2185	65.8742	67.4885	69.2461	71.9090	74.9681	77.4661 (42c)
Average daily hot water use (litres/day)	41.0056	39.5145	38.0234	36.5323	35.0412	33.5501	33.5501	35.0412	36.5323	38.0234	39.5145	41.0056 (43)
												109.3447 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	118.7345	116.0890	112.9722	108.4838	104.7483	100.7685	99.4243	102.5297	105.7784	109.9324	114.4826	118.4717 (44)
Energy content (annual)	188.0464	165.3091	173.6341	148.5089	141.0114	123.9067	120.2451	126.9531	130.4353	149.1773	163.1015	185.4980 (45)
Distribution loss (46)m = 0.15 x (45)m	28.2070	24.7964	26.0451	22.2763	21.1517	18.5860	18.0368	19.0430	19.5653	22.3766	24.4652	27.8247 (46)
Water storage loss (or HIU loss):												300.0000 (47)
Store volume												2.1100 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.7800 (49)
Temperature factor from Table 2b												1.6458 (55)
Enter (49) or (54) in (55)												
Total storage loss	51.0198	46.0824	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	49.3740	51.0198	49.3740	51.0198 (56)
If cylinder contains dedicated solar storage	51.0198	46.0824	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	49.3740	51.0198	49.3740	51.0198 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	262.3286	232.4027	247.9163	220.3949	215.2936	195.7927	194.5273	201.2353	202.3213	223.4595	234.9875	259.7802 (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	262.3286	232.4027	247.9163	220.3949	215.2936	195.7927	194.5273	201.2353	202.3213	223.4595	234.9875	259.7802 (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	121.9512	108.6402	117.1591	106.8880	106.3120	98.7078	99.4072	101.6377	100.8785	109.0272	111.7400	121.1039 (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	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.6334	21.8792	17.7933	13.4707	10.0695	8.5011	9.1857	11.9400	16.0258	20.3484	23.7496	25.3180 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	347.1426	350.7449	341.6673	322.3423	297.9479	275.0205	259.7037	256.1014	265.1790	284.5041	308.8985	331.8258 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285 (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)	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197 (71)
Water heating gains (Table 5)	163.9129	161.6669	157.4719	148.4556	142.8925	137.0941	133.6119	136.6098	140.1091	146.5419	155.1945	162.7740 (72)
Total internal gains	640.2272	638.8293	621.4709	588.8068	555.4482	525.1541	507.0396	509.1895	525.8522	555.9327	592.3809	624.4561 (73)

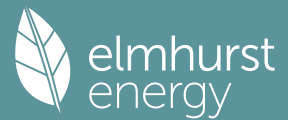
6. Solar gains

[Jan]			Area	Solar flux	g	FF	Access	Gains				
			m2	Table 6a	Specific data	Specific data	factor	W				
				W/m2	or Table 6b	or Table 6c	Table 6d					
Northeast			7.5000	11.2829	0.4000	0.7000	0.7700	16.4201 (75)				
Southeast			12.0000	36.7938	0.4000	0.7000	0.7700	85.6737 (77)				
Southwest			2.2000	36.7938	0.4000	0.7000	0.7700	15.7068 (79)				
Solar gains	117.8006	206.1121	296.4986	391.6586	460.8542	467.2707	446.4416	393.3282	329.2186	231.7039	142.0912	100.1701 (83)
Total gains	758.0278	844.9414	917.9695	980.4654	1016.3023	992.4247	953.4813	902.5176	855.0708	787.6366	734.4721	724.6262 (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	126.2484	126.9247	127.6083	131.1398	131.8697	135.6445	135.6445	136.4256	134.1090	131.8697	130.4180	128.9978
alpha	9.4166	9.4616	9.5072	9.7427	9.7913	10.0430	10.0430	10.0950	9.9406	9.7913	9.6945	9.5999
util living area	0.9260	0.8545	0.7351	0.5674	0.4191	0.2871	0.2055	0.2256	0.3634	0.6030	0.8365	0.9383 (86)
MIT	20.8658	20.9389	20.9841	20.9986	20.9999	21.0000	21.0000	21.0000	21.0000	20.9981	20.9593	20.8521 (87)
Th 2	20.4727	20.4754	20.4781	20.4915	20.4942	20.5076	20.5076	20.5103	20.5022	20.4942	20.4888	20.4834 (88)
util rest of house	0.9130	0.8354	0.7115	0.5438	0.3963	0.2650	0.1825	0.2016	0.3372	0.5742	0.8138	0.9269 (89)
MIT 2	20.3278	20.4127	20.4630	20.4903	20.4941	20.5076	20.5076	20.5103	20.5022	20.4926	20.4490	20.3220 (90)
Living area fraction												0.3447 (91)
MIT	20.5132	20.5940	20.6426	20.6655	20.6684	20.6773	20.6773	20.6791	20.6738	20.6668	20.6249	20.5047 (92)

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Temperature adjustment												0.0000
adjusted MIT	20.5132	20.5940	20.6426	20.6655	20.6684	20.6773	20.6773	20.6791	20.6738	20.6668	20.6249	20.5047 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9140	0.8398	0.7190	0.5519	0.4041	0.2727	0.1904	0.2099	0.3462	0.5841	0.8200	0.9275	(94)
Useful gains	692.8647	709.6052	660.0244	541.1083	410.7208	270.5949	181.5444	189.4373	296.0470	460.0486	602.2610	672.0548	(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	775.6284	746.7918	669.3632	541.8601	410.7552	270.5953	181.5444	189.4373	296.0521	461.0616	626.3344	763.3808	(97)
Space heating kWh	61.5762	24.9894	6.9480	0.5413	0.0256	0.0000	0.0000	0.0000	0.0000	0.7537	17.3328	67.9465	(98a)
Space heating requirement - total per year (kWh/year)												180.1136	
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	61.5762	24.9894	6.9480	0.5413	0.0256	0.0000	0.0000	0.0000	0.0000	0.7537	17.3328	67.9465	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												180.1136	
Space heating per m2												(98c) / (4) =	2.0810 (99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(301)
Fraction of space heat from community system												1.0000	(302)
Fraction of heat from community Boilers-Space and Water												1.0000	(303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000	(305)
Factor for charging method (Table 4c(3)) for water heating												1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system												1.1500	(306)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating:													
Space heating requirement	61.5762	24.9894	6.9480	0.5413	0.0256	0.0000	0.0000	0.0000	0.0000	0.7537	17.3328	67.9465	(98)
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.15													
307a	70.8126	28.7378	7.9902	0.6225	0.0294	0.0000	0.0000	0.0000	0.0000	0.8668	19.9328	78.1385	
Space heating requirement	70.8126	28.7378	7.9902	0.6225	0.0294	0.0000	0.0000	0.0000	0.0000	0.8668	19.9328	78.1385	(307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(309)
Water heating													
Annual water heating requirement	262.3286	232.4027	247.9163	220.3949	215.2936	195.7927	194.5273	201.2353	202.3213	223.4595	234.9875	259.7802	(64)
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.15													
310a	301.6779	267.2632	285.1038	253.4541	247.5876	225.1616	223.7064	231.4206	232.6695	256.9784	270.2356	298.7473	
Water heating fuel	301.6779	267.2632	285.1038	253.4541	247.5876	225.1616	223.7064	231.4206	232.6695	256.9784	270.2356	298.7473	(310)
Cooling System Energy Efficiency Ratio												0.0000	(314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(315)
Pumps and Fa	14.3632	12.9732	14.3632	13.8998	14.3632	13.8998	14.3632	14.3632	13.8998	14.3632	13.8998	14.3632	(331)
Lighting	21.5615	17.2974	15.5744	11.4105	8.8138	7.2009	8.0402	10.4510	13.5748	17.8109	20.1173	22.1607	(332)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335b)
Annual totals kWh/year													
Space heating fuel - community heating												207.1306	(307)
Space heating fuel - secondary												0.0000	(309)
Water heating fuel - community heating												3094.0058	(310)
Efficiency of water heater												0.0000	(311)
Electricity used for heat distribution												2.0713	(313)
Space cooling fuel												0.0000	(321)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)													
mechanical ventilation fans (SFP = 0.5720)												169.1145	(330a)
Total electricity for the above, kWh/year												169.1145	(331)
Electricity for lighting (calculated in Appendix L)												174.0133	(332)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(333)
Wind generation												0.0000	(334)
Hydro-electric generation (Appendix N)												0.0000	(335a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(335)
Appendix Q - special features													
Energy saved or generated												-0.0000	(336)
Energy used												0.0000	(337)
Total delivered energy for all uses												3644.2643	(338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	207.1306	4.4400	9.1966	(340a)
Space heating total			9.1966	(340)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	3094.0058	4.4400	137.3739	(342a)
Water heating total			137.3739	(342)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(347a)
Pumps, fans and electric keep-hot	169.1145	16.4900	27.8870	(349)
Energy for lighting	174.0133	16.4900	28.6948	(350)

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Additional standing charges 92.0000 (351)
Total energy cost 295.1522 (355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12): 0.3600 (356)
Energy cost factor (ECF) $[(255) \times (256)] / [(4) + 45.0] =$ 0.8077 (357)
SAP value 86.9070
SAP rating (Section 12) 87 (358)
SAP band B

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			89.5000 (367)
Space and Water heating from Boilers	3688.4206	0.2100	48.6005 (367)
Electrical energy for heat distribution (space & water)	2.0713	0.0000	4.6841 (372)
Overall CO2 factor for heat network			0.2361 (386)
Total CO2 associated with community systems			779.2524 (373)
Space and water heating			779.2524 (376)
Pumps, fans and electric keep-hot	169.1145	0.1387	23.4583 (378)
Energy for lighting	174.0133	0.1443	25.1155 (379)
Total CO2, kg/year			827.8262 (383)
CO2 emissions per m2			9.5600 (384)
EI value			91.5676 (384a)
EI rating			92 (385)
EI band			A

SAP 10 WORKSHEET FOR New Build (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)
Main dwelling	86.5500 (1b)	x 2.8000 (2b)	= 242.3400 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.5500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	242.3400 (5)

2. Ventilation rate

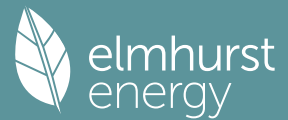
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.1339	0.1275	0.1275	0.1179	0.1179	0.1052	0.1084	0.1020	0.1052	0.1116	0.1116	0.1211 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												72.0000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2739	0.2675	0.2675	0.2579	0.2579	0.2452	0.2484	0.2420	0.2452	0.2516	0.2516	0.2611 (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
Main dwelling							
Opening Type 1			21.7000	0.8687	18.8514		(27)
External Wall 1 LG	40.3200	21.7000	18.6200	0.1400	2.6068	190.0000	3537.7997 (29a)
Total net area of external elements Aum(A, m2)			40.3200				(31)

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Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =					21.4582	(33)						
Main dwelling													
Party Wall 1	67.4800	0.0000	0.0000	180.0000	12146.4006	(32)							
Party Floor 1	86.5500			40.0000	3462.0000	(32d)							
Party Ceiling 1	86.5500			30.0000	2596.5000	(32b)							
Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =					21742.7003	(34)						
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K						251.2155	(35)						
List of Thermal Bridges													
K1 Element	Length	Psi-value	Total										
E2 Other lintels (including other steel lintels)	8.8000	0.0100	0.0880										
E3 Sill	8.8000	0.0200	0.1760										
E4 Jamb	25.0000	0.0150	0.3750										
E7 Party floor between dwellings (in blocks of flats)	14.4000	0.0700	1.0080										
E18 Party wall between dwellings	11.2000	0.0480	0.5376										
Thermal bridges (Sum(L x Psi) calculated using Appendix K)						2.1846	(36)						
Point Thermal bridges						0.0000	(36a) =						
Total fabric heat loss	(33) + (36) + (36a) =					23.6428	(37)						
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	21.9024	21.3926	21.3926	20.6278	20.6278	19.6082	19.8631	19.3533	19.6082	20.1180	20.1180	20.8827	(38)
Average = Sum(39)m / 12 =	45.5451	45.0353	45.0353	44.2706	44.2706	43.2509	43.5058	42.9960	43.2509	43.7608	43.7608	44.5255	(39)
												44.1006	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP (average)	0.5262	0.5203	0.5203	0.5115	0.5115	0.4997	0.5027	0.4968	0.4997	0.5056	0.5056	0.5144	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5755	(42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	77.7288	76.5745	74.9488	71.9515	69.7071	67.2185	65.8742	67.4885	69.2461	71.9090	74.9681	77.4661	(42b)
Hot water usage for other uses	41.0056	39.5145	38.0234	36.5323	35.0412	33.5501	33.5501	35.0412	36.5323	38.0234	39.5145	41.0056	(42c)
Average daily hot water use (litres/day)												109.3447	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	118.7345	116.0890	112.9722	108.4838	104.7483	100.7685	99.4243	102.5297	105.7784	109.9324	114.4826	118.4717	(44)
Energy content (annual)	188.0464	165.3091	173.6341	148.5089	141.0114	123.9067	120.2451	126.9531	130.4353	149.1773	163.1015	185.4980	(45)
Distribution loss (46)m = 0.15 x (45)m	28.2070	24.7964	26.0451	22.2763	21.1517	18.5860	18.0368	19.0430	19.5653	22.3766	24.4652	27.8247	(46)
Water storage loss (or HIU loss):												300.0000	(47)
Store volume												2.1100	(48)
a) If manufacturer declared loss factor is known (kWh/day):												0.7800	(49)
Temperature factor from Table 2b												1.6458	(55)
Enter (49) or (54) in (55)													
Total storage loss	51.0198	46.0824	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	49.3740	51.0198	49.3740	51.0198	(56)
If cylinder contains dedicated solar storage	51.0198	46.0824	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	49.3740	51.0198	49.3740	51.0198	(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	262.3286	232.4027	247.9163	220.3949	215.2936	195.7927	194.5273	201.2353	202.3213	223.4595	234.9875	259.7802	(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	262.3286	232.4027	247.9163	220.3949	215.2936	195.7927	194.5273	201.2353	202.3213	223.4595	234.9875	259.7802	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains from water heating, kWh/month	121.9512	108.6402	117.1591	106.8880	106.3120	98.7078	99.4072	101.6377	100.8785	109.0272	111.7400	121.1039	(65)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)

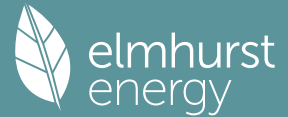
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.6334	21.8792	17.7933	13.4707	10.0695	8.5011	9.1857	11.9400	16.0258	20.3484	23.7496	25.3180	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	347.1426	350.7449	341.6673	322.3423	297.9479	275.0205	259.7037	256.1014	265.1790	284.5041	308.8985	331.8258	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	(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)	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	(71)
Water heating gains (Table 5)	163.9129	161.6669	157.4719	148.4556	142.8925	137.0941	133.6119	136.6098	140.1091	146.5419	155.1945	162.7740	(72)
Total internal gains	640.2272	638.8293	621.4709	588.8068	555.4482	525.1541	507.0396	509.1895	525.8522	555.9327	592.3809	624.4561	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.5000	12.9236	0.4000	0.7000	0.7700	18.8077	(75)

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Southeast			12.0000		40.4699		0.4000		0.7000		0.7700		94.2334 (77)
Southwest			2.2000		40.4699		0.4000		0.7000		0.7700		17.2761 (79)

Solar gains	130.3172	205.5008	293.1727	401.3739	462.0601	502.1644	474.2797	425.9361	353.6318	246.9634	161.0937	109.7130	(83)
Total gains	770.5444	844.3301	914.6436	990.1808	1017.5083	1027.3185	981.3193	935.1256	879.4840	802.8962	753.4746	734.1691	(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	132.6078	134.1090	134.1090	136.4256	136.4256	139.6418	138.8236	140.4697	139.6418	138.0150	138.0150	135.6445	
alpha	9.8405	9.9406	9.9406	10.0950	10.0950	10.3095	10.2549	10.3646	10.3095	10.2010	10.2010	10.0430	
util living area	0.8771	0.7979	0.6655	0.4961	0.3481	0.2105	0.1374	0.1471	0.2852	0.5121	0.7440	0.8920	(86)
MIT	20.9328	20.9724	20.9947	20.9997	21.0000	21.0000	21.0000	21.0000	21.0000	20.9997	20.9884	20.9260	(87)
Th 2	20.4968	20.5022	20.5022	20.5103	20.5103	20.5211	20.5184	20.5238	20.5211	20.5157	20.5157	20.5076	(88)
util rest of house	0.8595	0.7768	0.6422	0.4742	0.3268	0.1903	0.1161	0.1252	0.2617	0.4858	0.7190	0.8756	(89)
MIT 2	20.4272	20.4749	20.4974	20.5101	20.5103	20.5211	20.5184	20.5238	20.5211	20.5155	20.5050	20.4303	(90)
Living area fraction									fLA = Living area / (4) =			0.3447	(91)
MIT	20.6015	20.6464	20.6688	20.6788	20.6791	20.6861	20.6844	20.6879	20.6861	20.6824	20.6716	20.6012	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6015	20.6464	20.6688	20.6788	20.6791	20.6861	20.6844	20.6879	20.6861	20.6824	20.6716	20.6012	(93)

8. Space heating requirement													

Utilisation	0.8633	0.7830	0.6500	0.4818	0.3341	0.1973	0.1234	0.1328	0.2698	0.4948	0.7272	0.8789	(94)
Useful gains	665.1970	661.1031	594.5250	477.0288	339.9535	202.6803	121.1368	124.1690	237.2808	397.2968	547.8897	645.2314	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	706.0172	677.6173	597.5641	477.1847	339.9570	202.6803	121.1368	124.1690	237.2810	397.4508	554.5205	690.1969	(97)
Space heating kWh	30.3702	11.0976	2.2611	0.1122	0.0026	0.0000	0.0000	0.0000	0.0000	0.1146	4.7742	33.4543	(98a)
Space heating requirement - total per year (kWh/year)												82.1869	
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	30.3702	11.0976	2.2611	0.1122	0.0026	0.0000	0.0000	0.0000	0.0000	0.1146	4.7742	33.4543	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												82.1869	
Space heating per m2										(98c) / (4) =		0.9496	(99)

9b. Energy requirements													

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (301)
Fraction of space heat from community system													1.0000 (302)
Fraction of heat from community Boilers-Space and Water													1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating													1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating													1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system													1.1500 (306)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating:													
Space heating requirement	30.3702	11.0976	2.2611	0.1122	0.0026	0.0000	0.0000	0.0000	0.0000	0.1146	4.7742	33.4543	(98)
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.15													
307a	34.9258	12.7622	2.6003	0.1291	0.0030	0.0000	0.0000	0.0000	0.0000	0.1318	5.4903	38.4724	
Space heating requirement	34.9258	12.7622	2.6003	0.1291	0.0030	0.0000	0.0000	0.0000	0.0000	0.1318	5.4903	38.4724	(307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(309)

Water heating													
Annual water heating requirement	262.3286	232.4027	247.9163	220.3949	215.2936	195.7927	194.5273	201.2353	202.3213	223.4595	234.9875	259.7802	(64)
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.15													
310a	301.6779	267.2632	285.1038	253.4541	247.5876	225.1616	223.7064	231.4206	232.6695	256.9784	270.2356	298.7473	
Water heating fuel	301.6779	267.2632	285.1038	253.4541	247.5876	225.1616	223.7064	231.4206	232.6695	256.9784	270.2356	298.7473	(310)
Cooling System Energy Efficiency Ratio												0.0000	(314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(315)
Pumps and Fa	14.3632	12.9732	14.3632	13.8998	14.3632	13.8998	14.3632	14.3632	13.8998	14.3632	13.8998	14.3632	(331)
Lighting	21.5615	17.2974	15.5744	11.4105	8.8138	7.2009	8.0402	10.4510	13.5748	17.8109	20.1173	22.1607	(332)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335b)
Annual totals kWh/year													
Space heating fuel - community heating												94.5149	(307)
Space heating fuel - secondary												0.0000	(309)
Water heating fuel - community heating												3094.0058	(310)
Efficiency of water heater												0.0000	(311)
Electricity used for heat distribution												0.9451	(313)
Space cooling fuel												0.0000	(321)

Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)													
mechanical ventilation fans (SFP = 0.5720)													169.1145 (330a)
Total electricity for the above, kWh/year													169.1145 (331)
Electricity for lighting (calculated in Appendix L)													174.0133 (332)

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

PV generation	0.0000 (333)
Wind generation	0.0000 (334)
Hydro-electric generation (Appendix N)	0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (335)
Appendix Q - special features	
Energy saved or generated	-0.0000 (336)
Energy used	0.0000 (337)
Total delivered energy for all uses	3531.6486 (338)

10b. Fuel costs - using BEDF prices (597)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating from Boilers	94.5149	7.3200	6.9185 (340a)
Space heating total			6.9185 (340)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	0.0000	0.0000	0.0000 (341)
Water heating from Boilers	3094.0058	7.3200	226.4812 (342a)
Water heating total			226.4812 (342)
Energy for instantaneous electric shower(s)	0.0000	27.6700	0.0000 (347a)
Pumps, fans and electric keep-hot	169.1145	27.6700	46.7940 (349)
Energy for lighting	174.0133	27.6700	48.1495 (350)
Additional standing charges			108.0000 (351)
Total energy cost			436.3432 (355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			89.5000 (367)
Space and Water heating from Boilers	3562.5930	0.2100	22.1767 (367)
Electrical energy for heat distribution (space & water)	0.9451	0.0000	4.5036 (372)
Overall CO2 factor for heat network			0.2360 (386)
Total CO2 associated with community systems			752.6481 (373)
Space and water heating			752.6481 (376)
Pumps, fans and electric keep-hot	169.1145	0.1387	23.4583 (378)
Energy for lighting	174.0133	0.1443	25.1155 (379)
Total CO2, kg/year			801.2219 (383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Boilers			89.5000 (467a)
Space and Water heating from Boilers	3562.5930	1.1300	119.3317 (467)
Electrical energy for heat distribution (space & water)	0.9451	0.0000	48.5378 (472)
Overall CO2 factor for heat network			1.2778 (486)
Total CO2 associated with community systems			4074.2679 (473)
Space and water heating			4074.2679 (476)
Pumps, fans and electric keep-hot	169.1145	1.5128	255.8365 (478)
Energy for lighting	174.0133	1.5338	266.9074 (479)
Total Primary energy kWh/year			4597.0119 (483)

SAP 10 EPC IMPROVEMENTS

00001

Current energy efficiency rating:	B 87
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: (none)	SAP change	Cost change	CO2 change
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Recommended measures (none)	Typical annual savings		Energy efficiency	Environmental impact
	Total Savings	£0	0.00 kg/m²	

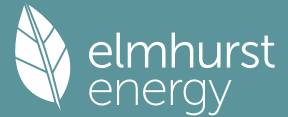
Potential energy efficiency rating:	B 87
Potential environmental impact rating:	A 92

Fuel prices for cost data on this page from database revision number 597 TEST (31 Jul 2026)
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	£95	£95	£0
Community scheme	£341	£341	£0
Space heating	£162	£162	£0
Water heating	£226	£226	£0
Lighting	£48	£48	£0
Total cost of fuels	£436	£436	£0
Total cost of uses	£436	£436	£0
Delivered energy	41 kWh/m²	41 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes

Full SAP Calculation Printout



CO2 emissions per m² 9 kg/m² 9 kg/m² 0 kg/m²
Primary energy 53 kWh/m² 53 kWh/m² 0 kWh/m²

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling	86.5500 (1b)	x 2.8000 (2b)	= 242.3400 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.5500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 242.3400 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.1500 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1275 (21)

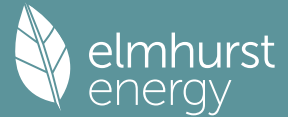
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												72.0000 (23c)
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Opening Type 1			21.7000	0.8687	18.8514		(27)
External Wall 1 LG	40.3200	21.7000	18.6200	0.1400	2.6068	190.0000	3537.7997 (29a)
Total net area of external elements Aum(A, m ²)			40.3200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.4582		(33)
Main dwelling							
Party Wall 1			67.4800	0.0000	0.0000	180.0000	12146.4006 (32)
Party Floor 1			86.5500			40.0000	3462.0000 (32d)
Party Ceiling 1			86.5500			30.0000	2596.5000 (32b)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	21742.7003 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							251.2155 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				8.8000	0.0100	0.0880	
E3 Sill				8.8000	0.0200	0.1760	
E4 Jamb				25.0000	0.0150	0.3750	
E7 Party floor between dwellings (in blocks of flats)				14.4000	0.0700	1.0080	
E18 Party wall between dwellings				11.2000	0.0480	0.5376	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							2.1846 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	23.6428 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	24.1966	23.9417	23.6868	22.4122	22.1573	20.8827	20.8827	20.6278	21.3926	22.1573	22.6671	23.1769 (38)
Average = Sum(39)m / 12 =	47.8393	47.5844	47.3295	46.0550	45.8000	44.5255	44.5255	44.2706	45.0353	45.8000	46.3099	46.8197 (39)
												45.9912
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.5527	0.5498	0.5468	0.5321	0.5292	0.5144	0.5144	0.5115	0.5203	0.5292	0.5351	0.5410 (40)
Days in month	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												2.5755 (42)
Hot water usage for mixer showers												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths												
77.7288	76.5745	74.9488	71.9515	69.7071	67.2185	65.8742	67.4885	69.2461	71.9090	74.9681	77.4661	(42b)
Hot water usage for other uses												
41.0056	39.5145	38.0234	36.5323	35.0412	33.5501	33.5501	35.0412	36.5323	38.0234	39.5145	41.0056	(42c)
Average daily hot water use (litres/day)												109.3447 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
118.7345	116.0890	112.9722	108.4838	104.7483	100.7685	99.4243	102.5297	105.7784	109.9324	114.4826	118.4717	(44)
Energy content	188.0464	165.3091	173.6341	148.5089	141.0114	123.9067	120.2451	126.9531	130.4353	149.1773	163.1015	185.4980 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1815.8269
28.2070	24.7964	26.0451	22.2763	21.1517	18.5860	18.0368	19.0430	19.5653	22.3766	24.4652	27.8247	(46)
Water storage loss (or HIU loss):												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1100 (48)
Temperature factor from Table 2b												0.7800 (49)
Enter (49) or (54) in (55)												1.6458 (55)
Total storage loss												
51.0198	46.0824	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	49.3740	51.0198	49.3740	51.0198	(56)
If cylinder contains dedicated solar storage												
51.0198	46.0824	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	49.3740	51.0198	49.3740	51.0198	(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	(61)
Total heat required for water heating calculated for each month												
262.3286	232.4027	247.9163	220.3949	215.2936	195.7927	194.5273	201.2353	202.3213	223.4595	234.9875	259.7802	(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												
262.3286	232.4027	247.9163	220.3949	215.2936	195.7927	194.5273	201.2353	202.3213	223.4595	234.9875	259.7802	(64)
Electric shower(s)												Total per year (kWh/year) = Sum(64)m = 2690.4399 (64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains from water heating, kWh/month												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
121.9512	108.6402	117.1591	106.8880	106.3120	98.7078	99.4072	101.6377	100.8785	109.0272	111.7400	121.1039	(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	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.6334	21.8792	17.7933	13.4707	10.0695	8.5011	9.1857	11.9400	16.0258	20.3484	23.7496	25.3180 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	347.1426	350.7449	341.6673	322.3423	297.9479	275.0205	259.7037	256.1014	265.1790	284.5041	308.8985	331.8258 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285 (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)	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197 (71)
Water heating gains (Table 5)	163.9129	161.6669	157.4719	148.4556	142.8925	137.0941	133.6119	136.6098	140.1091	146.5419	155.1945	162.7740 (72)
Total internal gains	640.2272	638.8293	621.4709	588.8068	555.4482	525.1541	507.0396	509.1895	525.8522	555.9327	592.3809	624.4561 (73)

6. Solar gains

[Jan]												
				Area	Solar flux		g	FF		Access		Gains
				m2	Table 6a		Specific data	Specific data		factor		W
					W/m2		or Table 6b	or Table 6c		Table 6d		
Northeast				7.5000	11.2829		0.4000	0.7000		0.7700		16.4201 (75)
Southeast				12.0000	36.7938		0.4000	0.7000		0.7700		85.6737 (77)
Southwest				2.2000	36.7938		0.4000	0.7000		0.7700		15.7068 (79)
Solar gains	117.8006	206.1121	296.4986	391.6586	460.8542	467.2707	446.4416	393.3282	329.2186	231.7039	142.0912	100.1701 (83)
Total gains	758.0278	844.9414	917.9695	980.4654	1016.3023	992.4247	953.4813	902.5176	855.0708	787.6366	734.4721	724.6262 (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	126.2484	126.9247	127.6083	131.1398	131.8697	135.6445	135.6445	136.4256	134.1090	131.8697	130.4180	128.9978
alpha	9.4166	9.4616	9.5072	9.7427	9.7913	10.0430	10.0430	10.0950	9.9406	9.7913	9.6945	9.5999
util living area	0.9260	0.8545	0.7351	0.5674	0.4191	0.2871	0.2055	0.2256	0.3634	0.6030	0.8365	0.9383 (86)
MIT	20.8658	20.9389	20.9841	20.9986	20.9999	21.0000	21.0000	21.0000	21.0000	20.9981	20.9593	20.8521 (87)
Th 2	20.4727	20.4754	20.4781	20.4915	20.4942	20.5076	20.5076	20.5103	20.5022	20.4942	20.4888	20.4834 (88)
util rest of house	0.9130	0.8354	0.7115	0.5438	0.3963	0.2650	0.1825	0.2016	0.3372	0.5742	0.8138	0.9269 (89)
MIT 2	20.3278	20.4127	20.4630	20.4903	20.4941	20.5076	20.5076	20.5103	20.5022	20.4926	20.4490	20.3220 (90)
Living area fraction	20.5132	20.5940	20.6426	20.6655	20.6684	20.6773	20.6773	20.6791	20.6738	20.6668	20.6249	20.5047 (91)
MIT	20.5132	20.5940	20.6426	20.6655	20.6684	20.6773	20.6773	20.6791	20.6738	20.6668	20.6249	20.5047 (92)
Temperature adjustment	20.5132	20.5940	20.6426	20.6655	20.6684	20.6773	20.6773	20.6791	20.6738	20.6668	20.6249	20.5047 (93)
adjusted MIT	20.5132	20.5940	20.6426	20.6655	20.6684	20.6773	20.6773	20.6791	20.6738	20.6668	20.6249	20.5047 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9140	0.8398	0.7190	0.5519	0.4041	0.2727	0.1904	0.2099	0.3462	0.5841	0.8200	0.9275	(94)
Useful gains	692.8647	709.6052	660.0244	541.1083	410.7208	270.5949	181.5444	189.4373	296.0470	460.0486	602.2610	672.0548	(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	775.6284	746.7918	669.3632	541.8601	410.7552	270.5953	181.5444	189.4373	296.0521	461.0616	626.3344	763.3808	(97)
Space heating kWh	61.5762	24.9894	6.9480	0.5413	0.0256	0.0000	0.0000	0.0000	0.0000	0.7537	17.3328	67.9465	(98a)
Space heating requirement - total per year (kWh/year)												180.1136	
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	61.5762	24.9894	6.9480	0.5413	0.0256	0.0000	0.0000	0.0000	0.0000	0.7537	17.3328	67.9465	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												180.1136	
Space heating per m2										(98c) / (4) =		2.0810	(99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(301)
Fraction of space heat from community system												1.0000	(302)
Fraction of heat from community Boilers-Space and Water												1.0000	(303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000	(305)
Factor for charging method (Table 4c(3)) for water heating												1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system												1.1500	(306)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating:													
Space heating requirement	61.5762	24.9894	6.9480	0.5413	0.0256	0.0000	0.0000	0.0000	0.0000	0.7537	17.3328	67.9465	(98)
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.15													
307a	70.8126	28.7378	7.9902	0.6225	0.0294	0.0000	0.0000	0.0000	0.0000	0.8668	19.9328	78.1385	
Space heating requirement	70.8126	28.7378	7.9902	0.6225	0.0294	0.0000	0.0000	0.0000	0.0000	0.8668	19.9328	78.1385	(307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(309)
Water heating													
Annual water heating requirement	262.3286	232.4027	247.9163	220.3949	215.2936	195.7927	194.5273	201.2353	202.3213	223.4595	234.9875	259.7802	(64)
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.15													
310a	301.6779	267.2632	285.1038	253.4541	247.5876	225.1616	223.7064	231.4206	232.6695	256.9784	270.2356	298.7473	
Water heating fuel	301.6779	267.2632	285.1038	253.4541	247.5876	225.1616	223.7064	231.4206	232.6695	256.9784	270.2356	298.7473	(310)
Cooling System Energy Efficiency Ratio												0.0000	(314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(315)
Pumps and Fa	14.3632	12.9732	14.3632	13.8998	14.3632	13.8998	14.3632	14.3632	13.8998	14.3632	13.8998	14.3632	(331)
Lighting	21.5615	17.2974	15.5744	11.4105	8.8138	7.2009	8.0402	10.4510	13.5748	17.8109	20.1173	22.1607	(332)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335b)
Annual totals kWh/year													
Space heating fuel - community heating												207.1306	(307)
Space heating fuel - secondary												0.0000	(309)
Water heating fuel - community heating												3094.0058	(310)
Efficiency of water heater												0.0000	(311)
Electricity used for heat distribution												2.0713	(313)
Space cooling fuel												0.0000	(321)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)													
mechanical ventilation fans (SFP = 0.5720)												169.1145	(330a)
Total electricity for the above, kWh/year												169.1145	(331)
Electricity for lighting (calculated in Appendix L)												174.0133	(332)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(333)
Wind generation												0.0000	(334)
Hydro-electric generation (Appendix N)												0.0000	(335a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(335)
Appendix Q - special features													
Energy saved or generated												-0.0000	(336)
Energy used												0.0000	(337)
Total delivered energy for all uses												3644.2643	(338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	207.1306	4.4400	9.1966	(340a)
Space heating total			9.1966	(340)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	3094.0058	4.4400	137.3739	(342a)
Water heating total			137.3739	(342)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(347a)
Pumps, fans and electric keep-hot	169.1145	16.4900	27.8870	(349)
Energy for lighting	174.0133	16.4900	28.6948	(350)
Additional standing charges			92.0000	(351)
Total energy cost			295.1522	(355)

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11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):		0.3600 (356)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.8077 (357)
SAP value		86.9070
SAP rating (Section 12)		87 (358)
SAP band		B

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Efficiency of heat source Boilers			89.5000 (367)
Space and Water heating from Boilers	3688.4206	0.2100	48.6005 (367)
Electrical energy for heat distribution (space & water)	2.0713	0.0000	4.6841 (372)
Overall CO ₂ factor for heat network			0.2361 (386)
Total CO ₂ associated with community systems			779.2524 (373)
Space and water heating			779.2524 (376)
Pumps, fans and electric keep-hot	169.1145	0.1387	23.4583 (378)
Energy for lighting	174.0133	0.1443	25.1155 (379)
Total CO ₂ , kg/year			827.8262 (383)
CO ₂ emissions per m ²			9.5600 (384)
EI value			91.5676 (384a)
EI rating			92 (385)
EI band			A

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling	86.5500 (1b)	x 2.8000 (2b)	= 242.3400 (1b) - (3b)
Ground floor			(4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.5500		(5)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	242.3400 (5)

2. Ventilation rate

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

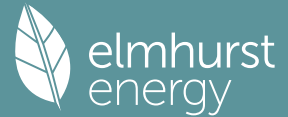
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) =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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.1339	0.1275	0.1275	0.1179	0.1179	0.1052	0.1084	0.1020	0.1052	0.1116	0.1116	0.1211 (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) =												72.0000 (23c)
Effective ac	0.2739	0.2675	0.2675	0.2579	0.2579	0.2452	0.2484	0.2420	0.2452	0.2516	0.2516	0.2611 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Opening Type 1			21.7000	0.8687	18.8514		(27)
External Wall 1 LG	40.3200	21.7000	18.6200	0.1400	2.6068	190.0000	3537.7997 (29a)
Total net area of external elements A _{um} (A, m ²)			40.3200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.4582		(33)
Main dwelling							
Party Wall 1			67.4800	0.0000	0.0000	180.0000	12146.4006 (32)
Party Floor 1			86.5500			40.0000	3462.0000 (32d)
Party Ceiling 1			86.5500			30.0000	2596.5000 (32b)

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Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =						21742.7003 (34)	
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												251.2155 (35)	
List of Thermal Bridges													
K1 Element						Length		Psi-value		Total			
E2 Other lintels (including other steel lintels)						8.8000		0.0100		0.0880			
E3 Sill						8.8000		0.0200		0.1760			
E4 Jamb						25.0000		0.0150		0.3750			
E7 Party floor between dwellings (in blocks of flats)						14.4000		0.0700		1.0080			
E18 Party wall between dwellings						11.2000		0.0480		0.5376			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												2.1846 (36)	
Point Thermal bridges												(36a) = 0.0000	
Total fabric heat loss						(33) + (36) + (36a) =						23.6428 (37)	
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		21.9024	21.3926	21.3926	20.6278	20.6278	19.6082	19.8631	19.3533	19.6082	20.1180	20.1180	20.8827 (38)
Heat transfer coeff		45.5451	45.0353	45.0353	44.2706	44.2706	43.2509	43.5058	42.9960	43.2509	43.7608	43.7608	44.5255 (39)
Average = Sum(39)m / 12 =													44.1006
HLP		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)		0.5262	0.5203	0.5203	0.5115	0.5115	0.4997	0.5027	0.4968	0.4997	0.5056	0.5056	0.5144 (40)
Days in mont		31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)													

Assumed occupancy													
Hot water usage for mixer showers													
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 2.5755 (42)													
Hot water usage for baths													
77.7288 76.5745 74.9488 71.9515 69.7071 67.2185 65.8742 67.4885 69.2461 71.9090 74.9681 77.4661 (42b)													
Hot water usage for other uses													
41.0056 39.5145 38.0234 36.5323 35.0412 33.5501 33.5501 35.0412 36.5323 38.0234 39.5145 41.0056 (42c)													
Average daily hot water use (litres/day)													
28.2070 24.7964 26.0451 22.2763 21.1517 18.5860 18.0368 19.0430 19.5653 22.3766 24.4652 27.8247 (43)													
Daily hot water use		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		118.7345	116.0890	112.9722	108.4838	104.7483	100.7685	99.4243	102.5297	105.7784	109.9324	114.4826	118.4717 (44)
Energy conte		188.0464	165.3091	173.6341	148.5089	141.0114	123.9067	120.2451	126.9531	130.4353	149.1773	163.1015	185.4980 (45)
Energy content (annual)													Total = Sum(45)m = 1815.8269
Distribution loss (46)m = 0.15 x (45)m													
		28.2070	24.7964	26.0451	22.2763	21.1517	18.5860	18.0368	19.0430	19.5653	22.3766	24.4652	27.8247 (46)
Water storage loss (or HIU loss):													
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.1100 (48)
Temperature factor from Table 2b													0.7800 (49)
Enter (49) or (54) in (55)													1.6458 (55)
Total storage loss		51.0198	46.0824	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	49.3740	51.0198	49.3740	51.0198 (56)
If cylinder contains dedicated solar storage		51.0198	46.0824	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	49.3740	51.0198	49.3740	51.0198 (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		262.3286	232.4027	247.9163	220.3949	215.2936	195.7927	194.5273	201.2353	202.3213	223.4595	234.9875	259.7802 (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		262.3286	232.4027	247.9163	220.3949	215.2936	195.7927	194.5273	201.2353	202.3213	223.4595	234.9875	259.7802 (64)
Electric shower(s)													Total per year (kWh/year) = Sum(64)m = 2690.4399 (64)
		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
													Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month		121.9512	108.6402	117.1591	106.8880	106.3120	98.7078	99.4072	101.6377	100.8785	109.0272	111.7400	121.1039 (65)

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

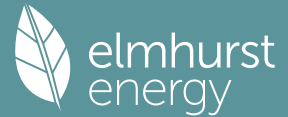
Metabolic gains (Table 5), Watts													
(66)m		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5		24.6334	21.8792	17.7933	13.4707	10.6695	8.5011	9.1857	11.9400	16.0258	20.3484	23.7496	25.3180 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5		347.1426	350.7449	341.6673	322.3423	297.9479	275.0205	259.7037	256.1014	265.1790	284.5041	308.8985	331.8258 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5		53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285 (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)		-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197 (71)
Water heating gains (Table 5)		163.9129	161.6669	157.4719	148.4556	142.8925	137.0941	133.6119	136.6098	140.1091	146.5419	155.1945	162.7740 (72)
Total internal gains		640.2272	638.8293	621.4709	588.8068	555.4482	525.1541	507.0396	509.1895	525.8522	555.9327	592.3809	624.4561 (73)

6. Solar gains													

[Jan]		Area		Solar flux		g		FF		Access		Gains	
		m2		Table 6a		Specific data		Specific data		factor		W	
				W/m2		or Table 6b		or Table 6c		Table 6d			
Northeast		7.5000		12.9236		0.4000		0.7000		0.7700		18.8077 (75)	
Southeast		12.0000		40.4699		0.4000		0.7000		0.7700		94.2334 (77)	
Southwest		2.2000		40.4699		0.4000		0.7000		0.7700		17.2761 (79)	

Solar gains		130.3172	205.5008	293.1727	401.3739	462.0601	502.1644	474.2797	425.9361	353.6318	246.9634	161.0937	109.7130 (83)

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Total gains 770.5444 844.3301 914.6436 990.1808 1017.5083 1027.3185 981.3193 935.1256 879.4840 802.8962 753.4746 734.1691 (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	132.6078	134.1090	134.1090	136.4256	136.4256	139.6418	138.8236	140.4697	139.6418	138.0150	138.0150	135.6445
alpha	9.8405	9.9406	9.9406	10.0950	10.0950	10.3095	10.2549	10.3646	10.3095	10.2010	10.2010	10.0430
util living area	0.8771	0.7979	0.6655	0.4961	0.3481	0.2105	0.1374	0.1471	0.2852	0.5121	0.7440	0.8920 (86)
MIT	20.9328	20.9724	20.9947	20.9997	21.0000	21.0000	21.0000	21.0000	21.0000	20.9997	20.9884	20.9260 (87)
Th 2	20.4968	20.5022	20.5022	20.5103	20.5103	20.5211	20.5184	20.5238	20.5211	20.5157	20.5157	20.5076 (88)
util rest of house	0.8595	0.7768	0.6422	0.4742	0.3268	0.1903	0.1161	0.1252	0.2617	0.4858	0.7190	0.8756 (89)
MIT 2	20.4272	20.4749	20.4974	20.5101	20.5103	20.5211	20.5184	20.5238	20.5211	20.5155	20.5050	20.4303 (90)
Living area fraction	fLA = Living area / (4) = 0.3447 (91)											
MIT	20.6015	20.6464	20.6688	20.6788	20.6791	20.6861	20.6844	20.6879	20.6861	20.6824	20.6716	20.6012 (92)
Temperature adjustment	0.0000											
adjusted MIT	20.6015	20.6464	20.6688	20.6788	20.6791	20.6861	20.6844	20.6879	20.6861	20.6824	20.6716	20.6012 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8633	0.7830	0.6500	0.4818	0.3341	0.1973	0.1234	0.1328	0.2698	0.4948	0.7272	0.8789 (94)
Useful gains	665.1970	661.1031	594.5250	477.0288	339.9535	202.6803	121.1368	124.1690	237.2808	397.2968	547.8897	645.2314 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	706.0172	677.6173	597.5641	477.1847	339.9570	202.6803	121.1368	124.1690	237.2810	397.4508	554.5205	690.1969 (97)
Space heating kWh	30.3702	11.0976	2.2611	0.1122	0.0026	0.0000	0.0000	0.0000	0.0000	0.1146	4.7742	33.4543 (98a)
Space heating requirement - total per year (kWh/year)												82.1869
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	30.3702	11.0976	2.2611	0.1122	0.0026	0.0000	0.0000	0.0000	0.0000	0.1146	4.7742	33.4543 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												82.1869
Space heating per m2												(98c) / (4) = 0.9496 (99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)
Fraction of space heat from community system
Fraction of heat from community Boilers-Space and Water
Factor for control and charging method (Table 4c(3)) for space heating
Factor for charging method (Table 4c(3)) for water heating
Distribution loss factor (Table 12c) for community heating system
Efficiency of secondary/supplementary heating system, %

0.0000 (301)
1.0000 (302)
1.0000 (303a)
1.0000 (305)
1.0000 (305a)
1.1500 (306)
0.0000 (208)

Space heating:

Space heating requirement	30.3702	11.0976	2.2611	0.1122	0.0026	0.0000	0.0000	0.0000	0.0000	0.1146	4.7742	33.4543 (98)
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.15												
307a	34.9258	12.7622	2.6003	0.1291	0.0030	0.0000	0.0000	0.0000	0.0000	0.1318	5.4903	38.4724
Space heating requirement	34.9258	12.7622	2.6003	0.1291	0.0030	0.0000	0.0000	0.0000	0.0000	0.1318	5.4903	38.4724 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)

Water heating

Annual water heating requirement	262.3286	232.4027	247.9163	220.3949	215.2936	195.7927	194.5273	201.2353	202.3213	223.4595	234.9875	259.7802 (64)
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.15												
310a	301.6779	267.2632	285.1038	253.4541	247.5876	225.1616	223.7064	231.4206	232.6695	256.9784	270.2356	298.7473
Water heating fuel	301.6779	267.2632	285.1038	253.4541	247.5876	225.1616	223.7064	231.4206	232.6695	256.9784	270.2356	298.7473 (310)
Cooling System Energy Efficiency Ratio	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	14.3632	12.9732	14.3632	13.8998	14.3632	13.8998	14.3632	14.3632	13.8998	14.3632	13.8998	14.3632 (331)
Lighting	21.5615	17.2974	15.5744	11.4105	8.8138	7.2009	8.0402	10.4510	13.5748	17.8109	20.1173	22.1607 (332)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year												
Space heating fuel - community heating												94.5149 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												3094.0058 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												0.9451 (313)
Space cooling fuel												0.0000 (321)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)
mechanical ventilation fans (SFP = 0.5720)

169.1145 (330a)
169.1145 (331)
174.0133 (332)

Total electricity for the above, kWh/year
Electricity for lighting (calculated in Appendix L)

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

PV generation 0.0000 (333)
Wind generation 0.0000 (334)
Hydro-electric generation (Appendix N) 0.0000 (335a)

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Electricity generated - Micro CHP (Appendix N)	0.0000 (335)
Appendix Q - special features	
Energy saved or generated	-0.0000 (336)
Energy used	0.0000 (337)
Total delivered energy for all uses	3531.6486 (338)

10b. Fuel costs - using BEDF prices (597)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating from Boilers	94.5149	7.3200	6.9185 (340a)
Space heating total			6.9185 (340)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	0.0000	0.0000	0.0000 (341)
Water heating from Boilers	3094.0058	7.3200	226.4812 (342a)
Water heating total			226.4812 (342)
Energy for instantaneous electric shower(s)	0.0000	27.6700	0.0000 (347a)
Pumps, fans and electric keep-hot	169.1145	27.6700	46.7940 (349)
Energy for lighting	174.0133	27.6700	48.1495 (350)
Additional standing charges			108.0000 (351)
Total energy cost			436.3432 (355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			89.5000 (367)
Space and Water heating from Boilers	3562.5930	0.2100	22.1767 (367)
Electrical energy for heat distribution (space & water)	0.9451	0.0000	4.5036 (372)
Overall CO2 factor for heat network			0.2360 (386)
Total CO2 associated with community systems			752.6481 (373)
Space and water heating			752.6481 (376)
Pumps, fans and electric keep-hot	169.1145	0.1387	23.4583 (378)
Energy for lighting	174.0133	0.1443	25.1155 (379)
Total CO2, kg/year			801.2219 (383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Boilers			89.5000 (467a)
Space and Water heating from Boilers	3562.5930	1.1300	119.3317 (467)
Electrical energy for heat distribution (space & water)	0.9451	0.0000	48.5378 (472)
Overall CO2 factor for heat network			1.2778 (486)
Total CO2 associated with community systems			4074.2679 (473)
Space and water heating			4074.2679 (476)
Pumps, fans and electric keep-hot	169.1145	1.5128	255.8365 (478)
Energy for lighting	174.0133	1.5338	266.9074 (479)
Total Primary energy kWh/year			4597.0119 (483)

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Electricity generated - Micro CHP (Appendix N)	0.0000 (335)
Appendix Q - special features	
Energy saved or generated	-0.0000 (336)
Energy used	0.0000 (337)
Total delivered energy for all uses	3046.9371 (338)

10b. Fuel costs - using BEDF prices (597)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating from Boilers	49.8176	7.3200	3.6467 (340a)
Space heating total			3.6467 (340)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	0.0000	0.0000	0.0000 (341)
Water heating from Boilers	2750.4735	7.3200	201.3347 (342a)
Water heating total			201.3347 (342)
Energy for instantaneous electric shower(s)	0.0000	27.6700	0.0000 (347a)
Pumps, fans and electric keep-hot	112.8016	27.6700	31.2122 (349)
Energy for lighting	133.8444	27.6700	37.0347 (350)
Additional standing charges			108.0000 (351)
Total energy cost			381.2283 (355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			89.5000 (367)
Space and Water heating from Boilers	3128.8169	0.2100	11.6891 (367)
Electrical energy for heat distribution (space & water)	0.4982	0.0000	3.9448 (372)
Overall CO2 factor for heat network			0.2360 (386)
Total CO2 associated with community systems			660.9963 (373)
Space and water heating			660.9963 (376)
Pumps, fans and electric keep-hot	112.8016	0.1387	15.6470 (378)
Energy for lighting	133.8444	0.1443	19.3179 (379)
Total CO2, kg/year			695.9612 (383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Boilers			89.5000 (467a)
Space and Water heating from Boilers	3128.8169	1.1300	62.8982 (467)
Electrical energy for heat distribution (space & water)	0.4982	0.0000	42.5890 (472)
Overall CO2 factor for heat network			1.2778 (486)
Total CO2 associated with community systems			3578.1521 (473)
Space and water heating			3578.1521 (476)
Pumps, fans and electric keep-hot	112.8016	1.5128	170.6463 (478)
Energy for lighting	133.8444	1.5338	205.2950 (479)
Total Primary energy kWh/year			3954.0934 (483)

Appendix A.2 - SAP Calculations (Be Green)

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Plot Reference	1B 2P NW 2F O			Issued on Date	27/08/2026
Assessment Reference	00001	Plot Type Ref			
Plot Address				SAP Version	10.2
SAP Rating	86 B	DER	3.22	TER	10.78
Environmental	98 A	% DER < TER			70.13
CO ₂ Emissions (t/year)	0.18	DFEE	18.97	TFEE	24.28
Compliance Check	See BREL	% DFEE < TFEE			21.89
% DPER < TPER	38.51	DPER	34.54	TPER	56.17
Assessor Details	Mr. Richard Denteh			Assessor ID	U148-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	57.7300 (1b)	2.8000 (2b)	161.6440 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.7300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	161.6440 (5)

2. Ventilation rate

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	3.0000	(17)
Infiltration rate	0.1500	(18)
Number of sides sheltered	2	(19)

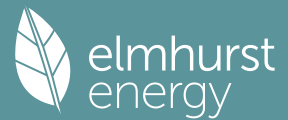
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												72.0000 (23c)
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Opening Type 1			13.9500	0.8687	12.1187		(27)
External Wall 1 LG	26.3200	13.9500	12.3700	0.1400	1.7318	190.0000	2350.2997 (29a)
Total net area of external elements Aum(A, m ²)			26.3200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	13.8505	(33)
Main dwelling							
Party Wall 1			24.1000	0.0000	0.0000	180.0000	4338.0001 (32)
Party Floor 1			57.7300			40.0000	2309.2000 (32a)
Party Ceiling 1			57.7300			30.0000	1731.9000 (32b)
Heat capacity Cm = Sum (A x k)							(28)...(30) + (32) + (32a)...(32e) =
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							10729.3998 (34)
List of Thermal Bridges							185.8548 (35)
K1 Element					Length	Psi-value	Total
E2 Other lintels (including other steel lintels)					6.3000	0.0100	0.0630
E3 Sill					6.3000	0.0200	0.1260

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E4 Jamb									13.0000	0.0150	0.1950	
E7 Party floor between dwellings (in blocks of flats)									9.4000	0.0450	0.4230	
E17 Corner (inverted - internal area greater than external area)									2.8000	-0.0980	-0.2744	
E16 Corner (normal)									5.6000	0.0450	0.2520	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												0.7846 (36)
Point Thermal bridges												0.0000
Total fabric heat loss										(33) + (36) + (36a) =		14.6351 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	16.1394	15.9694	15.7994	14.9492	14.7792	13.9291	13.9291	13.7590	14.2691	14.7792	15.1193	15.4593 (38)
Average = Sum(39)m / 12 =	30.7746	30.6045	30.4345	29.5844	29.4143	28.5642	28.5642	28.3942	28.9042	29.4143	29.7544	30.0945 (39)
												29.5419
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.5331	0.5301	0.5272	0.5125	0.5095	0.4948	0.4948	0.4918	0.5007	0.5095	0.5154	0.5213 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												1.9168 (42)
Hot water usage for mixer showers												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths												
	64.9416	63.9771	62.6189	60.1147	58.2395	56.1603	55.0372	56.3859	57.8543	60.0792	62.6350	64.7220 (42b)
Hot water usage for other uses												
	34.2597	33.0139	31.7681	30.5223	29.2765	28.0307	28.0307	29.2765	30.5223	31.7681	33.0139	34.2597 (42c)
Average daily hot water use (litres/day)												91.3563 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
	99.2013	96.9910	94.3870	90.6370	87.5160	84.1910	83.0679	85.6624	88.3767	91.8473	95.6489	98.9818 (44)
Energy content												
	157.1106	138.1139	145.0694	124.0775	117.8134	103.5226	100.4634	106.0679	108.9773	124.6359	136.2695	154.9815 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1517.1031
	23.5666	20.7171	21.7604	18.6116	17.6720	15.5284	15.0695	15.9102	16.3466	18.6954	20.4404	23.2472 (46)
Water storage loss (or HIU loss):												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1100 (48)
Temperature factor from Table 2b												0.7800 (49)
Enter (49) or (54) in (55)												1.6458 (55)
Total storage loss												
	51.0198	46.0824	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	49.3740	51.0198	49.3740	51.0198 (56)
If cylinder contains dedicated solar storage												
	51.0198	46.0824	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	49.3740	51.0198	49.3740	51.0198 (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												
	231.3928	205.2075	219.3516	195.9635	192.0956	175.4086	174.7456	180.3501	180.8633	198.9181	208.1555	229.2637 (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												
	231.3928	205.2075	219.3516	195.9635	192.0956	175.4086	174.7456	180.3501	180.8633	198.9181	208.1555	229.2637 (64)
Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 2391.7161 (64)
Electric shower(s)												2392 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
	111.6650	99.5978	107.6613	98.7646	98.5987	91.9301	92.8298	94.6933	93.7437	100.8672	102.8184	110.9571 (65)

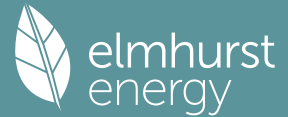
5. Internal gains (see Table 5 and 5a)												

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	84.5194	93.5751	84.5194	87.3367	84.5194	87.3367	84.5194	84.5194	87.3367	84.5194	87.3367	84.5194 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	167.1878	168.9227	164.5509	155.2437	143.4951	132.4530	125.0763	123.3414	127.7132	137.0204	148.7690	159.8111 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839 (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)	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712 (71)
Water heating gains (Table 5)	150.0874	148.2110	144.7061	137.1730	132.5252	127.6807	124.7713	127.2760	130.1996	135.5742	142.8033	149.1359 (72)
Total internal gains	453.5464	462.4605	445.5281	431.5052	412.2914	399.2221	386.1187	386.8885	397.0013	408.8657	430.6608	445.2181 (73)

6. Solar gains													
[Jan]				Area	Solar flux	g		FF	Access		Gains		
				m2	Table 6a	Specific data		Specific data	factor		W		
					W/m2	or Table 6b		or Table 6c	Table 6d				
Northeast				10.2000	11.2829	0.4000		0.7000	0.7700		22.3313 (75)		
Southwest				3.7500	36.7938	0.4000		0.7000	0.7700		26.7730 (79)		
Solar gains	49.1043	91.0604	144.2951	211.8128	267.3909	278.7161	263.1943	219.7035	167.3568	105.9534	60.1665	41.1490 (83)	
Total gains	502.6507	553.5208	589.8232	643.3180	679.6822	677.9382	649.3130	606.5920	564.3581	514.8191	490.8272	486.3671 (84)	

7. Mean internal temperature (heating season)

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Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	96.8458	97.3839	97.9279	100.7420	101.3244	104.3400	104.3400	104.9648	103.1125	101.3244	100.1663	99.0345
alpha	7.4564	7.4923	7.5285	7.7161	7.7550	7.9560	7.9560	7.9977	7.8742	7.7550	7.6778	7.6023
util living area	0.8913	0.8250	0.7250	0.5537	0.4023	0.2697	0.1936	0.2153	0.3533	0.5899	0.7966	0.9001 (86)
MIT	20.8212	20.9021	20.9629	20.9953	20.9996	21.0000	21.0000	21.0000	20.9999	20.9940	20.9384	20.8156 (87)
Th 2	20.4906	20.4933	20.4960	20.5094	20.5121	20.5256	20.5256	20.5283	20.5202	20.5121	20.5067	20.5013 (88)
util rest of house	0.8778	0.8075	0.7037	0.5319	0.3812	0.2497	0.1727	0.1932	0.3288	0.5633	0.7756	0.8875 (89)
MIT 2	20.3360	20.4112	20.4664	20.5060	20.5119	20.5256	20.5256	20.5283	20.5202	20.5079	20.4571	20.3411 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	20.5595	20.6373	20.6951	20.7313	20.7365	20.7441	20.7441	20.7456	20.7411	20.7318	20.6788	20.5596 (92)
Temperature adjustment												
adjusted MIT	20.5595	20.6373	20.6951	20.7313	20.7365	20.7441	20.7441	20.7456	20.7411	20.7318	20.6788	20.5596 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8797	0.8126	0.7122	0.5418	0.3909	0.2589	0.1823	0.2034	0.3401	0.5753	0.7831	0.8891 (94)
Useful gains	442.2018	449.8108	420.0929	348.5586	265.6918	175.4986	118.3731	123.3885	191.9307	296.1946	384.3588	432.4134 (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	500.3793	481.6343	432.0205	350.0226	265.8033	175.5013	118.3732	123.3888	191.9567	298.0193	404.0292	492.3346 (97)
Space heating kWh	43.2841	21.3854	8.8741	1.0541	0.0829	0.0000	0.0000	0.0000	0.0000	1.3575	14.1627	44.5814 (98a)
Space heating requirement - total per year (kWh/year)												
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)												
Space heating kWh	43.2841	21.3854	8.8741	1.0541	0.0829	0.0000	0.0000	0.0000	0.0000	1.3575	14.1627	44.5814 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												
Space heating per m2	(98c) / (4) =											

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (301)
Fraction of space heat from community system													1.0000 (302)
Fraction of heat from community Heat pump-Space and Water													1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating													1.0500 (305)
Factor for charging method (Table 4c(3)) for water heating													1.0500 (305a)
Distribution loss factor (Table 12c) for community heating system													1.1500 (306)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating:													
Space heating requirement	43.2841	21.3854	8.8741	1.0541	0.0829	0.0000	0.0000	0.0000	0.0000	1.3575	14.1627	44.5814 (98)	
Space heat from Heat pump = (98) x 1.00 x 1.05 x 1.15	52.2655	25.8228	10.7155	1.2728	0.1002	0.0000	0.0000	0.0000	0.0000	1.6392	17.1014	53.8321	
307a	52.2655	25.8228	10.7155	1.2728	0.1002	0.0000	0.0000	0.0000	0.0000	1.6392	17.1014	53.8321 (307)	
Space heating requirement	52.2655	25.8228	10.7155	1.2728	0.1002	0.0000	0.0000	0.0000	0.0000	1.6392	17.1014	53.8321 (308)	
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)													0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)	
Water heating													
Annual water heating requirement	231.3928	205.2075	219.3516	195.9635	192.0956	175.4086	174.7456	180.3501	180.8633	198.9181	208.1555	229.2637 (64)	
Water heat from Heat pump = (64) x 1.00 x 1.05 x 1.15	279.4069	247.7881	264.8670	236.6259	231.9555	211.8059	211.0053	217.7728	218.3924	240.1937	251.3477	276.8360	
310a	279.4069	247.7881	264.8670	236.6259	231.9555	211.8059	211.0053	217.7728	218.3924	240.1937	251.3477	276.8360 (310)	
Water heating fuel	279.4069	247.7881	264.8670	236.6259	231.9555	211.8059	211.0053	217.7728	218.3924	240.1937	251.3477	276.8360 (311)	
Cooling System Energy Efficiency Ratio	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (314)	
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)	
Pumps and Fa	9.5804	8.6533	9.5804	9.2714	9.5804	9.2714	9.5804	9.5804	9.2714	9.5804	9.2714	9.5804 (331)	
Lighting	16.5842	13.3045	11.9792	8.7765	6.7792	5.5387	6.1842	8.0385	10.4412	13.6994	15.4735	17.0452 (332)	
Electricity generated by PVs (Appendix M) (negative quantity)	-2.4255	-3.9903	-6.7370	-8.8762	-10.7468	-10.4796	-10.3261	-9.1104	-7.2225	-5.0308	-2.8478	-2.0297 (333a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)	
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)	
Annual totals kWh/year													
Space heating fuel - community heating													162.7495 (307)
Space heating fuel - secondary													0.0000 (309)
Water heating fuel - community heating													2887.9971 (310)
Efficiency of water heater													0.0000 (311)
Electricity used for heat distribution													1.6275 (313)
Space cooling fuel													0.0000 (321)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)													
mechanical ventilation fans (SFP = 0.5720)													112.8016 (330a)
Total electricity for the above, kWh/year													112.8016 (331)
Electricity for lighting (calculated in Appendix L)													133.8444 (332)

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

PV generation	-79.8225 (333)
Wind generation	0.0000 (334)
Hydro-electric generation (Appendix N)	0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (335)
Appendix Q - special features	
Energy saved or generated	-0.0000 (336)
Energy used	0.0000 (337)
Total delivered energy for all uses	3217.5702 (338)

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12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			275.0000 (367)
Space and Water heating from Heat pump	1109.3624	0.1602	9.4784 (367)
Electrical energy for heat distribution (space & water)	1.6275	0.0000	4.3185 (372)
Overall CO2 factor for heat network			0.0529 (386)
Total CO2 associated with community systems			161.3556 (373)
Space and water heating			161.3556 (376)
Pumps, fans and electric keep-hot	112.8016	0.1387	15.6470 (378)
Energy for lighting	133.8444	0.1443	19.3179 (379)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-79.8225	0.1316	-10.5027
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-10.5027 (380)
Total CO2, kg/year			185.8178 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.2200 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			275.0000 (467a)
Space and Water heating from Heat pump	1109.3624	1.5928	94.2616 (467)
Electrical energy for heat distribution (space & water)	1.6275	0.0000	46.4761 (472)
Overall CO2 factor for heat network			0.5692 (486)
Total CO2 associated with community systems			1736.5168 (473)
Space and water heating			1736.5168 (476)
Pumps, fans and electric keep-hot	112.8016	1.5128	170.6463 (478)
Energy for lighting	133.8444	1.5338	205.2950 (479)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-79.8225	1.4861	-118.6248
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-118.6248 (480)
Total Primary energy kWh/year			1993.8333 (483)
Dwelling Primary energy Rate (DPER)			34.5400 (484)

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

1. Overall dwelling characteristics

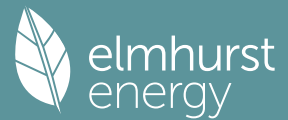
	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling	57.7300 (1b)	2.8000 (2b)	161.6440 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.7300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	161.6440 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1237 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3737 (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) = 0.3177 (21)
Wind speed	Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 4.7000 (22)
Wind factor	1.2750 1.2500 1.2250 1.1000 1.0750 0.9500 0.9500 0.9250 1.0000 1.0750 1.1250 1.1750 (22a)
Adj infilt rate	0.4050 0.3971 0.3891 0.3494 0.3415 0.3018 0.3018 0.2938 0.3177 0.3415 0.3574 0.3733 (22b)
Effective ac	0.5820 0.5788 0.5757 0.5611 0.5583 0.5455 0.5455 0.5432 0.5505 0.5583 0.5639 0.5697 (25)

3. Heat losses and heat loss parameter

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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	
Main dwelling						13.9500	1.1450	15.9733					(27)
TER Opening Type						12.3700	0.1800	2.2266					(29a)
External Wall 1 LG			26.3200	13.9500		26.3200							(31)
Total net area of external elements Aum(A, m2)													(33)
Fabric heat loss, W/K = Sum (A x U)						(26)...	(30) + (32) =	18.1999					
Main dwelling													
Party Wall 1						24.1000	0.0000	0.0000					(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												185.8548	(35)
List of Thermal Bridges													
K1 Element							Length	Psi-value		Total			
E2 Other lintels (including other steel lintels)							6.3000	0.0500		0.3150			
E3 Sill							6.3000	0.0500		0.3150			
E4 Jamb							13.0000	0.0500		0.6500			
E7 Party floor between dwellings (in blocks of flats)							9.4000	0.0700		0.6580			
E17 Corner (inverted - internal area greater than external area)							2.8000	-0.0900		-0.2520			
E16 Corner (normal)							5.6000	0.0900		0.5040			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												2.1900	(36)
Point Thermal bridges										(36a) =		0.0000	
Total fabric heat loss										(33) + (36) + (36a) =		20.3899	(37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	31.0466	30.8767	30.7102	29.9280	29.7816	29.1003	29.1003	28.9742	29.3628	29.7816	30.0777	30.3872	(38)
Average = Sum(39)m / 12 =	51.4365	51.2666	51.1001	50.3179	50.1715	49.4902	49.4902	49.3641	49.7526	50.1715	50.4676	50.7771	(39)
												50.3172	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.8910	0.8880	0.8852	0.8716	0.8691	0.8573	0.8573	0.8551	0.8618	0.8691	0.8742	0.8796	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	
												31	

4. Water heating energy requirements (kWh/year)													

Assumed occupancy													1.9168 (42)
Hot water usage for mixer showers													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths													
	64.9416	63.9771	62.6189	60.1147	58.2395	56.1603	55.0372	56.3859	57.8543	60.0792	62.6350	64.7220	(42b)
Hot water usage for other uses													
	34.2597	33.0139	31.7681	30.5223	29.2765	28.0307	28.0307	29.2765	30.5223	31.7681	33.0139	34.2597	(42c)
Average daily hot water use (litres/day)													91.3563 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	99.2013	96.9910	94.3870	90.6370	87.5160	84.1910	83.0679	85.6624	88.3767	91.8473	95.6489	98.9818	(44)
Energy content (annual)	157.1106	138.1139	145.0694	124.0775	117.8134	103.5226	100.4634	106.0679	108.9773	124.6359	136.2695	154.9815	(45)
Distribution loss (46)m = 0.15 x (45)m													
	23.5666	20.7171	21.7604	18.6116	17.6720	15.5284	15.0695	15.9102	16.3466	18.6954	20.4404	23.2472	(46)
Water storage loss (or HIU loss):													
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.1127 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.1409 (55)
Total storage loss													
	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(56)
If cylinder contains dedicated solar storage													
	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(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													
	215.7395	191.0690	203.6982	180.8151	176.4422	160.2602	159.0922	164.6967	165.7148	183.2648	193.0070	213.6103	(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													
	215.7395	191.0690	203.6982	180.8151	176.4422	160.2602	159.0922	164.6967	165.7148	183.2648	193.0070	213.6103	(64)
12Total per year (kWh/year)													2207.4100 (64)
Electric shower(s)													2207 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month													
	99.1423	88.2869	95.1386	86.6458	86.0760	79.8113	80.3071	82.1706	81.6250	88.3445	90.6996	98.4344	(65)

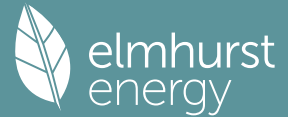
5. Internal gains (see Table 5 and 5a)													

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	84.3271	93.3621	84.3271	87.1380	84.3271	87.1380	84.3271	84.3271	87.1380	84.3271	87.1380	84.3271	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	167.1878	168.9227	164.5509	155.2437	143.4951	132.4530	125.0763	123.3414	127.7132	137.0204	148.7690	159.8111	(68)
Pumps, fans	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	(69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Water heating gains (Table 5)	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	(71)
Total internal gains													
	133.2558	131.3794	127.8745	120.3414	115.6936	110.8491	107.9397	110.4444	113.3680	118.7426	125.9717	132.3043	(72)
	439.5224	448.4159	431.5041	417.4748	398.2674	382.1918	369.0947	369.8645	379.9709	394.8418	416.6304	431.1942	(73)

6. Solar gains													

[Jan]	Area	Solar flux				g		FF		Access		Gains	

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	m2		Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		factor Table 6d		W	
Northeast	10.2000		11.2829		0.6300		0.7000		0.7700		35.1718	(75)
Southwest	3.7500		36.7938		0.6300		0.7000		0.7700		42.1675	(79)

Solar gains	77.3393	143.4201	227.2648	333.6051	421.1406	438.9779	414.5311	346.0331	263.5869	166.8766	94.7622	64.8097	(83)
Total gains	516.8618	591.8360	658.7689	751.0799	819.4080	821.1696	783.6258	715.8976	643.5579	561.7183	511.3926	496.0038	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.9431	58.1351	58.3246	59.2312	59.4040	60.2218	60.2218	60.3757	59.9041	59.4040	59.0555	58.6955	
alpha	4.8629	4.8757	4.8883	4.9487	4.9603	5.0148	5.0148	5.0250	4.9936	4.9603	4.9370	4.9130	
util living area	0.9645	0.9349	0.8750	0.7345	0.5539	0.3837	0.2776	0.3165	0.5224	0.8001	0.9328	0.9696	(86)
MIT	20.1075	20.3258	20.5921	20.8577	20.9683	20.9959	20.9994	20.9988	20.9823	20.8199	20.4420	20.0761	(87)
Th 2	20.1752	20.1777	20.1801	20.1917	20.1939	20.2040	20.2040	20.2058	20.2001	20.1939	20.1895	20.1849	(88)
util rest of house	0.9574	0.9228	0.8538	0.6993	0.5101	0.3368	0.2275	0.2622	0.4657	0.7622	0.9183	0.9634	(89)
MIT 2	19.1530	19.4239	19.7456	20.0547	20.1678	20.2014	20.2037	20.2053	20.1879	20.0239	19.5803	19.1214	(90)
Living area fraction	19.5927	19.8393	20.1355	20.4245	20.5365	20.5674	20.5702	20.5708	20.5538	20.3905	19.9772	19.5612	(91)
MIT	19.5927	19.8393	20.1355	20.4245	20.5365	20.5674	20.5702	20.5708	20.5538	20.3905	19.9772	19.5612	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5927	19.8393	20.1355	20.4245	20.5365	20.5674	20.5702	20.5708	20.5538	20.3905	19.9772	19.5612	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9514	0.9171	0.8526	0.7098	0.5289	0.3583	0.2506	0.2872	0.4910	0.7719	0.9140	0.9577	(94)
Useful gains	491.7212	542.7858	561.6532	533.1031	433.4191	294.2025	196.3421	205.6069	316.0179	433.6173	467.4109	475.0285	(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	786.6010	765.8879	696.7750	579.8901	443.3411	295.3256	196.4851	205.8867	321.0931	491.2061	649.8788	779.9948	(97)
Space heating kWh	219.3905	149.9246	100.5306	33.6866	7.3820	0.0000	0.0000	0.0000	0.0000	42.8461	131.3769	226.8950	(98a)
Space heating requirement - total per year (kWh/year)												912.0323	
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	219.3905	149.9246	100.5306	33.6866	7.3820	0.0000	0.0000	0.0000	0.0000	42.8461	131.3769	226.8950	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												912.0323	
Space heating per m2										(98c) / (4) =		15.7982	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	219.3905	149.9246	100.5306	33.6866	7.3820	0.0000	0.0000	0.0000	0.0000	42.8461	131.3769	226.8950	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	237.6929	162.4319	108.9172	36.4969	7.9978	0.0000	0.0000	0.0000	0.0000	46.4205	142.3368	245.8234	(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	215.7395	191.0690	203.6982	180.8151	176.4422	160.2602	159.0922	164.6967	165.7148	183.2648	193.0070	213.6103	(64)
Efficiency of water heater	84.0975	83.5218	82.5652	81.0907	80.1261	79.8000	79.8000	79.8000	79.8000	81.3626	83.2158	79.8000	(216)
Fuel for water heating, kWh/month	256.5351	228.7653	246.7120	222.9788	220.2056	200.8273	199.3637	206.3869	207.6627	225.2445	231.9355	253.7081	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.0685	7.3041	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	17.5215	14.0564	12.6562	9.2725	7.1623	5.8517	6.5337	8.4928	11.0313	14.4736	16.3480	18.0085	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-27.3468	-38.7335	-55.9529	-63.2655	-68.5602	-64.1585	-63.3996	-59.6987	-53.1975	-44.4805	-30.1408	-23.6246	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-14.9173	-31.4386	-62.5781	-94.1073	-124.5277	-125.1189	-123.6135	-104.5946	-76.5964	-44.9628	-19.9214	-11.7892	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												988.1174	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)

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Efficiency of water heater	79.8000
Water heating fuel used	2700.3254 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	141.4085 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1426.7249 (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	2489.1264 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	988.1174	0.2100	207.5047 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2700.3254	0.2100	567.0683 (264)
Space and water heating			774.5730 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	141.4085	0.1443	20.4096 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-592.5590	0.1345	-79.6767
PV Unit electricity exported	-834.1659	0.1259	-104.9928
Total			-184.6695 (269)
Total CO2, kg/year			622.2423 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.7800 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	988.1174	1.1300	1116.5726 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2700.3254	1.1300	3051.3677 (278)
Space and water heating			4167.9404 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	141.4085	1.5338	216.8971 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-592.5590	1.4969	-887.0265
PV Unit electricity exported	-834.1659	0.4620	-385.3952
Total			-1272.4217 (283)
Total Primary energy kWh/year			3242.5166 (286)
Target Primary Energy Rate (TPER)			56.1700 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

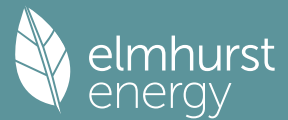
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	57.7300 (1b)	x 2.8000 (2b)	= 161.6440 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.7300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 161.6440 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	20.0000 / (5) = 0.1237 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.2737 (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) = 0.2327 (21)

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	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													
	0.2967	0.2908	0.2850	0.2559	0.2501	0.2210	0.2210	0.2152	0.2327	0.2501	0.2618	0.2734	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5440	0.5423	0.5406	0.5328	0.5313	0.5244	0.5244	0.5232	0.5271	0.5313	0.5343	0.5374	(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	
Main dwelling								
Opening Type 1			13.9500	0.8687	12.1187			(27)
External Wall 1 LG	26.3200	13.9500	12.3700	0.1400	1.7318	190.0000	2350.2997	(29a)
Total net area of external elements Aum(A, m2)			26.3200					(31)
Fabric heat loss, W/K = Sum (A x U)								(33)
Main dwelling								
Party Wall 1			24.1000	0.0000	0.0000	180.0000	4338.0001	(32)
Party Floor 1			57.7300			40.0000	2309.2000	(32d)
Party Ceiling 1			57.7300			30.0000	1731.9000	(32b)
Heat capacity Cm = Sum(A x k)								
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								(34)
List of Thermal Bridges								(35)
K1 Element								
E2 Other lintels (including other steel lintels)								
E3 Sill								
E4 Jamb								
E7 Party floor between dwellings (in blocks of flats)								
E17 Corner (inverted - internal area greater than external area)								
E16 Corner (normal)								
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								(36)
Point Thermal bridges								(36a) =
Total fabric heat loss								(33) + (36) + (36a) =

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	29.0184	28.9273	28.8379	28.4183	28.3398	27.9743	27.9743	27.9067	28.1151	28.3398	28.4986	28.6647	(38)
Heat transfer coeff	43.6535	43.5624	43.4731	43.0534	42.9749	42.6095	42.6095	42.5418	42.7502	42.9749	43.1338	43.2998	(39)
Average = Sum(39)m / 12 =												43.0531	(39)

HLP	0.7562	0.7546	0.7530	0.7458	0.7444	0.7381	0.7381	0.7369	0.7405	0.7444	0.7472	0.7500	(40)
HLP (average)												0.7458	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

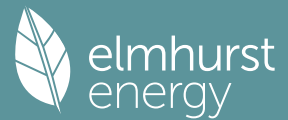
4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.9168	(42)
Hot water usage for mixer showers														
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths														
24.3589	23.9971	23.4877	22.5483	21.8450	21.0651	20.6438	21.1497	21.7005	22.5350	23.4937	24.2765	24.2765		(42b)
Hot water usage for other uses														
34.2597	33.0139	31.7681	30.5223	29.2765	28.0307	28.0307	29.2765	30.5223	31.7681	33.0139	34.2597	34.2597		(42c)
Average daily hot water use (litres/day)													53.7297	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use														
58.6186	57.0110	55.2558	53.0707	51.1215	49.0958	48.6745	50.4262	52.2228	54.3032	56.5076	58.5363	58.5363		(44)
Energy content	92.8375	81.1829	84.9261	72.6511	68.8194	60.3690	58.8676	62.4382	64.3960	73.6889	80.5055	91.6536	91.6536	(45)
Energy content (annual)										Total =	Sum(45)m =	892.3358		
Distribution loss (46)m = 0.15 x (45)m														
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):														
Total storage loss														
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage														
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month														
78.9119	69.0055	72.1872	61.7534	58.4965	51.3137	50.0375	53.0725	54.7366	62.6355	68.4297	77.9056	77.9056		(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	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	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	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	0.0000	(63d)
Output from w/h	78.9119	69.0055	72.1872	61.7534	58.4965	51.3137	50.0375	53.0725	54.7366	62.6355	68.4297	77.9056	77.9056	(64)
													758.4854	(64)
12Total per year (kWh/year)													758	(64)
Electric shower(s)														
45.1331	40.2139	43.9121	41.9048	42.6911	40.7232	42.0806	42.6911	41.9048	43.9121	43.0864	45.1331	45.1331		(64a)
													513.3862	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =														
Heat gains from water heating, kWh/month														
31.0112	27.3049	29.0248	25.9145	25.2969	23.0092	23.0295	23.9409	24.1603	26.6369	27.8790	30.7597	30.7597		(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	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	84.5194	93.5751	84.5194	87.3367	84.5194	87.3367	84.5194	84.5194	87.3367	84.5194	87.3367	84.5194	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	167.1878	168.9227	164.5509	155.2437	143.4951	132.4530	125.0763	123.3414	127.7132	137.0204	148.7690	159.8111	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	(69)

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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)	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712 (71)
Water heating gains (Table 5)	41.6818	40.6322	39.0118	35.9924	34.0012	31.9572	30.9537	32.1786	33.5560	35.8023	38.7208	41.3436 (72)
Total internal gains	345.1408	354.8818	339.8338	330.3246	313.7674	303.4987	292.3010	291.7911	300.3577	309.0938	326.5783	337.4258 (73)

6. Solar gains

[Jan]	Area m2				Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d	Gains W
Northeast	10.2000				11.2829		0.4000		0.7000		0.7700	22.3313 (75)
Southwest	3.7500				36.7938		0.4000		0.7000		0.7700	26.7730 (79)
Solar gains	49.1043	91.0604	144.2951	211.8128	267.3909	278.7161	263.1943	219.7035	167.3568	105.9534	60.1665	41.1490 (83)
Total gains	394.2451	445.9421	484.1290	542.1374	581.1583	582.2148	555.4954	511.4947	467.7145	415.0472	386.7448	378.5748 (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	68.2737	68.4165	68.5571	69.2253	69.3518	69.9466	69.9466	70.0579	69.7163	69.3518	69.0964	68.8315
alpha	5.5516	5.5611	5.5705	5.6150	5.6235	5.6631	5.6631	5.6705	5.6478	5.6235	5.6064	5.5888
util living area	0.9846	0.9691	0.9352	0.8314	0.6592	0.4650	0.3370	0.3816	0.6126	0.8786	0.9678	0.9874 (86)
MIT	20.1276	20.3106	20.5451	20.8198	20.9574	20.9949	20.9993	20.9987	20.9783	20.7888	20.4221	20.0934 (87)
Th 2	20.2915	20.2929	20.2942	20.3006	20.3018	20.3073	20.3073	20.3083	20.3052	20.3018	20.2994	20.2968 (88)
util rest of house	0.9813	0.9628	0.9225	0.8036	0.6169	0.4160	0.2842	0.3247	0.5570	0.8509	0.9602	0.9846 (89)
MIT 2	19.4949	19.6752	19.9021	20.1590	20.2732	20.3047	20.3071	20.3079	20.2929	20.1381	19.7914	19.4656 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.7863	19.9679	20.1983	20.4634	20.5883	20.6226	20.6259	20.6260	20.6086	20.4378	20.0819	19.7548 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.7863	19.9679	20.1983	20.4634	20.5883	20.6226	20.6259	20.6260	20.6086	20.4378	20.0819	19.7548 (93)

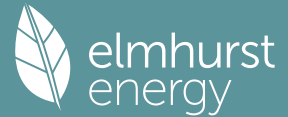
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9785	0.9594	0.9206	0.8104	0.6346	0.4384	0.3085	0.3509	0.5817	0.8567	0.9575	0.9821 (94)
Useful gains	385.7647	427.8516	445.6977	439.3602	368.7968	255.2271	171.3895	179.4724	272.0476	355.5888	370.2966	371.7967 (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	676.0314	656.3930	595.5063	497.8433	381.9762	256.6198	171.5423	179.7829	278.2430	422.7781	559.9595	673.5188 (97)
Space heating kWh	215.9584	153.5798	111.4576	42.1079	9.8055	0.0000	0.0000	0.0000	0.0000	49.9888	136.5572	224.4812 (98a)
Space heating requirement - total per year (kWh/year)												943.9365
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	215.9584	153.5798	111.4576	42.1079	9.8055	0.0000	0.0000	0.0000	0.0000	49.9888	136.5572	224.4812 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												943.9365
Space heating per m2												(98c) / (4) = 16.3509 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	400.5289	315.3100	323.3175	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9742	0.9892	0.9822	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	390.1834	311.9059	317.5784	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	649.5686	620.0081	570.2062	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	186.7573	229.2281	187.9551	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fc = cooled area / (4) =											
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	46.6893	57.3070	46.9888	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												150.9851 (107)
Energy for space heating												16.3509 (99)
Energy for space cooling												2.6154 (108)
Total												18.9662 (109)
Fabric Energy Efficiency (DFEE)												19.0 (109)

Full SAP Calculation Printout



1. Overall dwelling characteristics

Main dwelling	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	57.7300 (1b)	x 2.8000 (2b)	= 161.6440 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.7300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 161.6440 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 20.0000 / (5) = 0.1237 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3737 (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) = 0.3177 (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	0.4050	0.3971	0.3891	0.3494	0.3415	0.3018	0.3018	0.2938	0.3177	0.3415	0.3574	0.3733 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5820	0.5788	0.5757	0.5611	0.5583	0.5455	0.5455	0.5432	0.5505	0.5583	0.5639	0.5697 (25)

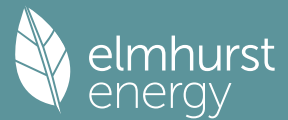
3. Heat losses and heat loss parameter

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					
Main dwelling												
TER Opening Type			13.9500	1.1450	15.9733		(27)					
External Wall 1 LG	26.3200	13.9500	12.3700	0.1800	2.2266		(29a)					
Total net area of external elements Aum(A, m2)			26.3200				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		18.1999		(33)					
Main dwelling												
Party Wall 1			24.1000	0.0000	0.0000		(32)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							185.8548 (35)					
List of Thermal Bridges												
K1 Element				Length	Psi-value	Total						
E2 Other lintels (including other steel lintels)				6.3000	0.0500	0.3150						
E3 Sill				6.3000	0.0500	0.3150						
E4 Jamb				13.0000	0.0500	0.6500						
E7 Party floor between dwellings (in blocks of flats)				9.4000	0.0700	0.6580						
E17 Corner (inverted - internal area greater than external area)				2.8000	-0.0900	-0.2520						
E16 Corner (normal)				5.6000	0.0900	0.5040						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							2.1900 (36)					
Point Thermal bridges						(36a) =	0.0000					
Total fabric heat loss					(33) + (36) + (36a) =		20.3899 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	31.0466	30.8767	30.7102	29.9280	29.7816	29.1003	29.1003	28.9742	29.3628	29.7816	30.0777	30.3872 (38)
Average = Sum(39)m / 12 =	51.4365	51.2666	51.1001	50.3179	50.1715	49.4902	49.4902	49.3641	49.7526	50.1715	50.4676	50.7771 (39)
												50.3172
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8910	0.8880	0.8852	0.8716	0.8691	0.8573	0.8573	0.8551	0.8618	0.8691	0.8742	0.8796 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9168 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths	24.3589	23.9971	23.4877	22.5483	21.8450	21.0651	20.6438	21.1497	21.7005	22.5350	23.4937	24.2765 (42b)
Hot water usage for other uses	34.2597	33.0139	31.7681	30.5223	29.2765	28.0307	28.0307	29.2765	30.5223	31.7681	33.0139	34.2597 (42c)
Average daily hot water use (litres/day)												53.7297 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	58.6186	57.0110	55.2558	53.0707	51.1215	49.0958	48.6745	50.4262	52.2228	54.3032	56.5076	58.5363 (44)
Energy content (annual)	92.8375	81.1829	84.9261	72.6511	68.8194	60.3690	58.8676	62.4382	64.3960	73.6889	80.5055	91.6536 (45)
Distribution loss (46)m = 0.15 x (45)m												892.3358
Water storage loss (or HIU 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 (46)
Total storage 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 (56)

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If cylinder contains dedicated solar storage											
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month											
	78.9119	69.0055	72.1872	61.7534	58.4965	51.3137	50.0375	53.0725	54.7366	62.6355	68.4297 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h											
	78.9119	69.0055	72.1872	61.7534	58.4965	51.3137	50.0375	53.0725	54.7366	62.6355	68.4297 (64)
Total per year (kWh/year)										758.4854 (64)	
Electric shower(s)										758 (64)	
	45.1331	40.2139	43.9121	41.9048	42.6911	40.7232	42.0806	42.6911	41.9048	43.9121	45.1331 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =										513.3862 (64a)	
Heat gains from water heating, kWh/month											
	31.0112	27.3049	29.0248	25.9145	25.2969	23.0092	23.0295	23.9409	24.1603	26.6369	30.7597 (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
(66)m	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390	95.8390 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5											
	84.3271	93.3621	84.3271	87.1380	84.3271	87.1380	84.3271	84.3271	87.1380	84.3271	87.1380 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5											
	167.1878	168.9227	164.5509	155.2437	143.4951	132.4530	125.0763	123.3414	127.7132	137.0204	148.7690 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5											
	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839	32.5839 (69)
Pumps, fans											
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)											
	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712 (71)
Water heating gains (Table 5)											
	41.6818	40.6322	39.0118	35.9924	34.0012	31.9572	30.9537	32.1786	33.5560	35.8023	38.7208 (72)
Total internal gains											
	344.9484	354.6688	339.6415	330.1258	313.5750	303.2999	292.1087	291.5988	300.1589	308.9015	326.3795 (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	10.2000				11.2829		0.6300		0.7000		0.7700		35.1718 (75)	
Southwest	3.7500				36.7938		0.6300		0.7000		0.7700		42.1675 (79)	
Solar gains	77.3393	143.4201	227.2648	333.6051	421.1406	438.9779	414.5311	346.0331	263.5869	166.8766	94.7622	64.8097 (83)		
Total gains	422.2877	498.0889	566.9063	663.7309	734.7157	742.2778	706.6398	637.6318	563.7458	475.7780	421.1417	402.0431 (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
tau	57.9431	58.1351	58.3246	59.2312	59.4040	60.2218	60.2218	60.3757	59.9041	59.4040	59.0555
alpha	4.8629	4.8757	4.8883	4.9487	4.9603	5.0148	5.0148	5.0250	4.9936	4.9603	4.9370
util living area											
	0.9837	0.9644	0.9200	0.7941	0.6089	0.4233	0.3076	0.3548	0.5879	0.8682	0.9662 (86)
MIT											
	19.9017	20.1451	20.4560	20.7965	20.9522	20.9936	20.9990	20.9980	20.9704	20.7294	20.2676 (87)
Th 2											
	20.1752	20.1777	20.1801	20.1917	20.1939	20.2040	20.2040	20.2058	20.2001	20.1939	20.1895 (88)
util rest of house											
	0.9800	0.9569	0.9042	0.7614	0.5630	0.3720	0.2522	0.2942	0.5268	0.8370	0.9578 (89)
MIT 2											
	19.1781	19.4180	19.7179	20.0354	20.1628	20.2009	20.2036	20.2051	20.1838	19.9870	19.5500 (90)
Living area fraction											
	19.5114	19.7529	20.0579	20.3860	20.5264	20.5660	20.5700	20.5703	20.5461	20.3289	19.8806 (91)
MIT											
	19.5114	19.7529	20.0579	20.3860	20.5264	20.5660	20.5700	20.5703	20.5461	20.3289	19.8806 (92)
Temperature adjustment											
	19.5114	19.7529	20.0579	20.3860	20.5264	20.5660	20.5700	20.5703	20.5461	20.3289	19.8806 (93)
adjusted MIT											

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9764	0.9524	0.9016	0.7696	0.5823	0.3954	0.2777	0.3221	0.5537	0.8427	0.9540	0.9805 (94)
Useful gains	412.3327	474.3817	511.1354	510.8227	427.8209	293.5050	196.2429	205.3871	312.1509	400.9344	401.7841	394.2222 (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												
	782.4208	761.4585	692.8086	577.9506	442.8333	295.2586	196.4743	205.8630	320.7103	488.1154	645.0034	775.9324 (97)
Space heating kWh	275.3455	192.9156	135.1649	48.3321	11.1693	0.0000	0.0000	0.0000	0.0000	64.8627	175.1180	283.9924 (98a)
Space heating requirement - total per year (kWh/year)												1186.9004
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	275.3455	192.9156	135.1649	48.3321	11.1693	0.0000	0.0000	0.0000	0.0000	64.8627	175.1180	283.9924 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1186.9004
Space heating per m2										(98c) / (4) =		20.5595 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov

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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
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	465.2081	366.2276	375.1668	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9759	0.9889	0.9813	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	454.0084	362.1786	368.1555	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	836.8707	796.8770	717.8405	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	275.6608	323.4157	260.1656	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area /	(4) =	1.0000	1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	68.9152	80.8539	65.0414	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												214.8105 (107)
Energy for space heating												20.5595 (99)
Energy for space cooling												3.7210 (108)
Total												24.2805 (109)
Fabric Energy Efficiency (TFEE)												24.3 (109)

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

1. Overall dwelling characteristics

Main dwelling	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	57.7300 (1b)	x 2.8000 (2b)	= 161.6440 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.7300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 161.6440 (5)

2. Ventilation rate

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

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												72.0000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898 (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
Main dwelling							
Opening Type 1			13.9500	0.8687	12.1187		(27)
External Wall 1 LG	26.3200	13.9500	12.3700	0.1400	1.7318	190.0000	2350.2997 (29a)
Total net area of external elements Aum(A, m2)			26.3200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		13.8505		(33)
Main dwelling							
Party Wall 1			24.1000	0.0000	0.0000	180.0000	4338.0001 (32)
Party Floor 1			57.7300			40.0000	2309.2000 (32d)
Party Ceiling 1			57.7300			30.0000	1731.9000 (32b)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 10729.3998 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							185.8548 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				6.3000	0.0100	0.0630	
E3 Sill				6.3000	0.0200	0.1260	
E4 Jamb				13.0000	0.0150	0.1950	
E7 Party floor between dwellings (in blocks of flats)				9.4000	0.0450	0.4230	
E17 Corner (inverted - internal area greater than external area)				2.8000	-0.0980	-0.2744	
E16 Corner (normal)				5.6000	0.0450	0.2520	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							0.7846 (36)

elmhurst
energy

$$\begin{aligned} (33) + (36) + (36a) &= 14.6351 \quad (37) \end{aligned}$$
[illegible]

4. Water heating energy requirements (kWh/year)

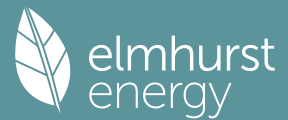
assumed occupancy												1.9168 (42)
Hot water usage for mixer showers												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths												
64.9416	63.9771	62.6189	60.1147	58.2395	56.1603	55.0372	56.3859	57.8543	60.0792	62.6350	64.7220	(42b)
Hot water usage for other uses												
34.2597	33.0139	31.7681	30.5223	29.2765	28.0307	28.0307	29.2765	30.5223	31.7681	33.0139	34.2597	(42c)
Average daily hot water use (litres/day)												91.3563 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
99.2013	96.9910	94.3870	90.6370	87.5160	84.1910	83.0679	85.6624	88.3767	91.8473	95.6489	98.9818	(44)
Energy content (annual)	157.1106	138.1139	145.0694	124.0775	117.8134	103.5226	100.4634	106.0679	108.9773	124.6359	136.2695	154.9815 (45)
Total = Sum(45)m =												1517.1031
Distribution loss (46)m = 0.15 x (45)m												
23.5666	20.7171	21.7604	18.6116	17.6720	15.5284	15.0695	15.9102	16.3466	18.6954	20.4404	23.2472	(46)
Water storage loss (or HIU loss):												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1100 (48)
Temperature factor from Table 2b												0.7800 (49)
Enter (49) or (54) in (55)												1.6458 (55)
Total storage loss												
51.0198	46.0824	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	49.3740	51.0198	49.3740	51.0198	(56)
If cylinder contains dedicated solar storage												
51.0198	46.0824	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	49.3740	51.0198	49.3740	51.0198	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month												
231.3928	205.2075	219.3516	195.9635	192.0956	175.4086	174.7456	180.3501	180.8633	198.9181	208.1555	229.2637	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGRHS	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												
231.3928	205.2075	219.3516	195.9635	192.0956	175.4086	174.7456	180.3501	180.8633	198.9181	208.1555	229.2637	(64)
												Total per year (kWh/year) = Sum(64)m = 2391.7161 (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)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.9471	16.8286	13.6859	10.3611	7.7451	6.5387	7.0653	9.1838	12.3264	15.6512	18.2673	19.4737 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	249.5341	252.1235	245.5983	231.7070	214.1718	197.6911	186.6810	184.0916	190.6168	204.5081	222.0433	238.5240 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175 (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)	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712 (71)
Water heating gains (Table 5)	150.0874	148.2110	144.7061	137.1730	132.5252	127.6807	124.7713	127.2760	130.1996	135.5742	142.8033	149.1359 (72)
Total internal gains	505.3216	503.9161	490.7434	465.9942	441.1950	418.6635	405.2706	407.3044	419.8959	442.4865	469.8670	493.8866 (73)

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				10.2000	11.2829	0.4000	0.7000	0.7700	22.3313 (75)			
Southwest				3.7500	36.7938	0.4000	0.7000	0.7700	26.7730 (79)			
Solar gains	49.1043	91.0604	144.2951	211.8128	267.3909	278.7161	263.1943	219.7035	167.3568	105.9534	60.1665	41.1490 (83)
Total gains	554.4260	594.9765	635.0385	677.8070	708.5859	697.3796	668.4650	627.0080	587.2526	548.4399	530.0335	535.0356 (84)

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	96.8458	97.3839	97.9279	100.7420	101.3244	104.3400	104.3400	104.9648	103.1125	101.3244	100.1663	99.0345
alpha	7.4564	7.4923	7.5285	7.7161	7.7550	7.9560	7.9560	7.9977	7.8742	7.7550	7.6778	7.6023

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util living area	0.8457	0.7848	0.6806	0.5263	0.3859	0.2621	0.1880	0.2083	0.3396	0.5551	0.7514	0.8572 (86)
MIT	20.8779	20.9299	20.9753	20.9966	20.9997	21.0000	21.0000	21.0000	20.9999	20.9960	20.9583	20.8723 (87)
Th 2	20.4906	20.4933	20.4960	20.5094	20.5121	20.5256	20.5256	20.5283	20.5202	20.5121	20.5067	20.5013 (88)
util rest of house												
MIT 2	0.8297	0.7662	0.6595	0.5054	0.3657	0.2427	0.1677	0.1870	0.3160	0.5298	0.7297	0.8420 (89)
Living area fraction	20.3868	20.4353	20.4765	20.5070	20.5119	20.5256	20.5256	20.5283	20.5202	20.5093	20.4736	20.3923 (90)
MIT	20.6130	20.6631	20.7062	20.7325	20.7366	20.7441	20.7441	20.7456	20.7411	20.7335	20.6968	20.6134 (92)
Temperature adjustment												0.0000
adjusted MIT	20.6130	20.6631	20.7062	20.7325	20.7366	20.7441	20.7441	20.7456	20.7411	20.7335	20.6968	20.6134 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8336	0.7725	0.6683	0.5149	0.3750	0.2517	0.1771	0.1968	0.3268	0.5413	0.7382	0.8455	(94)
Useful gains	462.1885	459.6144	424.4235	349.0208	265.7228	175.4991	118.3731	123.3886	191.9379	296.8611	391.2519	452.3823	(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													
	502.0255	482.4224	432.3596	350.0575	265.8057	175.5014	118.3732	123.3888	191.9572	298.0696	404.5659	493.9525	(97)
Space heating kWh													
	29.6387	15.3270	5.9045	0.7465	0.0616	0.0000	0.0000	0.0000	0.0000	0.8992	9.5861	30.9282	(98a)
Space heating requirement - total per year (kWh/year)												93.0917	
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													
	29.6387	15.3270	5.9045	0.7465	0.0616	0.0000	0.0000	0.0000	0.0000	0.8992	9.5861	30.9282	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												93.0917	
Space heating per m2												(98c) / (4) =	
												1.6125	(99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (301)
Fraction of space heat from community system												1.0000 (302)
Fraction of heat from community Heat pump-Space and Water												1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0500 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0500 (305a)
Distribution loss factor (Table 12c) for community heating system												1.1500 (306)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating:												
Space heating requirement												
29.6387	15.3270	5.9045	0.7465	0.0616	0.0000	0.0000	0.0000	0.0000	0.8992	9.5861	30.9282 (98)	
Space heat from Heat pump = (98) x 1.00 x 1.05 x 1.15												
307a	35.7888	18.5073	7.1297	0.9014	0.0744	0.0000	0.0000	0.0000	0.0000	1.0857	11.5752	37.3458
Space heating requirement												
35.7888	18.5073	7.1297	0.9014	0.0744	0.0000	0.0000	0.0000	0.0000	0.0000	1.0857	11.5752	37.3458 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000 (308)
Space heating fuel for secondary/supplementary system												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)	
Water heating												
Annual water heating requirement												
231.3928	205.2075	219.3516	195.9635	192.0956	175.4086	174.7456	180.3501	180.8633	198.9181	208.1555	229.2637 (64)	
Water heat from Heat pump = (64) x 1.00 x 1.05 x 1.15												
310a	279.4069	247.7881	264.8670	236.6259	231.9555	211.8059	211.0053	217.7728	218.3924	240.1937	251.3477	276.8360
Water heating fuel												
279.4069	247.7881	264.8670	236.6259	231.9555	211.8059	211.0053	217.7728	218.3924	240.1937	251.3477	276.8360 (310)	
Cooling System Energy Efficiency Ratio												0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)	
Pumps and Fa	9.5804	8.6533	9.5804	9.2714	9.5804	9.2714	9.5804	9.5804	9.2714	9.5804	9.2714 (331)	
Lighting	16.5842	13.3045	11.9792	8.7765	6.7792	5.5387	6.1842	8.0385	10.4412	13.6994	15.4735 (332)	
Electricity generated by PVs (Appendix M) (negative quantity)												
(333a)m	-2.4255	-3.9903	-6.7370	-8.8762	-10.7468	-10.4796	-10.3261	-9.1104	-7.2225	-5.0308	-2.8478	-2.0297 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)	
Electricity generated by PVs (Appendix M) (negative quantity)												
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)	
Annual totals kWh/year												
Space heating fuel - community heating												112.4082 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												2887.9971 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												1.1241 (313)
Space cooling fuel												0.0000 (321)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)												
mechanical ventilation fans (SFP = 0.5720)												112.8016 (330a)
Total electricity for the above, kWh/year												112.8016 (331)
Electricity for lighting (calculated in Appendix L)												133.8444 (332)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-79.8225 (333)
Wind generation												0.0000 (334)
Hydro-electric generation (Appendix N)												0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (335)
Appendix Q - special features												
Energy saved or generated												-0.0000 (336)
Energy used												0.0000 (337)
Total delivered energy for all uses												3167.2289 (338)

10b. Fuel costs - using Table 12 prices

Fuel	Fuel price	Fuel cost
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	kWh/year	p/kWh	£/year
Space heating from Heat pump	112.4082	4.4400	4.9909 (340a)
Space heating total			4.9909 (340)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	0.0000	0.0000	0.0000 (341)
Water heating from Heat pump	2887.9971	4.4400	128.2271 (342a)
Water heating total			128.2271 (342)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (347a)
Pumps, fans and electric keep-hot	112.8016	16.4900	18.6010 (349)
Energy for lighting	133.8444	16.4900	22.0709 (350)
Additional standing charges			92.0000 (351)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-79.8225	16.4900	-13.1627
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-13.1627 (352)
Total energy cost			252.7272 (355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):		0.3600 (356)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.8856 (357)
SAP value		85.6438
SAP rating (Section 12)		86 (358)
SAP band		B

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			275.0000 (367)
Space and Water heating from Heat pump	1091.0565	0.1602	6.5481 (367)
Electrical energy for heat distribution (space & water)	1.1241	0.0000	4.2379 (372)
Overall CO2 factor for heat network			0.0528 (386)
Total CO2 associated with community systems			158.3447 (373)
Space and water heating			158.3447 (376)
Pumps, fans and electric keep-hot	112.8016	0.1387	15.6470 (378)
Energy for lighting	133.8444	0.1443	19.3179 (379)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-79.8225	0.1316	-10.5027
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-10.5027 (380)
Total CO2, kg/year			182.8069 (383)
CO2 emissions per m2			3.1700 (384)
EI value			97.6155 (384a)
EI rating			98 (385)
EI band			A

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

1. Overall dwelling characteristics

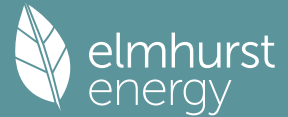
	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	57.7300 (1b)	x 2.8000 (2b)	= 161.6440 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.7300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 161.6440 (5)

2. Ventilation rate

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)

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Adj infilt rate	0.1339	0.1275	0.1275	0.1179	0.1179	0.1052	0.1084	0.1020	0.1052	0.1116	0.1116	0.1211 (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) =												72.0000 (23c)
Effective ac	0.2739	0.2675	0.2675	0.2579	0.2579	0.2452	0.2484	0.2420	0.2452	0.2516	0.2516	0.2611 (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
Main dwelling							
Opening Type 1							(27)
External Wall 1 LG	26.3200	13.9500	13.9500	0.8687	12.1187	190.0000	2350.2997 (29a)
Total net area of external elements Aum(A, m2)			26.3200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	13.8505		(33)
Main dwelling							
Party Wall 1			24.1000	0.0000	0.0000	180.0000	4338.0001 (32)
Party Floor 1			57.7300			40.0000	2309.2000 (32d)
Party Ceiling 1			57.7300			30.0000	1731.9000 (32b)
Heat capacity Cm = Sum(A x k)							10729.3998 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							185.8548 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				6.3000	0.0100	0.0630	
E3 Sill				6.3000	0.0200	0.1260	
E4 Jamb				13.0000	0.0150	0.1950	
E7 Party floor between dwellings (in blocks of flats)				9.4000	0.0450	0.4230	
E17 Corner (inverted - internal area greater than external area)				2.8000	-0.0980	-0.2744	
E16 Corner (normal)				5.6000	0.0450	0.2520	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							0.7846 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	14.6351 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	14.6092	14.2691	14.2691	13.7590	13.7590	13.0789	13.2489	12.9089	13.0789	13.4190	13.4190	13.9291 (38)
Average = Sum(39)m / 12 =	29.2443	28.9042	28.9042	28.3942	28.3942	27.7140	27.8841	27.5440	27.7140	28.0541	28.0541	28.5642 (39)
												28.2808
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.5066	0.5007	0.5007	0.4918	0.4918	0.4801	0.4830	0.4771	0.4801	0.4860	0.4860	0.4948 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

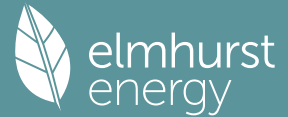
4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9168 (42)
Hot water usage for mixer showers												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths												
	64.9416	63.9771	62.6189	60.1147	58.2395	56.1603	55.0372	56.3859	57.8543	60.0792	62.6350	64.7220 (42b)
Hot water usage for other uses												
	34.2597	33.0139	31.7681	30.5223	29.2765	28.0307	28.0307	29.2765	30.5223	31.7681	33.0139	34.2597 (42c)
Average daily hot water use (litres/day)												91.3563 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	99.2013	96.9910	94.3870	90.6370	87.5160	84.1910	83.0679	85.6624	88.3767	91.8473	95.6489	98.9818 (44)
Energy content (annual)	157.1106	138.1139	145.0694	124.0775	117.8134	103.5226	100.4634	106.0679	108.9773	124.6359	136.2695	154.9815 (45)
Distribution loss (46)m = 0.15 x (45)m												
	23.5666	20.7171	21.7604	18.6116	17.6720	15.5284	15.0695	15.9102	16.3466	18.6954	20.4404	23.2472 (46)
Water storage loss (or HIU loss):												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1100 (48)
Temperature factor from Table 2b												0.7800 (49)
Enter (49) or (54) in (55)												1.6458 (55)
Total storage loss												
	51.0198	46.0824	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	49.3740	51.0198	49.3740	51.0198 (56)
If cylinder contains dedicated solar storage												
	51.0198	46.0824	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	49.3740	51.0198	49.3740	51.0198 (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												
	231.3928	205.2075	219.3516	195.9635	192.0956	175.4086	174.7456	180.3501	180.8633	198.9181	208.1555	229.2637 (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	231.3928	205.2075	219.3516	195.9635	192.0956	175.4086	174.7456	180.3501	180.8633	198.9181	208.1555	229.2637 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month												
	111.6650	99.5978	107.6613	98.7646	98.5987	91.9301	92.8298	94.6933	93.7437	100.8672	102.8184	110.9571 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	18.9471	16.8286	13.6859	10.3611	7.7451	6.5387	7.0653	9.1838	12.3264	15.6512	18.2673	19.4737 (67)
	249.5341	252.1235	245.5983	231.7070	214.1718	197.6911	186.6810	184.0916	190.6168	204.5081	222.0433	238.5240 (68)

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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
Pumps, fans	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	(69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Water heating gains (Table 5)	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	(71)
Total internal gains	150.0874	148.2110	144.7061	137.1730	132.5252	127.6807	124.7713	127.2760	130.1996	135.5742	142.8033	(72)
	505.3216	503.9161	490.7434	465.9942	441.1950	418.6635	405.2706	407.3044	419.8959	442.4865	469.8670	(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				10.2000	12.9236	0.4000	0.7000	0.7700	25.5784 (75)			
Southwest				3.7500	40.4699	0.4000	0.7000	0.7700	29.4479 (79)			
Solar gains	55.0263	92.2221	145.2135	220.5808	271.5272	302.8017	282.8968	241.4580	182.9325	114.8358	69.1572	45.6134 (83)
Total gains	560.3480	596.1382	635.9569	686.5750	712.7222	721.4652	688.1675	648.7624	602.8284	557.3223	539.0242	539.5000 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	101.9135	103.1125	103.1125	104.9648	104.9648	107.5407	106.8850	108.2046	107.5407	106.2372	106.2372	104.3400
alpha	7.7942	7.8742	7.8742	7.9977	7.9977	8.1694	8.1257	8.2136	8.1694	8.0825	8.0825	7.9560
util living area	0.7889	0.7262	0.6127	0.4586	0.3187	0.1921	0.1256	0.1359	0.2666	0.4726	0.6670	0.7988 (86)
MIT	20.9374	20.9666	20.9906	20.9991	21.0000	21.0000	21.0000	21.0000	21.0000	20.9991	20.9858	20.9364 (87)
Th 2	20.5148	20.5202	20.5202	20.5283	20.5283	20.5391	20.5364	20.5419	20.5391	20.5337	20.5337	20.5256 (88)
util rest of house	0.7706	0.7068	0.5922	0.4392	0.2999	0.1744	0.1068	0.1164	0.2455	0.4493	0.6450	0.7810 (89)
MIT 2	20.4630	20.4932	20.5130	20.5277	20.5283	20.5391	20.5364	20.5419	20.5391	20.5331	20.5229	20.4728 (90)
Living area fraction	MIT	20.6815	20.7112	20.7330	20.7448	20.7455	20.7514	20.7499	20.7529	20.7514	20.7478	20.6863 (92)
Temperature adjustment	adjusted MIT	20.6815	20.7112	20.7330	20.7448	20.7455	20.7514	20.7499	20.7529	20.7514	20.7478	20.7361
												0.0000 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	435.3951	426.0143	382.4036	307.6501	219.9154	131.6807	79.4682	81.3339	153.8502	256.3692	352.8536	424.6540 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	455.6700	436.7789	385.3793	307.9288	219.9279	131.6808	79.4682	81.3339	153.8519	256.6320	357.3000	445.2107 (97)
Space heating kWh	15.0846	7.2338	2.2139	0.2007	0.0093	0.0000	0.0000	0.0000	0.0000	0.1955	3.2014	15.2942 (98a)
Space heating requirement - total per year (kWh/year)												43.4334
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	15.0846	7.2338	2.2139	0.2007	0.0093	0.0000	0.0000	0.0000	0.0000	0.1955	3.2014	15.2942 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												43.4334
Space heating per m2										(98c) / (4) =		0.7524 (99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (301)
Fraction of space heat from community system												1.0000 (302)
Fraction of heat from community Heat pump-Space and Water												1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0500 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0500 (305a)
Distribution loss factor (Table 12c) for community heating system												1.1500 (306)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating:												
Space heating requirement	15.0846	7.2338	2.2139	0.2007	0.0093	0.0000	0.0000	0.0000	0.0000	0.1955	3.2014	15.2942 (98)
Space heat from Heat pump = (98) x 1.00 x 1.05 x 1.15												
307a	18.2146	8.7348	2.6733	0.2424	0.0113	0.0000	0.0000	0.0000	0.0000	0.2361	3.8657	18.4678
Space heating requirement	18.2146	8.7348	2.6733	0.2424	0.0113	0.0000	0.0000	0.0000	0.0000	0.2361	3.8657	18.4678 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating												
Annual water heating requirement	231.3928	205.2075	219.3516	195.9635	192.0956	175.4086	174.7456	180.3501	180.8633	198.9181	208.1555	229.2637 (64)
Water heat from Heat pump = (64) x 1.00 x 1.05 x 1.15												
310a	279.4069	247.7881	264.8670	236.6259	231.9555	211.8059	211.0053	217.7728	218.3924	240.1937	251.3477	276.8360
Water heating fuel	279.4069	247.7881	264.8670	236.6259	231.9555	211.8059	211.0053	217.7728	218.3924	240.1937	251.3477	276.8360 (310)
Cooling System Energy Efficiency Ratio												0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	9.5804	8.6533	9.5804	9.2714	9.5804	9.2714	9.5804	9.5804	9.2714	9.5804	9.2714	9.5804 (331)
Lighting	16.5842	13.3045	11.9792	8.7765	6.7792	5.5387	6.1842	8.0385	10.4412	13.6994	15.4735	17.0452 (332)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333a)m	-2.7184	-4.0493	-6.7592	-9.1371	-10.8043	-11.1597	-10.8962	-9.8111	-7.7773	-5.4177	-3.2614	-2.2545 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												

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(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335b)
Annual totals kWh/year													
Space heating fuel - community heating												52.4458	(307)
Space heating fuel - secondary												0.0000	(309)
Water heating fuel - community heating												2887.9971	(310)
Efficiency of water heater												0.0000	(311)
Electricity used for heat distribution												0.5245	(313)
Space cooling fuel												0.0000	(321)

Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)													
mechanical ventilation fans (SFP = 0.5720)												112.8016	(330a)
Total electricity for the above, kWh/year												112.8016	(331)
Electricity for lighting (calculated in Appendix L)												133.8444	(332)

Energy saving/generation technologies (Appendices M,N and Q)													
PV generation												-84.0462	(333)
Wind generation												0.0000	(334)
Hydro-electric generation (Appendix N)												0.0000	(335a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(335)
Appendix Q - special features													
Energy saved or generated												-0.0000	(336)
Energy used												0.0000	(337)
Total delivered energy for all uses												3103.0427	(338)

10b. Fuel costs - using BEDF prices (597)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating from Heat pump	52.4458	7.3200	3.8390 (340a)
Space heating total			3.8390 (340)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	0.0000	0.0000	0.0000 (341)
Water heating from Heat pump	2887.9971	7.3200	211.4014 (342a)
Water heating total			211.4014 (342)
Energy for instantaneous electric shower(s)	0.0000	27.6700	0.0000 (347a)
Pumps, fans and electric keep-hot	112.8016	27.6700	31.2122 (349)
Energy for lighting	133.8444	27.6700	37.0347 (350)
Additional standing charges			108.0000 (351)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-84.0462	27.6700	-23.2556
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-23.2556 (352)
Total energy cost			368.2318 (355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			275.0000 (367)
Space and Water heating from Heat pump	1069.2520	0.1609	3.0683 (367)
Electrical energy for heat distribution (space & water)	0.5245	0.0000	4.1422 (372)
Overall CO2 factor for heat network			0.0526 (386)
Total CO2 associated with community systems			154.7693 (373)
Space and water heating			154.7693 (376)
Pumps, fans and electric keep-hot	112.8016	0.1387	15.6470 (378)
Energy for lighting	133.8444	0.1443	19.3179 (379)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-84.0462	0.1315	-11.0510
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-11.0510 (380)
Total CO2, kg/year			178.6831 (383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			275.0000 (467a)
Space and Water heating from Heat pump	1069.2520	1.5954	30.4268 (467)
Electrical energy for heat distribution (space & water)	0.5245	0.0000	44.7207 (472)
Overall CO2 factor for heat network			0.5683 (486)
Total CO2 associated with community systems			1670.9265 (473)
Space and water heating			1670.9265 (476)
Pumps, fans and electric keep-hot	112.8016	1.5128	170.6463 (478)
Energy for lighting	133.8444	1.5338	205.2950 (479)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-84.0462	1.4858	-124.8725
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-124.8725 (480)
Total Primary energy kWh/year			1921.9953 (483)

SAP 10 EPC IMPROVEMENTS

00001

Current energy efficiency rating: B 86
Current environmental impact rating: A 98

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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 Environmental
 (none) efficiency impact
 Total Savings £0 0.00 kg/m²
 Potential energy efficiency rating: B 86
 Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 597 TEST (31 Jul 2026)
 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	£68	£68	£0
Community scheme	£323	£323	£0
Space heating	£143	£143	£0
Water heating	£211	£211	£0
Lighting	£37	£37	£0
Generated (PV)	-£23	-£23	£0
Total cost of fuels	£368	£368	£0
Total cost of uses	£368	£368	£0
Delivered energy	54 kWh/m²	54 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.2 tonnes	0.2 tonnes	0.0 tonnes
CO2 emissions per m²	3 kg/m²	3 kg/m²	0 kg/m²
Primary energy	33 kWh/m²	33 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (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)
Main dwelling	57.7300 (1b)	x 2.8000 (2b)	= 161.6440 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.7300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 161.6440 (5)

2. Ventilation rate

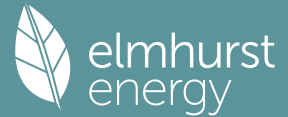
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												72.0000 (23c)
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898 (25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K
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Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K						
Opening Type 1			13.9500	0.8687	12.1187			(27)					
External Wall 1 LG	26.3200	13.9500	12.3700	0.1400	1.7318	190.0000	2350.2997	(29a)					
Total net area of external elements Aum(A, m2)			26.3200					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		13.8505			(33)					
Main dwelling													
Party Wall 1			24.1000	0.0000	0.0000	180.0000	4338.0001	(32)					
Party Floor 1			57.7300			40.0000	2309.2000	(32d)					
Party Ceiling 1			57.7300			30.0000	1731.9000	(32b)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		10729.3998	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							185.8548	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value	Total							
E2 Other lintels (including other steel lintels)				6.3000	0.0100	0.0630							
E3 Sill				6.3000	0.0200	0.1260							
E4 Jamb				13.0000	0.0150	0.1950							
E7 Party floor between dwellings (in blocks of flats)				9.4000	0.0450	0.4230							
E17 Corner (inverted - internal area greater than external area)				2.8000	-0.0980	-0.2744							
E16 Corner (normal)				5.6000	0.0450	0.2520							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							0.7846	(36)					
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss						(33) + (36) + (36a) =	14.6351	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	16.1394	15.9694	15.7994	14.9492	14.7792	13.9291	13.9291	13.7590	14.2691	14.7792	15.1193	15.4593	(38)
Heat transfer coeff	30.7746	30.6045	30.4345	29.5844	29.4143	28.5642	28.5642	28.3942	28.9042	29.4143	29.7544	30.0945	(39)
Average = Sum(39)m / 12 =												29.5419	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.5331	0.5301	0.5272	0.5125	0.5095	0.4948	0.4948	0.4918	0.5007	0.5095	0.5154	0.5213	(40)
HLP (average)												0.5117	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

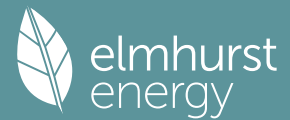
Assumed occupancy													1.9168	(42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	64.9416	63.9771	62.6189	60.1147	58.2395	56.1603	55.0372	56.3859	57.8543	60.0792	62.6350	64.7220	64.7220	(42b)
Hot water usage for other uses	34.2597	33.0139	31.7681	30.5223	29.2765	28.0307	28.0307	29.2765	30.5223	31.7681	33.0139	34.2597	34.2597	(42c)
Average daily hot water use (litres/day)													91.3563	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy conte	99.2013	96.9910	94.3870	90.6370	87.5160	84.1910	83.0679	85.6624	88.3767	91.8473	95.6489	98.9818	98.9818	(44)
Energy content (annual)	157.1106	138.1139	145.0694	124.0775	117.8134	103.5226	100.4634	106.0679	108.9773	124.6359	136.2695	154.9815	154.9815	(45)
Distribution loss (46)m = 0.15 x (45)m	23.5666	20.7171	21.7604	18.6116	17.6720	15.5284	15.0695	15.9102	16.3466	18.6954	20.4404	23.2472	23.2472	(46)
Water storage loss (or HIU loss):													300.0000	(47)
Store volume													2.1100	(48)
a) If manufacturer declared loss factor is known (kWh/day):													0.7800	(49)
Temperature factor from Table 2b													1.6458	(55)
Enter (49) or (54) in (55)														
Total storage loss	51.0198	46.0824	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	(56)
If cylinder contains dedicated solar storage	51.0198	46.0824	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	231.3928	205.2075	219.3516	195.9635	192.0956	175.4086	174.7456	180.3501	180.8633	198.9181	208.1555	229.2637	229.2637	(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	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	-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	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	0.0000	(63d)
Output from w/h	231.3928	205.2075	219.3516	195.9635	192.0956	175.4086	174.7456	180.3501	180.8633	198.9181	208.1555	229.2637	229.2637	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000	(64a)
Heat gains from water heating, kWh/month	111.6650	99.5978	107.6613	98.7646	98.5987	91.9301	92.8298	94.6933	93.7437	100.8672	102.8184	110.9571	110.9571	(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	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.9471	16.8286	13.6859	10.3611	7.7451	6.5387	7.0653	9.1838	12.3264	15.6512	18.2673	19.4737	19.4737	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	249.5341	252.1235	245.5983	231.7070	214.1718	197.6911	186.6810	184.0916	190.6168	204.5081	222.0433	238.5240	238.5240	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	(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	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	(71)
Water heating gains (Table 5)	150.0874	148.2110	144.7061	137.1730	132.5252	127.6807	124.7713	127.2760	130.1996	135.5742	142.8033	149.1359	149.1359	(72)
Total internal gains	505.3216	503.9161	490.7434	465.9942	441.1950	418.6635	405.2706	407.3044	419.8959	442.4865	469.8670	493.8866	493.8866	(73)

6. Solar gains

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[Jan]	Area m2				Solar flux Table 6a W/m2	Specific data or Table 6b		g	Specific data or Table 6c	FF	Access factor Table 6d		Gains W
Northeast	10.2000				11.2829	0.4000			0.7000		0.7700		22.3313 (75)
Southwest	3.7500				36.7938	0.4000			0.7000		0.7700		26.7730 (79)
Solar gains	49.1043	91.0604	144.2951	211.8128	267.3909	278.7161	263.1943	219.7035	167.3568	105.9534	60.1665		41.1490 (83)
Total gains	554.4260	594.9765	635.0385	677.8070	708.5859	697.3796	668.4650	627.0080	587.2526	548.4399	530.0335		535.0356 (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	96.8458	97.3839	97.9279	100.7420	101.3244	104.3400	104.3400	104.9648	103.1125	101.3244	100.1663	99.0345	
alpha	7.4564	7.4923	7.5285	7.7161	7.7550	7.9560	7.9560	7.9977	7.8742	7.7550	7.6778	7.6023	
util living area	0.8457	0.7848	0.6806	0.5263	0.3859	0.2621	0.1880	0.2083	0.3396	0.5551	0.7514	0.8572	(86)
MIT	20.8779	20.9299	20.9753	20.9966	20.9997	21.0000	21.0000	21.0000	20.9999	20.9960	20.9583	20.8723	(87)
Th 2	20.4906	20.4933	20.4960	20.5094	20.5121	20.5256	20.5256	20.5283	20.5202	20.5121	20.5067	20.5013	(88)
util rest of house	0.8297	0.7662	0.6595	0.5054	0.3657	0.2427	0.1677	0.1870	0.3160	0.5298	0.7297	0.8420	(89)
MIT 2	20.3868	20.4353	20.4765	20.5070	20.5119	20.5256	20.5256	20.5283	20.5202	20.5093	20.4736	20.3923	(90)
Living area fraction	fLA = Living area / (4) = 0.4606 (91)												
MIT	20.6130	20.6631	20.7062	20.7325	20.7366	20.7441	20.7441	20.7456	20.7411	20.7335	20.6968	20.6134	(92)
Temperature adjustment	0.0000												
adjusted MIT	20.6130	20.6631	20.7062	20.7325	20.7366	20.7441	20.7441	20.7456	20.7411	20.7335	20.6968	20.6134	(93)
8. Space heating requirement													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8336	0.7725	0.6683	0.5149	0.3750	0.2517	0.1771	0.1968	0.3268	0.5413	0.7382	0.8455	(94)
Useful gains	462.1885	459.6144	424.4235	349.0208	265.7228	175.4991	118.3731	123.3886	191.9379	296.8611	391.2519	452.3823	(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	502.0255	482.4224	432.3596	350.0575	265.8057	175.5014	118.3732	123.3888	191.9572	298.0696	404.5659	493.9525	(97)
Space heating kWh	29.6387	15.3270	5.9045	0.7465	0.0616	0.0000	0.0000	0.0000	0.0000	0.8992	9.5861	30.9282	(98a)
Space heating requirement - total per year (kWh/year)													93.0917
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	29.6387	15.3270	5.9045	0.7465	0.0616	0.0000	0.0000	0.0000	0.0000	0.8992	9.5861	30.9282	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)													93.0917
Space heating per m2	(98c) / (4) =												1.6125 (99)
9b. Energy requirements													
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (301)
Fraction of space heat from community system													1.0000 (302)
Fraction of heat from community Heat pump-Space and Water													1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating													1.0500 (305)
Factor for charging method (Table 4c(3)) for water heating													1.0500 (305a)
Distribution loss factor (Table 12c) for community heating system													1.1500 (306)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating:													
Space heating requirement	29.6387	15.3270	5.9045	0.7465	0.0616	0.0000	0.0000	0.0000	0.0000	0.8992	9.5861	30.9282	(98)
Space heat from Heat pump = (98) x 1.00 x 1.05 x 1.15	35.7888	18.5073	7.1297	0.9014	0.0744	0.0000	0.0000	0.0000	0.0000	1.0857	11.5752	37.3458	
307a	35.7888	18.5073	7.1297	0.9014	0.0744	0.0000	0.0000	0.0000	0.0000	1.0857	11.5752	37.3458	(307)
Space heating requirement	35.7888	18.5073	7.1297	0.9014	0.0744	0.0000	0.0000	0.0000	0.0000	1.0857	11.5752	37.3458	(307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)													0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(309)
Water heating													
Annual water heating requirement	231.3928	205.2075	219.3516	195.9635	192.0956	175.4086	174.7456	180.3501	180.8633	198.9181	208.1555	229.2637	(64)
Water heat from Heat pump = (64) x 1.00 x 1.05 x 1.15	279.4069	247.7881	264.8670	236.6259	231.9555	211.8059	211.0053	217.7728	218.3924	240.1937	251.3477	276.8360	
310a	279.4069	247.7881	264.8670	236.6259	231.9555	211.8059	211.0053	217.7728	218.3924	240.1937	251.3477	276.8360	
Water heating fuel	279.4069	247.7881	264.8670	236.6259	231.9555	211.8059	211.0053	217.7728	218.3924	240.1937	251.3477	276.8360	(310)
Cooling System Energy Efficiency Ratio	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(314)
Space coolin	9.5804	8.6533	9.5804	9.2714	9.5804	9.2714	9.5804	9.5804	9.2714	9.5804	9.2714	9.5804	(315)
Pumps and Fa	16.5842	13.3045	11.9792	8.7765	6.7792	5.5387	6.1842	8.0385	10.4412	13.6994	15.4735	17.0452	(332)
Electricity generated by PVs (Appendix M) (negative quantity)	-2.4255	-3.9903	-6.7370	-8.8762	-10.7468	-10.4796	-10.3261	-9.1104	-7.2225	-5.0308	-2.8478	-2.0297	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335b)
Annual totals kWh/year													
Space heating fuel - community heating													112.4082 (307)
Space heating fuel - secondary													0.0000 (309)
Water heating fuel - community heating													2887.9971 (310)
Efficiency of water heater													0.0000 (311)
Electricity used for heat distribution													1.1241 (313)
Space cooling fuel													0.0000 (321)
Electricity for pumps and fans:													

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(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)			
mechanical ventilation fans (SFP = 0.5720)			112.8016 (330a)
Total electricity for the above, kWh/year			112.8016 (331)
Electricity for lighting (calculated in Appendix L)			133.8444 (332)
Energy saving/generation technologies (Appendices M ,N and Q)			
PV generation			-79.8225 (333)
Wind generation			0.0000 (334)
Hydro-electric generation (Appendix N)			0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)			0.0000 (335)
Appendix Q - special features			
Energy saved or generated			-0.0000 (336)
Energy used			0.0000 (337)
Total delivered energy for all uses			3167.2289 (338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Heat pump	112.4082	4.4400	4.9909	(340a)
Space heating total			4.9909	(340)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Heat pump	2887.9971	4.4400	128.2271	(342a)
Water heating total			128.2271	(342)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(347a)
Pumps, fans and electric keep-hot	112.8016	16.4900	18.6010	(349)
Energy for lighting	133.8444	16.4900	22.0709	(350)
Additional standing charges			92.0000	(351)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-79.8225	16.4900	-13.1627	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-13.1627	(352)
Total energy cost			252.7272	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):		0.3600	(356)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8856	(357)
SAP value		85.6438	
SAP rating (Section 12)		86	(358)
SAP band		B	

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			275.0000	(367)
Space and Water heating from Heat pump	1091.0565	0.1602	6.5481	(367)
Electrical energy for heat distribution (space & water)	1.1241	0.0000	4.2379	(372)
Overall CO2 factor for heat network			0.0528	(386)
Total CO2 associated with community systems			158.3447	(373)
Space and water heating			158.3447	(376)
Pumps, fans and electric keep-hot	112.8016	0.1387	15.6470	(378)
Energy for lighting	133.8444	0.1443	19.3179	(379)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-79.8225	0.1316	-10.5027	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-10.5027	(380)
Total CO2, kg/year			182.8069	(383)
CO2 emissions per m2			3.1700	(384)
EI value			97.6155	(384a)
EI rating			98	(385)
EI band			A	

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

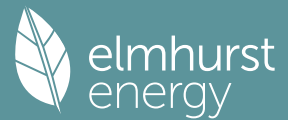
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling	57.7300 (1b)	x 2.8000 (2b)	= 161.6440 (1b) - (3b)	
Ground floor				(4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.7300			
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	161.6440 (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)

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Number of flues attached to other heater													0 * 35 =	0.0000 (6e)
Number of blocked chimneys													0 * 20 =	0.0000 (6f)
Number of intermittent extract fans													0 * 10 =	0.0000 (7a)
Number of passive vents													0 * 10 =	0.0000 (7b)
Number of flueless gas fires													0 * 40 =	0.0000 (7c)
														Air changes per hour
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =												0.0000 / (5) =	0.0000 (8)
Pressure test														Yes
Pressure Test Method														Blower Door
Measured/design AP50														3.0000 (17)
Infiltration rate														0.1500 (18)
Number of sides sheltered														2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =													0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =													0.1275 (21)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)	
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)	
Adj infilt rate	0.1339	0.1275	0.1275	0.1179	0.1179	0.1052	0.1084	0.1020	0.1052	0.1116	0.1116	0.1211	(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) =														72.0000 (23c)
Effective ac	0.2739	0.2675	0.2675	0.2579	0.2579	0.2452	0.2484	0.2420	0.2452	0.2516	0.2516	0.2611	(25)	

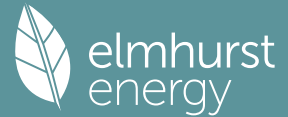
3. Heat losses and heat loss parameter														

Element			Gross	Openings	NetArea	U-value	A x U	K-value	A x K					
Main dwelling			m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K					
Opening Type 1					13.9500	0.8687	12.1187							(27)
External Wall 1 LG			26.3200	13.9500	12.3700	0.1400	1.7318	190.0000	2350.2997					(29a)
Total net area of external elements Aum(A, m2)														26.3200 (31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =													13.8505 (33)
Main dwelling														
Party Wall 1					24.1000	0.0000	0.0000	180.0000	4338.0001					(32)
Party Floor 1					57.7300			40.0000	2309.2000					(32d)
Party Ceiling 1					57.7300			30.0000	1731.9000					(32b)
Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =													10729.3998 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K														185.8548 (35)
List of Thermal Bridges														
K1 Element						Length	Psi-value	Total						
E2 Other lintels (including other steel lintels)						6.3000	0.0100	0.0630						
E3 Sill						6.3000	0.0200	0.1260						
E4 Jamb						13.0000	0.0150	0.1950						
E7 Party floor between dwellings (in blocks of flats)						9.4000	0.0450	0.4230						
E17 Corner (inverted - internal area greater than external area)						2.8000	-0.0980	-0.2744						
E16 Corner (normal)						5.6000	0.0450	0.2520						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)														0.7846 (36)
Point Thermal bridges	(36a) =													0.0000
Total fabric heat loss	(33) + (36) + (36a) =													14.6351 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)														
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat transfer coeff	14.6092	14.2691	14.2691	13.7590	13.7590	13.0789	13.2489	12.9089	13.0789	13.4190	13.4190	13.9291	(38)	
Average = Sum(39)m / 12 =	29.2443	28.9042	28.9042	28.3942	28.3942	27.7140	27.8841	27.5440	27.7140	28.0541	28.0541	28.5642	(39)	
														28.2808
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
HLP (average)	0.5066	0.5007	0.5007	0.4918	0.4918	0.4801	0.4830	0.4771	0.4801	0.4860	0.4860	0.4948	(40)	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31		

4. Water heating energy requirements (kWh/year)														

Assumed occupancy														1.9168 (42)
Hot water usage for mixer showers														
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)	
Hot water usage for baths														
	64.9416	63.9771	62.6189	60.1147	58.2395	56.1603	55.0372	56.3859	57.8543	60.0792	62.6350	64.7220	(42b)	
Hot water usage for other uses														
	34.2597	33.0139	31.7681	30.5223	29.2765	28.0307	28.0307	29.2765	30.5223	31.7681	33.0139	34.2597	(42c)	
Average daily hot water use (litres/day)														91.3563 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy conte	99.2013	96.9910	94.3870	90.6370	87.5160	84.1910	83.0679	85.6624	88.3767	91.8473	95.6489	98.9818	(44)	
Energy content (annual)	157.1106	138.1139	145.0694	124.0775	117.8134	103.5226	100.4634	106.0679	108.9773	124.6359	136.2695	154.9815	(45)	
Distribution loss (46)m = 0.15 x (45)m														Total = Sum(45)m = 1517.1031
Combi loss	23.5666	20.7171	21.7604	18.6116	17.6720	15.5284	15.0695	15.9102	16.3466	18.6954	20.4404	23.2472	(46)	
Water storage loss (or HIU loss):														
Store volume														300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):														2.1100 (48)
Temperature factor from Table 2b														0.7800 (49)
Enter (49) or (54) in (55)														1.6458 (55)
Total storage loss	51.0198	46.0824	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	49.3740	51.0198	49.3740	51.0198	(56)	
If cylinder contains dedicated solar storage														
Primary loss	51.0198	46.0824	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	49.3740	51.0198	49.3740	51.0198	(57)	
Combi loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)	
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)	
WWHRS	231.3928	205.2075	219.3516	195.9635	192.0956	175.4086	174.7456	180.3501	180.8633	198.9181	208.1555	229.2637	(62)	
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)	
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)	
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)	

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Output from w/h	231.3928	205.2075	219.3516	195.9635	192.0956	175.4086	174.7456	180.3501	180.8633	198.9181	208.1555	229.2637 (64)
	Total per year (kWh/year) = Sum(64)m = 2391.7161 (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	111.6650	99.5978	107.6613	98.7646	98.5987	91.9301	92.8298	94.6933	93.7437	100.8672	102.8184	110.9571 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068	115.0068 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.9471	16.8286	13.6859	10.3611	7.7451	6.5387	7.0653	9.1838	12.3264	15.6512	18.2673	19.4737 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	249.5341	252.1235	245.5983	231.7070	214.1718	197.6911	186.6810	184.0916	190.6168	204.5081	222.0433	238.5240 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175	48.4175 (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)	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712	-76.6712 (71)
Water heating gains (Table 5)	150.0874	148.2110	144.7061	137.1730	132.5252	127.6807	124.7713	127.2760	130.1996	135.5742	142.8033	149.1359 (72)
Total internal gains	505.3216	503.9161	490.7434	465.9942	441.1950	418.6635	405.2706	407.3044	419.8959	442.4865	469.8670	493.8866 (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					10.2000	12.9236	0.4000	0.7000			0.7700			25.5784 (75)
Southwest					3.7500	40.4699	0.4000	0.7000			0.7700			29.4479 (79)
Solar gains	55.0263	92.2221	145.2135	220.5808	271.5272	302.8017	282.8968	241.4580	182.9325	114.8358	69.1572			45.6134 (83)
Total gains	560.3480	596.1382	635.9569	686.5750	712.7222	721.4652	688.1675	648.7624	602.8284	557.3223	539.0242			539.5000 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	101.9135	103.1125	103.1125	104.9648	104.9648	107.5407	106.8850	108.2046	107.5407	106.2372	106.2372	104.3400
util living area	7.7942	7.8742	7.8742	7.9977	7.9977	8.1694	8.1257	8.2136	8.1694	8.0825	8.0825	7.9560
	0.7889	0.7262	0.6127	0.4586	0.3187	0.1921	0.1256	0.1359	0.2666	0.4726	0.6670	0.7988 (86)
MIT	20.9374	20.9666	20.9906	20.9991	21.0000	21.0000	21.0000	21.0000	21.0000	20.9991	20.9858	20.9364 (87)
Th 2	20.5148	20.5202	20.5202	20.5283	20.5283	20.5391	20.5364	20.5419	20.5391	20.5337	20.5337	20.5256 (88)
util rest of house	0.7706	0.7068	0.5922	0.4392	0.2999	0.1744	0.1068	0.1164	0.2455	0.4493	0.6450	0.7810 (89)
MIT 2	20.4630	20.4932	20.5130	20.5277	20.5283	20.5391	20.5364	20.5419	20.5391	20.5331	20.5229	20.4728 (90)
Living area fraction	20.6815	20.7112	20.7330	20.7448	20.7455	20.7514	20.7499	20.7529	20.7514	20.7478	20.7361	0.4606 (91)
MIT	20.6815	20.7112	20.7330	20.7448	20.7455	20.7514	20.7499	20.7529	20.7514	20.7478	20.7361	20.6863 (92)
Temperature adjustment												0.0000
adjusted MIT	20.6815	20.7112	20.7330	20.7448	20.7455	20.7514	20.7499	20.7529	20.7514	20.7478	20.7361	20.6863 (93)

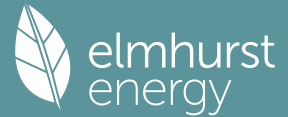
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.7770	0.7146	0.6013	0.4481	0.3086	0.1825	0.1155	0.1254	0.2552	0.4600	0.6546	0.7871 (94)
Useful gains	435.3951	426.0143	382.4036	307.6501	219.9154	131.6807	79.4682	81.3339	153.8502	256.3692	352.8536	424.6540 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	455.6700	436.7789	385.3793	307.9288	219.9279	131.6808	79.4682	81.3339	153.8519	256.6320	357.3000	445.2107 (97)
Space heating kWh	15.0846	7.2338	2.2139	0.2007	0.0093	0.0000	0.0000	0.0000	0.0000	0.1955	3.2014	15.2942 (98a)
Space heating requirement - total per year (kWh/year)												43.4334
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	15.0846	7.2338	2.2139	0.2007	0.0093	0.0000	0.0000	0.0000	0.0000	0.1955	3.2014	15.2942 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												43.4334
Space heating per m2										(98c) / (4) =		0.7524 (99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (301)
Fraction of space heat from community system												1.0000 (302)
Fraction of heat from community Heat pump-Space and Water												1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0500 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0500 (305a)
Distribution loss factor (Table 12c) for community heating system												1.1500 (306)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating:												
Space heating requirement	15.0846	7.2338	2.2139	0.2007	0.0093	0.0000	0.0000	0.0000	0.0000	0.1955	3.2014	15.2942 (98)
Space heat from Heat pump = (98) x 1.00 x 1.05 x 1.15	307a	18.2146	8.7348	2.6733	0.2424	0.0113	0.0000	0.0000	0.0000	0.2361	3.8657	18.4678
Space heating requirement												

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Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	18.2146	8.7348	2.6733	0.2424	0.0113	0.0000	0.0000	0.0000	0.0000	0.2361	3.8657	18.4678 (307)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (308)
Water heating												
Annual water heating requirement	231.3928	205.2075	219.3516	195.9635	192.0956	175.4086	174.7456	180.3501	180.8633	198.9181	208.1555	229.2637 (64)
Water heat from Heat pump = (64) x 1.00 x 1.05 x 1.15	279.4069	247.7881	264.8670	236.6259	231.9555	211.8059	211.0053	217.7728	218.3924	240.1937	251.3477	276.8360
Water heating fuel	279.4069	247.7881	264.8670	236.6259	231.9555	211.8059	211.0053	217.7728	218.3924	240.1937	251.3477	276.8360 (310)
Cooling System Energy Efficiency Ratio	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	9.5804	8.6533	9.5804	9.2714	9.5804	9.2714	9.5804	9.5804	9.2714	9.5804	9.2714	9.5804 (331)
Lighting	16.5842	13.3045	11.9792	8.7765	6.7792	5.5387	6.1842	8.0385	10.4412	13.6994	15.4735	17.0452 (332)
Electricity generated by PVs (Appendix M) (negative quantity)	-2.7184	-4.0493	-6.7592	-9.1371	-10.8043	-11.1597	-10.8962	-9.8111	-7.7773	-5.4177	-3.2614	-2.2545 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year												
Space heating fuel - community heating												52.4458 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												2887.9971 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												0.5245 (313)
Space cooling fuel												0.0000 (321)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)												
mechanical ventilation fans (SFP = 0.5720)												112.8016 (330a)
Total electricity for the above, kWh/year												112.8016 (331)
Electricity for lighting (calculated in Appendix L)												133.8444 (332)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-84.0462 (333)
Wind generation												0.0000 (334)
Hydro-electric generation (Appendix N)												0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (335)
Appendix Q - special features												
Energy saved or generated												-0.0000 (336)
Energy used												0.0000 (337)
Total delivered energy for all uses												3103.0427 (338)

10b. Fuel costs - using BEDF prices (597)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating from Heat pump	52.4458	7.3200	3.8390 (340a)
Space heating total			3.8390 (340)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	0.0000	0.0000	0.0000 (341)
Water heating from Heat pump	2887.9971	7.3200	211.4014 (342a)
Water heating total			211.4014 (342)
Energy for instantaneous electric shower(s)	0.0000	27.6700	0.0000 (347a)
Pumps, fans and electric keep-hot	112.8016	27.6700	31.2122 (349)
Energy for lighting	133.8444	27.6700	37.0347 (350)
Additional standing charges			108.0000 (351)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-84.0462	27.6700	-23.2556
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-23.2556 (352)
Total energy cost			368.2318 (355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			275.0000 (367)
Space and Water heating from Heat pump	1069.2520	0.1609	3.0683 (367)
Electrical energy for heat distribution (space & water)	0.5245	0.0000	4.1422 (372)
Overall CO2 factor for heat network			0.0526 (386)
Total CO2 associated with community systems			154.7693 (373)
Space and water heating			154.7693 (376)
Pumps, fans and electric keep-hot	112.8016	0.1387	15.6470 (378)
Energy for lighting	133.8444	0.1443	19.3179 (379)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-84.0462	0.1315	-11.0510
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-11.0510 (380)
Total CO2, kg/year			178.6831 (383)

13b. Primary energy - Community heating scheme

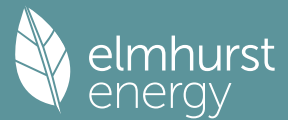
	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			275.0000 (467a)
Space and Water heating from Heat pump	1069.2520	1.5954	30.4268 (467)
Electrical energy for heat distribution (space & water)	0.5245	0.0000	44.7207 (472)
Overall CO2 factor for heat network			0.5683 (486)
Total CO2 associated with community systems			1670.9265 (473)
Space and water heating			1670.9265 (476)

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Pumps, fans and electric keep-hot	112.8016	1.5128	170.6463 (478)
Energy for lighting	133.8444	1.5338	205.2950 (479)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-84.0462	1.4858	-124.8725
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-124.8725 (480)
Total Primary energy kWh/year			1921.9953 (483)

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Plot Reference	3B 5P NW				Issued on Date	27/08/2026	
Assessment Reference	00001			Plot Type Ref			
Plot Address					SAP Version	10.2	
SAP Rating	87 B	DER	2.62	TER	10.37		
Environmental	98 A	% DER < TER				74.73	
CO ₂ Emissions (t/year)	0.21	DFEE	19.13	TFEE	23.14		
Compliance Check	See BREL	% DFEE < TFEE				17.31	
% DPER < TPER	49.18	DPER	28.07	TPER	55.24		
Assessor Details	Mr. Richard Denteh				Assessor ID	U148-0001	
Client							

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	86.5500 (1b)	2.8000 (2b)	242.3400 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.5500		242.3400 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	242.3400 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.1500 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1275 (21)

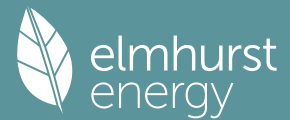
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												72.0000 (23c)
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Opening Type 1			21.7000	0.8687	18.8514		(27)
External Wall 1 LG	40.3200	21.7000	18.6200	0.1400	2.6068	190.0000	3537.7997 (29a)
Total net area of external elements Aum(A, m ²)			40.3200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	21.4582	(33)
Main dwelling							
Party Wall 1			67.4800	0.0000	0.0000	180.0000	12146.4006 (32)
Party Floor 1			86.5500			40.0000	3462.0000 (32a)
Party Ceiling 1			86.5500			30.0000	2596.5000 (32b)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	21742.7003 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							251.2155 (35)
List of Thermal Bridges							
K1 Element					Length	Psi-value	Total
E2 Other lintels (including other steel lintels)					8.8000	0.0100	0.0880
E3 Sill					8.8000	0.0200	0.1760

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Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	126.2484	126.9247	127.6083	131.1398	131.8697	135.6445	135.6445	136.4256	134.1090	131.8697	130.4180	128.9978
alpha	9.4166	9.4616	9.5072	9.7427	9.7913	10.0430	10.0430	10.0950	9.9406	9.7913	9.6945	9.5999
util living area	0.9549	0.8872	0.7758	0.5920	0.4335	0.2933	0.2100	0.2313	0.3744	0.6341	0.8742	0.9632 (86)
MIT	20.8106	20.9151	20.9756	20.9980	20.9999	21.0000	21.0000	21.0000	21.0000	20.9971	20.9403	20.7964 (87)
Th 2	20.4727	20.4754	20.4781	20.4915	20.4942	20.5076	20.5076	20.5103	20.5022	20.4942	20.4888	20.4834 (88)
util rest of house	0.9457	0.8701	0.7522	0.5675	0.4100	0.2707	0.1865	0.2067	0.3474	0.6042	0.8535	0.9553 (89)
MIT 2	20.3094	20.4062	20.4597	20.4902	20.4941	20.5076	20.5076	20.5103	20.5022	20.4923	20.4422	20.3062 (90)
Living area fraction									fLA = Living area / (4) = 0.3447 (91)			
MIT	20.4821	20.5816	20.6375	20.6652	20.6684	20.6773	20.6773	20.6791	20.6738	20.6663	20.6139	20.4751 (92)
Temperature adjustment												0.0000
adjusted MIT	20.4821	20.5816	20.6375	20.6652	20.6684	20.6773	20.6773	20.6791	20.6738	20.6663	20.6139	20.4751 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9459	0.8738	0.7595	0.5759	0.4181	0.2785	0.1946	0.2151	0.3567	0.6144	0.8588	0.9552 (94)
Useful gains	655.7770	694.0643	654.6229	540.7625	410.7079	270.5948	181.5444	189.4372	296.0453	459.4771	590.1238	634.5066 (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	774.1425	746.2007	669.1209	541.8463	410.7547	270.5953	181.5444	189.4373	296.0521	461.0362	625.8267	761.9969 (97)
Space heating kWh	88.0640	35.0356	10.7866	0.7803	0.0348	0.0000	0.0000	0.0000	0.0000	1.1600	25.7061	94.8528 (98a)
Space heating requirement - total per year (kWh/year)												256.4202
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	88.0640	35.0356	10.7866	0.7803	0.0348	0.0000	0.0000	0.0000	0.0000	1.1600	25.7061	94.8528 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												256.4202
Space heating per m2										(98c) / (4) =		2.9627 (99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (301)
Fraction of space heat from community system												1.0000 (302)
Fraction of heat from community Heat pump-Space and Water												1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0500 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0500 (305a)
Distribution loss factor (Table 12c) for community heating system												1.1500 (306)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating:												
Space heating requirement	88.0640	35.0356	10.7866	0.7803	0.0348	0.0000	0.0000	0.0000	0.0000	1.1600	25.7061	94.8528 (98)
Space heat from Heat pump = (98) x 1.00 x 1.05 x 1.15												
307a	106.3372	42.3055	13.0248	0.9422	0.0421	0.0000	0.0000	0.0000	0.0000	1.4007	31.0402	114.5348
Space heating requirement	106.3372	42.3055	13.0248	0.9422	0.0421	0.0000	0.0000	0.0000	0.0000	1.4007	31.0402	114.5348 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating												
Annual water heating requirement	262.3286	232.4027	247.9163	220.3949	215.2936	195.7927	194.5273	201.2353	202.3213	223.4595	234.9875	259.7802 (64)
Water heat from Heat pump = (64) x 1.00 x 1.05 x 1.15												
310a	316.7617	280.6263	299.3590	266.1268	259.9670	236.4197	234.8917	242.9917	244.3030	269.8273	283.7474	313.6846
Water heating fuel	316.7617	280.6263	299.3590	266.1268	259.9670	236.4197	234.8917	242.9917	244.3030	269.8273	283.7474	313.6846 (310)
Cooling System Energy Efficiency Ratio												0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	14.3632	12.9732	14.3632	13.8998	14.3632	13.8998	14.3632	14.3632	13.8998	14.3632	13.8998	14.3632 (331)
Lighting	21.5615	17.2974	15.5744	11.4105	8.8138	7.2009	8.0402	10.4510	13.5748	17.8109	20.1173	22.1607 (332)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333a)m	-2.4640	-4.0785	-6.9299	-9.1916	-11.1856	-10.9276	-10.7653	-9.4689	-7.4683	-5.1618	-2.9005	-2.0594 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year												
Space heating fuel - community heating												309.6274 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												3248.7061 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												3.0963 (313)
Space cooling fuel												0.0000 (321)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)												
mechanical ventilation fans (SFP = 0.5720)												169.1145 (330a)
Total electricity for the above, kWh/year												169.1145 (331)
Electricity for lighting (calculated in Appendix L)												174.0133 (332)

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

PV generation	-82.6015 (333)
Wind generation	0.0000 (334)
Hydro-electric generation (Appendix N)	0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (335)
Appendix Q - special features	
Energy saved or generated	-0.0000 (336)
Energy used	0.0000 (337)
Total delivered energy for all uses	3818.8600 (338)

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12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			275.0000 (367)
Space and Water heating from Heat pump	1293.9395	0.1608	18.1024 (367)
Electrical energy for heat distribution (space & water)	3.0963	0.0000	5.0662 (372)
Overall CO2 factor for heat network			0.0532 (386)
Total CO2 associated with community systems			189.2932 (373)
Space and water heating			189.2932 (376)
Pumps, fans and electric keep-hot	169.1145	0.1387	23.4583 (378)
Energy for lighting	174.0133	0.1443	25.1155 (379)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-82.6015	0.1315	-10.8589
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-10.8589 (380)
Total CO2, kg/year			227.0080 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.6200 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			275.0000 (467a)
Space and Water heating from Heat pump	1293.9395	1.5950	179.5829 (467)
Electrical energy for heat distribution (space & water)	3.0963	0.0000	54.3175 (472)
Overall CO2 factor for heat network			0.5704 (486)
Total CO2 associated with community systems			2029.5000 (473)
Space and water heating			2029.5000 (476)
Pumps, fans and electric keep-hot	169.1145	1.5128	255.8365 (478)
Energy for lighting	174.0133	1.5338	266.9074 (479)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-82.6015	1.4857	-122.7191
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-122.7191 (480)
Total Primary energy kWh/year			2429.5248 (483)
Dwelling Primary energy Rate (DPER)			28.0700 (484)

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

1. Overall dwelling characteristics

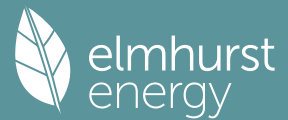
	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling	86.5500 (1b)	2.8000 (2b)	242.3400 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.5500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	242.3400 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1238 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3738 (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) = 0.3177 (21)
Wind speed	Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 4.7000 (22)
Wind factor	1.2750 1.2500 1.2250 1.1000 1.0750 0.9500 0.9500 0.9250 1.0000 1.0750 1.1750 1.1750 (22a)
Adj infilt rate	0.4051 0.3972 0.3892 0.3495 0.3416 0.3018 0.3018 0.2939 0.3177 0.3416 0.3574 0.3733 (22b)
Effective ac	0.5821 0.5789 0.5757 0.5611 0.5583 0.5456 0.5456 0.5432 0.5505 0.5583 0.5639 0.5697 (25)

3. Heat losses and heat loss parameter

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Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K						
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K						
TER Opening Type			21.6400	1.1450	24.7786		(27)						
External Wall 1 LG	40.3200	21.6400	18.6800	0.1800	3.3624		(29a)						
Total net area of external elements Aum(A, m2)			40.3200				(31)						
Fabric heat loss, W/K = Sum (A x U)			(26)... (30) + (32) =		28.1410		(33)						
Main dwelling													
Party Wall 1			67.4800	0.0000	0.0000		(32)						
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							251.2155 (35)						
List of Thermal Bridges													
K1 Element				Length	Psi-value	Total							
E2 Other lintels (including other steel lintels)				8.8000	0.0500	0.4400							
E3 Sill				8.8000	0.0500	0.4400							
E4 Jamb				25.0000	0.0500	1.2500							
E7 Party floor between dwellings (in blocks of flats)				14.4000	0.0700	1.0080							
E18 Party wall between dwellings				11.2000	0.0600	0.6720							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.8100 (36)						
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss						(33) + (36) + (36a) =	31.9510 (37)						
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	46.5480	46.2932	46.0434	44.8703	44.6508	43.6291	43.6291	43.4399	44.0226	44.6508	45.0948	45.5590	(38)
Average = Sum(39)m / 12 =	78.4990	78.2442	77.9945	76.8213	76.6019	75.5801	75.5801	75.3909	75.9737	76.6019	77.0459	77.5101	(39)
												76.8203	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9070	0.9040	0.9011	0.8876	0.8851	0.8733	0.8733	0.8711	0.8778	0.8851	0.8902	0.8956	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.5755 (42)
Hot water usage for mixer showers													(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	77.7288	76.5745	74.9488	71.9515	69.7071	67.2185	65.8742	67.4885	69.2461	71.9090	74.9681	77.4661	(42c)
Average daily hot water use (litres/day)	41.0056	39.5145	38.0234	36.5323	35.0412	33.5501	33.5501	35.0412	36.5323	38.0234	39.5145	41.0056	(43)
												109.3447	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	118.7345	116.0890	112.9722	108.4838	104.7483	100.7685	99.4243	102.5297	105.7784	109.9324	114.4826	118.4717	(44)
Energy content (annual)	188.0464	165.3091	173.6341	148.5089	141.0114	123.9067	120.2451	126.9531	130.4353	149.1773	163.1015	185.4980	(45)
Distribution loss (46)m = 0.15 x (45)m	28.2070	24.7964	26.0451	22.2763	21.1517	18.5860	18.0368	19.0430	19.5653	22.3766	24.4652	27.8247	(46)
Water storage loss (or HIU loss):													
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.1127 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.1409 (55)
Total storage loss	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(56)
If cylinder contains dedicated solar storage	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	246.6752	218.2642	232.2629	205.2465	199.6402	180.6442	178.8739	185.5819	187.1729	207.8061	219.8390	244.1268	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	246.6752	218.2642	232.2629	205.2465	199.6402	180.6442	178.8739	185.5819	187.1729	207.8061	219.8390	244.1268	(64)
12Total per year (kWh/year)													2506.1339 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains from water heating, kWh/month	109.4285	97.3293	104.6364	94.7693	93.7893	86.5890	86.8845	89.1150	88.7598	96.5045	99.6213	108.5811	(65)

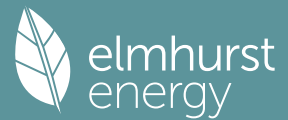
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	117.3127	129.8819	117.3127	121.2231	117.3127	121.2231	117.3127	117.3127	121.2231	117.3127	121.2231	117.3127	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	232.5856	234.9991	228.9171	215.9693	199.6251	184.2638	174.0015	171.5880	177.6699	190.6177	206.9620	222.3233	(68)
Pumps, fans	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	(69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Water heating gains (Table 5)	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	(71)
Total internal gains	147.0813	144.8353	140.6403	131.6240	126.0609	120.2625	116.7803	119.7782	123.2775	129.7103	138.3629	145.9424	(72)
	561.6120	574.3487	551.5025	533.4488	507.6311	487.3818	469.7269	470.3112	483.8030	502.2732	531.1804	550.2108	(73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m2	Table 6a	Specific data	Specific data	factor	W

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	W/m2				or Table 6b		or Table 6c		Table 6d		
Northeast			7.4800		11.2829	0.6300		0.7000	0.7700		25.7926 (75)
Southeast			11.9700		36.7938	0.6300		0.7000	0.7700		134.5987 (77)
Southwest			2.1900		36.7938	0.6300		0.7000	0.7700		24.6258 (79)

Solar gains	185.0172	323.7200	465.6841	615.1480	723.8321	733.9117	701.1962	617.7718	517.0760	363.9153	223.1682	157.3266 (83)
Total gains	746.6292	898.0688	1017.1866	1148.5969	1231.4632	1221.2935	1170.9231	1088.0831	1000.8789	866.1884	754.3486	707.5374 (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	76.9390	77.1896	77.4368	78.6193	78.8446	79.9104	79.9104	80.1110	79.4965	78.8446	78.3902	77.9207
alpha	6.1293	6.1460	6.1625	6.2413	6.2563	6.3274	6.3274	6.3407	6.2998	6.2563	6.2260	6.1947
util living area	0.9861	0.9606	0.9016	0.7567	0.5704	0.3954	0.2839	0.3186	0.5195	0.8236	0.9638	0.9894 (86)
MIT	20.2582	20.4873	20.7237	20.9218	20.9871	20.9989	20.9999	20.9998	20.9944	20.8921	20.5547	20.2212 (87)
Th 2	20.1616	20.1641	20.1665	20.1781	20.1802	20.1903	20.1903	20.1922	20.1864	20.1802	20.1758	20.1713 (88)
util rest of house	0.9821	0.9505	0.8797	0.7177	0.5229	0.3457	0.2317	0.2627	0.4601	0.7817	0.9527	0.9864 (89)
MIT 2	19.3138	19.5995	19.8828	20.1081	20.1708	20.1897	20.1903	20.1921	20.1832	20.0858	19.6960	19.2749 (90)
Living area fraction												0.3447 (91)
MIT	19.6393	19.9055	20.1726	20.3885	20.4521	20.4686	20.4693	20.4705	20.4628	20.3637	19.9920	19.6010 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6393	19.9055	20.1726	20.3885	20.4521	20.4686	20.4693	20.4705	20.4628	20.3637	19.9920	19.6010 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9790	0.9469	0.8799	0.7280	0.5388	0.3628	0.2497	0.2820	0.4804	0.7917	0.9497	0.9837 (94)
Useful gains	730.9535	850.3794	894.9792	836.2044	663.5408	443.0858	292.4087	306.8040	480.8420	685.7240	716.4401	695.9850 (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	1204.1220	1174.0920	1066.3896	882.5644	670.4294	443.5513	292.4425	306.8760	483.4053	747.9154	993.2717	1193.7346 (97)
Space heating kWh	352.0373	217.5349	127.5294	33.3792	5.1251	0.0000	0.0000	0.0000	0.0000	46.2704	199.3188	370.3256 (98a)
Space heating requirement - total per year (kWh/year)												1351.5208
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	352.0373	217.5349	127.5294	33.3792	5.1251	0.0000	0.0000	0.0000	0.0000	46.2704	199.3188	370.3256 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1351.5208
Space heating per m2										(98c) / (4) =		15.6155 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	352.0373	217.5349	127.5294	33.3792	5.1251	0.0000	0.0000	0.0000	0.0000	46.2704	199.3188	370.3256 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	381.4056	235.6824	138.1683	36.1639	5.5526	0.0000	0.0000	0.0000	0.0000	50.1305	215.9467	401.2195 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	246.6752	218.2642	232.2629	205.2465	199.6402	180.6442	178.8739	185.5819	187.1729	207.8061	219.8390	244.1268 (64)
Efficiency of water heater (217)m	84.8569	84.0523	82.7736	80.9476	80.0029	79.8000	79.8000	79.8000	79.8000	81.3006	83.8407	79.8000 (216)
Fuel for water heating, kWh/month	290.6954	259.6767	280.6003	253.5547	249.5410	226.3712	224.1527	232.5588	234.5525	255.6022	262.2104	287.2365 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.0685	7.3041	7.3041	7.3041	7.3041	7.3041	7.0685	7.3041 (221)
Lighting	24.3753	19.5547	17.6069	12.8996	9.9640	8.1407	9.0895	11.8149	15.3463	20.1352	22.7427	25.0527 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-16.2649	-24.5487	-37.7432	-45.4833	-51.7567	-49.3008	-48.6912	-44.6026	-37.9045	-29.3615	-18.4433	-13.8791 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-4.8561	-10.5192	-21.4915	-33.1622	-44.7371	-45.2887	-44.7668	-37.5013	-26.9588	-15.3369	-6.5747	-3.8186 (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												1464.2695 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)

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Efficiency of water heater	79.8000
Water heating fuel used	3056.7525 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	196.7223 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-712.9918 (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	4090.7526 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1464.2695	0.2100	307.4966 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3056.7525	0.2100	641.9180 (264)
Space and water heating			949.4146 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	196.7223	0.1443	28.3931 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-417.9799	0.1332	-55.6707
PV Unit electricity exported	-295.0119	0.1251	-36.9085
Total			-92.5792 (269)
Total CO2, kg/year			897.1578 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.3700 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1464.2695	1.1300	1654.6246 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3056.7525	1.1300	3454.1303 (278)
Space and water heating			5108.7549 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	196.7223	1.5338	301.7393 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-417.9799	1.4922	-623.6962
PV Unit electricity exported	-295.0119	0.4592	-135.4680
Total			-759.1642 (283)
Total Primary energy kWh/year			4781.4308 (286)
Target Primary Energy Rate (TPER)			55.2400 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	86.5500 (1b)	2.8000 (2b)	242.3400 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.5500		242.3400 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	242.3400 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1238 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.2738 (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) = 0.2327 (21)

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	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													
	0.2967	0.2909	0.2851	0.2560	0.2502	0.2211	0.2211	0.2153	0.2327	0.2502	0.2618	0.2735	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5440	0.5423	0.5406	0.5328	0.5313	0.5244	0.5244	0.5232	0.5271	0.5313	0.5343	0.5374	(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	
Main dwelling								
Opening Type 1			21.7000	0.8687	18.8514			(27)
External Wall 1 LG	40.3200	21.7000	18.6200	0.1400	2.6068	190.0000	3537.7997	(29a)
Total net area of external elements Aum(A, m2)			40.3200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	21.4582			(33)
Main dwelling								
Party Wall 1			67.4800	0.0000	0.0000	180.0000	12146.4006	(32)
Party Floor 1			86.5500			40.0000	3462.0000	(32d)
Party Ceiling 1			86.5500			30.0000	2596.5000	(32b)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	21742.7003	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							251.2155	(35)
List of Thermal Bridges								
K1 Element				Length	Psi-value	Total		
E2 Other lintels (including other steel lintels)				8.8000	0.0100	0.0880		
E3 Sill				8.8000	0.0200	0.1760		
E4 Jamb				25.0000	0.0150	0.3750		
E7 Party floor between dwellings (in blocks of flats)				14.4000	0.0700	1.0080		
E18 Party wall between dwellings				11.2000	0.0480	0.5376		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							2.1846	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss						(33) + (36) + (36a) =	23.6428	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	43.5067	43.3700	43.2360	42.6066	42.4888	41.9406	41.9406	41.8391	42.1518	42.4888	42.7270	42.9761	(38)
Average = Sum(39)m / 12 =	67.1494	67.0127	66.8787	66.2493	66.1316	65.5834	65.5834	65.4819	65.7945	66.1316	66.3698	66.6188	(39)
												66.2487	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.7758	0.7743	0.7727	0.7654	0.7641	0.7578	0.7578	0.7566	0.7602	0.7641	0.7668	0.7697	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

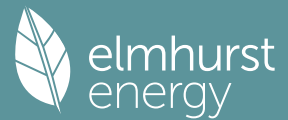
4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5755 (42)
Hot water usage for mixer showers												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths												
	29.1084	28.6761	28.0673	26.9449	26.1044	25.1724	24.6690	25.2735	25.9317	26.9290	28.0746	29.0100 (42b)
Hot water usage for other uses												
	41.0056	39.5145	38.0234	36.5323	35.0412	33.5501	33.5501	35.0412	36.5323	38.0234	39.5145	41.0056 (42c)
Average daily hot water use (litres/day)												64.2659 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
	70.1140	68.1906	66.0907	63.4772	61.1456	58.7225	58.2191	60.3147	62.4640	64.9524	67.5891	70.0156 (44)
Energy content (annual)												
	111.0435	97.1025	101.5790	86.8971	82.3137	72.2061	70.4109	74.6822	77.0244	88.1398	96.2930	109.6276 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1067.3198
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss (or HIU loss):												
Total storage 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 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	94.3870	82.5372	86.3422	73.8625	69.9666	61.3752	59.8493	63.4799	65.4707	74.9188	81.8491	93.1834 (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												
	94.3870	82.5372	86.3422	73.8625	69.9666	61.3752	59.8493	63.4799	65.4707	74.9188	81.8491	93.1834 (64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 907.2219 (64)
Electric shower(s)												907 (64)
	53.9780	48.0948	52.5177	50.1170	51.0575	48.7039	50.3273	51.0575	50.1170	52.5177	51.5302	53.9780 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												613.9966 (64a)
Heat gains from water heating, kWh/month												
	37.0912	32.6580	34.7150	30.9949	30.2560	27.5198	27.5442	28.6343	28.8969	31.8591	33.3448	36.7904 (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	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	117.3640	129.9388	117.3640	121.2762	117.3640	121.2762	117.3640	117.3640	121.2762	117.3640	121.2762	117.3640	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	232.5856	234.9991	228.9171	215.9693	199.6251	184.2638	174.0015	171.5880	177.6699	190.6177	206.9620	222.3233	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	(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)

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Losses e.g. evaporation (negative values) (Table 5)	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	(71)
Water heating gains (Table 5)	49.8538	48.5982	46.6599	43.0484	40.6667	38.2219	37.0217	38.4870	40.1346	42.8214	46.3122	49.4494	(72)
Total internal gains	461.4358	475.1685	454.5735	441.9263	419.2882	405.3942	390.0196	389.0714	400.7131	412.4356	436.1828	450.7691	(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					7.5000	11.2829		0.4000	0.7000	0.7700		16.4201 (75)		
Southeast					12.0000	36.7938		0.4000	0.7000	0.7700		85.6737 (77)		
Southwest					2.2000	36.7938		0.4000	0.7000	0.7700		15.7068 (79)		

Solar gains	117.8006	206.1121	296.4986	391.6586	460.8542	467.2707	446.4416	393.3282	329.2186	231.7039	142.0912	100.1701 (83)		
Total gains	579.2364	681.2806	751.0721	833.5849	880.1424	872.6649	836.4612	782.3996	729.9317	644.1394	578.2740	550.9392 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	89.9433	90.1268	90.3074	91.1653	91.3276	92.0910	92.0910	92.2338	91.7955	91.3276	90.9998	90.6596	
alpha	6.9962	7.0085	7.0205	7.0777	7.0885	7.1394	7.1394	7.1489	7.1197	7.0885	7.0667	7.0440	
util living area	0.9952	0.9849	0.9570	0.8584	0.6812	0.4796	0.3449	0.3847	0.6138	0.9031	0.9859	0.9965	(86)
MIT	20.2787	20.4599	20.6676	20.8859	20.9795	20.9984	20.9999	20.9997	20.9921	20.8593	20.5327	20.2444	(87)
Th 2	20.2743	20.2757	20.2770	20.2834	20.2846	20.2901	20.2901	20.2911	20.2880	20.2846	20.2822	20.2797	(88)
util rest of house	0.9938	0.9806	0.9454	0.8282	0.6345	0.4271	0.2893	0.3256	0.5539	0.8738	0.9812	0.9955	(89)
MIT 2	19.6164	19.7960	19.9971	20.1988	20.2723	20.2894	20.2901	20.2910	20.2842	20.1816	19.8744	19.5869	(90)
Living area fraction									fLA = Living area / (4) =			0.3447	(91)
MIT	19.8447	20.0248	20.2282	20.4356	20.5160	20.5338	20.5347	20.5353	20.5282	20.4152	20.1013	19.8135	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8447	20.0248	20.2282	20.4356	20.5160	20.5338	20.5347	20.5353	20.5282	20.4152	20.1013	19.8135	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9927	0.9789	0.9445	0.8350	0.6499	0.4452	0.3085	0.3460	0.5744	0.8797	0.9797	0.9946	(94)
Ext temp.	575.0116	666.8830	709.3780	696.0414	572.0030	388.4819	258.0109	270.6972	419.2407	566.6492	566.5346	547.9741	(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	1043.8154	1013.5557	918.1234	764.2251	583.0170	389.1586	258.0512	270.7871	422.9383	649.0948	862.8924	1040.1523	(97)
Space heating kWh	348.7901	232.9640	155.3066	49.0923	8.1943	0.0000	0.0000	0.0000	0.0000	61.3395	213.3776	366.1806	(98a)
Space heating requirement - total per year (kWh/year)												1435.2451	
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	348.7901	232.9640	155.3066	49.0923	8.1943	0.0000	0.0000	0.0000	0.0000	61.3395	213.3776	366.1806	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1435.2451	
Space heating per m ²										(98c) / (4) =		16.5828	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b													
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	616.4836	485.3169	497.6621	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.9857	0.9955	0.9922	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	607.6405	483.1324	493.7798	0.0000	0.0000	0.0000	0.0000	(102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	974.2102	934.1745	873.2838	0.0000	0.0000	0.0000	0.0000	(103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	263.9301	335.5753	282.3510	0.0000	0.0000	0.0000	0.0000	(104)
Intermittency factor (Table 10b)									fC = cooled area / (4) =			1.0000	(105)
Space cooling kWh	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling requirement	0.0000	0.0000	0.0000	0.0000	0.0000	65.9825	83.8938	70.5877	0.0000	0.0000	0.0000	0.0000	(107)
Energy for space heating												220.4641	(107)
Energy for space cooling												16.5828	(99)
Total												2.5472	(108)
Fabric Energy Efficiency (DFEE)												19.1301	(109)
												19.1	(109)

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1. Overall dwelling characteristics

Main dwelling	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	86.5500 (1b)	x 2.8000 (2b)	= 242.3400 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.5500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 242.3400 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 30.0000 / (5) = 0.1238 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3738 (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) = 0.3177 (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	0.4051	0.3972	0.3892	0.3495	0.3416	0.3018	0.3018	0.2939	0.3177	0.3416	0.3574	0.3733 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5821	0.5789	0.5757	0.5611	0.5583	0.5456	0.5456	0.5432	0.5505	0.5583	0.5639	0.5697 (25)

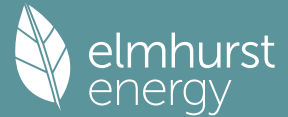
3. Heat losses and heat loss parameter

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					
Main dwelling												
TER Opening Type			21.6400	1.1450	24.7786		(27)					
External Wall 1 LG	40.3200	21.6400	18.6800	0.1800	3.3624		(29a)					
Total net area of external elements Aum(A, m2)			40.3200				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		28.1410		(33)					
Main dwelling												
Party Wall 1			67.4800	0.0000	0.0000		(32)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							251.2155 (35)					
List of Thermal Bridges												
K1 Element				Length	Psi-value	Total						
E2 Other lintels (including other steel lintels)				8.8000	0.0500	0.4400						
E3 Sill				8.8000	0.0500	0.4400						
E4 Jamb				25.0000	0.0500	1.2500						
E7 Party floor between dwellings (in blocks of flats)				14.4000	0.0700	1.0080						
E18 Party wall between dwellings				11.2000	0.0600	0.6720						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.8100 (36)					
Point Thermal bridges						(36a) =	0.0000					
Total fabric heat loss						(33) + (36) + (36a) =	31.9510 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 46.5480	Feb 46.2932	Mar 46.0434	Apr 44.8703	May 44.6508	Jun 43.6291	Jul 43.6291	Aug 43.4399	Sep 44.0226	Oct 44.6508	Nov 45.0948	Dec 45.5590 (38)
Heat transfer coeff	78.4990	78.2442	77.9945	76.8213	76.6019	75.5801	75.5801	75.3909	75.9737	76.6019	77.0459	77.5101 (39)
Average = Sum(39)m / 12 =												76.8203
HLP	Jan 0.9070	Feb 0.9040	Mar 0.9011	Apr 0.8876	May 0.8851	Jun 0.8733	Jul 0.8733	Aug 0.8711	Sep 0.8778	Oct 0.8851	Nov 0.8902	Dec 0.8956 (40)
HLP (average)												0.8876
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5755 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	29.1084	28.6761	28.0673	26.9449	26.1044	25.1724	24.6690	25.2735	25.9317	26.9290	28.0746	29.0100 (42b)
Hot water usage for other uses	41.0056	39.5145	38.0234	36.5323	35.0412	33.5501	33.5501	35.0412	36.5323	38.0234	39.5145	41.0056 (42c)
Average daily hot water use (litres/day)												64.2659 (43)
Daily hot water use	Jan 70.1140	Feb 68.1906	Mar 66.0907	Apr 63.4772	May 61.1456	Jun 58.7225	Jul 58.2191	Aug 60.3147	Sep 62.4640	Oct 64.9524	Nov 67.5891	Dec 70.0156 (44)
Energy conte	111.0435	97.1025	101.5790	86.8971	82.3137	72.2061	70.4109	74.6822	77.0244	88.1398	96.2930	109.6276 (45)
Energy content (annual)										Total = Sum(45)m =		1067.3198
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss (or HIU loss):												
Total storage 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 (56)
If cylinder contains dedicated solar storage												

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Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
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 (59)
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
94.3870	82.5372	86.3422	73.8625	69.9666	61.3752	59.8493	63.4799	65.4707	74.9188	81.8491	93.1834	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	94.3870	82.5372	86.3422	73.8625	69.9666	61.3752	59.8493	63.4799	65.4707	74.9188	81.8491	93.1834 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											907.2219 (64)
Electric shower(s)	53.9780	48.0948	52.5177	50.1170	51.0575	48.7039	50.3273	51.0575	50.1170	52.5177	51.5302	53.9780 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											613.9966 (64a)
Heat gains from water heating, kWh/month	37.0912	32.6580	34.7150	30.9949	30.2560	27.5198	27.5442	28.6343	28.8969	31.8591	33.3448	36.7904 (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	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	128.7747	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	117.3127	129.8819	117.3127	121.2231	117.3127	121.2231	117.3127	117.3127	121.2231	117.3127	121.2231	117.3127	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	232.5856	234.9991	228.9171	215.9693	199.6251	184.2638	174.0015	171.5880	177.6699	190.6177	206.9620	222.3233	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	35.8775	(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)	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	(71)
Water heating gains (Table 5)	49.8538	48.5982	46.6599	43.0484	40.6667	38.2219	37.0217	38.4870	40.1346	42.8214	46.3122	49.4494	(72)
Total internal gains	461.3845	475.1116	454.5221	441.8733	419.2369	405.3412	389.9683	389.0201	400.6601	412.3842	436.1298	450.7178	(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				7.4800	11.2829		0.6300		0.7000		0.7700		25.7926 (75)
Southeast				11.9700	36.7938		0.6300		0.7000		0.7700		134.5987 (77)
Southwest				2.1900	36.7938		0.6300		0.7000		0.7700		24.6258 (79)
Solar gains	185.0172	323.7200	465.6841	615.1480	723.8321	733.9117	701.1962	617.7718	517.0760	363.9153	223.1682	157.3266	(83)
Total gains	646.4017	798.8317	920.2062	1057.0213	1143.0690	1139.2529	1091.1645	1006.7919	917.7361	776.2995	659.2979	608.0444	(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	76.9390	77.1896	77.4368	78.6193	78.8446	79.9104	79.9104	80.1110	79.4965	78.8446	78.3902	77.9207	
alpha	6.1293	6.1460	6.1625	6.2413	6.2563	6.3274	6.3274	6.3407	6.2998	6.2563	6.2260	6.1947	
util living area	0.9933	0.9768	0.9322	0.8009	0.6106	0.4235	0.3047	0.3442	0.5639	0.8731	0.9807	0.9952	(86)
MIT	20.1367	20.3809	20.6471	20.8925	20.9813	20.9984	20.9998	20.9997	20.9913	20.8459	20.4505	20.0984	(87)
Th 2	20.1616	20.1641	20.1665	20.1781	20.1802	20.1903	20.1903	20.1922	20.1864	20.1802	20.1758	20.1713	(88)
util rest of house	0.9913	0.9704	0.9151	0.7637	0.5610	0.3704	0.2487	0.2839	0.5005	0.8368	0.9741	0.9937	(89)
MIT 2	19.3815	19.6227	19.8773	20.1014	20.1694	20.1896	20.1903	20.1921	20.1824	20.0710	19.7030	19.3516	(90)
Living area fraction	19.6418	19.8840	20.1427	20.3740	20.4493	20.4684	20.4693	20.4704	20.4612	20.3381	19.9606	19.6090	(91)
MIT	19.6418	19.8840	20.1427	20.3740	20.4493	20.4684	20.4693	20.4704	20.4612	20.3381	19.9606	19.6090	(92)
Temperature adjustment	19.6418	19.8840	20.1427	20.3740	20.4493	20.4684	20.4693	20.4704	20.4612	20.3381	19.9606	19.6090	(93)

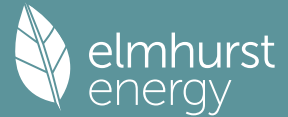
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	639.7161	773.0909	841.6030	817.0435	660.1782	442.8400	292.3892	306.7578	479.2202	655.5191	640.8662	603.4519	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1204.3152	1172.4146	1064.0513	881.4516	670.2103	443.5332	292.4407	306.8719	483.2836	745.9560	990.8563	1194.3496	(97)
Space heating kWh	420.0617	268.3455	165.5015	46.3738	7.4639	0.0000	0.0000	0.0000	0.0000	67.2850	251.9928	439.6279	(98a)
Space heating requirement - total per year (kWh/year)													1666.6522
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	420.0617	268.3455	165.5015	46.3738	7.4639	0.0000	0.0000	0.0000	0.0000	67.2850	251.9928	439.6279	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)													1666.6522
Space heating per m ²													19.2565 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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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
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	710.4530	559.2928	572.9708	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9894	0.9963	0.9935	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	702.9078	557.2216	569.2367	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1285.8641	1231.9348	1135.6143	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	419.7285	501.9866	421.3849	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area /	(4) =		1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	104.9321	125.4966	105.3462	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												335.7750 (107)
Energy for space heating												19.2565 (99)
Energy for space cooling												3.8795 (108)
Total												23.1361 (109)
Fabric Energy Efficiency (TFEE)												23.1 (109)

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

1. Overall dwelling characteristics

Main dwelling	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	86.5500 (1b)	x 2.8000 (2b)	= 242.3400 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.5500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 242.3400 (5)

2. Ventilation rate

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

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												72.0000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898 (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
Main dwelling							
Opening Type 1			21.7000	0.8687	18.8514		(27)
External Wall 1 LG	40.3200	21.7000	18.6200	0.1400	2.6068	190.0000	3537.7997 (29a)
Total net area of external elements Aum(A, m2)			40.3200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.4582		(33)
Main dwelling							
Party Wall 1			67.4800	0.0000	0.0000	180.0000	12146.4006 (32)
Party Floor 1			86.5500			40.0000	3462.0000 (32d)
Party Ceiling 1			86.5500			30.0000	2596.5000 (32b)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	21742.7003 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							251.2155 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				8.8000	0.0100	0.0880	
E3 Sill				8.8000	0.0200	0.1760	
E4 Jamb				25.0000	0.0150	0.3750	
E7 Party floor between dwellings (in blocks of flats)				14.4000	0.0700	1.0080	
E18 Party wall between dwellings				11.2000	0.0480	0.5376	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							2.1846 (36)
Point Thermal bridges						(36a) =	0.0000

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Total fabric heat loss (33) + (36) + (36a) = 23.6428 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	24.1966	23.9417	23.6868	22.4122	22.1573	20.8827	20.8827	20.6278	21.3926	22.1573	22.6671	23.1769 (38)
Average = Sum(39)m / 12 =	47.8393	47.5844	47.3295	46.0550	45.8000	44.5255	44.5255	44.2706	45.0353	45.8000	46.3099	46.8197 (39)
												45.9912
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.5527	0.5498	0.5468	0.5321	0.5292	0.5144	0.5144	0.5115	0.5203	0.5292	0.5351	0.5410 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	0.5314 (40)
												31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												
Hot water usage for mixer showers												2.5755 (42)
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 (42a)
Hot water usage for other uses	77.7288	76.5745	74.9488	71.9515	69.7071	67.2185	65.8742	67.4885	69.2461	71.9090	74.9681	77.4661 (42b)
Average daily hot water use (litres/day)	41.0056	39.5145	38.0234	36.5323	35.0412	33.5501	33.5501	35.0412	36.5323	38.0234	39.5145	41.0056 (42c)
												109.3447 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	118.7345	116.0890	112.9722	108.4838	104.7483	100.7685	99.4243	102.5297	105.7784	109.9324	114.4826	118.4717 (44)
Energy content (annual)	188.0464	165.3091	173.6341	148.5089	141.0114	123.9067	120.2451	126.9531	130.4353	149.1773	163.1015	185.4980 (45)
Distribution loss (46)m = 0.15 x (45)m	28.2070	24.7964	26.0451	22.2763	21.1517	18.5860	18.0368	19.0430	19.5653	22.3766	24.4652	27.8247 (46)
Water storage loss (or HIU loss):												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1100 (48)
Temperature factor from Table 2b												0.7800 (49)
Enter (49) or (54) in (55)												1.6458 (55)
Total storage loss	51.0198	46.0824	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	49.3740	51.0198	49.3740	51.0198 (56)
If cylinder contains dedicated solar storage	51.0198	46.0824	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	49.3740	51.0198	49.3740	51.0198 (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	262.3286	232.4027	247.9163	220.3949	215.2936	195.7927	194.5273	201.2353	202.3213	223.4595	234.9875	259.7802 (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	262.3286	232.4027	247.9163	220.3949	215.2936	195.7927	194.5273	201.2353	202.3213	223.4595	234.9875	259.7802 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	121.9512	108.6402	117.1591	106.8880	106.3120	98.7078	99.4072	101.6377	100.8785	109.0272	111.7400	121.1039 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	24.6334	21.8792	17.7933	13.4707	10.0695	8.5011	9.1857	11.9400	16.0258	20.3484	23.7496	25.3180 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	347.1426	350.7449	341.6673	322.3423	297.9479	275.0205	259.7037	256.1014	265.1790	284.5041	308.8985	331.8258 (68)
Pumps, fans	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285 (69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Water heating gains (Table 5)	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197 (71)
Total internal gains	163.9129	161.6669	157.4719	148.4556	142.8925	137.0941	133.6119	136.6098	140.1091	146.5419	155.1945	162.7740 (72)
	640.2272	638.8293	621.4709	588.8068	555.4482	525.1541	507.0396	509.1895	525.8522	555.9327	592.3809	624.4561 (73)

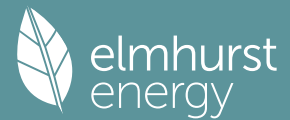
6. Solar gains

[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					7.5000	11.2829	0.4000	0.7000	0.7700		16.4201 (75)	
Southeast					12.0000	36.7938	0.4000	0.7000	0.7700		85.6737 (77)	
Southwest					2.2000	36.7938	0.4000	0.7000	0.7700		15.7068 (79)	
Solar gains	117.8006	206.1121	296.4986	391.6586	460.8542	467.2707	446.4416	393.3282	329.2186	231.7039	142.0912	100.1701 (83)
Total gains	758.0278	844.9414	917.9695	980.4654	1016.3023	992.4247	953.4813	902.5176	855.0708	787.6366	734.4721	724.6262 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	126.2484	126.9247	127.6083	131.1398	131.8697	135.6445	135.6445	136.4256	134.1090	131.8697	130.4180	128.9978
	9.4166	9.4616	9.5072	9.7427	9.7913	10.0430	10.0430	10.0950	9.9406	9.7913	9.6945	9.5999

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util living area	0.9260	0.8545	0.7351	0.5674	0.4191	0.2871	0.2055	0.2256	0.3634	0.6030	0.8365	0.9383 (86)
MIT	20.8658	20.9389	20.9841	20.9986	20.9999	21.0000	21.0000	21.0000	21.0000	20.9981	20.9593	20.8521 (87)
Th 2	20.4727	20.4754	20.4781	20.4915	20.4942	20.5076	20.5076	20.5103	20.5022	20.4942	20.4888	20.4834 (88)
util rest of house												
MIT 2	0.9130	0.8354	0.7115	0.5438	0.3963	0.2650	0.1825	0.2016	0.3372	0.5742	0.8138	0.9269 (89)
Living area fraction	20.3598	20.4265	20.4663	20.4906	20.4941	20.5076	20.5076	20.5103	20.5022	20.4930	20.4577	20.3576 (90)
MIT	20.5342	20.6031	20.6448	20.6657	20.6685	20.6773	20.6773	20.6791	20.6738	20.6671	20.6306	20.5280 (92)
Temperature adjustment												0.0000
adjusted MIT	20.5342	20.6031	20.6448	20.6657	20.6685	20.6773	20.6773	20.6791	20.6738	20.6671	20.6306	20.5280 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9146	0.8402	0.7191	0.5519	0.4041	0.2727	0.1904	0.2099	0.3462	0.5841	0.8203	0.9280	(94)
Useful gains	693.2777	709.8901	660.1158	541.1160	410.7212	270.5949	181.5444	189.4373	296.0471	460.0586	602.4530	672.4511	(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													
	776.6313	747.2235	669.4664	541.8679	410.7555	270.5953	181.5444	189.4373	296.0522	461.0718	626.6012	764.4739	(97)
Space heating kWh													
	62.0151	25.0880	6.9568	0.5414	0.0256	0.0000	0.0000	0.0000	0.0000	0.7539	17.3867	68.4650	(98a)
Space heating requirement - total per year (kWh/year)												181.2324	
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													
	62.0151	25.0880	6.9568	0.5414	0.0256	0.0000	0.0000	0.0000	0.0000	0.7539	17.3867	68.4650	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												181.2324	
Space heating per m2											(98c) / (4) =	2.0940	(99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(301)
Fraction of space heat from community system												1.0000	(302)
Fraction of heat from community Heat pump-Space and Water												1.0000	(303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0500	(305)
Factor for charging method (Table 4c(3)) for water heating												1.0500	(305a)
Distribution loss factor (Table 12c) for community heating system												1.1500	(306)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating:													
Space heating requirement													
	62.0151	25.0880	6.9568	0.5414	0.0256	0.0000	0.0000	0.0000	0.0000	0.7539	17.3867	68.4650	(98)
Space heat from Heat pump = (98) x 1.00 x 1.05 x 1.15													
307a	74.8833	30.2938	8.4004	0.6537	0.0309	0.0000	0.0000	0.0000	0.0000	0.9103	20.9944	82.6714	
Space heating requirement													
	74.8833	30.2938	8.4004	0.6537	0.0309	0.0000	0.0000	0.0000	0.0000	0.9103	20.9944	82.6714	(307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000	(308)
Space heating fuel for secondary/supplementary system													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(309)
Water heating													
Annual water heating requirement													
	262.3286	232.4027	247.9163	220.3949	215.2936	195.7927	194.5273	201.2353	202.3213	223.4595	234.9875	259.7802	(64)
Water heat from Heat pump = (64) x 1.00 x 1.05 x 1.15													
310a	316.7617	280.6263	299.3590	266.1268	259.9670	236.4197	234.8917	242.9917	244.3030	269.8273	283.7474	313.6846	
Water heating fuel													
	316.7617	280.6263	299.3590	266.1268	259.9670	236.4197	234.8917	242.9917	244.3030	269.8273	283.7474	313.6846	(310)
Cooling System Energy Efficiency Ratio													
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(314)
Pumps and Fa	14.3632	12.9732	14.3632	13.8998	14.3632	13.8998	14.3632	14.3632	13.8998	14.3632	13.8998	14.3632	(331)
Lighting	21.5615	17.2974	15.5744	11.4105	8.8138	7.2009	8.0402	10.4510	13.5748	17.8109	20.1173	22.1607	(332)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333a)m	-2.4640	-4.0785	-6.9299	-9.1916	-11.1856	-10.9276	-10.7653	-9.4689	-7.4683	-5.1618	-2.9005	-2.0594	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335b)
Annual totals kWh/year													
Space heating fuel - community heating												218.8382	(307)
Space heating fuel - secondary												0.0000	(309)
Water heating fuel - community heating												3248.7061	(310)
Efficiency of water heater												0.0000	(311)
Electricity used for heat distribution												2.1884	(313)
Space cooling fuel												0.0000	(321)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)													
mechanical ventilation fans (SFP = 0.5720)												169.1145	(330a)
Total electricity for the above, kWh/year												169.1145	(331)
Electricity for lighting (calculated in Appendix L)												174.0133	(332)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-82.6015	(333)
Wind generation												0.0000	(334)
Hydro-electric generation (Appendix N)												0.0000	(335a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(335)
Appendix Q - special features													
Energy saved or generated												-0.0000	(336)
Energy used												0.0000	(337)
Total delivered energy for all uses												3728.0707	(338)

10b. Fuel costs - using Table 12 prices

Fuel Fuel price Fuel cost

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	kWh/year	p/kWh	£/year
Space heating from Heat pump	218.8382	4.4400	9.7164 (340a)
Space heating total			9.7164 (340)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	0.0000	0.0000	0.0000 (341)
Water heating from Heat pump	3248.7061	4.4400	144.2426 (342a)
Water heating total			144.2426 (342)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (347a)
Pumps, fans and electric keep-hot	169.1145	16.4900	27.8870 (349)
Energy for lighting	174.0133	16.4900	28.6948 (350)
Additional standing charges			92.0000 (351)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-82.6015	16.4900	-13.6210
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-13.6210 (352)
Total energy cost			288.9198 (355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):		0.3600 (356)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.7907 (357)
SAP value		87.1834
SAP rating (Section 12)		87 (358)
SAP band		B

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			275.0000 (367)
Space and Water heating from Heat pump	1260.9252	0.1609	12.8019 (367)
Electrical energy for heat distribution (space & water)	2.1884	0.0000	4.9205 (372)
Overall CO2 factor for heat network			0.0530 (386)
Total CO2 associated with community systems			183.8469 (373)
Space and water heating			183.8469 (376)
Pumps, fans and electric keep-hot	169.1145	0.1387	23.4583 (378)
Energy for lighting	174.0133	0.1443	25.1155 (379)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-82.6015	0.1315	-10.8589
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-10.8589 (380)
Total CO2, kg/year			221.5617 (383)
CO2 emissions per m2			2.5600 (384)
EI value			97.7431 (384a)
EI rating			98 (385)
EI band			A

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

1. Overall dwelling characteristics

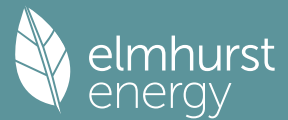
	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	86.5500 (1b)	x 2.8000 (2b)	= 242.3400 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.5500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 242.3400 (5)

2. Ventilation rate

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)

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Adj infilt rate	0.1339	0.1275	0.1275	0.1179	0.1179	0.1052	0.1084	0.1020	0.1052	0.1116	0.1116	0.1211 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												72.0000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2739	0.2675	0.2675	0.2579	0.2579	0.2452	0.2484	0.2420	0.2452	0.2516	0.2516	0.2611 (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	
Main dwelling								
Opening Type 1			21.7000	0.8687	18.8514			(27)
External Wall 1 LG	40.3200	21.7000	18.6200	0.1400	2.6068	190.0000	3537.7997	(29a)
Total net area of external elements Aum(A, m2)			40.3200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =			21.4582		(33)
Main dwelling								
Party Wall 1			67.4800	0.0000	0.0000	180.0000	12146.4006	(32)
Party Floor 1			86.5500			40.0000	3462.0000	(32d)
Party Ceiling 1			86.5500			30.0000	2596.5000	(32b)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =		21742.7003 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							251.2155	(35)
List of Thermal Bridges								
K1 Element				Length	Psi-value		Total	
E2 Other lintels (including other steel lintels)				8.8000	0.0100		0.0880	
E3 Sill				8.8000	0.0200		0.1760	
E4 Jamb				25.0000	0.0150		0.3750	
E7 Party floor between dwellings (in blocks of flats)				14.4000	0.0700		1.0080	
E18 Party wall between dwellings				11.2000	0.0480		0.5376	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							2.1846	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss						(33) + (36) + (36a) =	23.6428	(37)

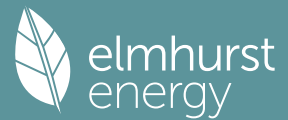
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.5755 (42)
Hot water usage for mixer showers													0.0000 (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	77.7288	76.5745	74.9488	71.9515	69.7071	67.2185	65.8742	67.4885	69.2461	71.9090	74.9681	77.4661	(42c)
Average daily hot water use (litres/day)	41.0056	39.5145	38.0234	36.5323	35.0412	33.5501	33.5501	35.0412	36.5323	38.0234	39.5145	41.0056	(43)
												109.3447	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	118.7345	116.0890	112.9722	108.4838	104.7483	100.7685	99.4243	102.5297	105.7784	109.9324	114.4826	118.4717	(44)
Energy content (annual)	188.0464	165.3091	173.6341	148.5089	141.0114	123.9067	120.2451	126.9531	130.4353	149.1773	163.1015	185.4980	(45)
Distribution loss (46)m = 0.15 x (45)m	28.2070	24.7964	26.0451	22.2763	21.1517	18.5860	18.0368	19.0430	19.5653	22.3766	24.4652	27.8247	(46)
Water storage loss (or HIU loss):													
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.1100 (48)
Temperature factor from Table 2b													0.7800 (49)
Enter (49) or (54) in (55)													1.6458 (55)
Total storage loss													
If cylinder contains dedicated solar storage	51.0198	46.0824	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	49.3740	51.0198	49.3740	51.0198	(56)
Primary loss	51.0198	46.0824	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	49.3740	51.0198	49.3740	51.0198	(57)
Combi loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	(59)
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
WWHRS	262.3286	232.4027	247.9163	220.3949	215.2936	195.7927	194.5273	201.2353	202.3213	223.4595	234.9875	259.7802	(62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
Output from w/h	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)
Electric shower(s)	262.3286	232.4027	247.9163	220.3949	215.2936	195.7927	194.5273	201.2353	202.3213	223.4595	234.9875	259.7802	(64)
Heat gains from water heating, kWh/month													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month	121.9512	108.6402	117.1591	106.8880	106.3120	98.7078	99.4072	101.6377	100.8785	109.0272	111.7400	121.1039	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	24.6334	21.8792	17.7933	13.4707	10.0695	8.5011	9.1857	11.9400	16.0258	20.3484	23.7496	25.3180	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	347.1426	350.7449	341.6673	322.3423	297.9479	275.0205	259.7037	256.1014	265.1790	284.5041	308.8985	331.8258	(68)

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Pumps, fans	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	(69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	(71)
Water heating gains (Table 5)	163.9129	161.6669	157.4719	148.4556	142.8925	137.0941	133.6119	136.6098	140.1091	146.5419	155.1945	162.7740	(72)
Total internal gains	640.2272	638.8293	621.4709	588.8068	555.4482	525.1541	507.0396	509.1895	525.8522	555.9327	592.3809	624.4561	(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				7.5000	12.9236	0.4000	0.7000		0.7700		18.8077 (75)	
Southeast				12.0000	40.4699	0.4000	0.7000		0.7700		94.2334 (77)	
Southwest				2.2000	40.4699	0.4000	0.7000		0.7700		17.2761 (79)	
Solar gains	130.3172	205.5008	293.1727	401.3739	462.0601	502.1644	474.2797	425.9361	353.6318	246.9634	161.0937	109.7130 (83)
Total gains	770.5444	844.3301	914.6436	990.1808	1017.5083	1027.3185	981.3193	935.1256	879.4840	802.8962	753.4746	734.1691 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	132.6078	134.1090	134.1090	136.4256	136.4256	139.6418	138.8236	140.4697	139.6418	138.0150	138.0150	135.6445	
alpha	9.8405	9.9406	9.9406	10.0950	10.0950	10.3095	10.2549	10.3646	10.3095	10.2010	10.2010	10.0430	
util living area	0.8771	0.7979	0.6655	0.4961	0.3481	0.2105	0.1374	0.1471	0.2852	0.5121	0.7440	0.8920 (86)	
MIT	20.9328	20.9724	20.9947	20.9997	21.0000	21.0000	21.0000	21.0000	21.0000	20.9997	20.9884	20.9260 (87)	
Th 2	20.4968	20.5022	20.5022	20.5103	20.5103	20.5211	20.5184	20.5238	20.5211	20.5157	20.5157	20.5076 (88)	
util rest of house	0.8595	0.7768	0.6422	0.4742	0.3268	0.1903	0.1161	0.1252	0.2617	0.4858	0.7190	0.8756 (89)	
MIT 2	20.4426	20.4809	20.4985	20.5101	20.5103	20.5211	20.5184	20.5238	20.5211	20.5155	20.5074	20.4474 (90)	
Living area fraction	20.6115	20.6503	20.6695	20.6789	20.6791	20.6861	20.6844	20.6879	20.6861	20.6824	20.6732	20.6123 (92)	
MIT	20.6115	20.6503	20.6695	20.6789	20.6791	20.6861	20.6844	20.6879	20.6861	20.6824	20.6732	20.6123 (93)	
Temperature adjustment												0.0000	
adjusted MIT	20.6115	20.6503	20.6695	20.6789	20.6791	20.6861	20.6844	20.6879	20.6861	20.6824	20.6732	20.6123 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	665.4761	661.2465	594.5550	477.0303	339.9535	202.6803	121.1368	124.1690	237.2808	397.2982	547.9500	645.5135 (94)	
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)	
Heat loss rate W	706.4757	677.7954	597.5956	477.1862	339.9570	202.6803	121.1368	124.1690	237.2810	397.4522	554.5879	690.6945 (97)	
Space heating kWh	30.5037	11.1208	2.2622	0.1122	0.0026	0.0000	0.0000	0.0000	0.0000	0.1146	4.7793	33.6147 (98a)	
Space heating requirement - total per year (kWh/year)												82.5102	
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	30.5037	11.1208	2.2622	0.1122	0.0026	0.0000	0.0000	0.0000	0.0000	0.1146	4.7793	33.6147 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												82.5102	
Space heating per m2										(98c) / (4) =		0.9533 (99)	

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (301)
Fraction of space heat from community system													1.0000 (302)
Fraction of heat from community Heat pump-Space and Water													1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating													1.0500 (305)
Factor for charging method (Table 4c(3)) for water heating													1.0500 (305a)
Distribution loss factor (Table 12c) for community heating system													1.1500 (306)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating:													
Space heating requirement	30.5037	11.1208	2.2622	0.1122	0.0026	0.0000	0.0000	0.0000	0.0000	0.1146	4.7793	33.6147 (98)	
Space heat from Heat pump = (98) x 1.00 x 1.05 x 1.15													
307a	36.8332	13.4284	2.7316	0.1355	0.0032	0.0000	0.0000	0.0000	0.0000	0.1384	5.7710	40.5897	
Space heating requirement	36.8332	13.4284	2.7316	0.1355	0.0032	0.0000	0.0000	0.0000	0.0000	0.1384	5.7710	40.5897 (307)	
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000 (308)	
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)	
Water heating													
Annual water heating requirement	262.3286	232.4027	247.9163	220.3949	215.2936	195.7927	194.5273	201.2353	202.3213	223.4595	234.9875	259.7802 (64)	
Water heat from Heat pump = (64) x 1.00 x 1.05 x 1.15													
310a	316.7617	280.6263	299.3590	266.1268	259.9670	236.4197	234.8917	242.9917	244.3030	269.8273	283.7474	313.6846	
Water heating fuel	316.7617	280.6263	299.3590	266.1268	259.9670	236.4197	234.8917	242.9917	244.3030	269.8273	283.7474	313.6846 (310)	
Cooling System Energy Efficiency Ratio												0.0000 (314)	
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)	
Pumps and Fa	14.3632	12.9732	14.3632	13.8998	14.3632	13.8998	14.3632	14.3632	13.8998	14.3632	13.8998	14.3632 (331)	
Lighting	21.5615	17.2974	15.5744	11.4105	8.8138	7.2009	8.0402	10.4510	13.5748	17.8109	20.1173	22.1607 (332)	
Electricity generated by PVs (Appendix M) (negative quantity)													
(333a)m	-2.7643	-4.1396	-6.9532	-9.4674	-11.2469	-11.6554	-11.3752	-10.2148	-8.0538	-5.5648	-3.3265	-2.2895 (333a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													

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(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335b)
Annual totals kWh/year													
Space heating fuel - community heating												99.6310	(307)
Space heating fuel - secondary												0.0000	(309)
Water heating fuel - community heating												3248.7061	(310)
Efficiency of water heater												0.0000	(311)
Electricity used for heat distribution												0.9963	(313)
Space cooling fuel												0.0000	(321)

Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)													
mechanical ventilation fans (SFP = 0.5720)												169.1145	(330a)
Total electricity for the above, kWh/year												169.1145	(331)
Electricity for lighting (calculated in Appendix L)												174.0133	(332)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-87.0515	(333)
Wind generation												0.0000	(334)
Hydro-electric generation (Appendix N)												0.0000	(335a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(335)
Appendix Q - special features													
Energy saved or generated												-0.0000	(336)
Energy used												0.0000	(337)
Total delivered energy for all uses												3604.4135	(338)

10b. Fuel costs - using BEDF prices (597)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Heat pump	99.6310	7.3200	7.2930	(340a)
Space heating total			7.2930	(340)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Heat pump	3248.7061	7.3200	237.8053	(342a)
Water heating total			237.8053	(342)
Energy for instantaneous electric shower(s)	0.0000	27.6700	0.0000	(347a)
Pumps, fans and electric keep-hot	169.1145	27.6700	46.7940	(349)
Energy for lighting	174.0133	27.6700	48.1495	(350)
Additional standing charges			108.0000	(351)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-87.0515	27.6700	-24.0871	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-24.0871	(352)
Total energy cost			423.9546	(355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			275.0000	(367)
Space and Water heating from Heat pump	1217.5771	0.1616	5.8533	(367)
Electrical energy for heat distribution (space & water)	0.9963	0.0000	4.7294	(372)
Overall CO2 factor for heat network			0.0528	(386)
Total CO2 associated with community systems			176.7072	(373)
Space and water heating			176.7072	(376)
Pumps, fans and electric keep-hot	169.1145	0.1387	23.4583	(378)
Energy for lighting	174.0133	0.1443	25.1155	(379)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-87.0515	0.1314	-11.4354	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-11.4354	(380)
Total CO2, kg/year			213.8455	(383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Heat pump			275.0000	(467a)
Space and Water heating from Heat pump	1217.5771	1.5979	57.8904	(467)
Electrical energy for heat distribution (space & water)	0.9963	0.0000	50.9710	(472)
Overall CO2 factor for heat network			0.5688	(486)
Total CO2 associated with community systems			1904.4610	(473)
Space and water heating			1904.4610	(476)
Pumps, fans and electric keep-hot	169.1145	1.5128	255.8365	(478)
Energy for lighting	174.0133	1.5338	266.9074	(479)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-87.0515	1.4853	-129.2972	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-129.2972	(480)
Total Primary energy kWh/year			2297.9077	(483)

SAP 10 EPC IMPROVEMENTS

00001

Current energy efficiency rating: B 87
Current environmental impact rating: A 98

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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 Environmental
 (none) efficiency impact
 Total Savings £0 0.00 kg/m²
 Potential energy efficiency rating: B 87
 Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 597 TEST (31 Jul 2026)
 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	£95	£95	£0
Community scheme	£353	£353	£0
Space heating	£162	£162	£0
Water heating	£238	£238	£0
Lighting	£48	£48	£0
Generated (PV)	-£24	-£24	£0
Total cost of fuels	£424	£424	£0
Total cost of uses	£424	£424	£0
Delivered energy	42 kWh/m²	42 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.2 tonnes	0.2 tonnes	0.0 tonnes
CO2 emissions per m²	2 kg/m²	2 kg/m²	0 kg/m²
Primary energy	27 kWh/m²	27 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (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)
Main dwelling	86.5500 (1b)	x 2.8000 (2b)	= 242.3400 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.5500		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 242.3400 (5)
Dwelling volume			

2. Ventilation rate

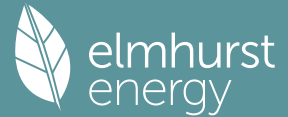
	m³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												72.0000 (23c)
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898 (25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K
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Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K						
Opening Type 1			21.7000	0.8687	18.8514			(27)					
External Wall 1 LG	40.3200	21.7000	18.6200	0.1400	2.6068	190.0000	3537.7997	(29a)					
Total net area of external elements Aum(A, m2)			40.3200					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.4582			(33)					
Main dwelling													
Party Wall 1			67.4800	0.0000	0.0000	180.0000	12146.4006	(32)					
Party Floor 1			86.5500			40.0000	3462.0000	(32d)					
Party Ceiling 1			86.5500			30.0000	2596.5000	(32b)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		21742.7003	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							251.2155	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value	Total							
E2 Other lintels (including other steel lintels)				8.8000	0.0100	0.0880							
E3 Sill				8.8000	0.0200	0.1760							
E4 Jamb				25.0000	0.0150	0.3750							
E7 Party floor between dwellings (in blocks of flats)				14.4000	0.0700	1.0080							
E18 Party wall between dwellings				11.2000	0.0480	0.5376							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							2.1846	(36)					
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss						(33) + (36) + (36a) =	23.6428	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	24.1966	23.9417	23.6868	22.4122	22.1573	20.8827	20.8827	20.6278	21.3926	22.1573	22.6671	23.1769	(38)
Average = Sum(39)m / 12 =	47.8393	47.5844	47.3295	46.0550	45.8000	44.5255	44.5255	44.2706	45.0353	45.8000	46.3099	46.8197	(39)
												45.9912	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.5527	0.5498	0.5468	0.5321	0.5292	0.5144	0.5144	0.5115	0.5203	0.5292	0.5351	0.5410	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.5755	(42)
Hot water usage for mixer showers														
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	0.0000	(42a)
Hot water usage for other uses	77.7288	76.5745	74.9488	71.9515	69.7071	67.2185	65.8742	67.4885	69.2461	71.9090	74.9681	77.4661	77.4661	(42b)
Average daily hot water use (litres/day)	41.0056	39.5145	38.0234	36.5323	35.0412	33.5501	33.5501	35.0412	36.5323	38.0234	39.5145	41.0056	41.0056	(42c)
													109.3447	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy conte	118.7345	116.0890	112.9722	108.4838	104.7483	100.7685	99.4243	102.5297	105.7784	109.9324	114.4826	118.4717	118.4717	(44)
Energy content (annual)	188.0464	165.3091	173.6341	148.5089	141.0114	123.9067	120.2451	126.9531	130.4353	149.1773	163.1015	185.4980	185.4980	(45)
Distribution loss (46)m = 0.15 x (45)m	28.2070	24.7964	26.0451	22.2763	21.1517	18.5860	18.0368	19.0430	19.5653	22.3766	24.4652	27.8247	27.8247	(46)
Water storage loss (or HIU loss):														
Store volume													300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													2.1100	(48)
Temperature factor from Table 2b													0.7800	(49)
Enter (49) or (54) in (55)													1.6458	(55)
Total storage loss	51.0198	46.0824	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	(56)
If cylinder contains dedicated solar storage	51.0198	46.0824	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	49.3740	51.0198	49.3740	51.0198	51.0198	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	262.3286	232.4027	247.9163	220.3949	215.2936	195.7927	194.5273	201.2353	202.3213	223.4595	234.9875	259.7802	259.7802	(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	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	-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	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	0.0000	(63d)
Output from w/h	262.3286	232.4027	247.9163	220.3949	215.2936	195.7927	194.5273	201.2353	202.3213	223.4595	234.9875	259.7802	259.7802	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains from water heating, kWh/month	121.9512	108.6402	117.1591	106.8880	106.3120	98.7078	99.4072	101.6377	100.8785	109.0272	111.7400	121.1039	121.1039	(65)

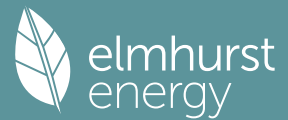
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts														
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	24.6334	21.8792	17.7933	13.4707	10.0695	8.5011	9.1857	11.9400	16.0258	20.3484	23.7496	25.3180	25.3180	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	347.1426	350.7449	341.6673	322.3423	297.9479	275.0205	259.7037	256.1014	265.1790	284.5041	308.8985	331.8258	331.8258	(68)
Pumps, fans	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	(69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Water heating gains (Table 5)	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	(71)
Total internal gains	163.9129	161.6669	157.4719	148.4556	142.8925	137.0941	133.6119	136.6098	140.1091	146.5419	155.1945	162.7740	162.7740	(72)
	640.2272	638.8293	621.4709	588.8068	555.4482	525.1541	507.0396	509.1895	525.8522	555.9327	592.3809	624.4561	624.4561	(73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
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				m2	Table 6a W/m2	Specific data or Table 6b		Specific data or Table 6c		factor Table 6d		W
Northeast	7.5000				11.2829	0.4000		0.7000		0.7700		16.4201 (75)
Southeast	12.0000				36.7938	0.4000		0.7000		0.7700		85.6737 (77)
Southwest	2.2000				36.7938	0.4000		0.7000		0.7700		15.7068 (79)
Solar gains	117.8006	206.1121	296.4986	391.6586	460.8542	467.2707	446.4416	393.3282	329.2186	231.7039	142.0912	100.1701 (83)
Total gains	758.0278	844.9414	917.9695	980.4654	1016.3023	992.4247	953.4813	902.5176	855.0708	787.6366	734.4721	724.6262 (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	126.2484	126.9247	127.6083	131.1398	131.8697	135.6445	135.6445	136.4256	134.1090	131.8697	130.4180	128.9978
alpha	9.4166	9.4616	9.5072	9.7427	9.7913	10.0430	10.0430	10.0950	9.9406	9.7913	9.6945	9.5999
util living area	0.9260	0.8545	0.7351	0.5674	0.4191	0.2871	0.2055	0.2256	0.3634	0.6030	0.8365	0.9383 (86)
MIT	20.8658	20.9389	20.9841	20.9986	20.9999	21.0000	21.0000	21.0000	21.0000	20.9981	20.9593	20.8521 (87)
Th 2	20.4727	20.4754	20.4781	20.4915	20.4942	20.5076	20.5076	20.5103	20.5022	20.4942	20.4888	20.4834 (88)
util rest of house	0.9130	0.8354	0.7115	0.5438	0.3963	0.2650	0.1825	0.2016	0.3372	0.5742	0.8138	0.9269 (89)
MIT 2	20.3598	20.4265	20.4663	20.4906	20.4941	20.5076	20.5076	20.5103	20.5022	20.4930	20.4577	20.3576 (90)
Living area fraction	fLA = Living area / (4) = 0.3447 (91)											
MIT	20.5342	20.6031	20.6448	20.6657	20.6685	20.6773	20.6773	20.6791	20.6738	20.6671	20.6306	20.5280 (92)
Temperature adjustment	0.0000											
adjusted MIT	20.5342	20.6031	20.6448	20.6657	20.6685	20.6773	20.6773	20.6791	20.6738	20.6671	20.6306	20.5280 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9146	0.8402	0.7191	0.5519	0.4041	0.2727	0.1904	0.2099	0.3462	0.5841	0.8203	0.9280 (94)
Useful gains	693.2777	709.8901	660.1158	541.1160	410.7212	270.5949	181.5444	189.4373	296.0471	460.0586	602.4530	672.4511 (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	776.6313	747.2235	669.4664	541.8679	410.7555	270.5953	181.5444	189.4373	296.0522	461.0718	626.6012	764.4739 (97)
Space heating kWh	62.0151	25.0880	6.9568	0.5414	0.0256	0.0000	0.0000	0.0000	0.0000	0.7539	17.3867	68.4650 (98a)
Space heating requirement - total per year (kWh/year)	181.2324											
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	62.0151	25.0880	6.9568	0.5414	0.0256	0.0000	0.0000	0.0000	0.0000	0.7539	17.3867	68.4650 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	181.2324											
Space heating per m2	(98c) / (4) = 2.0940 (99)											
9b. Energy requirements												
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (301)
Fraction of space heat from community system												1.0000 (302)
Fraction of heat from community Heat pump-Space and Water												1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0500 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0500 (305a)
Distribution loss factor (Table 12c) for community heating system												1.1500 (306)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating:												
Space heating requirement	62.0151	25.0880	6.9568	0.5414	0.0256	0.0000	0.0000	0.0000	0.0000	0.7539	17.3867	68.4650 (98)
Space heat from Heat pump = (98) x 1.00 x 1.05 x 1.15	74.8833	30.2938	8.4004	0.6537	0.0309	0.0000	0.0000	0.0000	0.0000	0.9103	20.9944	82.6714
307a	74.8833	30.2938	8.4004	0.6537	0.0309	0.0000	0.0000	0.0000	0.0000	0.9103	20.9944	82.6714 (307)
Space heating requirement	74.8833	30.2938	8.4004	0.6537	0.0309	0.0000	0.0000	0.0000	0.0000	0.9103	20.9944	82.6714 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)											
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating												
Annual water heating requirement	262.3286	232.4027	247.9163	220.3949	215.2936	195.7927	194.5273	201.2353	202.3213	223.4595	234.9875	259.7802 (64)
Water heat from Heat pump = (64) x 1.00 x 1.05 x 1.15	316.7617	280.6263	299.3590	266.1268	259.9670	236.4197	234.8917	242.9917	244.3030	269.8273	283.7474	313.6846
310a	316.7617	280.6263	299.3590	266.1268	259.9670	236.4197	234.8917	242.9917	244.3030	269.8273	283.7474	313.6846 (310)
Water heating fuel	316.7617	280.6263	299.3590	266.1268	259.9670	236.4197	234.8917	242.9917	244.3030	269.8273	283.7474	313.6846 (310)
Cooling System Energy Efficiency Ratio	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	14.3632	12.9732	14.3632	13.8998	14.3632	13.8998	14.3632	14.3632	13.8998	14.3632	13.8998	14.3632 (331)
Lighting	21.5615	17.2974	15.5744	11.4105	8.8138	7.2009	8.0402	10.4510	13.5748	17.8109	20.1173	22.1607 (332)
Electricity generated by PVs (Appendix M) (negative quantity)	(333a)m	-2.4640	-4.0785	-6.9299	-9.1916	-11.1856	-10.9276	-9.4689	-7.4683	-5.1618	-2.9005	-2.0594 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)	(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year												
Space heating fuel - community heating	218.8382 (307)											
Space heating fuel - secondary	0.0000 (309)											
Water heating fuel - community heating	3248.7061 (310)											
Efficiency of water heater	0.0000 (311)											
Electricity used for heat distribution	2.1884 (313)											
Space cooling fuel	0.0000 (321)											
Electricity for pumps and fans:												

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(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)			
mechanical ventilation fans (SFP = 0.5720)			169.1145 (330a)
Total electricity for the above, kWh/year			169.1145 (331)
Electricity for lighting (calculated in Appendix L)			174.0133 (332)
Energy saving/generation technologies (Appendices M ,N and Q)			
PV generation			-82.6015 (333)
Wind generation			0.0000 (334)
Hydro-electric generation (Appendix N)			0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)			0.0000 (335)
Appendix Q - special features			
Energy saved or generated			-0.0000 (336)
Energy used			0.0000 (337)
Total delivered energy for all uses			3728.0707 (338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Heat pump	218.8382	4.4400	9.7164	(340a)
Space heating total			9.7164	(340)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Heat pump	3248.7061	4.4400	144.2426	(342a)
Water heating total			144.2426	(342)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(347a)
Pumps, fans and electric keep-hot	169.1145	16.4900	27.8870	(349)
Energy for lighting	174.0133	16.4900	28.6948	(350)
Additional standing charges			92.0000	(351)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-82.6015	16.4900	-13.6210	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-13.6210	(352)
Total energy cost			288.9198	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):		0.3600 (356)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.7907 (357)
SAP value		87.1834
SAP rating (Section 12)		87 (358)
SAP band		B

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			275.0000	(367)
Space and Water heating from Heat pump	1260.9252	0.1609	12.8019	(367)
Electrical energy for heat distribution (space & water)	2.1884	0.0000	4.9205	(372)
Overall CO2 factor for heat network			0.0530	(386)
Total CO2 associated with community systems			183.8469	(373)
Space and water heating			183.8469	(376)
Pumps, fans and electric keep-hot	169.1145	0.1387	23.4583	(378)
Energy for lighting	174.0133	0.1443	25.1155	(379)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-82.6015	0.1315	-10.8589	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-10.8589	(380)
Total CO2, kg/year			221.5617	(383)
CO2 emissions per m2			2.5600	(384)
EI value			97.7431	(384a)
EI rating			98	(385)
EI band			A	

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

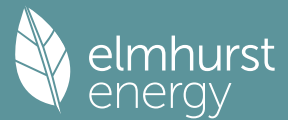
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	86.5500 (1b)	x 2.8000 (2b)	= 242.3400 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.5500		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	242.3400 (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)

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Number of flues attached to other heater 0 * 35 = 0.0000 (6e)
Number of blocked chimneys 0 * 20 = 0.0000 (6f)
Number of intermittent extract fans 0 * 10 = 0.0000 (7a)
Number of passive vents 0 * 10 = 0.0000 (7b)
Number of flueless gas fires 0 * 40 = 0.0000 (7c)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.1339	0.1275	0.1275	0.1179	0.1179	0.1052	0.1084	0.1020	0.1052	0.1116	0.1116	0.1211	(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) =												72.0000	(23c)
Effective ac	0.2739	0.2675	0.2675	0.2579	0.2579	0.2452	0.2484	0.2420	0.2452	0.2516	0.2516	0.2611	(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	
Main dwelling								
Opening Type 1			21.7000	0.8687	18.8514			(27)
External Wall 1 LG	40.3200	21.7000	18.6200	0.1400	2.6068	190.0000	3537.7997	(29a)
Total net area of external elements Aum(A, m2)			40.3200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.4582			(33)
Main dwelling								
Party Wall 1			67.4800	0.0000	0.0000	180.0000	12146.4006	(32)
Party Floor 1			86.5500			40.0000	3462.0000	(32d)
Party Ceiling 1			86.5500			30.0000	2596.5000	(32b)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 21742.7003 (34)
List of Thermal Bridges 251.2155 (35)

	Length	Psi-value	Total	
K1 Element	8.8000	0.0100	0.0880	
E2 Other lintels (including other steel lintels)	8.8000	0.0200	0.1760	
E3 Sill	25.0000	0.0150	0.3750	
E4 Jamb	14.4000	0.0700	1.0080	
E7 Party floor between dwellings (in blocks of flats)	11.2000	0.0480	0.5376	
E18 Party wall between dwellings				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				2.1846 (36)
Point Thermal bridges				(36a) = 0.0000
Total fabric heat loss				(33) + (36) + (36a) = 23.6428 (37)

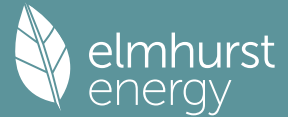
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)
Jan 21.9024 Feb 21.3926 Mar 21.3926 Apr 20.6278 May 20.6278 Jun 19.6082 Jul 19.8631 Aug 19.3533 Sep 19.6082 Oct 20.1180 Nov 20.1180 Dec 20.8827 (38)
Heat transfer coeff 45.5451 45.0353 45.0353 44.2706 44.2706 43.2509 43.5058 42.9960 43.2509 43.7608 43.7608 44.5255 (39)
Average = Sum(39)m / 12 = 44.1006

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5262	0.5203	0.5203	0.5115	0.5115	0.4997	0.5027	0.4968	0.4997	0.5056	0.5056	0.5144	(40)
HLP (average)												0.5095	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5755 (42)
Hot water usage for mixer showers 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42a)
Hot water usage for baths 77.7288 76.5745 74.9488 71.9515 69.7071 67.2185 65.8742 67.4885 69.2461 71.9090 74.9681 77.4661 (42b)
Hot water usage for other uses 41.0056 39.5145 38.0234 36.5323 35.0412 33.5501 33.5501 35.0412 36.5323 38.0234 39.5145 41.0056 (42c)
Average daily hot water use (litres/day) 109.3447 (43)
Daily hot water use
Jan 118.7345 Feb 116.0890 Mar 112.9722 Apr 108.4838 May 104.7483 Jun 100.7685 Jul 99.4243 Aug 102.5297 Sep 105.7784 Oct 109.9324 Nov 114.4826 Dec 118.4717 (44)
Energy conte 188.0464 165.3091 173.6341 148.5089 141.0114 123.9067 120.2451 126.9531 130.4353 149.1773 163.1015 185.4980 (45)
Energy content (annual)
Distribution loss (46)m = 0.15 x (45)m
28.2070 24.7964 26.0451 22.2763 21.1517 18.5860 18.0368 19.0430 19.5653 22.3766 24.4652 27.8247 (46)
Water storage loss (or HIU loss):
Store volume 300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):
Temperature factor from Table 2b 2.1100 (48)
Enter (49) or (54) in (55) 0.7800 (49)
Total storage loss 1.6458 (55)
51.0198 46.0824 51.0198 49.3740 51.0198 49.3740 51.0198 51.0198 49.3740 51.0198 49.3740 51.0198 (56)
If cylinder contains dedicated solar storage
51.0198 46.0824 51.0198 49.3740 51.0198 49.3740 51.0198 51.0198 49.3740 51.0198 49.3740 51.0198 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 (59)
Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)
Total heat required for water heating calculated for each month
262.3286 232.4027 247.9163 220.3949 215.2936 195.7927 194.5273 201.2353 202.3213 223.4595 234.9875 259.7802 (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

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	262.3286	232.4027	247.9163	220.3949	215.2936	195.7927	194.5273	201.2353	202.3213	223.4595	234.9875	259.7802 (64)
	Total per year (kWh/year) = Sum(64)m =											2690.4399 (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	121.9512	108.6402	117.1591	106.8880	106.3120	98.7078	99.4072	101.6377	100.8785	109.0272	111.7400	121.1039 (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	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	154.5296	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.6334	21.8792	17.7933	13.4707	10.0695	8.5011	9.1857	11.9400	16.0258	20.3484	23.7496	25.3180	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	347.1426	350.7449	341.6673	322.3423	297.9479	275.0205	259.7037	256.1014	265.1790	284.5041	308.8985	331.8258	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	53.0285	(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)	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	-103.0197	(71)
Water heating gains (Table 5)	163.9129	161.6669	157.4719	148.4556	142.8925	137.0941	133.6119	136.6098	140.1091	146.5419	155.1945	162.7740	(72)
Total internal gains	640.2272	638.8293	621.4709	588.8068	555.4482	525.1541	507.0396	509.1895	525.8522	555.9327	592.3809	624.4561	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g Specific data or Table 6c	FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast				7.5000	12.9236		0.4000	0.7000		0.7700		18.8077 (75)
Southeast				12.0000	40.4699		0.4000	0.7000		0.7700		94.2334 (77)
Southwest				2.2000	40.4699		0.4000	0.7000		0.7700		17.2761 (79)
Solar gains	130.3172	205.5008	293.1727	401.3739	462.0601	502.1644	474.2797	425.9361	353.6318	246.9634	161.0937	109.7130 (83)
Total gains	770.5444	844.3301	914.6436	990.1808	1017.5083	1027.3185	981.3193	935.1256	879.4840	802.8962	753.4746	734.1691 (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	132.6078	134.1090	134.1090	136.4256	136.4256	139.6418	138.8236	140.4697	139.6418	138.0150	138.0150	135.6445
alpha	9.8405	9.9406	9.9406	10.0950	10.0950	10.3095	10.2549	10.3646	10.3095	10.2010	10.2010	10.0430
util living area	0.8771	0.7979	0.6655	0.4961	0.3481	0.2105	0.1374	0.1471	0.2852	0.5121	0.7440	0.8920 (86)
MIT	20.9328	20.9724	20.9947	20.9997	21.0000	21.0000	21.0000	21.0000	21.0000	20.9997	20.9884	20.9260 (87)
Th 2	20.4968	20.5022	20.5022	20.5103	20.5103	20.5211	20.5184	20.5238	20.5211	20.5157	20.5157	20.5076 (88)
util rest of house	0.8595	0.7768	0.6422	0.4742	0.3268	0.1903	0.1161	0.1252	0.2617	0.4858	0.7190	0.8756 (89)
MIT 2	20.4426	20.4809	20.4985	20.5101	20.5103	20.5211	20.5184	20.5238	20.5211	20.5155	20.5074	20.4474 (90)
Living area fraction	20.6115	20.6503	20.6695	20.6789	20.6791	20.6861	20.6844	20.6879	20.6861	20.6824	20.6732	20.6123 (91)
MIT	20.6115	20.6503	20.6695	20.6789	20.6791	20.6861	20.6844	20.6879	20.6861	20.6824	20.6732	20.6123 (92)
Temperature adjustment												0.0000
adjusted MIT	20.6115	20.6503	20.6695	20.6789	20.6791	20.6861	20.6844	20.6879	20.6861	20.6824	20.6732	20.6123 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	665.4761	661.2465	594.5550	477.0303	339.9535	202.6803	121.1368	124.1690	237.2808	397.2982	547.9500	645.5135	(94)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	706.4757	677.7954	597.5956	477.1862	339.9570	202.6803	121.1368	124.1690	237.2810	397.4522	554.5879	690.6945	(97)
Space heating kWh	30.5037	11.1208	2.2622	0.1122	0.0026	0.0000	0.0000	0.0000	0.0000	0.1146	4.7793	33.6147	(98a)
Space heating requirement - total per year (kWh/year)												82.5102	
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	30.5037	11.1208	2.2622	0.1122	0.0026	0.0000	0.0000	0.0000	0.0000	0.1146	4.7793	33.6147	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												82.5102	
Space heating per m ²										(98c) / (4) =		0.9533	(99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (301)
Fraction of space heat from community system													1.0000 (302)
Fraction of heat from community Heat pump-Space and Water													1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating													1.0500 (305)
Factor for charging method (Table 4c(3)) for water heating													1.0500 (305a)
Distribution loss factor (Table 12c) for community heating system													1.1500 (306)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating:													
Space heating requirement	30.5037	11.1208	2.2622	0.1122	0.0026	0.0000	0.0000	0.0000	0.0000	0.1146	4.7793	33.6147	(98)
Space heat from Heat pump = (98) x 1.00 x 1.05 x 1.15													
307a	36.8332	13.4284	2.7316	0.1355	0.0032	0.0000	0.0000	0.0000	0.0000	0.1384	5.7710	40.5897	
Space heating requirement													

Full SAP Calculation Printout



Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	36.8332	13.4284	2.7316	0.1355	0.0032	0.0000	0.0000	0.0000	0.0000	0.1384	5.7710	40.5897 (307)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (308)
Water heating	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Annual water heating requirement	262.3286	232.4027	247.9163	220.3949	215.2936	195.7927	194.5273	201.2353	202.3213	223.4595	234.9875	259.7802 (64)
Water heat from Heat pump = (64) x 1.00 x 1.05 x 1.15	316.7617	280.6263	299.3590	266.1268	259.9670	236.4197	234.8917	242.9917	244.3030	269.8273	283.7474	313.6846
Water heating fuel	316.7617	280.6263	299.3590	266.1268	259.9670	236.4197	234.8917	242.9917	244.3030	269.8273	283.7474	313.6846 (310)
Cooling System Energy Efficiency Ratio	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	14.3632	12.9732	14.3632	13.8998	14.3632	13.8998	14.3632	14.3632	13.8998	14.3632	13.8998	14.3632 (331)
Lighting	21.5615	17.2974	15.5744	11.4105	8.8138	7.2009	8.0402	10.4510	13.5748	17.8109	20.1173	22.1607 (332)
Electricity generated by PVs (Appendix M) (negative quantity)	-2.7643	-4.1396	-6.9532	-9.4674	-11.2469	-11.6554	-11.3752	-10.2148	-8.0538	-5.5648	-3.3265	-2.2895 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year												
Space heating fuel - community heating												99.6310 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												3248.7061 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												0.9963 (313)
Space cooling fuel												0.0000 (321)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)												
mechanical ventilation fans (SFP = 0.5720)												169.1145 (330a)
Total electricity for the above, kWh/year												169.1145 (331)
Electricity for lighting (calculated in Appendix L)												174.0133 (332)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-87.0515 (333)
Wind generation												0.0000 (334)
Hydro-electric generation (Appendix N)												0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (335)
Appendix Q - special features												
Energy saved or generated												-0.0000 (336)
Energy used												0.0000 (337)
Total delivered energy for all uses												3604.4135 (338)

10b. Fuel costs - using BEDF prices (597)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating from Heat pump	99.6310	7.3200	7.2930 (340a)
Space heating total			7.2930 (340)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	0.0000	0.0000	0.0000 (341)
Water heating from Heat pump	3248.7061	7.3200	237.8053 (342a)
Water heating total			237.8053 (342)
Energy for instantaneous electric shower(s)	0.0000	27.6700	0.0000 (347a)
Pumps, fans and electric keep-hot	169.1145	27.6700	46.7940 (349)
Energy for lighting	174.0133	27.6700	48.1495 (350)
Additional standing charges			108.0000 (351)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-87.0515	27.6700	-24.0871
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-24.0871 (352)
Total energy cost			423.9546 (355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			275.0000 (367)
Space and Water heating from Heat pump	1217.5771	0.1616	5.8533 (367)
Electrical energy for heat distribution (space & water)	0.9963	0.0000	4.7294 (372)
Overall CO2 factor for heat network			0.0528 (386)
Total CO2 associated with community systems			176.7072 (373)
Space and water heating			176.7072 (376)
Pumps, fans and electric keep-hot	169.1145	0.1387	23.4583 (378)
Energy for lighting	174.0133	0.1443	25.1155 (379)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-87.0515	0.1314	-11.4354
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-11.4354 (380)
Total CO2, kg/year			213.8455 (383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			275.0000 (467a)
Space and Water heating from Heat pump	1217.5771	1.5979	57.8904 (467)
Electrical energy for heat distribution (space & water)	0.9963	0.0000	50.9710 (472)
Overall CO2 factor for heat network			0.5688 (486)
Total CO2 associated with community systems			1904.4610 (473)
Space and water heating			1904.4610 (476)

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Pumps, fans and electric keep-hot	169.1145	1.5128	255.8365 (478)
Energy for lighting	174.0133	1.5338	266.9074 (479)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-87.0515	1.4853	-129.2972
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-129.2972 (480)
Total Primary energy kWh/year			2297.9077 (483)

Appendix A.3 – BRUKL Output (Be Lean)

BRUKL Output Document

 HM Government

Compliance with England Building Regulations Part L 2021

Project name

AP Commercial Be Lean

As designed

Date: Tue Aug 25 10:47:38 2026

Administrative information

Building Details

Address: Address 1, City, Postcode

Certifier details

Name: Name
Telephone number: Phone
Address: Street Address, City, Postcode

Certification tool

Calculation engine: Apache
Calculation engine version: 7.0.31
Interface to calculation engine: IES Virtual Environment
Interface to calculation engine version: 7.0.31
BRUKL compliance module version: v6.1.e.1

Foundation area [m²]: 123.37

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

Target CO ₂ emission rate (TER), kgCO ₂ /m²:annum	4.71
Building CO ₂ emission rate (BER), kgCO ₂ /m²:annum	3.52
Target primary energy rate (TPER), kWh _{PE} /m²:annum	51.05
Building primary energy rate (BPER), kWh _{PE} /m²:annum	38.2
Do the building's emission and primary energy rates exceed the targets?	BER =< TER BPER =< TPER

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

Fabric element	U _a -Limit	U _a -Calc	U _i -Calc	First surface with maximum value
Walls*	0.26	0.14	0.14	A_000014:Surf[9]
Floors	0.18	0.1	0.1	A_000014:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	-	-	No flat roofs in building
Windows** and roof windows	1.6	1.33	1.33	A_000014:Surf[3]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	1.01	1.01	A_000014:Surf[1]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building
U _a -Limit = Limiting area-weighted average U-values [W/(m²K)] U _a -Calc = Calculated area-weighted average U-values [W/(m²K)] U _i -Calc = Calculated maximum individual element U-values [W/(m²K)] * Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. ** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position. ^ For fire doors, limiting U-value is 1.8 W/m²K 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
m³/(h.m²) at 50 Pa	8	3

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- BL

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.64	5	0	1.1	0.8
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					
^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.					

1- 1b. DHW - Notional Heat pump

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	2.86	-
Standard value	2*	N/A
* Standard shown is for all types except absorption and gas engine heat pumps.		

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

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
L00: COMMERCIAL		120	100	1.5
L00: COMMERCIAL		120	100	1.5

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?
L00: COMMERCIAL	NO (-43%)	NO
L00: COMMERCIAL	NO (-31.5%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

Building Use

	Actual	Notional	% Area	Building Type
Floor area [m²]	856.1	856.1		Retail/Financial and Professional Services
External area [m²]	1096.9	1096.9		Restaurants and Cafes/Drinking Establishments/Takeaways
Weather	LON	LON		Offices and Workshop Businesses
Infiltration [m³/hm²@ 50Pa]	3	3		General Industrial and Special Industrial Groups
Average conductance [W/K]	422.06	395.11		Storage or Distribution
Average U-value [W/m²K]	0.38	0.36		Hotels
Alpha value* [%]	25	10		Residential Institutions: Hospitals and Care Homes
				83 Residential Institutions: Residential Schools
				17 Residential Institutions: Universities and Colleges

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	5.95	6.12
Cooling	2.98	2.39
Auxiliary	10.26	13.03
Lighting	5.84	10.12
Hot water	9.53	12.73
Equipment*	35.74	35.74
TOTAL **	34.56	44.39

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	95.14	69.12
Primary energy [kWh _{PE} /m²]	49.97	63.38
Total emissions [kg/m²]	5.22	6.47

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] Variable refrigerant flow, [HS] ASHP, [HFT] Natural Gas, [CFT] Electricity									
	Actual	57.2	38	5.9	3	10.3	2.67	3.54	2.64
	Notional	29.2	39.9	6.1	2.4	11.7	1.33	4.63	----

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

BRUKL Output Document

 HM Government

Compliance with England Building Regulations Part L 2021

Project name

AP SH Be Lean

As designed

Date: Tue Aug 25 18:12:04 2026

Administrative information

Building Details

Address: Address 1, City, Postcode

Certifier details

Name: Name
Telephone number: Phone
Address: Street Address, City, Postcode

Certification tool

Calculation engine: Apache
Calculation engine version: 7.0.31
Interface to calculation engine: IES Virtual Environment
Interface to calculation engine version: 7.0.31
BRUKL compliance module version: v6.1.e.1

Foundation area [m²]: 428.04

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

Target CO ₂ emission rate (TER), kgCO ₂ /m²:annum	6.47
Building CO ₂ emission rate (BER), kgCO ₂ /m²:annum	5.22
Target primary energy rate (TPER), kWh _{PE} /m²:annum	63.38
Building primary energy rate (BPER), kWh _{PE} /m²:annum	49.97
Do the building's emission and primary energy rates exceed the targets?	BER =< TER BPER =< TPER

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

Fabric element	U _a -Limit	U _a -Calc	U _i -Calc	First surface with maximum value
Walls*	0.26	0.14	0.14	L2000002:Surf[2]
Floors	0.18	0.1	0.1	A_00002B:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	-	-	No flat roofs in building
Windows** and roof windows	1.6	1.21	1.21	L2000002:Surf[0]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	-	-	No personnel doors in building
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building
U _a -Limit = Limiting area-weighted average U-values [W/(m²K)] U _a -Calc = Calculated area-weighted average U-values [W/(m²K)] U _i -Calc = Calculated maximum individual element U-values [W/(m²K)] * Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. ** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position. ^ For fire doors, limiting U-value is 1.8 W/m²K 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
m³/(h.m²) at 50 Pa	8	3

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- BL

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.64	5	0	1.1	0.8
Standard value	1	N/A	N/A	2^	N/A

Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system

YES

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

1- 1b. DHW - Notional Heat pump

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	2.86	-
Standard value	2*	N/A

* Standard shown is for all types except absorption and gas engine heat pumps.

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

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
L21:	120	-	-
L21:	120	-	-
L21:	120	-	-
L21: GYM_01	120	-	-
L21: GYM_02	120	-	-
L21:	120	-	-
L00: SHARED LIVING AMENITIES	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?
L21:	NO (-18.6%)	NO
L21:	NO (-40.4%)	NO
L21:	NO (-38.8%)	NO
L21: GYM_01	YES (+1.6%)	NO
L21: GYM_02	NO (-4.8%)	NO
L21:	NO (-18.2%)	NO
L00: SHARED LIVING AMENITIES	NO (-2.9%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global ParametersBuilding Use

	Actual	Notional	% Area	Building Type
Floor area [m²]	76.9	76.9	100	Retail/Financial and Professional Services
External area [m²]	148	148		Restaurants and Cafes/Drinking Establishments/Takeaways
Weather	LON	LON		Offices and Workshop Businesses
Infiltration [m³/hm²@ 50Pa]	3	3		General Industrial and Special Industrial Groups
Average conductance [W/K]	50.29	55.16		Storage or Distribution
Average U-value [W/m²K]	0.34	0.37		Hotels
Alpha value* [%]	25	10		Residential Institutions: Hospitals and Care Homes

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	4.43	3.82
Cooling	9.01	3.49
Auxiliary	2.91	9.59
Lighting	8.11	14.52
Hot water	0.61	0.56
Equipment*	20.26	20.26
TOTAL **	25.07	31.99

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	157.3	96.46
Primary energy [kWh _{PE} /m²]	37.69	47.24
Total emissions [kg/m²]	3.42	4.34

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] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity									
Actual	42.5	114.8	4.4	9	2.9	2.67	3.54	2.64	5
Notional	38.2	58.3	3.8	3.5	9.6	2.78	4.63	----	----

Key to terms

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

Project name

Ashley House Aff Comm Be Lean

As designed

Date: Tue Aug 25 15:49:56 2026

Administrative information

Building Details

Address: Address 1, City, Postcode

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.31

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.31

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

Foundation area [m²]: 76.85

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

Target CO ₂ emission rate (TER), kgCO ₂ /m²:annum	4.34
Building CO ₂ emission rate (BER), kgCO ₂ /m²:annum	3.42
Target primary energy rate (TPER), kWh _{PE} /m²:annum	47.24
Building primary energy rate (BPER), kWh _{PE} /m²:annum	37.69
Do the building's emission and primary energy rates exceed the targets?	BER =< TER BPER =< TPER

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

Fabric element	U _a -Limit	U _a -Calc	U _i -Calc	First surface with maximum value
Walls*	0.26	0.14	0.14	A_00008F:Surf[5]
Floors	0.18	0.1	0.1	A_00008F:Surf[6]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.1	0.1	A_00008F:Surf[7]
Windows** and roof windows	1.6	1.21	1.21	A_00008F:Surf[0]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	1.01	1.01	A_00008F:Surf[3]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building
U _a -Limit = Limiting area-weighted average U-values [W/(m²K)] U _a -Calc = Calculated area-weighted average U-values [W/(m²K)] U _i -Calc = Calculated maximum individual element U-values [W/(m²K)] * Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. ** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position. ^ For fire doors, limiting U-value is 1.8 W/m²K 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
m³/(h.m²) at 50 Pa	8	3

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- BL

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.64	5	0	1.1	0.8
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					
^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.					

1- 1b. DHW - Notional Heat pump

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	2.86	-
Standard value	2*	N/A
* Standard shown is for all types except absorption and gas engine heat pumps.		

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

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
L00: COMMERCIAL	120	100	1.5

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?
L00: COMMERCIAL	NO (-3.5%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global ParametersBuilding Use

	Actual	Notional	% Area	Building Type
Floor area [m²]	123.4	123.4	100	Retail/Financial and Professional Services
External area [m²]	245.6	245.6		Restaurants and Cafes/Drinking Establishments/Takeaways
Weather	LON	LON		Offices and Workshop Businesses
Infiltration [m³/hm²@ 50Pa]	3	3		General Industrial and Special Industrial Groups
Average conductance [W/K]	85.38	80.37		Storage or Distribution
Average U-value [W/m²K]	0.35	0.33		Hotels
Alpha value* [%]	25	10		Residential Institutions: Hospitals and Care Homes

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	6.7	4.77
Cooling	5.34	1.94
Auxiliary	2.91	7.41
Lighting	9.6	19.8
Hot water	0.62	0.56
Equipment*	20.26	20.26
TOTAL **	25.17	34.48

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	132.36	80.02
Primary energy [kWh _{PE} /m²]	38.2	51.05
Total emissions [kg/m²]	3.52	4.71

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] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity									
	Actual	64.4	68	6.7	5.3	2.9	2.67	3.54	2.64
	Notional	47.7	32.3	4.8	1.9	7.4	2.78	4.63	5

Key to terms

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

Appendix A.4 – BRUKL Output (Be Green)

BRUKL Output Document

 HM Government

Compliance with England Building Regulations Part L 2021

Project name

AP Commercial Be Green

As designed

Date: Tue Aug 25 16:00:42 2026

Administrative information

Building Details

Address: Address 1, City, Postcode

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.31

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.31

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

Foundation area [m²]: 123.37

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

Target CO ₂ emission rate (TER), kgCO ₂ /m²:annum	4.86
Building CO ₂ emission rate (BER), kgCO ₂ /m²:annum	2.81
Target primary energy rate (TPER), kWh _{PE} /m²:annum	52.6
Building primary energy rate (BPER), kWh _{PE} /m²:annum	30.39
Do the building's emission and primary energy rates exceed the targets?	BER =< TER BPER =< TPER

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

Fabric element	U _a -Limit	U _a -Calc	U _i -Calc	First surface with maximum value
Walls*	0.26	0.14	0.14	A_000014:Surf[9]
Floors	0.18	0.1	0.1	A_000014:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	-	-	No flat roofs in building
Windows** and roof windows	1.6	1.21	1.21	A_000014:Surf[3]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	1.01	1.01	A_000014:Surf[1]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building
U _a -Limit = Limiting area-weighted average U-values [W/(m²K)] U _a -Calc = Calculated area-weighted average U-values [W/(m²K)] U _i -Calc = Calculated maximum individual element U-values [W/(m²K)] * Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. ** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position. ^ For fire doors, limiting U-value is 1.8 W/m²K 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
m³/(h.m²) at 50 Pa	8	3

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- BG Comm

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	5.1	8.7	0	1.1	0.9
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					
^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.					

1- DHW - BG

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

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

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	
	L00: COMMERCIAL	120	100	1.5	
	L00: COMMERCIAL	120	100	1.5	

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?
L00: COMMERCIAL	NO (-54.7%)	NO
L00: COMMERCIAL	NO (-45.4%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

Building Use

	Actual	Notional
Floor area [m²]	123.4	123.4
External area [m²]	245.6	245.6
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	81.44	80.37
Average U-value [W/m²K]	0.33	0.33
Alpha value* [%]	25	10

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

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	3.21	4.77
Cooling	2.6	1.94
Auxiliary	2.91	7.41
Lighting	9.6	19.8
Hot water	1.7	1.61
Equipment*	20.26	20.26
TOTAL **	20.02	35.53

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	115.12	80.02
Primary energy [kWh _{PE} /m²]	30.39	52.6
Total emissions [kg/m²]	2.81	4.86

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] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity									
	Actual	58.4	56.8	3.2	2.6	2.9	5.06	6.06	5.1
	Notional	47.7	32.3	4.8	1.9	7.4	2.78	4.63	----

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

BRUKL Output Document

 HM Government

Compliance with England Building Regulations Part L 2021

Project name

AP SH Be Green

As designed

Date: Tue Aug 25 17:40:05 2026

Administrative information

Building Details

Address: Address 1, City, Postcode

Certifier details

Name: Name
Telephone number: Phone
Address: Street Address, City, Postcode

Certification tool

Calculation engine: Apache
Calculation engine version: 7.0.31
Interface to calculation engine: IES Virtual Environment
Interface to calculation engine version: 7.0.31
BRUKL compliance module version: v6.1.e.1

Foundation area [m²]: 428.04

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

Target CO ₂ emission rate (TER), kgCO ₂ /m²:annum	5.63
Building CO ₂ emission rate (BER), kgCO ₂ /m²:annum	3.13
Target primary energy rate (TPER), kWh _{PE} /m²:annum	60.99
Building primary energy rate (BPER), kWh _{PE} /m²:annum	33.81
Do the building's emission and primary energy rates exceed the targets?	BER =< TER BPER =< TPER

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

Fabric element	U _a -Limit	U _a -Calc	U _i -Calc	First surface with maximum value
Walls*	0.26	0.14	0.14	L2000002:Surf[2]
Floors	0.18	0.1	0.1	A_00002B:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	-	-	No flat roofs in building
Windows** and roof windows	1.6	1.21	1.21	L2000002:Surf[0]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	-	-	No personnel doors in building
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building
U _a -Limit = Limiting area-weighted average U-values [W/(m²K)] U _a -Calc = Calculated area-weighted average U-values [W/(m²K)] U _i -Calc = Calculated maximum individual element U-values [W/(m²K)] * Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. ** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position. ^ For fire doors, limiting U-value is 1.8 W/m²K 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
m³/(h.m²) at 50 Pa	8	3

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- BG

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	5.1	8.7	0	1.1	0.9
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					
^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.					

1- DHW - BG

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	3.26	-
Standard value	2*	N/A
* Standard shown is for all types except absorption and gas engine heat pumps.		

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

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
L21:		120	-	-
L21:		120	-	-
L21:		120	-	-
L21: GYM_01		120	-	-
L21: GYM_02		120	-	-
L21:		120	-	-
L00: SHARED LIVING AMENITIES		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?
L21:	NO (-18.6%)	NO
L21:	NO (-40.4%)	NO
L21:	NO (-38.8%)	NO
L21: GYM_01	YES (+1.6%)	NO
L21: GYM_02	NO (-4.8%)	NO
L21:	NO (-18.2%)	NO
L00: SHARED LIVING AMENITIES	NO (-2.9%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global ParametersBuilding Use

	Actual	Notional	% Area	Building Type
Floor area [m²]	76.9	76.9	100	Retail/Financial and Professional Services
External area [m²]	148	148		Restaurants and Cafes/Drinking Establishments/Takeaways
Weather	LON	LON		Offices and Workshop Businesses
Infiltration [m³/hm²@ 50Pa]	3	3		General Industrial and Special Industrial Groups
Average conductance [W/K]	50.29	55.16		Storage or Distribution
Average U-value [W/m²K]	0.34	0.37		Hotels
Alpha value* [%]	25	10		Residential Institutions: Hospitals and Care Homes

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	2.17	3.82
Cooling	5.18	3.49
Auxiliary	2.91	9.59
Lighting	8.11	14.52
Hot water	1.7	1.61
Equipment*	20.26	20.26
TOTAL **	20.07	33.04

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	0	0

Energy & CO2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	155.04	96.46
Primary energy [kWh _{PE} /m²]	30.25	48.78
Total emissions [kg/m²]	2.76	4.48

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] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity									
Actual	40.3	114.8	2.2	5.2	2.9	5.16	6.15	5.1	8.7
Notional	38.2	58.3	3.8	3.5	9.6	2.78	4.63	----	----

Key to terms

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

Project name

Ashley House Aff Comm Be Green

As designed

Date: Tue Aug 25 16:10:13 2026

Administrative information

Building Details

Address: Address 1, City, Postcode

Certifier details

Name: Name
Telephone number: Phone
Address: Street Address, City, Postcode

Certification tool

Calculation engine: Apache
Calculation engine version: 7.0.31
Interface to calculation engine: IES Virtual Environment
Interface to calculation engine version: 7.0.31
BRUKL compliance module version: v6.1.e.1

Foundation area [m²]: 76.85

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

Target CO ₂ emission rate (TER), kgCO ₂ /m²:annum	4.48
Building CO ₂ emission rate (BER), kgCO ₂ /m²:annum	2.76
Target primary energy rate (TPER), kWh _{PE} /m²:annum	48.78
Building primary energy rate (BPER), kWh _{PE} /m²:annum	30.25
Do the building's emission and primary energy rates exceed the targets?	BER =< TER BPER =< TPER

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

Fabric element	U _a -Limit	U _a -Calc	U _i -Calc	First surface with maximum value
Walls*	0.26	0.14	0.14	A_00008F:Surf[5]
Floors	0.18	0.1	0.1	A_00008F:Surf[6]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.1	0.1	A_00008F:Surf[7]
Windows** and roof windows	1.6	1.21	1.21	A_00008F:Surf[0]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	1.01	1.01	A_00008F:Surf[3]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building
U _a -Limit = Limiting area-weighted average U-values [W/(m²K)] U _a -Calc = Calculated area-weighted average U-values [W/(m²K)] U _i -Calc = Calculated maximum individual element U-values [W/(m²K)] * Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. ** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position. ^ For fire doors, limiting U-value is 1.8 W/m²K 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
m³/(h.m²) at 50 Pa	8	3

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- BG

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	5.1	8.7	0	1.1	0.9
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					
^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.					

1- DHW - BG

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

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

General lighting and display lighting	General luminaire			Display light source	
	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]		
Zone name					
Standard value	95	80	0.3		
L00: COMMERCIAL	120	100	1.5		

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?
L00: COMMERCIAL	NO (-3.5%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global ParametersBuilding Use

	Actual	Notional	% Area	Building Type
Floor area [m²]	856.1	856.1		Retail/Financial and Professional Services
External area [m²]	1096.9	1096.9		Restaurants and Cafes/Drinking Establishments/Takeaways
Weather	LON	LON		Offices and Workshop Businesses
Infiltration [m³/hm²@ 50Pa]	3	3		General Industrial and Special Industrial Groups
Average conductance [W/K]	422.06	395.11		Storage or Distribution
Average U-value [W/m²K]	0.38	0.36		Hotels
Alpha value* [%]	25	10		Residential Institutions: Hospitals and Care Homes
				83 Residential Institutions: Residential Schools
				17 Residential Institutions: Universities and Colleges

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	2.08	2.92
Cooling	2.5	2.39
Auxiliary	3.9	13.03
Lighting	5.84	10.12
Hot water	7.94	12.73
Equipment*	35.74	35.74
TOTAL **	22.26	41.19

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	0	0

Energy & CO2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	92.73	69.12
Primary energy [kWh _{PE} /m²]	33.81	60.99
Total emissions [kg/m²]	3.13	5.63

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 SSEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	38	54.7	2.1	2.5	3.9	5.08	6.08	5.1	8.7
	Notional	29.2	39.9	2.9	2.4	11.7	2.78	4.63	----	----

Key to terms

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

Appendix A.5 – Early Stage Overheating Risk Tool

KEY FACTORS INCREASING THE LIKELIHOOD OF OVERHEATING **KEY FACTORS REDUCING THE LIKELIHOOD OF OVERHEATING**

Geographical and local context

#1 Where is the scheme in the UK? See guidance for map	South east	4	4	
	Northern England, Scotland & NI	0		
	Rest of England and Wales	2		
#2 Is the site likely to see an Urban Heat Island effect? See guidance for details	Central London (see guidance)	3	2	
	Grtr London, Manchester, B'ham	2		
	Other cities, towns & dense sub-urban areas	1		
#8 Do the site surroundings feature significant blue/green infrastructure? Proximity to green spaces and large water bodies has beneficial effects on local temperatures; as guidance, this would require at least 50% of surroundings within a 100m radius to be blue/green, or a rural context				
			1	0

Site characteristics

#3 Does the site have barriers to windows opening? - Noise/Acoustic risks - Poor air quality/smells e.g. near factory or car park or very busy road - Security risks/crime - Adjacent to heat rejection plant	Day - reasons to keep all windows closed	8	0
	Day - barriers some of the time, or for some windows e.g. on quiet side	4	
	Night - reasons to keep all windows closed	8	4
	Night - bedroom windows OK to open, but other windows are likely to stay closed	4	

#9 Are immediate surrounding surfaces in majority pale in colour, or blue/green? Lighter surfaces reflect more heat and absorb less so their temperatures remain lower; consider horizontal and vertical surfaces within 10m of the scheme	1	0
--	---	---

#10 Does the site have existing tall trees or buildings that will shade solar-exposed glazed areas? Shading onto east, south and west facing areas can reduce solar gains, but may also reduce daylight levels	1	0
--	---	---

Scheme characteristics and dwelling design

#4 Are the dwellings flats? Flats often combine a number of factors contributing to overheating risk e.g. dwelling size, heat gains from surrounding areas; other dense and enclosed dwellings may be similarly affected - see guidance for examples	3	3
#5 Does the scheme have community heating? i.e. with hot pipework operating during summer, especially in internal areas, leading to heat gains and higher temperatures	3	3
#11 Do dwellings have high exposed thermal mass AND a means for secure and quiet night ventilation? Thermal mass can help slow down temperature rises, but it can also cause properties to be slower to cool, so needs to be used with care - see guidance		
		1 0
#12 Do floor-to-ceiling heights allow ceiling fans, now or in the future? Higher ceilings increase stratification and air movement, and offer the potential for ceiling fans		
		>2.8m and fan installed 2 0
		> 2.8m 1

Solar heat gains and ventilation

#6 What is the estimated average glazing ratio for the dwellings? (as a proportion of the facade on solar-exposed areas i.e. orientations facing east, south, west, and anything in between). Higher proportions of glazing allow higher heat gains into the space	>65%	12	4
	>50%	7	
	>35%	4	

#13 Is there useful external shading? Shading should apply to solar exposed (E/S/W) glazing. It may include shading devices, balconies above, facade articulation etc. See guidance on "full" and "part". Scoring depends on glazing proportions as per #6		Full	Part	1
	>65%	6	3	
	>50%	4	2	
	>35%	2	1	

#7 Are the dwellings single aspect? Single aspect dwellings have all openings on the same facade. This reduces the potential for ventilation	Single-aspect	3	3
	Dual aspect	0	

#14 Do windows & openings support effective ventilation? Larger, effective and secure openings will help dissipate heat - see guidance	Openings compared to Part F purge rates			3	
		= Part F	+50%		+100%
	Single-aspect	minimum required	3		4
	Dual aspect		2		3

TOTAL SCORE 19 = Sum of contributing factors: 23 minus Sum of mitigating factors: 4



score >12:
Incorporate design changes to reduce risk factors and increase mitigation factors AND Carry out a detailed assessment (e.g. dynamic modelling against CIBSE TM59)

score between 8 and 12:
Seek design changes to reduce risk factors and/or increase mitigation factors AND Carry out a detailed assessment (e.g. dynamic modelling against CIBSE TM59)

score <8:
Ensure the mitigating measures are retained, and that risk factors do not increase (e.g. in planning conditions)

Appendix A.6 - Overheating Assessment

A.6 Overheating Assessment

As requested in the Energy Assessment Guidance, the Good Homes Alliance (GHA) Early Stage Overheating Risk Tool has been completed and is provided in Appendix A.5.

The proposed development has been assessed in accordance with the cooling hierarchy detailed in policy SI 4 of the London Plan, the latest GLA Energy Assessment Guidance 2022 and Building Regulations Part O 2021, in order to reduce overheating and minimise the use of air conditioning.

The assessment includes dynamic thermal modelling of the proposed development to assess the risk of overheating, using IES modelling software, in accordance with the guidance and data sets in CIBSE TM49 and TM59.

A.6.1 Overheating Risk Assessment Methodology

The Chartered Institution of Building Services Engineers (CIBSE) has produced guidance on assessing and mitigating overheating risk in new developments. TM 59 Design Methodology for the Assessment of Overheating Risk in Homes should be used for residential developments.

For compliance with CIBSE TM 59, the modelled apartments must pass both of the following two criteria:

- a) For living rooms, kitchens and bedrooms: the number of hours during which ΔT is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3% of occupied hours.
- b) For bedrooms only: to guarantee comfort during the sleeping hours the operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26°C for more than 1% of annual hours. (Note: 1% of the annual hours between 22:00 and 07:00 for bedrooms is 32 hours, so 33 or more hours above 26°C will be recorded as a fail).

Both (a) and (b) above must be passed for all relevant rooms.

Weather Data

The weather file used for the assessment is as per TM59: DSY1 (Design Summer Year) for the site location, for the 2020s, high emissions, 50% percentile scenario.

The London Heathrow weather data set has been used which is the most representative for the site location.

It is expected that the CIBSE compliance criteria are met for the DSY1 weather scenario.

Additional testing has been undertaken for the residential apartments using the 2020 versions of the following more extreme design weather years:-

- DSY2 – 2003: a year with a very intense single warm spell.
- DSY3 – 1976: a year with a prolonged period of sustained warmth.

It is acknowledged in the GLA Energy Assessment Guidance 2022 that meeting the CIBSE compliance criteria is challenging for the DSY 2 & 3 weather files, and compliance is therefore not expected.

A.6.2 Domestic Model Input Data

This section summarises the input assumptions that have been used in the dynamic thermal modelling. The modelling has been carried out in accordance with CIBSE TM59: Design methodology for the assessment of overheating risk in home.

Fabric Performance

Refer to Section 6.

Solar Gain

For the residential apartments the size and g-value of the glazing has been optimised using the dynamic thermal modelling, in order to provide a balance between minimising summer heat gain to prevent overheating, maximising winter heat gain to reduce heating loads, and maximising natural daylight to reduce lighting energy. This has resulted in the g-value of the residential glazing being set at 0.35.

Blinds and Shading Devices

Internal blinds have not been included in the dwellings.

The balconies and external corridors have been modelled to provide external shading for the apartments.

Mechanical Ventilation

Individual Mechanical Ventilation with Heat Recovery (MHVR) units are proposed to provide fresh air and extract ventilation for the residential dwellings.

These units will be equipped with a summer bypass mode and a boost mode that will enable the unit to achieve an increased total flow rate of up to 80l/s in the summer condition, exceeding the minimum ventilation requirement of Part F of the Building Regulations.

Fixed ceiling fans are not proposed and have not been included in the modelling.

Natural Ventilation

A typical apartment has balcony doors which can be fully opened and side hung opening windows elsewhere to allow natural ventilation when required.

Window opening methodology is in accordance with Building Regulations Part O 2021.

All residential dwellings tested have been modelled with natural ventilation via fully open windows/doors and increased mechanical ventilation to demonstrate that passive measures have been maximised and the façade design has been optimised.

Building Regulations Part O 2021 requires the modelling to assume that bedroom windows are closed at night if the average 8 hour ambient noise level exceeds 40 dB.

The Noise Assessment carried out by Trium Acoustics demonstrates that if the windows are fully open some of the bedrooms are subject to background noise levels at night that exceed the limit prescribed in Building Regulations Part O 2021.

Their report includes zoning plans which detail the maximum window opening area for each part of the building to achieve the Part O noise criteria.

Additional modelling has been carried out for the sampled apartments with the bedroom windows fully closed at night to reflect the maximum window areas on the zoning plans, and with the increased mechanical ventilation in operation.

Infiltration

The target air permeability for the proposed development is 3m³/hr.m²@50Pa. An average infiltration air change of 0.25ACH has been assumed in the dynamic thermal modelling in accordance with Table 4.24 in CIBSE Guide A.

Air Speed Assumptions

Operative air speed in the apartments has been set at 0.1m/s and assumed elevated air speed of 0.8m/s used where applicable in the thermal modelling calculation in accordance with CIBSE TM59.

Thermal Comfort Category

This is a proposed new build development, therefore Cat II building was selected as Normal Expectations.

Internal Gains

A thermal template has been created for each of the spaces within the sample apartments taking into account the internal gains. The internal heat gains consist of occupancy gains, equipment gains and lighting gains. CIBSE TM59 has been used in developing the internal gains profile.

Occupancy Gains

Occupancy heat gains and profiles were assumed in accordance with Table 2 in CIBSE TM59.

Occupancy gain has been set at 75 W/person sensible, 55 W/person latent.

Room Type	Profile/ Gain
Single Bedroom	1 person at 70% gains from 11pm -8am 1 person at full gains from 8am to 11pm
Double Bedroom	2 person at 70% gains from 11pm -8am 2 person at full gains from 8am to 9am and from 10pm to 11pm 1 person at full gains in the bedroom from 9am to 10pm
1 Bedroom (Living room/ kitchen)	1 person from 9am -10am, room is unoccupied for the rest the day
2 Bedroom (Living room/ kitchen)	2 person from 9am -10am, room is unoccupied for the rest the day
3 Bedroom (Living room/ kitchen)	3 person from 9am -10am, room is unoccupied for the rest the day

Table A-6-1: Occupancy Gains

Equipment Gains

Equipment heat gains and profiles were assumed in accordance with Table 2 in CISBE TM59.

Room Type	Profile/ Gain
Living Room/ Kitchen	Peak load of 450W from 6pm-8pm 200W from 8pm- 10pm 110W from 9am to 6pm and from 10pm to 12pm Base load of 85W for the rest of the day
Single Bedroom	Peak load of 80W from 8am to 11pm Base load of 10W during the sleeping hours
Double Bedroom	Peak load of 80W from 8am to 11pm Base load of 10W during the sleeping hours

Table A-6-2: Equipment Gains

Lighting Gains

Lighting gains of 2 W/m² have been assumed for each flat for the period of 6pm –11pm in accordance with CIBSE TM59. Lighting Gains of 8W/m² have been assumed for the communal corridors.

A.6.3 Modelling Results

A.6.3.1 Open Windows

Room Name	DSY1	DSY2	DSY3	DSY1	DSY2	DSY3
	Criteria a >3			Criteria b >33		
L01: UNITE 2_1B2P_BEDROOM	0.7	1.6	2.3	12	34	32
L01: UNITE 2_1B2P_LKD	0.7	2	2.4	N/A	N/A	N/A
L01: UNITE 7_4B6P_BEDROOM	0.8	2.2	1.6	16	41	39
L01: UNITE 7_4B6P_BEDROOM	0.8	2.2	1.6	16	41	39
L01: UNITE 7_4B6P_BEDROOM	0.8	2.2	1.6	16	41	39
L01: UNITE 8_4B6P_BEDROOM	0.8	2.2	2.1	16	41	39
L01: UNITE 8_4B6P_BEDROOM	0.8	2.2	2.1	16	41	39
L01: UNITE 8_4B6P_BEDROOM	0.8	2.2	2.1	16	41	39
L01: UNITE 8_4B6P_BEDROOM	0.8	2.2	2.1	16	41	39
L01: UNITE 12_4B6P_BEDROOM	0.7	1.8	1.9	22	48	48
L01: UNITE 12_4B6P_BEDROOM	0.7	1.8	1.9	22	48	48
L01: UNITE 12_4B6P_BEDROOM	0.7	1.8	1.9	22	48	48
L01: UNITE 16_2B4P_LKD	0.7	1.9	2.3	N/A	N/A	N/A
L01: UNITE 17_1B2P_BEDROOM	0.8	1.9	2.5	14	35	33
L01: UNITE 17_1B2P_LKD	0.8	2	2.6	N/A	N/A	N/A
L01: UNITE 18_2B4P_BEDROOM	0.9	2.1	2.3	11	32	28
L01: UNITE 18_2B4P_BEDROOM	0.9	2.1	2.3	11	32	28
L01: UNITE 18_2B4P_LKD	0.9	2.3	2.8	N/A	N/A	N/A
L01: UNITE 19_2B4P_BEDROOM	0.9	2.2	2.8	16	41	39
L01: UNITE 19_2B4P_BEDROOM	0.9	2.2	2.8	16	41	39
L01: UNITE 19_2B4P_LKD	0.9	2	2.6	N/A	N/A	N/A
L01:UNITE 3_2B4P_BEDROOM	0.9	2.3	2.8	12	32	31
L01:UNITE 3_2B4P_BEDROOM	0.9	2.3	2.8	12	32	31
L01:UNITE 3_2B4P_LKD	0.8	2.3	2.8	N/A	N/A	N/A
L02: UNITE 1_2B4P_BEDROOM	0.5	1.5	2	18	45	45
L02: UNITE 1_2B4P_BEDROOM	0.5	1.5	2	18	45	45
L02: UNITE 1_2B4P_LKD	0.8	2.1	2.6	N/A	N/A	N/A
L02: UNITE 2_1B2P_BEDROOM	0.7	1.6	2.3	12	34	32
L02: UNITE 2_1B2P_LKD	0.8	1.9	2.4	N/A	N/A	N/A
L02: UNITE 3_2B4P_BEDROOM	0.9	2.3	2.8	12	32	31
L02: UNITE 3_2B4P_BEDROOM	0.9	2.3	2.8	12	32	31
L02: UNITE 3_2B4P_LKD	0.9	2.4	2.8	N/A	N/A	N/A
L02: UNITE 4_2B4P_BEDROOM	0.6	1.5	2.1	16	45	42
L02: UNITE 4_2B4P_BEDROOM	0.6	1.5	2.1	16	45	42
L02: UNITE 4_2B4P_LKD	0.7	1.8	2.3	N/A	N/A	N/A
L02: UNITE 5_3B5P_BEDROOM	0.7	1.7	1.6	14	36	34
L02: UNITE 5_3B5P_BEDROOM	0.7	1.7	1.6	14	36	34

L02: UNITE 5_3B5P_BEDROOM	0.7	1.7	1.6
L02: UNITE 5_3B5P_LKD	0.5	1.4	1.8
L02: UNITE 6_3B5P_BEDROOM	0.7	1.8	1.9
L02: UNITE 6_3B5P_BEDROOM	0.7	1.8	1.9
L02: UNITE 6_3B5P_BEDROOM	0.7	1.8	1.9
L02: UNITE 6_3B5P_LKD	0.8	2.1	2.5
L02: UNITE 7_3B5P_BEDROOM	0.5	1.4	1.8
L02: UNITE 7_3B5P_BEDROOM	0.5	1.4	1.8
L02: UNITE 7_3B5P_BEDROOM	0.5	1.4	1.8
L02: UNITE 7_3B5P_LKD	0.8	2.1	2.5
L02: UNITE 9_2B4P_BEDROOM	0.7	0.9	1.3
L02: UNITE 9_2B4P_BEDROOM	0.7	0.9	1.3
L02: UNITE 9_2B4P_LKD	0.9	2.2	2.6
L02: UNITE 10_2B4P_BEDROOM	0.4	1.1	1.6
L02: UNITE 10_2B4P_BEDROOM	0.4	1.1	1.6
L02: UNITE 10_2B4P_LKD	0.8	2.1	2.6
L02: UNITE 11_2B4P_BEDROOM	0.4	1.1	1.6
L02: UNITE 11_2B4P_BEDROOM	0.4	1.1	1.6
L02: UNITE 11_2B4P_LKD	0.8	2	2.5
L02: UNITE 12_2B4P_BEDROOM	0.5	1.5	1.9
L02: UNITE 12_2B4P_BEDROOM	0.5	1.5	1.9
L02: UNITE 12_2B4P_LKD	0.8	2.2	2.6
L02: UNITE 14_2B4P_BEDROOM	0.6	1.4	1.9
L02: UNITE 14_2B4P_BEDROOM	0.6	1.4	1.9
L02: UNITE 14_2B4P_LKD	0.7	1.9	2.4
L02: UNITE 15_1B2P_BEDROOM	0.8	1.9	2.5
L02: UNITE 15_1B2P_LKD	0.8	2	2.6
L02: UNITE 16_2B4P_BEDROOM	0.9	2.1	2.7
L02: UNITE 16_2B4P_BEDROOM	0.9	2.1	2.7
L02: UNITE 16_2B4P_LKD	0.9	2.3	2.8
L02: UNITE 17_2B4P_BEDROOM	0.9	2.3	2.3
L02: UNITE 17_2B4P_BEDROOM	0.9	2.3	2.3
L02: UNITE 17_2B4P_LKD	0.8	2.1	2.5
L05: UNITE 1_2B4P_BEDROOM	0.6	1.6	2.2
L05: UNITE 1_2B4P_BEDROOM	0.6	1.6	2.2
L05: UNITE 1_2B4P_LKD	0.8	2	2.6
L05: UNITE 2_1B2P_BEDROOM	0.7	1.6	2.4
L05: UNITE 2_1B2P_LKD	0.8	2	2.4
L05: UNITE 3_2B4P_BEDROOM	0.9	2.3	2.8
L05: UNITE 3_2B4P_BEDROOM	0.9	2.3	2.8
L05: UNITE 3_2B4P_LKD	0.9	2.3	2.9
L05: UNITE 4_2B4P_BEDROOM	0.6	1.6	2.2
L05: UNITE 4_2B4P_BEDROOM	0.6	1.6	2.2
L05: UNITE 4_2B4P_LKD	0.7	1.9	2.3
L05: UNITE 5_3B5P_BEDROOM	0.5	1.7	2.1
L05: UNITE 5_3B5P_BEDROOM	0.5	1.7	2.1
L05: UNITE 5_3B5P_BEDROOM	0.5	1.7	2.1
L05: UNITE 5_3B5P_LKD	0.5	1.5	1.9

14	36	34
N/A	N/A	N/A
14	36	33
14	36	33
14	36	33
N/A	N/A	N/A
13	35	34
13	35	34
13	35	34
N/A	N/A	N/A
14	36	34
14	36	34
N/A	N/A	N/A
10	32	29
10	32	29
N/A	N/A	N/A
10	32	30
10	32	30
N/A	N/A	N/A
11	32	31
11	32	31
N/A	N/A	N/A
20	47	46
20	47	46
N/A	N/A	N/A
14	36	33
N/A	N/A	N/A
11	32	28
11	32	28
N/A	N/A	N/A
16	41	39
16	41	39
N/A	N/A	N/A
19	46	45
19	46	45
N/A	N/A	N/A
12	34	31
N/A	N/A	N/A
12	32	31
12	32	31
N/A	N/A	N/A
16	43	41
16	43	41
N/A	N/A	N/A
25	58	58
25	58	58
25	58	58
N/A	N/A	N/A

L05: UNITE 6_3B5P_BEDROOM	0.7	1.9	2.2
L05: UNITE 6_3B5P_BEDROOM	0.7	1.9	2.2
L05: UNITE 6_3B5P_BEDROOM	0.7	1.9	2.2
L05: UNITE 6_3B5P_LKD	0.9	2.2	2.6
L05: UNITE 7_3B5P_BEDROOM	0.5	1.5	1.9
L05: UNITE 7_3B5P_BEDROOM	0.5	1.5	1.9
L05: UNITE 7_3B5P_BEDROOM	0.5	1.5	1.9
L05: UNITE 7_3B5P_LKD	0.9	2.2	2.6
L05: UNITE 8_1B2P_BEDROOM	0.5	1.3	1.7
L05: UNITE 8_1B2P_LKD	0.7	2	2.5
L05: UNITE 9_2B4P_BEDROOM	0.5	1.7	2.1
L05: UNITE 9_2B4P_BEDROOM	0.5	1.7	2.1
L05: UNITE 9_2B4P_LKD	0.9	2.2	2.8
L05: UNITE 10_2B4P_BEDROOM	0.5	1.2	1.6
L05: UNITE 10_2B4P_BEDROOM	0.5	1.2	1.6
L05: UNITE 10_2B4P_LKD	0.9	2.2	2.6
L05: UNITE 11_2B4P_BEDROOM	0.6	1.5	2.1
L05: UNITE 11_2B4P_BEDROOM	0.6	1.5	2.1
L05: UNITE 11_2B4P_LKD	0.9	2.2	2.6
L05: UNITE 13_2B4P_BEDROOM	0.5	0.7	1.7
L05: UNITE 13_2B4P_BEDROOM	0.5	0.7	1.7
L05: UNITE 14_2B4P_BEDROOM	0.7	1.8	1.8
L05: UNITE 14_2B4P_BEDROOM	0.7	1.8	1.8
L05: UNITE 14_2B4P_LKD	0.7	1.9	2.3
L05: UNITE 15_1B2P_BEDROOM	0.8	2	2.4
L05: UNITE 15_1B2P_LKD	0.8	2	2.6
L05: UNITE 16_2B4P_BEDROOM	0.7	1.8	2.4
L05: UNITE 16_2B4P_BEDROOM	0.7	1.8	2.4
L05: UNITE 16_2B4P_LKD	1	2.3	2.8
L05: UNITE 17_2B4P_BEDROOM	0.7	1.9	2.4
L05: UNITE 17_2B4P_BEDROOM	0.7	1.9	2.4
L05: UNITE 17_2B4P_LKD	0.8	2.1	2.6
L02: STUDIO_03	1.5	2.9	3.5
L02: STUDIO_04	1.6	2.9	3.7
L02: STUDIO_05	1.6	2.9	3.6
L02: STUDIO_06	1.6	2.9	3.6
L02: STUDIO_07	1.3	2.1	2.7
L02: STUDIO_10	1.5	3.1	3.7
L02: STUDIO_11	1.3	2.6	3.2
L02: STUDIO_34	1.2	3.1	3.6
L02: STUDIO_41	1	3.3	3.8
L02: STUDIO_44	1	2.4	2.8
L02: STUDIO_45	1.4	2.8	3.5
L02: STUDIO_54	1.4	2.9	3.5
L02: STUDIO_55	1.4	2.8	3.4
L02: STUDIO_56	1.4	2.9	3.5
L02: STUDIO_57	1.2	2.9	3.4
L15: STUDIO_03	1.4	2.8	3.3

26	59	58
26	59	58
26	59	58
N/A	N/A	N/A
13	36	34
13	36	34
13	36	34
N/A	N/A	N/A
13	36	33
N/A	N/A	N/A
25	59	58
25	59	58
N/A	N/A	N/A
10	31	29
10	31	29
N/A	N/A	N/A
15	38	38
15	38	38
N/A	N/A	N/A
13	36	33
13	36	33
19	46	45
19	46	45
N/A	N/A	N/A
14	36	33
N/A	N/A	N/A
18	45	43
18	45	43
N/A	N/A	N/A
17	45	41
17	45	41
N/A	N/A	N/A
29	65	66
30	65	65
30	65	66
29	65	66
14	43	40
28	64	62
31	66	67
28	65	68
31	75	78
31	70	67
29	65	65
29	65	64
29	65	65
29	64	64
28	63	64
25	59	55

L15: STUDIO_04	1.4	2.8	3.3	26	55	55
L15: STUDIO_05	1.4	2.8	3.3	26	58	55
L15: STUDIO_06	1.4	2.8	3.3	25	55	55
L15: STUDIO_07	1.2	2.1	2.6	14	37	39
Sample Total	137	137	137	101	101	101
Non-Compliant	0	0	0	0	83	71
Compliant	137	134	120	101	18	30
Pass Rate	100%	98%	88%	100%	18%	30%

A.6.3.2 Bedroom Windows Closed at Night

Room Name	DSY1 Criteria a >3	DSY1 Criteria b >33
L01: UNITE 2_1B2P_BEDROOM	0.7	47
L01: UNITE 2_1B2P_LKD	0.7	N/A
L01: UNITE 7_4B6P_BEDROOM	1	90
L01: UNITE 7_4B6P_BEDROOM	1	90
L01: UNITE 7_4B6P_BEDROOM	1	90
L01: UNITE 8_4B6P_BEDROOM	1.1	88
L01: UNITE 8_4B6P_BEDROOM	1.1	88
L01: UNITE 8_4B6P_BEDROOM	1.1	88
L01: UNITE 8_4B6P_BEDROOM	1.1	88
L01: UNITE 12_4B6P_BEDROOM	0.9	97
L01: UNITE 12_4B6P_BEDROOM	0.9	97
L01: UNITE 12_4B6P_BEDROOM	0.9	97
L01: UNITE 16_2B4P_LKD	0.7	N/A
L01: UNITE 17_1B2P_BEDROOM	0.8	50
L01: UNITE 17_1B2P_LKD	0.8	N/A
L01: UNITE 18_2B4P_BEDROOM	1	68
L01: UNITE 18_2B4P_BEDROOM	1	68
L01: UNITE 18_2B4P_LKD	1	N/A
L01: UNITE 19_2B4P_BEDROOM	1.2	73
L01: UNITE 19_2B4P_BEDROOM	1.2	73
L01: UNITE 19_2B4P_LKD	0.9	N/A
L01: UNITE 3_2B4P_BEDROOM	1.1	67
L01: UNITE 3_2B4P_BEDROOM	1.1	67
L01: UNITE 3_2B4P_LKD	0.9	N/A
L02: UNITE 1_2B4P_BEDROOM	0.7	85
L02: UNITE 1_2B4P_BEDROOM	0.7	85
L02: UNITE 1_2B4P_LKD	0.8	N/A
L02: UNITE 2_1B2P_BEDROOM	0.8	52
L02: UNITE 2_1B2P_LKD	0.8	N/A
L02: UNITE 3_2B4P_BEDROOM	1.1	67

L02: UNITE 3_2B4P_BEDROOM	1.1	67
L02: UNITE 3_2B4P_LKD	0.9	N/A
L02: UNITE 4_2B4P_BEDROOM	0.7	74
L02: UNITE 4_2B4P_BEDROOM	0.7	74
L02: UNITE 4_2B4P_LKD	0.7	N/A
L02: UNITE 5_3B5P_BEDROOM	0.7	61
L02: UNITE 5_3B5P_BEDROOM	0.7	61
L02: UNITE 5_3B5P_BEDROOM	0.7	61
L02: UNITE 5_3B5P_LKD	0.6	N/A
L02: UNITE 6_3B5P_BEDROOM	0.8	65
L02: UNITE 6_3B5P_BEDROOM	0.8	65
L02: UNITE 6_3B5P_BEDROOM	0.8	65
L02: UNITE 6_3B5P_LKD	0.8	N/A
L02: UNITE 7_3B5P_BEDROOM	0.7	48
L02: UNITE 7_3B5P_BEDROOM	0.7	48
L02: UNITE 7_3B5P_BEDROOM	0.7	48
L02: UNITE 7_3B5P_LKD	0.8	N/A
L02: UNITE 9_2B4P_BEDROOM	0.7	48
L02: UNITE 9_2B4P_BEDROOM	0.7	48
L02: UNITE 9_2B4P_LKD	0.9	N/A
L02: UNITE 10_2B4P_BEDROOM	0.5	34
L02: UNITE 10_2B4P_BEDROOM	0.5	34
L02: UNITE 10_2B4P_LKD	0.8	N/A
L02: UNITE 11_2B4P_BEDROOM	0.5	34
L02: UNITE 11_2B4P_BEDROOM	0.5	34
L02: UNITE 11_2B4P_LKD	0.8	N/A
L02: UNITE 12_2B4P_BEDROOM	0.6	34
L02: UNITE 12_2B4P_BEDROOM	0.6	34
L02: UNITE 12_2B4P_LKD	0.9	N/A
L02: UNITE 14_2B4P_BEDROOM	0.7	82
L02: UNITE 14_2B4P_BEDROOM	0.7	82
L02: UNITE 14_2B4P_LKD	0.7	N/A
L02: UNITE 15_1B2P_BEDROOM	0.9	54
L02: UNITE 15_1B2P_LKD	0.8	N/A
L02: UNITE 16_2B4P_BEDROOM	1.1	69
L02: UNITE 16_2B4P_BEDROOM	1.1	69
L02: UNITE 16_2B4P_LKD	0.9	N/A
L02: UNITE 17_2B4P_BEDROOM	1.2	76
L02: UNITE 17_2B4P_BEDROOM	1.2	76
L02: UNITE 17_2B4P_LKD	0.8	N/A
L05: UNITE 1_2B4P_BEDROOM	0.7	76
L05: UNITE 1_2B4P_BEDROOM	0.7	76
L05: UNITE 1_2B4P_LKD	0.8	N/A
L05: UNITE 2_1B2P_BEDROOM	0.8	52
L05: UNITE 2_1B2P_LKD	0.8	N/A
L05: UNITE 3_2B4P_BEDROOM	1.1	69
L05: UNITE 3_2B4P_BEDROOM	1.1	69
L05: UNITE 3_2B4P_LKD	1	N/A

L05: UNITE 4_2B4P_BEDROOM	0.7	74
L05: UNITE 4_2B4P_BEDROOM	0.7	74
L05: UNITE 4_2B4P_LKD	0.7	N/A
L05: UNITE 5_3B5P_BEDROOM	0.8	78
L05: UNITE 5_3B5P_BEDROOM	0.8	78
L05: UNITE 5_3B5P_BEDROOM	0.8	78
L05: UNITE 5_3B5P_LKD	0.6	N/A
L05: UNITE 6_3B5P_BEDROOM	0.9	79
L05: UNITE 6_3B5P_BEDROOM	0.9	79
L05: UNITE 6_3B5P_BEDROOM	0.9	79
L05: UNITE 6_3B5P_LKD	0.9	N/A
L05: UNITE 7_3B5P_BEDROOM	0.7	58
L05: UNITE 7_3B5P_BEDROOM	0.7	58
L05: UNITE 7_3B5P_BEDROOM	0.7	58
L05: UNITE 7_3B5P_LKD	0.9	N/A
L05: UNITE 8_1B2P_BEDROOM	0.5	47
L05: UNITE 8_1B2P_LKD	0.8	N/A
L05: UNITE 9_2B4P_BEDROOM	0.7	60
L05: UNITE 9_2B4P_BEDROOM	0.7	60
L05: UNITE 9_2B4P_LKD	0.9	N/A
L05: UNITE 10_2B4P_BEDROOM	0.5	35
L05: UNITE 10_2B4P_BEDROOM	0.5	35
L05: UNITE 10_2B4P_LKD	0.9	N/A
L05: UNITE 11_2B4P_BEDROOM	0.7	64
L05: UNITE 11_2B4P_BEDROOM	0.7	64
L05: UNITE 11_2B4P_LKD	0.9	N/A
L05: UNITE 13_2B4P_BEDROOM	0.5	47
L05: UNITE 13_2B4P_BEDROOM	0.5	47
L05: UNITE 14_2B4P_BEDROOM	0.9	85
L05: UNITE 14_2B4P_BEDROOM	0.9	85
L05: UNITE 14_2B4P_LKD	0.7	N/A
L05: UNITE 15_1B2P_BEDROOM	0.8	43
L05: UNITE 15_1B2P_LKD	0.8	N/A
L05: UNITE 16_2B4P_BEDROOM	0.9	79
L05: UNITE 16_2B4P_BEDROOM	0.9	79
L05: UNITE 16_2B4P_LKD	1	N/A
L05: UNITE 17_2B4P_BEDROOM	1	87
L05: UNITE 17_2B4P_BEDROOM	1	87
L05: UNITE 17_2B4P_LKD	1	N/A
L02: STUDIO_03	2.1	136
L02: STUDIO_04	2.1	144
L02: STUDIO_05	2.1	144
L02: STUDIO_06	2.1	136
L02: STUDIO_07	1.7	106
L02: STUDIO_10	1.9	123
L02: STUDIO_11	1.7	134
L02: STUDIO_34	1.5	128
L02: STUDIO_41	1.3	109

L02: STUDIO_44	1.7	131
L02: STUDIO_45	1.8	141
L02: STUDIO_54	1.9	143
L02: STUDIO_55	1.9	142
L02: STUDIO_56	1.8	141
L02: STUDIO_57	1.5	121
L15: STUDIO_03	1.8	126
L15: STUDIO_04	1.9	131
L15: STUDIO_05	1.9	131
L15: STUDIO_06	1.9	126
L15: STUDIO_07	1.6	102
Sample Total	137	101
Non-Compliant	0	101
Compliant	137	0
Pass Rate	100%	0%

Appendix A.7 – Email Correspondence

Richard Denteh

From: Richard Denteh
Sent: 04 June 2026 14:24
To: 'help@energetik.support'
Subject: District Heating Network

Dear All,

We are working on the planning application for the development at Ashley, Tottenham Hale N17 9LN which falls in the borough of Haringey.

The Greater London Authority and London Borough of Haringey have asked us for written confirmation, if there is currently an existing or any planning for district heating network within the close vicinity of our site.

Could you please confirm or refer me to a colleague who will be able to confirm that this is the case?

Kind Regards

Richard Denteh
Senior Consultant
BEng (Hons) CEng MCIBSE OCDEA DipNDEA DEA

TEL: 0207831 7969 **MOB:** 07890 025702



Please kindly update your records with our new address details

Meinhardt (UK) Ltd, One London Wall, London, EC2Y 5EA

Infrastructure & Environment | Structures | MEP | Mobility | Project Management | Planning & Urban Development | Façade Engineering | Environmentally Sustainable Design | Specialist and Architectural Lighting | Fire Performance Engineering | Integrated Design Management | Mission Critical Facility Design

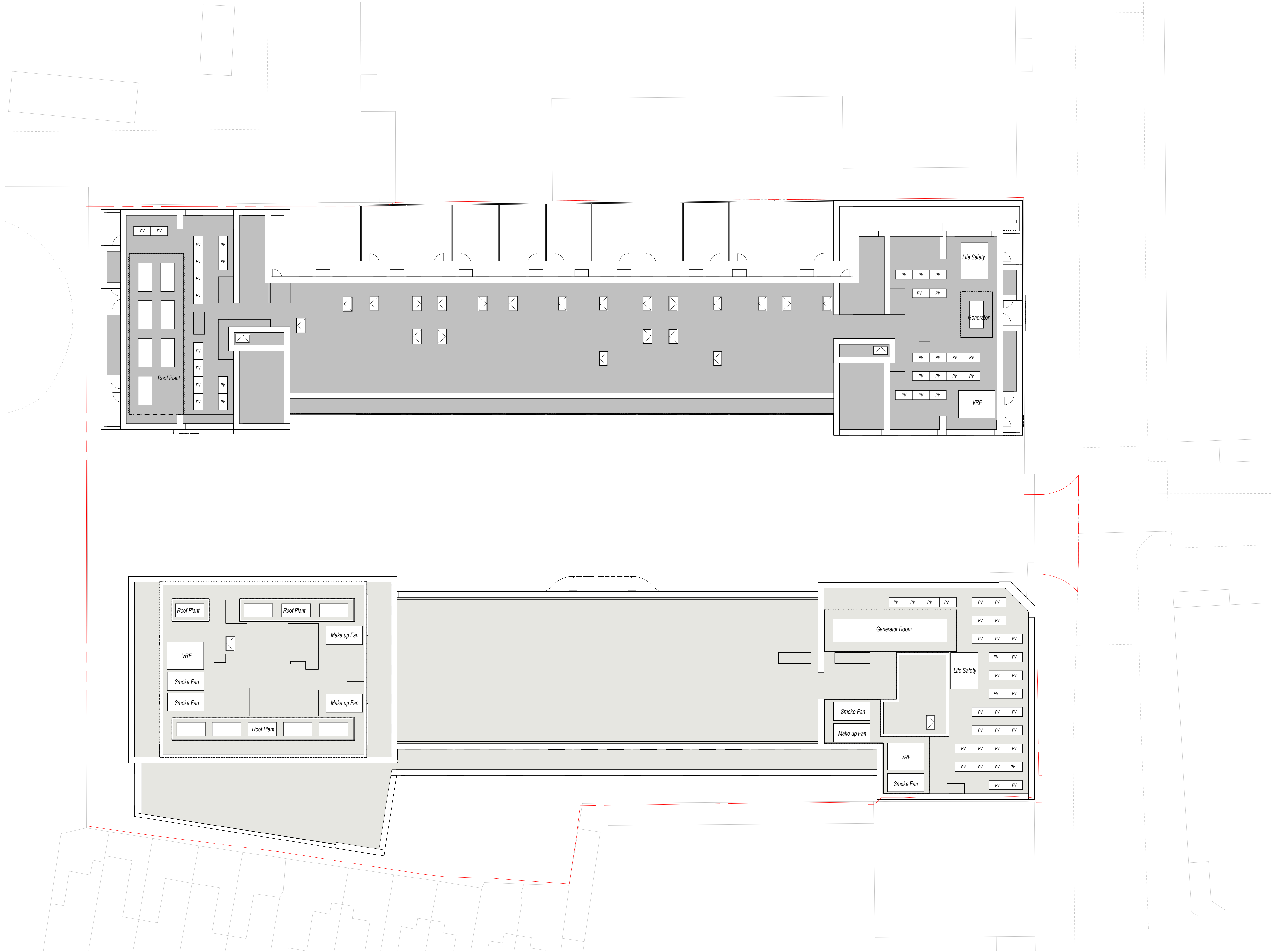
E: richard.denteh@meinhardt.co.uk | **W:** www.meinhardt.co.uk



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ASHLEY HOUSE SITE - PROPOSED ROOF PLAN

1 : 200



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REVISIONS

P01	WIP Issue	19/06/2026
P02	Issue to Relevant Consultants	11/06/2026
P03	WIP Issue	22/06/2026
P04	WIP Issue	03/07/2026
P05	Design Freeze Information Pack	10/07/2026
P06	Updated Design Freeze	22/07/2026
P07	Roof Plant Layout Updated	29/07/2026
P08	Updated Design Freeze	05/08/2026
P09	Updated Design Freeze & MSE Updated	07/08/2026
P10	PV panels added to Roof Level	12/08/2026
P11	Planning Drawings - Draft	14/08/2026
P12	Final Draft Issue for review	21/08/2026

FOR PLANNING ONLY

These drawings reflect the currently proposed scheme at RIBA Stage 2. They should be read in conjunction with the Design and Access Statement prepared by DLA Architecture Ltd.

These should also be read in conjunction with the following information, prepared by other consultants, to demonstrate a coordinated design proposal at RIBA Stage 2:

- Structural Engineers Drawings and Specification (Whitby Wood)
- MEP Engineers Drawings and Specification (Meinhardt)
- Fire Report (Ashton Fire)
- Landscape Drawings and Specification (Bosk Studio)

EXTENTS AND BOUNDARIES:

Existing site information, context, surrounding infrastructure, neighbouring building extents and plots are derived from 2D Surveys, produced by:
Cloud 10 Ltd
Drawing numbers: 2049-T(2) Topographical Survey

NOTES

All workspace furniture layouts are indicative only
All unit layouts are indicative only
Cycle store layouts are indicative only
Student and Shared Living amenity spaces are only indicative and subject to operator specifications

DRAFT

Ashley House Application Boundary

dlA

1 Naoroji Street Clerkenwell London WC1X 0GB
0207 553 3030
www.dla-architecture.co.uk

PROJECT

Ashley House Tottenham Hale

TITLE

ROOF PLAN
ASHLEY HOUSE SITE

SCALE

As indicated @ A1

DATE

21/08/2026

DLA REF

2025-032

DRAWN REVIEWED

VLM CJ

DOCUMENT NUMBER

AHCF-DLA-ZZ-RF-DR-A- 20230

DOCUMENT PURPOSE

PLANNING

REVISION

P12



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