FLINT ENERGY

SUSTAINABILITY & ENERGY STATEMENT

212 High Street Sutton, SM1 1NU

DOCUMENT CONTROL

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VERSION	DATE	PROJECT STAGE	STATUS	DESCRIPTION
1.0	05/10/2023	Strategic Design	The issue for Planning Submission	Initial report as per the proposed layout drawings

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1. EXECUTIVE SUMMARY

Flint Energy Ltd has been commissioned to prepare an energy and sustainability statement for a full planning application proposal in the London Borough of Sutton. The site is located on the land at 212 High Street, Sutton, SM1 1NU. The applicant wishes to redevelop the existing commercial space into four four-storey House in Multiple Occupations (HMO).

This 'Sustainability and Energy Statement' demonstrates that the development will incorporate sustainable design and construction measures throughout all stages of the development. It sets out how the development will comply with relevant National, Regional and Local Policies. This energy statement provides an assessment of the energy demand and Carbon Dioxide (CO_2) emissions for the proposed residential development. The proposed residential development will be compared with the notional dwelling set under the Building Regulations Approved Document Part L Volume 1, 2021 edition. The predicted energy consumption and demand has been based upon preliminary proposed drawings received from 'KJC Architects'.

The energy strategy seeks to address the following main objectives for the proposed building:

1. Comply with 2021 Building Regulations, Approved Document Part L Volume 1, 2021 Edition
2. Achieve 35% CO2 emissions reductions. To satisfy the planning conditions:
    a. An Energy Statement and Water Efficiency statement to satisfy the planning condition as described below:
    b. The development hereby approved shall not be first occupied unless and until an Energy and Water Efficiency Statement has been submitted to and approved in writing by the Local Planning Authority. The Statement shall detail how the development will:
        - Ensure that the potential water consumption by occupants of each new dwelling does not exceed 110 litres per person per day
        - Achieve 35% carbon emission reduction
    c. SAP calculations and Water Efficiency calculations to submit to Building Control in line with achieving 35% CO2 emissions

Energy Efficiency Measures for Proposed Case

The following energy efficiency measures are proposed:

- Improved u-values for the building fabric
- Alpha Intec 40 GS2 main gas boiler for space heating and water heating
- Programmer, room thermostat and TRVs for heating controls
- Window size, orientation, opening and solar shading - windows on the south-facing elevation have been designed to benefit from passive solar gain. This will reduce space heating demand. Glazing with an optimal 'g' value has been specified to maximise solar gains and benefits whilst not causing an overheating risk, in conjunction with the use of openable windows
- Natural Ventilation
- Use low water use fittings- This reduces the amount of hot water consumed and hence the energy used to produce hot water, 105 litres/person/day using the Code for Sustainable Homes WAT 01 calculation procedure, this equates to 110 litres/person/day using the Building Regulations Approved Document Part G calculation procedure and is the enhanced standard target.
- Default thermal bridging details

Low and Zero Carbon & Renewable Technology

The site is not suitable for an on-site Combined Heat and Power (CHP) system due to the size of the development. The **10kWp** solar photovoltaic renewable technology is proposed for the proposed development. The various low and zero-carbon technologies were investigated and these have been described within this report.

CO_2 Savings

- It is highlighted that this energy strategy has been developed at a very early stage in the design process and much of the information that has been used as the basis for the thermal modelling is at a preliminary stage and hence subject to change.
- Actual energy demands for the proposed design may, therefore, vary from the consumption figures used for modelling purposes at this stage and hence the results of this energy strategy must be considered as indicative only. The stated energy reduction targets will be adhered to as part of the developed design process.

Table 1: Carbon Dioxide Emissions for Residential Buildings

SAP 10.2 CO2 PERFORMANCE	Carbon Dioxide Emissions for Domestic Buildings (Tonnes CO2 per annum)		
	Regulated	Unregulated	Total
Baseline: Part L 2021 of the Building Regulations Complaint Development (A)	5.85	0.50	6.35
Proposed Case (B)	3.64	0.50	4.14

Table 2: Regulated Residential Carbon Dioxide Savings

SAP 10.2 CO2 PERFORMANCE	Regulated domestic carbon dioxide savings		
		Tonnes CO2 per annum	%
Proposed Case Savings	A-B	2.21	37.77%
Cumulative on-site savings		2.21	37.77%
Carbon Shortfall		3.64	-
	(Tonnes CO2)		
Cumulative Savings for Offset Payment (G)	-		
Cash-in-Lieu Contribution (£)	-		

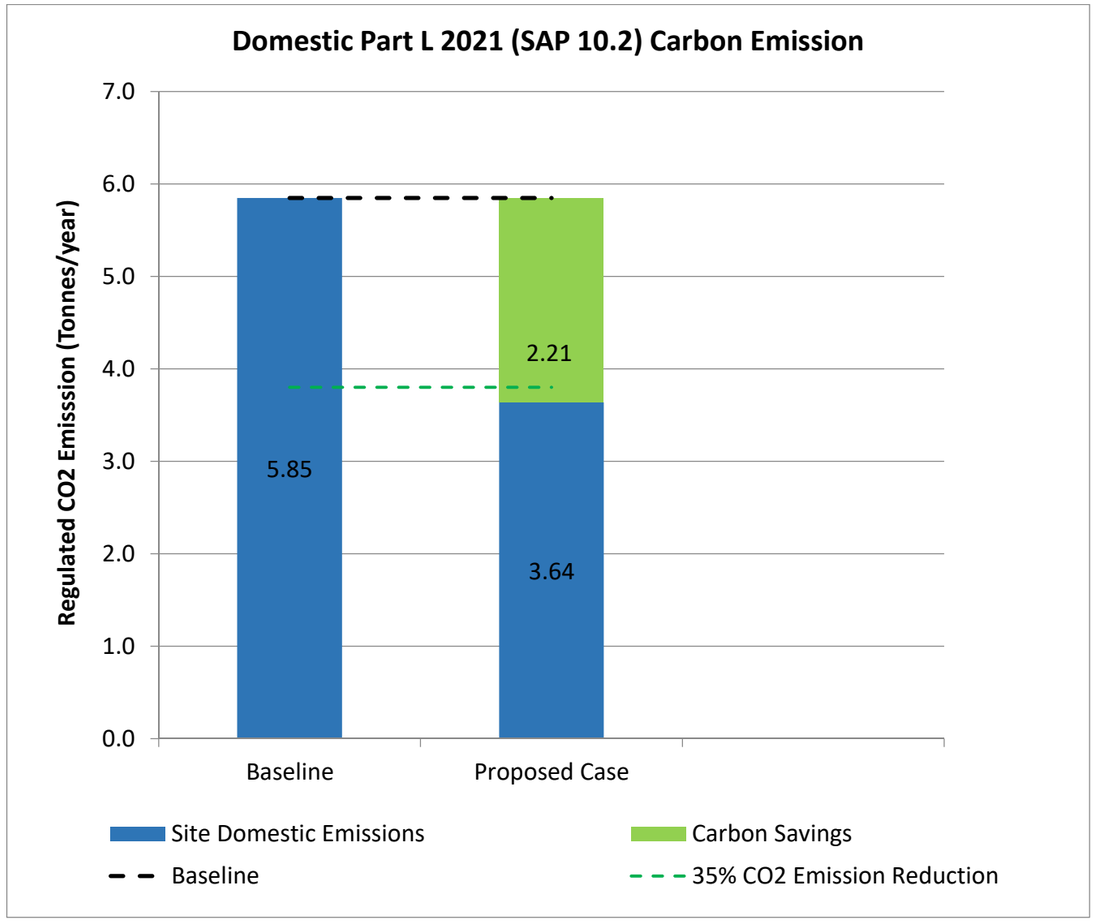


Figure 1: Domestic Part L 2021 Carbon Emissions

- The proposed development achieves a cumulative saving of **2.21 Tonnes of CO2 per annum** which is a **37.77%** improvement over a baseline Part L 2021 of the building regulation-compliant development.

2. INTRODUCTION & SITE CONTEXT

Flint Energy Ltd has been commissioned to prepare an energy and sustainability statement for a full planning application proposal in the London Borough of Sutton. The site is located on the land at 212 High Street, Sutton, SM1 1NU. The applicant wishes to redevelop the existing commercial space into four four-storey House in Multiple Occupations (HMOs).

The purpose of this document is to highlight the sustainable and energy-efficient features of the proposed new construction. It also addresses the current planning framework identifying the design measures that meet these policies. This report details the energy strategy that has been completed for the development site. As part of this, detailed SAP calculations have been undertaken to ensure that even at this early stage, potential energy wastage as part of the operation of the development has been designed out.

Figure 2: Aerial Image of Existing Site

Figure 3: Location Plan

The site is in a busy area of High Street and Elm Groove. The site is surrounded by various residential developments. The applicant wishes to redevelop the existing commercial space into a four-storey HMO unit.

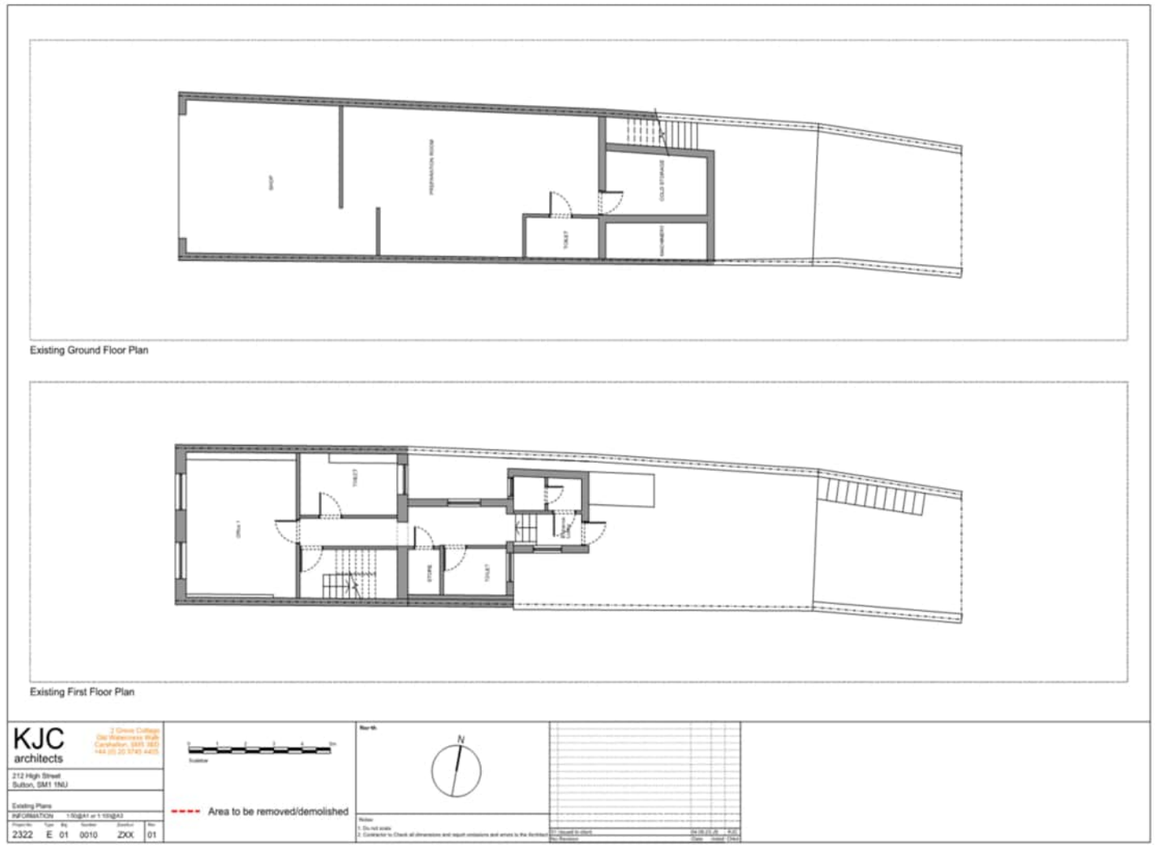


Figure 4: Existing Development – Ground and First Floor Plan

Figure 5: Proposed Development – Ground and First Floor Plan

3. ROAD TO SUSTAINABILITY

Developing sustainable projects is part of today's business reality. Costs for sustainable initiatives and strategies are reduced through improvements in technology, supply, design techniques and construction methods. Utility prices are rising and continue to do so. Individuals and organisations are starting to value the more intangible benefits associated with sustainability. Tenants, the Government and the general public are becoming increasingly more educated about the need for sustainable environments and are starting to demand these are provided where they live, work and play. Organisations that embrace sustainability as an integral part of business planning seek to retain or grow the value of their assets over the medium to long term.

Adaptation

Even if we were to immediately curb our impact on the environment, the time lag in realising the benefits of these changes would be measured in decades. For a long time, the main focus of climate change has been on mitigation – making sure we minimise our impact on the environment. Adaptation strategies are those that take into account climate change and ensure that the building is capable of dealing with a future change in the climate. Given the time lag associated with climate change, even if we change the way we live, there is likely to be a noticeable change in the climate during the life of the building.

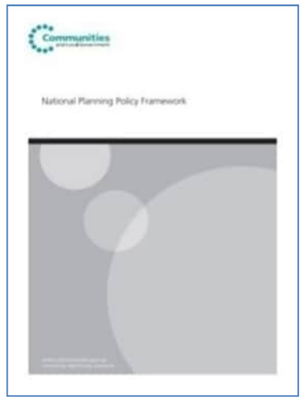
To ensure that buildings maintain their relevance, adaptation strategies must be addressed during the design phase. Adoption of these strategies will mean that, even as we undergo climate change, the buildings can still function as required.

Sustainability in the Design Process

Sustainable development is a core principle throughout this project. It is important to understand the issues and drivers related to the site and the local area. Starting with a review of national, regional and local planning policies, key policies and regulations have been highlighted and used to guide the direction of the design.

3.1 NATIONAL-LEVEL PLANNING POLICY

The Government has developed the National Planning Policy Framework (NPPF) (Department for Communities and Local Government, 2019) which plays a key role in delivering the Government's objectives on sustainable development. The framework encourages ownership at the local level and guides to promote of effective environmental protection, economic growth and ensuring a better quality of life for all, both now and in future generations.

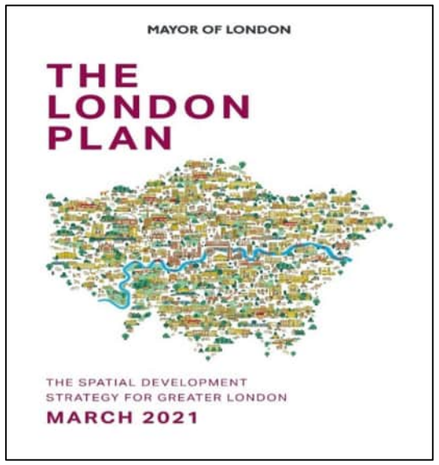


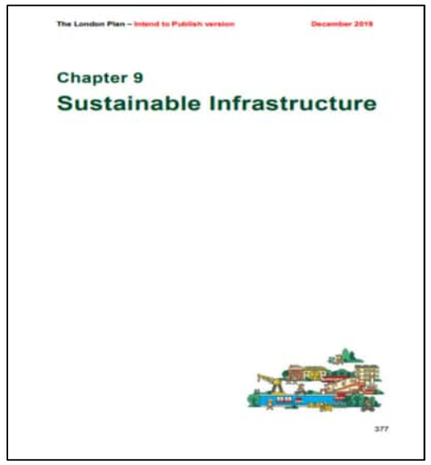
Some of the main objectives of the Government's planning framework concerning sustainability are:

- Build prosperous communities with opportunities for employment and economic growth across all areas of society;
- Reduce the need for car dependency and provide easy access to public transport;
- Maintain, and enhance or restore biodiversity and geological interests;
- Help reduce carbon emissions through the adoption of passive design, and low and zero-carbon renewable technologies (LZCs);
- Protect the condition of the land, its use, and its development from potential hazards;
- Ensure that all new developments contribute to the Government's targets of carbon emission reductions.
- Supporting the building of zero-carbon homes and business premises that are low energy and produce lower carbon emissions
- Supporting integrated development

3.2 REGIONAL-LEVEL PLANNING POLICY

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, which the London Plan sets out.





Policy SI 3 Energy infrastructure

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

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

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

C) Development Plans should:

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

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

1) the heat source for the communal heating system should be selected in accordance with the following heating hierarchy:
   a) connect to local existing or planned heat networks
   b) use zero-emission or local secondary heat sources (in conjunction with a heat pump, if required)
   c) use low-emission combined heat and power (CHP) (only where there is a case for CHP to enable the delivery of an area-wide heat network, meet the development's electricity demand and provide demand response to the local electricity network)
   d) use ultra-low NOx gas boilers

2) CHP and ultra-low NOx gas boiler communal or district heating systems should be designed to ensure that they meet the requirements in Part B of Policy SI 1 Improving Air quality
3) where a heat network is planned but not yet in existence the development should be designed to allow for a cost-effective connection at a later date.

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

Policy SI 2 Minimising greenhouse gas emissions

A. Major development should be net zero-carbon. This means reducing greenhouse gas emissions in operation and minimising both annual and peak energy demand in accordance with the following energy hierarchy:
   1) Be lean: use less energy and manage demand during operation
   2) Be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly
   3) Be green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site
   4) Be seen: monitor, verify and report on energy performance

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

C. A minimum on-site reduction of at least 35 per cent beyond Building Regulations is required for major development. Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, in agreement with the borough, either:
   1) through a cash-in-lieu contribution to the borough's carbon offset fund, or
   2) off-site provided that an alternative proposal is identified, and delivery is certain.

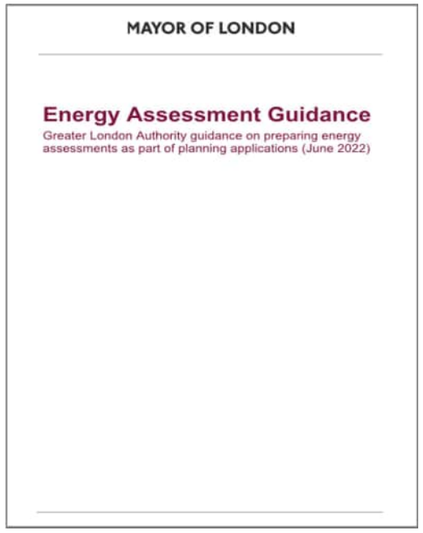
D. Boroughs must establish and administer a carbon offset fund. Offset fund payments must be ring-fenced to implement projects that deliver carbon reductions. The operation of offset funds should be monitored and reported on annually.

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

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

GLA Energy Assessment Guidance (June 2022)

London Plan requires each major development proposal to submit a detailed energy assessment based on the GLA guidance.



This guidance document explains how to prepare an energy assessment to accompany strategic planning applications referred to the Mayor as set out in London Plan Policy SI 2. It is for anyone involved, or with an interest, in developing energy assessments, including developers, energy consultants and local government officials. Although primarily aimed at strategic planning applications, London boroughs are encouraged to apply the same structure for energy assessments related to non-referable applications and adapt it for relevant scales of development.

Major developments are required to achieve a minimum of 35 per cent on-site carbon reduction over Part L 2021. Residential developments are expected to be able to exceed this, and so an additional benchmark has been set that residential developments should be aiming to achieve. The benchmarks may be updated periodically to include additional building types and to reflect improvements in performance over time.

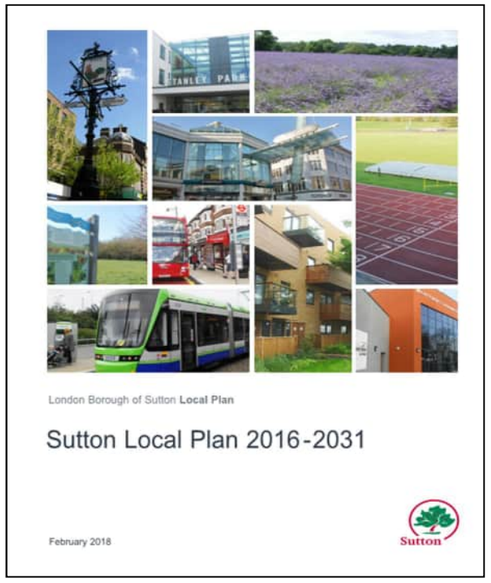
Building type	Minimum on-site improvement over Part L 2021(per cent)	Benchmark improvement over Part L 2021 (per cent)
Residential	35 per cent	50 per cent+

3.3 LOCAL PLANNING POLICY

The Sutton Local Plan is a development plan document and is part of the government's Planning policy system which was introduced by the Planning and Compulsory Purchase Act in 2004.

The Purpose of the Sutton Local Plan is:

- To set out and deliver the council's long-term aims and aspirations for the borough
- To provide a consistent basis for deciding on planning applications



The Climate Change Act 2008 sets a target to reduce UK emissions by 80% below 1990 levels by 2050. Accordingly, national planning policy requires all new developments to minimise CO2 emissions through energy-efficient design and make use of renewable or low-carbon energy sources. The Mayor's climate change mitigation and energy strategy set out further targets to achieve a 60% reduction in London's CO2 emissions by 2025 against a 1990 baseline and to ensure that 25 % of London's energy is delivered through the district heating network and other forms of decentralised energy by that date.

Sutton is committed to becoming a one-planet borough by 2025 and has set some of the most challenging sustainability targets in the UK.

- **Policy 31 –Carbon & Energy**

Policy 31: Carbon and Energy

a Proposed developments should meet the following targets for reducing CO_2 emissions expressed as a percentage improvement over Part L of the 2013 Building Regulations:

- all residential buildings forming part of major developments should achieve 'zero carbon' standards, by:
  - (i) achieving at least a 35% reduction in regulated CO_2 emissions on site.
  - (ii) offsetting the remaining regulated emissions (to 100%) through the delivery of CO_2 reduction measures elsewhere through a Section 106 contribution to the council's carbon offset fund priced at £60 per tonne over 30 years.
- all major non-residential developments should achieve at least a 35% reduction in regulated CO_2 emissions on site.
- all minor residential developments should achieve at least a 35% reduction in regulated CO_2 emissions on site.

b In seeking to minimise CO_2 emissions in line with the above targets, all proposed developments will apply the Mayor's energy hierarchy by:

- achieving the highest standards of energy efficient design and layout.
- supplying energy efficiently in line with the following order of priority:
  - (i) being designed to connect to existing or planned district heating and/or cooling networks supplied by low or zero-carbon energy, unless it can be demonstrated through whole life cycle evidence that connection is not reasonably possible. All major developments located within identified Decentralised Energy Opportunity Areas (Maps 10.1 and 10.2) should apply the council's 'Decentralised Energy Protocol' (Schedule 10.A).
  - (ii) site wide heating and/or cooling network supplied by low or zero-carbon energy.
  - (iii) communal heating and cooling.
- using renewable energy generated on-site. Major developments will be expected to achieve at least a 20% reduction in total CO_2 emissions (regulated and unregulated) through renewables with minor developments achieving a reduction of at least 10%.

c All planning applications for new dwellings or major non-residential developments should be supported by an Energy Statement incorporating 'as-designed' Building Regulations Part L outputs to demonstrate how the relevant targets for reducing CO_2 emissions will be met. The Energy Statement should include calculations of energy demand and emissions at each stage of the Mayor's energy hierarchy for both regulated and non-regulated elements in line with GLA 'Guidance on Preparing Energy Assessments' as amended.

d The council will collaborate with potential heat suppliers, energy service companies, major developers and the community to deliver district heating networks to serve new and existing developments in Hackbridge and within other identified 'Decentralised Energy Opportunity Areas' over the plan period.

e All major non-residential developments should achieve BREEAM 'Excellent'.

For Decentralised Energy Opportunity Areas see Appendix 10, Maps 10.1 and 10.2 and Policies Map.

Government guidance indicates that the council may require compliance with energy standards that exceed the building regulations. The council considers that new development should reduce greenhouse gas emissions and that setting local requirements for building sustainability is justified. When considering potentially suitable areas for renewable energy development, government guidance advises local planning authorities to take an account of the range of technologies that could be accommodated, the requirements of the technology and the potential impacts on the local environment, including from cumulative impacts.

The technology in this field is changing and new guidance is emerging from various sources. Government policy is still emerging. There are a number of measures available that can improve the environmental impact of new development and new ones are likely to emerge in the future. It would not be appropriate for this policy to provide detailed guidance on techniques or approaches. The council will therefore prepare more detailed policies to provide this guidance and to set appropriate targets.

3.4 CONSERVE ENERGY, WATER AND OTHER RESOURCES

The impact that the built environment has on climate change and the associated feedback loop of climate change on the built environment is well documented. The development has an opportunity to demonstrate a best-practice approach to addressing these issues. The most significant source of emissions is associated with the ongoing operation of the building. A hierarchy for reducing these emissions are integer to the design process of the buildings.

Measures to be considered for the proposed development:

- Improved u-values for the building fabric
- Alpha Intec 40 GS2 main gas boiler for space heating and water heating
- Programmer, room thermostat and TRVs for heating controls
- Window size, orientation, opening and solar shading - windows on the south-facing elevation have been designed to benefit from passive solar gain. This will reduce space heating demand. Glazing with an optimal 'g' value has been specified to maximise solar gains and benefits whilst not causing an overheating risk, in conjunction with the use of openable windows
- Natural Ventilation
- Use low water use fittings- This reduces the amount of hot water consumed and hence the energy used to produce hot water, 105 litres/person/day using the Code for Sustainable Homes WAT 01 calculation procedure, this equates to 110 litres/person/day using the Building Regulations Approved Document Part G calculation procedure and is the enhanced standard target.
- Default thermal bridging details

3.5 CONSERVE & ENHANCE THE NATURAL ENVIRONMENT & BIODIVERSITY

It is important to recognise the benefits of wildlife to people and help to identify ways to better promote, and engage people in, biodiversity conservation in the area. The site is not within a conservation area.

3.6 CLIMATE CHANGE ADAPTATION AND RESILIENCE

Climate change is the rise in average global temperature due to increasing levels of greenhouse gases in the earth's atmosphere (primarily CO_2) that prevent the radiation of heat into space. The climate change projections for London are

- Hotter summers
- Milder winters
- Increased periods without rain
- Increased intensity in rainfall
- More extreme weather events

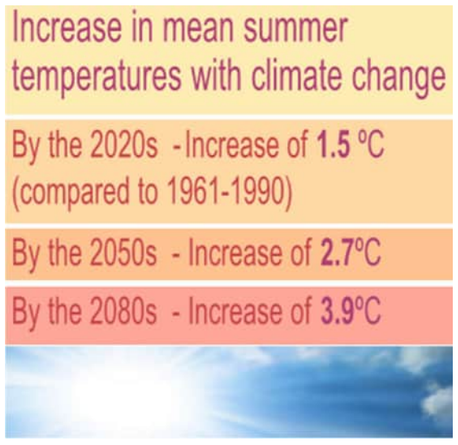
Buildings and spaces built today should respond to climate change issues and adapt to mitigation and adaptation measures. The council through its policies addresses these issues and will be required to consider how their developments will function in the future in the context of changing climate

3.7 CLIMATE CHANGE MITIGATION AND ADAPTATION MEASURES

Even if we were to immediately curb our impact on the environment, the time lag in realising the benefits of these changes would be measured in decades. For a long time, the main focus of climate change has been on mitigation – making sure we minimise our impact on the environment. Adaptation strategies are those that take into account climate change and ensure that the building is capable of dealing with present and future changes in the climate. Given the time lag associated with climate change, even if we change the way we live, there is likely to be a noticeable change in the climate during the life of the building.

To ensure that buildings maintain their relevance, adaptation strategies must be addressed during the design phase. Adoption of these strategies will mean that, even as we undergo climate change, the buildings can still function as required.

According to the latest climate projections, London will experience hotter and drier summers, warmer and wetter winters and an increase in the frequency and severity of storm events over the coming decades.



London and the southeast are classified as 'Seriously' water stressed, meaning that more water is taken from the environment than the environment can sustain in the long term. For development proposals, the early design stage is the most cost-effective time to incorporate relevant design and technological measures to adapt to climate change.

Responding to climate change must be an integral and essential part of the development process. This will be to ensure that buildings are fit for purpose in the future.

Preventative and adaptive measures will generate long-term savings, particularly for energy and water use and over time the inclusion of such measures should have positive impacts on the property value as occupiers become more aware of the impacts of climate change on their environment.

Energy-efficient dwellings/buildings will be well insulated, have low air permeability and make use of winter solar gain, however, the effects of these improved standards are an increased risk of overheating from solar gains in summer which could result in increased use of energy for cooling.

The next chapter will discuss the guiding principles and building services system selection for the proposed development.

4. GUIDING PRINCIPLES FOR BUILDING SERVICES SYSTEM SELECTION

4.1 ASSESSMENT AND ANALYSIS

The predicted energy consumption is based on concept design stage information. Actual energy demands for the proposed design may vary from the consumption figures used for modelling purposes at this stage. This is a combination of conversion and new build construction development of residential units.

The calculation methodology used to predict energy consumption and carbon dioxide emissions are the same as that approved for demonstrating compliance with Part L 2021 Volume 1 of the Building Regulations

- The Standard Assessment Procedure for the Energy Rating of Dwellings (SAP 10). Approved Document L Volume 1, 2021 explains how the Target Emission Rate (TER) and Dwelling Emission Rate (DER) are calculated.
- The Building Regulations only control the certain end uses of energy (heating, hot water, cooling, fans, pumps and controls; and lighting). The approved software also calculates the major non-controlled end uses.

4.2 NOTIONAL BUILDING ENERGY PERFORMANCE RATINGS

This is the building designed to comply with the Notional Dwelling minimum standards of the building regulations using energy-efficient gas boilers. The baseline emissions are set from the 'notional dwelling', which is the same size and shape as the 'actual dwelling', built to a concurrent specification, and is used to determine the TER and TFEE. The ADL1 2021 notional dwelling specification is summarised in Table 1.1 of Approved document 2021 voulme 1. The main elements of the concurrent specification of the notional dwelling that relate to the opaque building fabric.

Table 3: Building Regulations Approved Document L Volume 1, 2021 Notional Building Energy Performance Ratings

Element	Value
All Roofs	0.11 W/m²·K
Walls	0.18 W/m²·K
Floors	0.13 W/m²·K
Party Walls	0.00 W/m²·K
Windows, Roof Windows, Glazed Roof lights & Glazed Doors	1.20 W/m²·K / g–value 0.63
Opaque Doors	1.00 W/m²·K
Semi Glazed Doors	1.20 W/m²·K
Air-tightness	5.00 m3/hr/m² at 50 Pa
Linear Thermal Transmittance	Standardised ψ–values (see Appendix R of SAP 2012)
Ventilation System	Natural Ventilation with intermittent extract fans
Heating System	Boilers and Radiators, Central heating pump 2013 or later in heated space, Design flow temperature = 55 deg C
Boiler	Efficiency, SEDBUK 2009=89.5%
Hot Water System	Heated by Boiler, Separate time control for Space and water heating
Lighting	Fixed Lighting Capacity (lm) =185*total floor area Efficacy of all fixed lighting =80 lm/W
Air Conditioning	None
Photovoltaic (PV) System	For Houses: kWp=40% of the ground floor area, including unheated spaces/6.5 For Flats: kWp=40% of dwelling floor area/(6.5*number of stories in block)

5. SAP MODEL INPUT PARAMETERS

The following Tables show the comparison of modelling input parameters. The baseline dwelling performance is compared with the actual proposed design dwelling performance.

Table 4: Comparison of SAP Model Input Parameters

Elements	Baseline Dwelling Performance	Proposed Dwelling Performance
Existing External Wall_Improved ($W/m^2.K$)	0.30	0.30
New External Wall ($W/m^2.K$)	0.18	0.18
Existing Roof_Improved ($W/m^2.K$)	0.22	0.22
New Roof ($W/m^2.K$)	0.11	0.11
New Floor ($W/m^2.K$)	0.13	0.13
Existing Floor_Improved ($W/m^2.K$)	0.22	0.22
Windows ($W/m^2.K$)	1.20 (Double Glazed)	1.20 (Double Glazed)
Thermal Bridging, Y value	Default Y Value	Default Y Value
Thermal Mass	Medium	Precise Calculations
Air Permeability, $m^3.hr/m^2$	Default	Default
Ventilation	Natural	Natural
Low Energy Lighting %	Incandescent Lighting Power 60 W, Efficacy 11 lm/W, Capacity 660 lm	LED Lighting Power 10 W, Efficacy 67 lm/W, Capacity 660 lm
Space Heating	SAP Table_Main Gas Boiler	Main Gas Boiler-Alpha Intec 40 GS2

Table 5: Comparison of SAP Model Input Parameters

Elements	Notional Dwelling Performance	Proposed Dwelling Performance
Heating Controls	Programmer, Room Thermostat & TRVs	Programmer, Room Thermostat & TRVs
Hot Water Heating	From Main Heating 1	From Main Heating 1
Photovoltaic System Units (kWh/year)	Not applicable	10kWp Solar PV Proposed on the rooftop of HMO

After completing all fabric input parameters and various energy utilization parameters for each dwelling, the software provides results in terms of carbon dioxide emissions and fabric energy efficiency. The next chapter discusses the summary of SAP modelling results with various design options and their comparisons.

6. SUMMARY OF MODELLING RESULTS

6.1 BUILDING REGULATIONS PART L 2021

Table 6: Carbon Dioxide Emissions for Residential Buildings

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Proposed Case Savings	A-B	2.21	37.77%
Cumulative on-site savings		2.21	37.77%
Carbon Shortfall		3.64	-
	(Tonnes CO2)		
Cumulative Savings for Offset Payment (G)	-		
Cash-in-Lieu Contribution (£)	-		

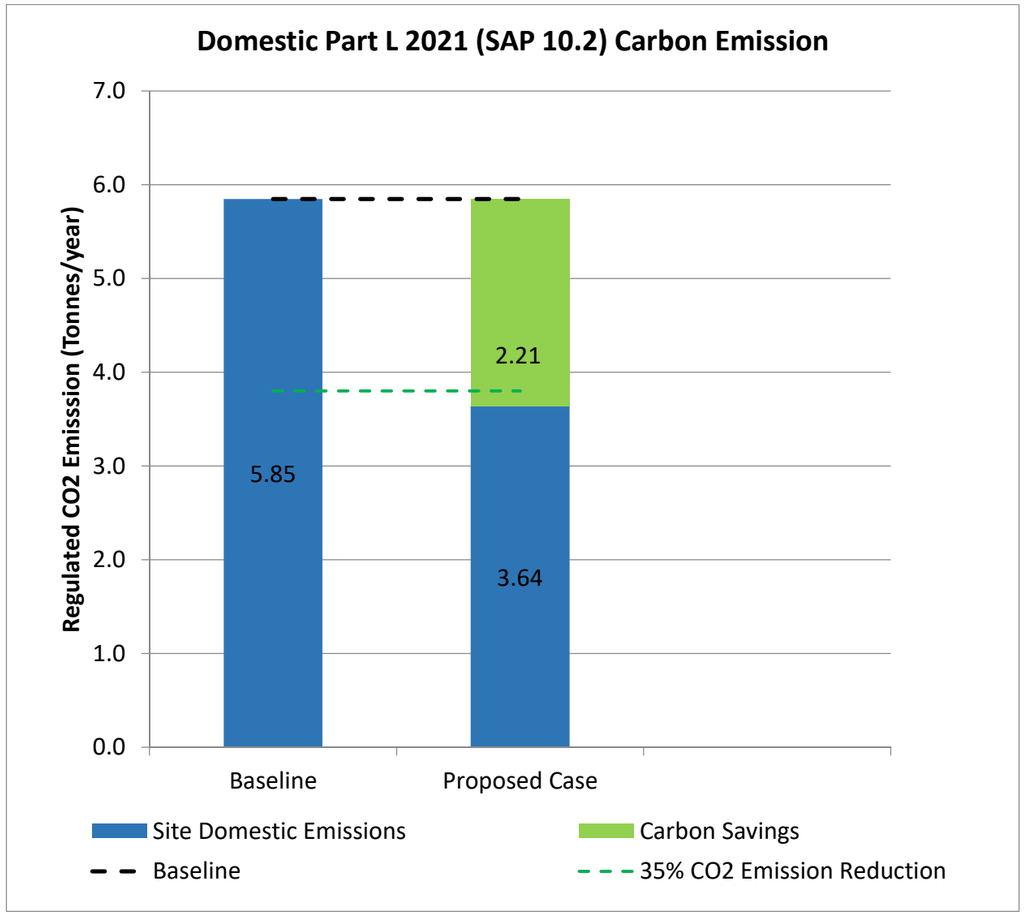

Figure 6: Domestic Part L 2021 Carbon Emissions

- The proposed development achieves a cumulative saving of **2.21 Tonnes of CO2 per annum** which is a **37.77%** improvement over a baseline Part L 2021 of the building regulation-compliant development.

7. CONCLUSION

This report represents the energy and sustainability statement for a full planning application proposal in the London Borough of Sutton. The site is located on the land at 212 High Street, Sutton, SM1 1NU. The applicant wishes to redevelop the existing commercial space into four-storey House in Multiple Occupations (HMO).

The new residential HMO unit will be compared with the notional dwelling set under the Building Regulations Approved Document Part L 2021 edition. The site is not suitable for an on-site Combined Heat and Power (CHP) system due to the size of the development. The **10kWp** solar photovoltaic renewable technology is proposed for the proposed development.

- SAP10.2 CO2 emission results

  - The proposed development achieves a cumulative saving of **2.21 Tonnes of CO2 per annum** which is a **37.77%** improvement over a baseline Part L 2021 of the building regulation-compliant development.

It is highlighted that this energy strategy has been developed at a very early stage in the design process and much of the information that has been used as the basis for the thermal modelling is at a preliminary stage and hence subject to change. Actual energy demands for the proposed design may, therefore, vary from the consumption figures used for modelling purposes at this stage and hence the results of this energy strategy must be considered as indicative only.

8. APPENDIX A SAP OUTPUT SHEET

Summary for Input Data

elmhurst energy

Property Reference	Rev 01	**Issued on Date**	06/10/2023
Assessment Reference	00001_Copy	**Prop Type Ref**	HMO
Property	212 High Street, SM1 1NU		

SAP Rating	95 A	**DER**	20.17	**TER**	13.23
Environmental	79 C	**% DER < TER**			-52.46
CO_2 Emissions (t/year)	2.61	**DFEE**	75.14	**TFEE**	46.96
Compliance Check	See BREL	**% DFEE < TFEE**			-60.00
% DPER < TPER	-31.09	**DPER**	93.30	**TPER**	71.17

Assessor Details	Mr. Dion Mellows	**Assessor ID**	G297-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East	
Property Tenture	ND	
Transaction Type	5	
Terrain Type	Urban	
1.0 Property Type	House, Semi-Detached	
Which Floor	0	
2.0 Number of Storeys	4	
3.0 Date Built	2023	
3.0 Property Age Band	L	
4.0 Sheltered Sides	2	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	N/A	kJ/m²K
7.0 Electricity Tariff	Standard	
Smart electricity meter fitted	No	
Smart gas meter fitted	No	

7.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Basement:	0.00 m	0.00 m²	0.00 m
Ground floor:	10.86 m	14.72 m²	2.58 m
1st Storey:	20.20 m	98.34 m²	3.38 m
2nd Storey:	12.34 m	39.37 m²	2.64 m
3rd Storey:	21.26 m	27.97 m²	2.75 m
4th Storey:	0.00 m	0.00 m²	0.00 m
5th Storey:	0.00 m	0.00 m²	0.00 m
6th Storey:	0.00 m	0.00 m²	0.00 m
7th Storey:	0.00 m	0.00 m²	0.00 m

8.0 Living Area	45.10	m²

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
Low New Ext Wall	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	28.02	24.43	0.00	None	3.59	Enter Gross Area
+1 New Ext Wall	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	54.82	45.75	0.00	None	9.07	Enter Gross Area
+2 New Ext Wall	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	12.36	12.36	0.00	None	0.00	Enter Gross Area
+3 New Ext Wall	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	58.47	52.21	0.00	None	6.26	Enter Gross Area
+1 Existing Ext Wall_Improved	Solid Wall	Solid wall : dense plaster, 200 mm dense block, insulated externally	0.30	190.00	14.42	9.28	0.00	None	5.14	Enter Gross Area
+2 Existing Ext Wall_Improved	Solid Wall	Solid wall : dense plaster, 200 mm dense block, insulated externally	0.30	190.00	20.22	13.76	0.00	None	6.46	Enter Gross Area

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)	Shelter Res	Shelter
Low Party Wall	Filled Cavity with Edge Sealing	Single plasterboard on both sides, dense cellular blocks, cavity	0.00	70.00	13.21	0.00	None

+1 Party Wall	Filled Cavity with Edge Sealing	Single plasterboard on both sides, dense cellular blocks, cavity	0.00	70.00	144.82	0.00	None
+2 Party Wall	Filled Cavity with Edge Sealing	Single plasterboard on both sides, dense cellular blocks, cavity	0.00	70.00	40.68	0.00	None

9.2 Internal Walls

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Low Internal Wall	Plasterboard on timber frame	9.00	11.61
+1 Internal Wall	Plasterboard on timber frame	9.00	264.76
+2 Internal Wall	Plasterboard on timber frame	9.00	61.01
+3 Internal Wall	Plasterboard on timber frame	9.00	26.48

10.0 External Roofs

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Code	Shelter Factor	Calculation Type	Openings
+1 New Flat HLR	External Plane Roof	Plasterboard, insulated at ceiling level	0.11	9.00	34.87	34.87	None	0.00	Enter Gross Area	0.00
+3 New Flat HLR	External Plane Roof	Plasterboard, insulated at ceiling level	0.11	9.00	27.97	27.97	None	0.00	Enter Gross Area	0.00
+1 Existing Flat HLR_Improved	External Plane Roof	Plasterboard, insulated at ceiling level	0.22	9.00	23.84	23.84	None	0.00	Enter Gross Area	0.00
+2 Existing Flat HLR_Improved	External Plane Roof	Plasterboard, insulated at ceiling level	0.22	9.00	11.45	11.45	None	0.00	Enter Gross Area	0.00

10.2 Internal Ceilings

Description	Storey	Construction	Area (m²)
Low Internal Ceiling	Lowest occupied	Plasterboard ceiling, carpeted chipboard floor	14.72
+1 Internal Ceiling	+1	Plasterboard ceiling, carpeted chipboard floor	63.47
+2 Internal Ceiling	+2	Plasterboard ceiling, carpeted chipboard floor	27.92

11.0 Heat Loss Floors

Description	Type	Storey Index	Construction	U-Value (W/m²K)	Shelter Code	Shelter Factor	Kappa (kJ/m²K)	Area (m²)
Low New HLF	Ground Floor - Solid	Lowest occupied	Slab on ground, screed over insulation	0.13	None	0.00	110.00	14.72
+1 HLF to commercial_Improved	Exposed Floor - Solid	+1	Other	0.22	None	0.00	0.00	63.47
+1 New HLF	Exposed Floor - Solid	+1	Other	0.13	None	0.00	0.00	20.31

11.2 Internal Floors

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
+1 Internal Floor		Plasterboard ceiling, carpeted chipboard floor	9.00	14.72
+2 Internal Floor		Plasterboard ceiling, carpeted chipboard floor	9.00	39.37
+3 Internal Floor		Plasterboard ceiling, carpeted chipboard floor	9.00	27.97

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Windows	BFRC, BSI or CERTASS data	Window	Double glazed		Air Filled	0.76	Wood	1.00	1.20
Door	BFRC, BSI or CERTASS data	Solid Door			Air Filled	0.00	Wood	1.00	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
Low N1	Door	Low New Ext Wall	North	1.91	0
Low E1	Windows	Low New Ext Wall	East	1.68	0
+1 N1	Windows	+1 New Ext Wall	North	1.02	0
+1 E1	Windows	+1 New Ext Wall	East	1.20	0
+1 E2	Windows	+1 New Ext Wall	East	1.20	0
+1 E3	Windows	+1 New Ext Wall	East	1.04	0
+1 W1	Door	+1 New Ext Wall	West	1.70	0
+1 W2	Windows	+1 New Ext Wall	West	1.20	0
+1 W3	Door	+1 New Ext Wall	West	1.70	0
+1 W4	Windows	+1 Existing Ext Wall_Improved	West	2.57	0
+1 W5	Windows	+1 Existing Ext Wall_Improved	West	2.57	0
+2 E1	Windows	+2 Existing Ext Wall_Improved	East	1.68	0
+2 W1	Windows	+2 Existing Ext Wall_Improved	West	2.39	0
+2 W2	Windows	+2 Existing Ext Wall_Improved	West	2.39	0
+3 E1	Windows	+3 New Ext Wall	East	1.35	0
+3 E2	Windows	+3 New Ext Wall	East	1.40	0
+3 W1	Windows	+3 New Ext Wall	West	1.76	0
+3 W2	Windows	+3 New Ext Wall	West	1.76	0

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Default	
Y-value	0.20	W/m²K

Summary for Input Data

elmhurst energy

18.0 Pressure Testing	No
Property Tested?	Yes
Test Method	Blower Door

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System	No

22.0 Lighting

No Fixed Lighting	No

Name	Efficacy	Power	Capacity	Count
LED	67.00	10	670	20

24.0 Main Heating 1	Database	
Description	Main Gas Boiler	
Percentage of Heat	100.00	%
Database Ref. No.	18269	
Fuel Type	Mains gas	
SAP Code	0	
In Winter	88.30	
In Summer	98.90	
Model Name	InTec 40 GS2	
Manufacturer	Alpha Therm	
System Type	Combi boiler	
Controls SAP Code	2106	
Delayed Start Stat	No	
Burner Control	Modulating	
HETAS approved System	No	
Oil Pump Inside	No	
FI Case	0.00	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heating Pump Age	2013 or later	
Heat Emitter	Radiators and Underfloor	
Underfloor Heating	Yes - Pipes in thin screed	
Flow Temperature	Enter value	
Flow Temperature Value	35.00	
Boiler Interlock	No	
Combi boiler type	Standard Combi	
Combi keep hot type	None	

25.0 Main Heating 2	None
26.0 Heat Networks	None

	Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power Ratio	Electrical	Fuel Factor	Efficiency type
Heat source 1	None									
Heat source 2	None									
Heat source 3	None									
Heat source 4	None									
Heat source 5	None									

28.0 Water Heating

Summary for Input Data

Water Heating	Main Heating 1	
SAP Code	901	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	No	
Summer Immersion	No	
Cold Water Source	From mains	
Bath Count	8	
Supplementary Immersion	No	
Immersion Only Heating Hot Water	No	

28.3 Waste Water Heat Recovery System

29.0 Hot Water Cylinder	None	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	167.00	L
Loss	0.68	kWh/day
Pipes insulation	Fully insulated primary pipework	
In Airing Cupboard	No	

31.0 Thermal Store	None

32.0 Photovoltaic Unit	One Dwelling	
Export Capable Meter?	No	
Connected To Dwelling	Yes	
Diverter	Yes	
Battery Capacity [kWh]	10.00	

PV Cells kWp	Orientation	Elevation	Overshading	FGHRS	MCS Certificate	Overshading Factor	MCS Certificate Reference	Panel Manufacturer
10.00	South	30°	None Or Little	No	No	1.00		tbc

34.0 Small-scale Hydro	None	
Electricity Generated	0.00	
Apportioned	0.00	kWh/Year
Connected to dwelling's electricity meter	Yes	
Electricity Generation	Annual	

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

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

Full SAP Calculation Printout

Property Reference	Rev 01	Issued on Date	06/10/2023
Assessment Reference	00001_Copy	Prop Type Ref	HMO
Property	212 High Street, SM1 1NU		

SAP Rating	95 A	DER	20.17	TER	13.23
Environmental	79 C	% DER < TER			-52.46
CO_2 Emissions (t/year)	2.61	DFEE	75.14	TFEE	46.96
Compliance Check	See BREL	% DFEE < TFEE			-60.00
% DPER < TPER	-31.09	DPER	93.30	TPER	71.17

Assessor Details	Mr. Dion Mellows	Assessor ID	G297-0001
Client			

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

---
1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	14.7200 (1b)	x	2.5800 (2b)	=	37.9776 (1b)	-
First floor	98.3400 (1c)	x	3.3800 (2c)	=	332.3892 (1c)	-
Second floor	39.3700 (1d)	x	2.6400 (2d)	=	103.9368 (1d)	-
Third floor	27.9700 (1e)	x	2.7500 (2e)	=	76.9175 (1e)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	180.4000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	551.2211	(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	8 * 10 =	80.0000 (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) =	80.0000 / (5) =	0.1451	(8)
Pressure test		No	
Pressure Test Method		Blower Door	
Measured/design AP50		15.0000	(17)
Infiltration rate		0.8951	(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) =	0.7609	(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	0.9701	0.9511	0.9321	0.8369	0.8179	0.7228	0.7228	0.7038	0.7609	0.8179	0.8560	0.8940	(22b)
Effective ac	0.9705	0.9523	0.9344	0.8502	0.8345	0.7612	0.7612	0.7477	0.7895	0.8345	0.8663	0.8996	(25)

---
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			25.2100	1.1450	28.8664			(27)
Door			5.3100	1.2000	6.3720			(26)
Low New HLF			14.7200	0.1300	1.9136	110.0000	1619.2000	(28a)
+1 HLF to commercial_Improved			63.4700	0.2200	13.9634			(28b)
+1 New HLF			20.3100	0.1300	2.6403			(28b)

Low New Ext Wall	28.0200	3.5900	24.4300	0.1800	4.3974	70.0000	1710.1000 (29a)
+1 New Ext Wall	54.8200	9.0600	45.7600	0.1800	8.2368	70.0000	3203.2000 (29a)
+2 New Ext Wall	12.3600		12.3600	0.1800	2.2248	70.0000	865.2000 (29a)
+3 New Ext Wall	58.4700	6.2700	52.2000	0.1800	9.3960	70.0000	3654.0000 (29a)
+1 Existing Ext Wall_Improved	14.4200	5.1400	9.2800	0.3000	2.7840	190.0000	1763.2000 (29a)
+2 Existing Ext Wall_Improved	20.2200	6.4600	13.7600	0.3000	4.1280	190.0000	2614.4000 (29a)
+1 New Flat HLR	34.8700		34.8700	0.1100	3.8357	9.0000	313.8300 (30)
+3 New Flat HLR	27.9700		27.9700	0.1100	3.0767	9.0000	251.7300 (30)
+1 Existing Flat HLR_Improved	23.8400		23.8400	0.2200	5.2448	9.0000	214.5600 (30)
+2 Existing Flat HLR_Improved	11.4500		11.4500	0.2200	2.5190	9.0000	103.0500 (30)
Total net area of external elements Aum(A, m2)			384.9400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		99.5989		(33)
Low Party Wall			13.2100	0.0000	0.0000	70.0000	924.7000 (32)
+1 Party Wall			144.8200	0.0000	0.0000	70.0000	10137.4000 (32)
+2 Party Wall			40.6800	0.0000	0.0000	70.0000	2847.6000 (32)
Low Internal Wall			11.6100			9.0000	104.4900 (32c)
+1 Internal Wall			264.7600			9.0000	2382.8400 (32c)
+2 Internal Wall			61.0100			9.0000	549.0900 (32c)
+3 Internal Wall			26.4800			9.0000	238.3200 (32c)
+1 Internal Floor			14.7200			18.0000	264.9600 (32d)
+2 Internal Floor			39.3700			18.0000	708.6600 (32d)
+3 Internal Floor			27.9700			18.0000	503.4600 (32d)
Low Internal Ceiling			14.7200			9.0000	132.4800 (32e)
+1 Internal Ceiling			63.4700			9.0000	571.2300 (32e)
+2 Internal Ceiling			27.9200			9.0000	251.2800 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	35928.9800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		199.1629 (35)
Thermal bridges (Default value 0.200 * total exposed area)		76.9880 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	176.5869 (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	176.5453	173.2216	169.9637	154.6615	151.7985	138.4707	138.4707	136.0026	143.6044	151.7985	157.5903	163.6454	(38)
Heat transfer coeff	353.1322	349.8085	346.5506	331.2484	328.3854	315.0576	315.0576	312.5895	320.1913	328.3854	334.1772	340.2323	(39)
Average = Sum(39)m / 12 =												331.2347	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.9575	1.9391	1.9210	1.8362	1.8203	1.7464	1.7464	1.7328	1.7749	1.8203	1.8524	1.8860	(40)
HLP (average)												1.8361	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9763	(42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	90.0108	88.6740	86.7915	83.3206	80.7216	77.8397	76.2831	78.1524	80.1877	83.2714	86.8138	89.7065	(42b)
Hot water usage for other uses	47.4849	45.7582	44.0315	42.3048	40.5780	38.8513	38.8513	40.5780	42.3048	44.0315	45.7582	47.4849	(42c)
Average daily hot water use (litres/day)												126.6223	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.4957	134.4322	130.8230	125.6254	121.2996	116.6910	115.1344	118.7304	122.4925	127.3029	132.5720	137.1914	(44)
Energy conte	217.7596	191.4297	201.0701	171.9748	163.2926	143.4852	139.2450	147.0130	151.0455	172.7488	188.8732	214.8086	(45)
Energy content (annual)										Total = Sum(45)m =		2102.7463	
Distribution loss (46)m = 0.15 x (45)m	32.6639	28.7145	30.1605	25.7962	24.4939	21.5228	20.8868	22.0520	22.6568	25.9123	28.3310	32.2213	(46)
Water storage 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	35.5274	32.0865	35.5083	34.3155	35.4303	34.2559	35.3735	35.3878	34.2623	35.4387	34.3398	35.5206	(61)
Total heat required for water heating calculated for each month	253.2871	223.5162	236.5784	206.2903	198.7229	177.7411	174.6185	182.4008	185.3078	208.1875	223.2130	250.3293	(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	253.2871	223.5162	236.5784	206.2903	198.7229	177.7411	174.6185	182.4008	185.3078	208.1875	223.2130	250.3293	(64)
										Total per year (kWh/year) = Sum(64)m =		2520.1928	(64)
12Total per year (kWh/year)												2520	(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	81.2869	71.6720	75.7329	65.7605	63.1524	56.2728	55.1423	57.7288	58.7882	66.2987	71.3853	80.3040	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.8170	148.8170	148.8170	148.8170	148.8170	148.8170	148.8170	148.8170	148.8170	148.8170	148.8170	148.8170	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	190.5545	210.9710	190.5545	196.9063	190.5545	196.9063	190.5545	190.5545	196.9063	190.5545	196.9063	190.5545	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	352.0135	355.6663	346.4613	326.8651	302.1284	278.8794	263.3476	259.6948	268.8998	288.4960	313.2327	336.4817	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.8817	37.8817	37.8817	37.8817	37.8817	37.8817	37.8817	37.8817	37.8817	37.8817	37.8817	37.8817	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-119.0536	-119.0536	-119.0536	-119.0536	-119.0536	-119.0536	-119.0536	-119.0536	-119.0536	-119.0536	-119.0536	-119.0536	(71)
Water heating gains (Table 5)													
	109.2566	106.6548	101.7915	91.3340	84.8822	78.1567	74.1161	77.5924	81.6503	89.1111	99.1462	107.9355	(72)
Total internal gains													
	722.4697	743.9371	709.4524	685.7505	648.2102	621.5874	595.6632	595.4868	615.1014	638.8066	679.9303	705.6168	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0200	10.6334	0.7600	0.0000	0.7700	6.3471	(74)
East	9.5500	19.6403	0.7600	0.0000	0.7700	109.7628	(76)
West	14.6400	19.6403	0.7600	0.0000	0.7700	168.2646	(80)

Solar gains	284.3745	556.0101	916.3049	1339.4227	1645.5371	1686.5896	1604.8229	1375.5945	1066.5102	659.7988	354.4974	233.9274	(83)
Total gains	1006.8441	1299.9473	1625.7573	2025.1732	2293.7473	2308.1770	2200.4862	1971.0813	1681.6116	1298.6054	1034.4277	939.5442	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	28.2621	28.5307	28.7989	30.1293	30.3920	31.6776	31.6776	31.9277	31.1697	30.3920	29.8652	29.3337	
alpha	2.8841	2.9020	2.9199	3.0086	3.0261	3.1118	3.1118	3.1285	3.0780	3.0261	2.9910	2.9556	
util living area													
	0.9949	0.9890	0.9746	0.9322	0.8470	0.7035	0.5649	0.6285	0.8464	0.9661	0.9913	0.9960	(86)
MIT	18.6816	18.9238	19.3298	19.9179	20.3834	20.7167	20.8339	20.8079	20.5327	19.8969	19.2295	18.7074	(87)
Th 2	19.3618	19.3743	19.3865	19.4448	19.4558	19.5077	19.5077	19.5174	19.4876	19.4558	19.4335	19.4104	(88)
util rest of house													
	0.9933	0.9856	0.9661	0.9082	0.7895	0.5912	0.4000	0.4652	0.7643	0.9498	0.9880	0.9947	(89)
MIT 2	17.3041	17.5538	17.9644	18.5783	19.0131	19.3235	19.3921	19.3921	19.1822	18.5779	17.9026	17.3649	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	17.6484	17.8963	18.3057	18.9132	19.3557	19.6718	19.7525	19.7460	19.5198	18.9077	18.2343	17.7005	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.6484	17.8963	18.3057	18.9132	19.3557	19.6718	19.7525	19.7460	19.5198	18.9077	18.2343	17.7005	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9908	0.9810	0.9582	0.8976	0.7849	0.6053	0.4297	0.4936	0.7665	0.9416	0.9842	0.9927	(94)
Useful gains	997.5941	1275.2276	1557.7418	1817.7124	1800.4664	1397.0806	945.5752	972.9892	1288.9953	1222.8073	1018.0957	932.6681	(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													
	4713.7678	4546.2121	4091.2779	3316.8683	2514.0095	1597.9167	993.2291	1045.9358	1735.3693	2728.1186	3720.8399	4593.3054	(97)
Space heating kWh													
	2764.8332	2198.1016	1884.9509	1079.3922	530.8761	0.0000	0.0000	0.0000	0.0000	1119.9516	1945.9758	2723.5141	(98a)
Space heating requirement - total per year (kWh/year)												14247.5955	
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													
	2764.8332	2198.1016	1884.9509	1079.3922	530.8761	0.0000	0.0000	0.0000	0.0000	1119.9516	1945.9758	2723.5141	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												14247.5955	
Space heating per m2											(98c) / (4) =	78.9778	(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 %)	83.3000	(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													
	2764.8332	2198.1016	1884.9509	1079.3922	530.8761	0.0000	0.0000	0.0000	0.0000	1119.9516	1945.9758	2723.5141	(98)
Space heating efficiency (main heating system 1)													

	83.3000	83.3000	83.3000	83.3000	83.3000	0.0000	0.0000	0.0000	0.0000	83.3000	83.3000	83.3000 (210)
Space heating fuel (main heating system)												
	3319.1275	2638.7774	2262.8462	1295.7889	637.3062	0.0000	0.0000	0.0000	0.0000	1344.4797	2336.1054	3269.5247 (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												
	253.2871	223.5162	236.5784	206.2903	198.7229	177.7411	174.6185	182.4008	185.3078	208.1875	223.2130	250.3293 (64)
Efficiency of water heater												98.9000 (216)
(217)m	98.9000	98.9000	98.9000	98.9000	98.9000	98.9000	98.9000	98.9000	98.9000	98.9000	98.9000	98.9000 (217)
Fuel for water heating, kWh/month												
	256.1042	226.0023	239.2097	208.5847	200.9332	179.7180	176.5607	184.4295	187.3688	210.5030	225.6956	253.1135 (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	47.8560	38.3919	34.5676	25.3257	19.5623	15.9826	17.8454	23.1961	30.1295	39.5315	44.6507	49.1861 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-235.6401	-362.4639	-445.3975	-401.8444	-381.1628	-340.9345	-336.3818	-337.6763	-344.3570	-385.9939	-270.7680	-199.3522 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	17103.9562 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	98.9000
Water heating fuel used	2548.2233 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	386.2254 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-4041.9723 (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	16082.4325 (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	17103.9562	0.2100	3591.8308	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2548.2233	0.2100	535.1269	(264)
Space and water heating			4126.9577	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	386.2254	0.1443	55.7443	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-4041.9723	0.1376	-556.2840	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-556.2840	(269)
Total CO2, kg/year			3638.3472	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			20.1700	(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	17103.9562	1.1300	19327.4705	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2548.2233	1.1300	2879.4923	(278)
Space and water heating			22206.9628	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	386.2254	1.5338	592.4054	(282)

Energy saving/generation technologies				
PV Unit electricity used in dwelling	-4041.9723	1.5089	-6098.7418	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-6098.7418	(283)
Total Primary energy kWh/year			16830.7272	(286)
Dwelling Primary energy Rate (DPER)			93.3000	(287)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	14.7200 (1b)	x	2.5800 (2b)	=	37.9776 (1b)	-
First floor	98.3400 (1c)	x	3.3800 (2c)	=	332.3892 (1c)	-
Second floor	39.3700 (1d)	x	2.6400 (2d)	=	103.9368 (1d)	-
Third floor	27.9700 (1e)	x	2.7500 (2e)	=	76.9175 (1e)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	180.4000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	551.2211	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0726	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3226	(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) =	0.2742	(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	0.3496	0.3427	0.3359	0.3016	0.2947	0.2605	0.2605	0.2536	0.2742	0.2947	0.3085	0.3222	(22b)
Effective ac	0.5611	0.5587	0.5564	0.5455	0.5434	0.5339	0.5339	0.5322	0.5376	0.5434	0.5476	0.5519	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.3100	1.0000	5.3100			(26)
TER Opening Type (Uw = 1.20)			25.2100	1.1450	28.8664			(27)
Low New HLF			14.7200	0.1300	1.9136			(28a)
+1 HLF to commercial_Improved			63.4700	0.1300	8.2511			(28b)
+1 New HLF			20.3100	0.1300	2.6403			(28b)
Low New Ext Wall	28.0200	3.5900	24.4300	0.1800	4.3974			(29a)
+1 New Ext Wall	54.8200	9.0600	45.7600	0.1800	8.2368			(29a)
+2 New Ext Wall	12.3600		12.3600	0.1800	2.2248			(29a)
+3 New Ext Wall	58.4700	6.2700	52.2000	0.1800	9.3960			(29a)
+1 Existing Ext Wall_Improved	14.4200	5.1400	9.2800	0.1800	1.6704			(29a)
+2 Existing Ext Wall_Improved	20.2200	6.4600	13.7600	0.1800	2.4768			(29a)
+1 New Flat HLR	34.8700		34.8700	0.1100	3.8357			(30)
+3 New Flat HLR	27.9700		27.9700	0.1100	3.0767			(30)
+1 Existing Flat HLR_Improved	23.8400		23.8400	0.1100	2.6224			(30)
+2 Existing Flat HLR_Improved	11.4500		11.4500	0.1100	1.2595			(30)
Total net area of external elements Aum(A, m2)			384.9400					(31)

Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	86.1779	(33)
Low Party Wall	13.2100	0.0000	0.0000		(32)
+1 Party Wall	144.8200	0.0000	0.0000		(32)
+2 Party Wall	40.6800	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	199.1629	(35)
Thermal bridges (User defined value 0.050 * total exposed area)	19.2470	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	105.4249	(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	102.0664	101.6348	101.2117	99.2246	98.8528	97.1222	97.1222	96.8017	97.7888	98.8528	99.6050	100.3912	(38)
Heat transfer coeff	207.4913	207.0597	206.6366	204.6495	204.2778	202.5471	202.5471	202.2266	203.2137	204.2778	205.0299	205.8162	(39)
Average = Sum(39)m / 12 =												204.6478	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1502	1.1478	1.1454	1.1344	1.1324	1.1228	1.1228	1.1210	1.1265	1.1324	1.1365	1.1409	(40)
HLP (average)												1.1344	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9763	(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	85.5103	84.2403	82.4520	79.1546	76.6855	73.9477	72.4689	74.2447	76.1783	79.1078	82.4731	85.2212	(42b)
Hot water usage for other uses	45.1107	43.4703	41.8299	40.1895	38.5491	36.9087	36.9087	38.5491	40.1895	41.8299	43.4703	45.1107	(42c)
Average daily hot water use (litres/day)												120.2912	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	130.6210	127.7106	124.2819	119.3441	115.2346	110.8565	109.3776	112.7939	116.3678	120.9378	125.9434	130.3319	(44)
Energy conte	206.8717	181.8582	191.0166	163.3761	155.1280	136.3110	132.2828	139.6624	143.4932	164.1114	179.4295	204.0682	(45)
Energy content (annual)										Total = Sum(45)m =		1997.6090	
Distribution loss (46)m = 0.15 x (45)m	31.0307	27.2787	28.6525	24.5064	23.2692	20.4466	19.8424	20.9494	21.5240	24.6167	26.9144	30.6102	(46)
Water storage 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	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	257.8306	227.8856	241.9755	212.6912	206.0869	185.6260	183.2417	190.6213	192.8082	215.0703	228.7446	255.0271	(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	257.8306	227.8856	241.9755	212.6912	206.0869	185.6260	183.2417	190.6213	192.8082	215.0703	228.7446	255.0271	(64)
									Total per year (kWh/year) = Sum(64)m =			2597.6090	(64)
12Total per year (kWh/year)												2598	(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	81.5246	71.9747	76.2528	66.6513	64.3198	57.6522	56.7238	59.1775	60.0402	67.3068	71.9891	80.5924	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.8170	148.8170	148.8170	148.8170	148.8170	148.8170	148.8170	148.8170	148.8170	148.8170	148.8170	148.8170	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	190.5545	210.9710	190.5545	196.9063	190.5545	196.9063	190.5545	190.5545	196.9063	190.5545	196.9063	190.5545	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	352.0135	355.6663	346.4613	326.8651	302.1284	278.8794	263.3476	259.6948	268.8998	288.4960	313.2327	336.4817	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8817	37.8817	37.8817	37.8817	37.8817	37.8817	37.8817	37.8817	37.8817	37.8817	37.8817	37.8817	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-119.0536	-119.0536	-119.0536	-119.0536	-119.0536	-119.0536	-119.0536	-119.0536	-119.0536	-119.0536	-119.0536	-119.0536	(71)
Water heating gains (Table 5)	109.5760	107.1052	102.4903	92.5713	86.4513	80.0724	76.2416	79.5396	83.3892	90.4661	99.9848	108.3231	(72)
Total internal gains	722.7890	744.3876	710.1511	686.9878	649.7793	623.5032	597.7888	597.4340	616.8404	640.1616	680.7689	706.0044	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.0200	10.6334	0.6300	0.7000	0.7700	3.3147 (74)
East	9.5500	19.6403	0.6300	0.7000	0.7700	57.3222 (76)
West	14.6400	19.6403	0.6300	0.7000	0.7700	87.8740 (80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	148.5108	290.3690	478.5282	699.4959	859.3601	880.7992	838.0977	718.3861	556.9709	344.5712	185.1316	122.1655	(83)
Total gains	871.2998	1034.7565	1188.6793	1386.4837	1509.1394	1504.3024	1435.8864	1315.8201	1173.8113	984.7328	865.9005	828.1699	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.0997	48.2000	48.2987	48.7676	48.8564	49.2738	49.2738	49.3519	49.1122	48.8564	48.6772	48.4912	
alpha	4.2066	4.2133	4.2199	4.2512	4.2571	4.2849	4.2849	4.2901	4.2741	4.2571	4.2451	4.2327	
util living area	0.9977	0.9950	0.9877	0.9607	0.8900	0.7461	0.5875	0.6513	0.8748	0.9793	0.9956	0.9982	(86)
MIT	19.1622	19.3678	19.7086	20.1871	20.6044	20.8761	20.9661	20.9478	20.7329	20.1754	19.5884	19.1334	(87)
Th 2	19.9601	19.9620	19.9639	19.9728	19.9745	19.9823	19.9823	19.9837	19.9793	19.9745	19.9711	19.9676	(88)
util rest of house	0.9971	0.9936	0.9840	0.9480	0.8527	0.6633	0.4664	0.5308	0.8175	0.9705	0.9941	0.9977	(89)
MIT 2	17.7973	18.0617	18.4974	19.1052	19.6065	19.8979	19.9683	19.9597	19.7645	19.0995	18.3508	17.7655	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	18.1385	18.3882	18.8002	19.3757	19.8560	20.1424	20.2177	20.2067	20.0066	19.3685	18.6602	18.1075	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1385	18.3882	18.8002	19.3757	19.8560	20.1424	20.2177	20.2067	20.0066	19.3685	18.6602	18.1075	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9954	0.9903	0.9780	0.9384	0.8476	0.6776	0.4959	0.5592	0.8193	0.9631	0.9911	0.9963	(94)
Useful gains	867.2701	1024.7690	1162.5734	1301.0157	1279.0912	1019.3380	712.0766	735.7849	961.7362	948.4447	858.2133	825.0749	(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	2871.3741	2792.8637	2541.6724	2143.8466	1666.0831	1122.6010	732.7582	769.8146	1200.3043	1791.2120	2370.1843	2862.3834	(97)
Space heating kWh	1491.0534	1188.1596	1026.0496	606.8383	287.9220	0.0000	0.0000	0.0000	0.0000	627.0189	1088.6191	1515.7575	(98a)
Space heating requirement - total per year (kWh/year)												7831.4183	
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	1491.0534	1188.1596	1026.0496	606.8383	287.9220	0.0000	0.0000	0.0000	0.0000	627.0189	1088.6191	1515.7575	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7831.4183	
Space heating per m2											(98c) / (4) =	43.4114	(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 %)	92.4000 (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	1491.0534	1188.1596	1026.0496	606.8383	287.9220	0.0000	0.0000	0.0000	0.0000	627.0189	1088.6191	1515.7575	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	1613.6942	1285.8870	1110.4433	656.7514	311.6039	0.0000	0.0000	0.0000	0.0000	678.5919	1178.1592	1640.4302	(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	257.8306	227.8856	241.9755	212.6912	206.0869	185.6260	183.2417	190.6213	192.8082	215.0703	228.7446	255.0271	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.5182	87.3937	87.1195	86.4958	85.0980	80.3000	80.3000	80.3000	80.3000	86.5331	87.2770	87.5496	(217)
Fuel for water heating, kWh/month	294.6023	260.7574	277.7513	245.8976	242.1761	231.1657	228.1964	237.3864	240.1099	248.5412	262.0905	291.2944	(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	39.5935	31.7633	28.5994	20.9531	16.1848	13.2231	14.7643	19.1912	24.9275	32.7062	36.9416	40.6939	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233a)m	-17.3695	-26.6518	-41.6377	-50.9929	-58.7336	-56.1783	-55.4682	-50.4650	-42.3865	-32.2049	-19.8399	-14.7739 (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	-4.1835	-9.1332	-18.8083	-29.2610	-39.7336	-40.3456	-39.9011	-33.3180	-23.8033	-13.4076	-5.6898	-3.2857 (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	8475.5610 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	80.3000
Water heating fuel used	3059.9690 (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)	319.5418 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-727.5729 (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	11213.4989 (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	8475.5610	0.2100	1779.8678	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3059.9690	0.2100	642.5935	(264)
Space and water heating			2422.4613	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	319.5418	0.1443	46.1198	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-466.7022	0.1329	-62.0163	
PV Unit electricity exported	-260.8707	0.1249	-32.5729	
Total			-94.5892	(269)
Total CO2, kg/year			2385.9211	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.2300	(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	8475.5610	1.1300	9577.3839	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3059.9690	1.1300	3457.7650	(278)
Space and water heating			13035.1489	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	319.5418	1.5338	490.1239	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-466.7022	1.4910	-695.8584	
PV Unit electricity exported	-260.8707	0.4583	-119.5510	
Total			-815.4094	(283)
Total Primary energy kWh/year			12839.9642	(286)
Target Primary Energy Rate (TPER)			71.1700	(287)

Summary for Input Data

elmhurst energy

Property Reference	Rev 01	**Issued on Date**	06/10/2023
Assessment Reference	00001	**Prop Type Ref**	HMO
Property	212 High Street, SM1 1NU		

SAP Rating	66 D	**DER**	32.41	**TER**	13.23
Environmental	66 D	**% DER < TER**			-144.97
CO_2 Emissions (t/year)	4.36	**DFEE**	75.14	**TFEE**	46.96
Compliance Check	See BREL	**% DFEE < TFEE**			-60.00
% DPER < TPER	-155.02	**DPER**	181.50	**TPER**	71.17

Assessor Details	Mr. Dion Mellows	**Assessor ID**	G297-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East	
Property Tenture	ND	
Transaction Type	5	
Terrain Type	Urban	
1.0 Property Type	House, Semi-Detached	
Which Floor	0	
2.0 Number of Storeys	4	
3.0 Date Built	2023	
3.0 Property Age Band	L	
4.0 Sheltered Sides	2	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	N/A	kJ/m²K
7.0 Electricity Tariff	Standard	
Smart electricity meter fitted	No	
Smart gas meter fitted	No	

7.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Basement:	0.00 m	0.00 m²	0.00 m
Ground floor:	10.86 m	14.72 m²	2.58 m
1st Storey:	20.20 m	98.34 m²	3.38 m
2nd Storey:	12.34 m	39.37 m²	2.64 m
3rd Storey:	21.26 m	27.97 m²	2.75 m
4th Storey:	0.00 m	0.00 m²	0.00 m
5th Storey:	0.00 m	0.00 m²	0.00 m
6th Storey:	0.00 m	0.00 m²	0.00 m
7th Storey:	0.00 m	0.00 m²	0.00 m

8.0 Living Area	45.10	m²	

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
Low New Ext Wall	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	28.02	24.43	0.00	None	3.59	Enter Gross Area
+1 New Ext Wall	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	54.82	45.75	0.00	None	9.07	Enter Gross Area
+2 New Ext Wall	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	12.36	12.36	0.00	None	0.00	Enter Gross Area
+3 New Ext Wall	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	58.47	52.21	0.00	None	6.26	Enter Gross Area
+1 Existing Ext Wall_Improved	Solid Wall	Solid wall : dense plaster, 200 mm dense block, insulated externally	0.30	190.00	14.42	9.28	0.00	None	5.14	Enter Gross Area
+2 Existing Ext Wall_Improved	Solid Wall	Solid wall : dense plaster, 200 mm dense block, insulated externally	0.30	190.00	20.22	13.76	0.00	None	6.46	Enter Gross Area

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)	Shelter Res	Shelter
Low Party Wall	Filled Cavity with Edge Sealing	Single plasterboard on both sides, dense cellular blocks, cavity	0.00	70.00	13.21	0.00	None

+1 Party Wall	Filled Cavity with Edge Sealing	Single plasterboard on both sides, dense cellular blocks, cavity	0.00	70.00	144.82	0.00	None
+2 Party Wall	Filled Cavity with Edge Sealing	Single plasterboard on both sides, dense cellular blocks, cavity	0.00	70.00	40.68	0.00	None

9.2 Internal Walls

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Low Internal Wall	Plasterboard on timber frame	9.00	11.61
+1 Internal Wall	Plasterboard on timber frame	9.00	264.76
+2 Internal Wall	Plasterboard on timber frame	9.00	61.01
+3 Internal Wall	Plasterboard on timber frame	9.00	26.48

10.0 External Roofs

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Code	Shelter Factor	Calculation Type	Openings
+1 New Flat HLR	External Plane Roof	Plasterboard, insulated at ceiling level	0.11	9.00	34.87	34.87	None	0.00	Enter Gross Area	0.00
+3 New Flat HLR	External Plane Roof	Plasterboard, insulated at ceiling level	0.11	9.00	27.97	27.97	None	0.00	Enter Gross Area	0.00
+1 Existing Flat HLR_Improved	External Plane Roof	Plasterboard, insulated at ceiling level	0.22	9.00	23.84	23.84	None	0.00	Enter Gross Area	0.00
+2 Existing Flat HLR_Improved	External Plane Roof	Plasterboard, insulated at ceiling level	0.22	9.00	11.45	11.45	None	0.00	Enter Gross Area	0.00

10.2 Internal Ceilings

Description	Storey	Construction	Area (m²)
Low Internal Ceiling	Lowest occupied	Plasterboard ceiling, carpeted chipboard floor	14.72
+1 Internal Ceiling	+1	Plasterboard ceiling, carpeted chipboard floor	63.47
+2 Internal Ceiling	+2	Plasterboard ceiling, carpeted chipboard floor	27.92

11.0 Heat Loss Floors

Description	Type	Storey Index	Construction	U-Value (W/m²K)	Shelter Code	Shelter Factor	Kappa (kJ/m²K)	Area (m²)
Low New HLF	Ground Floor - Solid	Lowest occupied	Slab on ground, screed over insulation	0.13	None	0.00	110.00	14.72
+1 HLF to commercial_Improved	Exposed Floor - Solid	+1	Other	0.22	None	0.00	0.00	63.47
+1 New HLF	Exposed Floor - Solid	+1	Other	0.13	None	0.00	0.00	20.31

11.2 Internal Floors

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
+1 Internal Floor		Plasterboard ceiling, carpeted chipboard floor	9.00	14.72
+2 Internal Floor		Plasterboard ceiling, carpeted chipboard floor	9.00	39.37
+3 Internal Floor		Plasterboard ceiling, carpeted chipboard floor	9.00	27.97

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Windows	BFRC, BSI or CERTASS data	Window	Double glazed		Air Filled	0.76	Wood	1.00	1.20
Door	BFRC, BSI or CERTASS data	Solid Door			Air Filled	0.00	Wood	1.00	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
Low N1	Door	Low New Ext Wall	North	1.91	0
Low E1	Windows	Low New Ext Wall	East	1.68	0
+1 N1	Windows	+1 New Ext Wall	North	1.02	0
+1 E1	Windows	+1 New Ext Wall	East	1.20	0
+1 E2	Windows	+1 New Ext Wall	East	1.20	0
+1 E3	Windows	+1 New Ext Wall	East	1.04	0
+1 W1	Door	+1 New Ext Wall	West	1.70	0
+1 W2	Windows	+1 New Ext Wall	West	1.20	0
+1 W3	Door	+1 New Ext Wall	West	1.70	0
+1 W4	Windows	+1 Existing Ext Wall_Improved	West	2.57	0
+1 W5	Windows	+1 Existing Ext Wall_Improved	West	2.57	0
+2 E1	Windows	+2 Existing Ext Wall_Improved	East	1.68	0
+2 W1	Windows	+2 Existing Ext Wall_Improved	West	2.39	0
+2 W2	Windows	+2 Existing Ext Wall_Improved	West	2.39	0
+3 E1	Windows	+3 New Ext Wall	East	1.35	0
+3 E2	Windows	+3 New Ext Wall	East	1.40	0
+3 W1	Windows	+3 New Ext Wall	West	1.76	0
+3 W2	Windows	+3 New Ext Wall	West	1.76	0

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Default	
Y-value	0.20	W/m²K

Summary for Input Data

elmhurst energy

18.0 Pressure Testing	No
Property Tested?	Yes
Test Method	Blower Door

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System	No

22.0 Lighting

No Fixed Lighting	No

Name	Efficacy	Power	Capacity	Count
Incandenscent Lighting	11.20	60	660	20

24.0 Main Heating 1	SAP table	
Description	Main Gas Boiler	
Percentage of Heat	100.00	%
Database Ref. No.	0	
Fuel Type	Mains gas	
SAP Code	118	
In Winter	66.00	
In Summer	57.00	
Controls SAP Code	2106	
Delayed Start Stat	No	
HETAS approved System	No	
Oil Pump Inside	No	
Flue Type	Open	
Fan Assisted Flue	No	
Is MHS Pumped	Pump in heated space	
Heating Pump Age	2013 or later	
Heat Emitter	Radiators and Underfloor	
Underfloor Heating	Yes - Pipes in thin screed	
Boiler Interlock	No	
Combi boiler type	Standard Combi	
Combi keep hot type	Electric, time clock	

25.0 Main Heating 2	None

26.0 Heat Networks	None

	Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power Ratio	Electrical	Fuel Factor	Efficiency type
Heat source 1	None									
Heat source 2	None									
Heat source 3	None									
Heat source 4	None									
Heat source 5	None									

28.0 Water Heating

Water Heating	Main Heating 1
SAP Code	901
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No

Summary for Input Data

Solar Panel	No	
Water use <= 125 litres/person/day	No	
Summer Immersion	No	
Cold Water Source	From mains	
Bath Count	8	
Supplementary Immersion	No	
Immersion Only Heating Hot Water	No	

28.3 Waste Water Heat Recovery System

29.0 Hot Water Cylinder	None	
Cylinder Stat	No	
Cylinder In Heated Space	No	
Independent Time Control	No	
In Airing Cupboard	No	

31.0 Thermal Store	None	

34.0 Small-scale Hydro	None	
Electricity Generated	0.00	
Apportioned	0.00	kWh/Year
Connected to dwelling's electricity meter	Yes	
Electricity Generation	Annual	

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

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

Full SAP Calculation Printout

Property Reference	Rev 01	Issued on Date	06/10/2023
Assessment Reference	00001	Prop Type Ref	HMO
Property	212 High Street, SM1 1NU		

SAP Rating	66 D	DER	32.41	TER	13.23
Environmental	66 D	% DER < TER			-144.97
CO_2 Emissions (t/year)	4.36	DFEE	75.14	TFEE	46.96
Compliance Check	See BREL	% DFEE < TFEE			-60.00
% DPER < TPER	-155.02	DPER	181.50	TPER	71.17

Assessor Details	Mr. Dion Mellows	Assessor ID	G297-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	14.7200 (1b)	x	2.5800 (2b)	=	37.9776 (1b)	-
First floor	98.3400 (1c)	x	3.3800 (2c)	=	332.3892 (1c)	-
Second floor	39.3700 (1d)	x	2.6400 (2d)	=	103.9368 (1d)	-
Third floor	27.9700 (1e)	x	2.7500 (2e)	=	76.9175 (1e)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	180.4000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	551.2211	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	8 * 10 =	80.0000 (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) =	80.0000 / (5) =	0.1451	(8)
Pressure test		No	
Pressure Test Method		Blower Door	
Measured/design AP50		15.0000	(17)
Infiltration rate		0.8951	(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) =	0.7609	(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	0.9701	0.9511	0.9321	0.8369	0.8179	0.7228	0.7228	0.7038	0.7609	0.8179	0.8560	0.8940	(22b)
Effective ac	0.9705	0.9523	0.9344	0.8502	0.8345	0.7612	0.7612	0.7477	0.7895	0.8345	0.8663	0.8996	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			25.2100	1.1450	28.8664			(27)
Door			5.3100	1.2000	6.3720			(26)
Low New HLF			14.7200	0.1300	1.9136	110.0000	1619.2000	(28a)
+1 HLF to commercial_Improved			63.4700	0.2200	13.9634			(28b)
+1 New HLF			20.3100	0.1300	2.6403			(28b)

Low New Ext Wall	28.0200	3.5900	24.4300	0.1800	4.3974	70.0000	1710.1000 (29a)
+1 New Ext Wall	54.8200	9.0600	45.7600	0.1800	8.2368	70.0000	3203.2000 (29a)
+2 New Ext Wall	12.3600		12.3600	0.1800	2.2248	70.0000	865.2000 (29a)
+3 New Ext Wall	58.4700	6.2700	52.2000	0.1800	9.3960	70.0000	3654.0000 (29a)
+1 Existing Ext Wall_Improved	14.4200	5.1400	9.2800	0.3000	2.7840	190.0000	1763.2000 (29a)
+2 Existing Ext Wall_Improved	20.2200	6.4600	13.7600	0.3000	4.1280	190.0000	2614.4000 (29a)
+1 New Flat HLR	34.8700		34.8700	0.1100	3.8357	9.0000	313.8300 (30)
+3 New Flat HLR	27.9700		27.9700	0.1100	3.0767	9.0000	251.7300 (30)
+1 Existing Flat HLR_Improved	23.8400		23.8400	0.2200	5.2448	9.0000	214.5600 (30)
+2 Existing Flat HLR_Improved	11.4500		11.4500	0.2200	2.5190	9.0000	103.0500 (30)
Total net area of external elements Aum(A, m2)			384.9400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		99.5989		(33)
Low Party Wall			13.2100	0.0000	0.0000	70.0000	924.7000 (32)
+1 Party Wall			144.8200	0.0000	0.0000	70.0000	10137.4000 (32)
+2 Party Wall			40.6800	0.0000	0.0000	70.0000	2847.6000 (32)
Low Internal Wall			11.6100			9.0000	104.4900 (32c)
+1 Internal Wall			264.7600			9.0000	2382.8400 (32c)
+2 Internal Wall			61.0100			9.0000	549.0900 (32c)
+3 Internal Wall			26.4800			9.0000	238.3200 (32c)
+1 Internal Floor			14.7200			18.0000	264.9600 (32d)
+2 Internal Floor			39.3700			18.0000	708.6600 (32d)
+3 Internal Floor			27.9700			18.0000	503.4600 (32d)
Low Internal Ceiling			14.7200			9.0000	132.4800 (32e)
+1 Internal Ceiling			63.4700			9.0000	571.2300 (32e)
+2 Internal Ceiling			27.9200			9.0000	251.2800 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	35928.9800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		199.1629 (35)
Thermal bridges (Default value 0.200 * total exposed area)		76.9880 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	176.5869 (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	176.5453	173.2216	169.9637	154.6615	151.7985	138.4707	138.4707	136.0026	143.6044	151.7985	157.5903	163.6454	(38)
Heat transfer coeff	353.1322	349.8085	346.5506	331.2484	328.3854	315.0576	315.0576	312.5895	320.1913	328.3854	334.1772	340.2323	(39)
Average = Sum(39)m / 12 =												331.2347	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.9575	1.9391	1.9210	1.8362	1.8203	1.7464	1.7464	1.7328	1.7749	1.8203	1.8524	1.8860	(40)
HLP (average)												1.8361	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9763	(42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	90.0108	88.6740	86.7915	83.3206	80.7216	77.8397	76.2831	78.1524	80.1877	83.2714	86.8138	89.7065	(42b)
Hot water usage for other uses	47.4849	45.7582	44.0315	42.3048	40.5780	38.8513	38.8513	40.5780	42.3048	44.0315	45.7582	47.4849	(42c)
Average daily hot water use (litres/day)												126.6223	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.4957	134.4322	130.8230	125.6254	121.2996	116.6910	115.1344	118.7304	122.4925	127.3029	132.5720	137.1914	(44)
Energy conte	217.7596	191.4297	201.0701	171.9748	163.2926	143.4852	139.2450	147.0130	151.0455	172.7488	188.8732	214.8086	(45)
Energy content (annual)										Total = Sum(45)m =		2102.7463	
Distribution loss (46)m = 0.15 x (45)m	32.6639	28.7145	30.1605	25.7962	24.4939	21.5228	20.8868	22.0520	22.6568	25.9123	28.3310	32.2213	(46)
Water storage 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	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	268.7185	237.4571	252.0290	221.2899	214.2515	192.8003	190.2039	197.9719	200.3605	223.7077	238.1883	265.7675	(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	268.7185	237.4571	252.0290	221.2899	214.2515	192.8003	190.2039	197.9719	200.3605	223.7077	238.1883	265.7675	(64)
										Total per year (kWh/year) = Sum(64)m =		2702.7463	(64)
12Total per year (kWh/year)												2703	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	85.1448	75.1572	79.5955	69.5104	67.0345	60.0376	59.0387	61.6216	62.5514	70.1787	75.1291	84.1636	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.8170	148.8170	148.8170	148.8170	148.8170	148.8170	148.8170	148.8170	148.8170	148.8170	148.8170	148.8170	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	190.5545	210.9710	190.5545	196.9063	190.5545	196.9063	190.5545	190.5545	196.9063	190.5545	196.9063	190.5545	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	352.0135	355.6663	346.4613	326.8651	302.1284	278.8794	263.3476	259.6948	268.8998	288.4960	313.2327	336.4817	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.8817	37.8817	37.8817	37.8817	37.8817	37.8817	37.8817	37.8817	37.8817	37.8817	37.8817	37.8817	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-119.0536	-119.0536	-119.0536	-119.0536	-119.0536	-119.0536	-119.0536	-119.0536	-119.0536	-119.0536	-119.0536	-119.0536	(71)
Water heating gains (Table 5)													
	114.4419	111.8411	106.9833	96.5422	90.1002	83.3856	79.3531	82.8247	86.8769	94.3262	104.3460	113.1231	(72)
Total internal gains													
	727.6550	749.1235	714.6441	690.9587	653.4281	626.8163	600.9003	600.7191	620.3281	644.0218	685.1300	710.8044	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0200	10.6334	0.7600	0.0000	0.7700	6.3471	(74)
East	9.5500	19.6403	0.7600	0.0000	0.7700	109.7628	(76)
West	14.6400	19.6403	0.7600	0.0000	0.7700	168.2646	(80)

Solar gains	284.3745	556.0101	916.3049	1339.4227	1645.5371	1686.5896	1604.8229	1375.5945	1066.5102	659.7988	354.4974	233.9274	(83)
Total gains	1012.0294	1305.1336	1630.9490	2030.3814	2298.9653	2313.4059	2205.7232	1976.3136	1686.8382	1303.8205	1039.6274	944.7318	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	28.2621	28.5307	28.7989	30.1293	30.3920	31.6776	31.6776	31.9277	31.1697	30.3920	29.8652	29.3337	
alpha	2.8841	2.9020	2.9199	3.0086	3.0261	3.1118	3.1118	3.1285	3.0780	3.0261	2.9910	2.9556	
util living area													
	0.9949	0.9889	0.9744	0.9318	0.8463	0.7026	0.5639	0.6273	0.8455	0.9657	0.9912	0.9959	(86)
MIT	18.6839	18.9260	19.3319	19.9198	20.3847	20.7174	20.8343	20.8084	20.5340	19.8990	19.2318	18.7097	(87)
Th 2	19.3618	19.3743	19.3865	19.4448	19.4558	19.5077	19.5077	19.5174	19.4876	19.4558	19.4335	19.4104	(88)
util rest of house													
	0.9932	0.9854	0.9658	0.9076	0.7887	0.5902	0.3991	0.4642	0.7632	0.9493	0.9878	0.9946	(89)
MIT 2	17.3064	17.5560	17.9664	18.5801	19.0142	19.3239	19.3922	19.3923	19.1831	18.5799	17.9049	17.3672	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	17.6507	17.8985	18.3078	18.9150	19.3568	19.6723	19.7527	19.7463	19.5208	18.9097	18.2366	17.7028	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.6507	17.8985	18.3078	18.9150	19.3568	19.6723	19.7527	19.7463	19.5208	18.9097	18.2366	17.7028	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9907	0.9808	0.9579	0.8970	0.7842	0.6043	0.4288	0.4926	0.7654	0.9411	0.9840	0.9926	(94)
Useful gains	1002.6099	1280.0748	1562.2283	1821.3474	1802.8507	1398.0931	945.8945	973.4977	1291.1903	1227.0480	1023.0046	937.7173	(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													
	4714.5760	4546.9944	4092.0067	3317.4487	2514.3844	1598.0678	993.2798	1046.0143	1735.7085	2728.7873	3721.6074	4594.0984	(97)
Space heating kWh													
	2761.7028	2195.3700	1882.1551	1077.1930	529.3811	0.0000	0.0000	0.0000	0.0000	1117.2940	1942.9940	2720.3475	(98a)
Space heating requirement - total per year (kWh/year)												14226.4374	
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													
	2761.7028	2195.3700	1882.1551	1077.1930	529.3811	0.0000	0.0000	0.0000	0.0000	1117.2940	1942.9940	2720.3475	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												14226.4374	
Space heating per m2											(98c) / (4) =	78.8605	(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 %)	61.0000	(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													
	2761.7028	2195.3700	1882.1551	1077.1930	529.3811	0.0000	0.0000	0.0000	0.0000	1117.2940	1942.9940	2720.3475	(98)
Space heating efficiency (main heating system 1)													

	61.0000	61.0000	61.0000	61.0000	61.0000	0.0000	0.0000	0.0000	0.0000	61.0000	61.0000	61.0000 (210)
Space heating fuel (main heating system)												
	4527.3816	3598.9671	3085.5002	1765.8901	867.8378	0.0000	0.0000	0.0000	0.0000	1831.6295	3185.2361	4459.5861 (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												
	268.7185	237.4571	252.0290	221.2899	214.2515	192.8003	190.2039	197.9719	200.3605	223.7077	238.1883	265.7675 (64)
Efficiency of water heater												57.0000 (216)
(217)m	65.0887	64.9983	64.7919	64.2706	63.1282	57.0000	57.0000	57.0000	57.0000	64.3062	64.8813	65.0854 (217)
Fuel for water heating, kWh/month												
	334.5584	294.5150	310.3322	267.5795	258.6683	251.7284	244.2895	257.9176	264.9920	268.6350	291.1058	330.0414 (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	54.4411	49.1726	54.4411	52.6849	54.4411	52.6849	54.4411	54.4411	52.6849	54.4411	52.6849	54.4411 (231)
Lighting	129.6628	104.0203	93.6588	68.6184	53.0029	43.3038	48.3510	62.8484	81.6339	107.1081	120.9783	133.2666 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	23322.0286 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	57.0000
Water heating fuel used	3374.3631 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
maintaining electric keep-hot facility for gas combi boiler	600.0000 (230f)
Total electricity for the above, kWh/year	641.0000 (231)
Electricity for lighting (calculated in Appendix L)	1046.4534 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	28383.8450 (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	23322.0286	0.2100	4897.6260	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3374.3631	0.2100	708.6162	(264)
Space and water heating			5606.2422	(265)
Pumps, fans and electric keep-hot	641.0000	0.1387	88.9146	(267)
Energy for lighting	1046.4534	0.1443	151.0356	(268)
Total CO2, kg/year			5846.1924	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			32.4100	(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	23322.0286	1.1300	26353.8923	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3374.3631	1.1300	3813.0303	(278)
Space and water heating			30166.9226	(279)
Pumps, fans and electric keep-hot	641.0000	1.5128	969.7048	(281)
Energy for lighting	1046.4534	1.5338	1605.0851	(282)
Total Primary energy kWh/year			32741.7125	(286)
Dwelling Primary energy Rate (DPER)			181.5000	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	14.7200 (1b)	x	2.5800 (2b)	=	37.9776 (1b)	-
First floor	98.3400 (1c)	x	3.3800 (2c)	=	332.3892 (1c)	-
Second floor	39.3700 (1d)	x	2.6400 (2d)	=	103.9368 (1d)	-
Third floor	27.9700 (1e)	x	2.7500 (2e)	=	76.9175 (1e)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	180.4000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	551.2211	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0726 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3226 (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) =	0.2742 (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	0.3496	0.3427	0.3359	0.3016	0.2947	0.2605	0.2605	0.2536	0.2742	0.2947	0.3085	0.3222	(22b)
Effective ac	0.5611	0.5587	0.5564	0.5455	0.5434	0.5339	0.5339	0.5322	0.5376	0.5434	0.5476	0.5519	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.3100	1.0000	5.3100			(26)
TER Opening Type (Uw = 1.20)			25.2100	1.1450	28.8664			(27)
Low New HLF			14.7200	0.1300	1.9136			(28a)
+1 HLF to commercial_Improved			63.4700	0.1300	8.2511			(28b)
+1 New HLF			20.3100	0.1300	2.6403			(28b)
Low New Ext Wall	28.0200	3.5900	24.4300	0.1800	4.3974			(29a)
+1 New Ext Wall	54.8200	9.0600	45.7600	0.1800	8.2368			(29a)
+2 New Ext Wall	12.3600		12.3600	0.1800	2.2248			(29a)
+3 New Ext Wall	58.4700	6.2700	52.2000	0.1800	9.3960			(29a)
+1 Existing Ext Wall_Improved	14.4200	5.1400	9.2800	0.1800	1.6704			(29a)
+2 Existing Ext Wall_Improved	20.2200	6.4600	13.7600	0.1800	2.4768			(29a)
+1 New Flat HLR	34.8700		34.8700	0.1100	3.8357			(30)
+3 New Flat HLR	27.9700		27.9700	0.1100	3.0767			(30)
+1 Existing Flat HLR_Improved	23.8400		23.8400	0.1100	2.6224			(30)
+2 Existing Flat HLR_Improved	11.4500		11.4500	0.1100	1.2595			(30)
Total net area of external elements Aum(A, m2)			384.9400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		86.1779			(33)
Low Party Wall			13.2100	0.0000	0.0000			(32)
+1 Party Wall			144.8200	0.0000	0.0000			(32)
+2 Party Wall			40.6800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		199.1629 (35)
Thermal bridges (User defined value 0.050 * total exposed area)		19.2470 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	105.4249 (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	102.0664	101.6348	101.2117	99.2246	98.8528	97.1222	97.1222	96.8017	97.7888	98.8528	99.6050	100.3912	(38)
Heat transfer coeff	207.4913	207.0597	206.6366	204.6495	204.2778	202.5471	202.5471	202.2266	203.2137	204.2778	205.0299	205.8162	(39)
Average = Sum(39)m / 12 =												204.6478	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1502	1.1478	1.1454	1.1344	1.1324	1.1228	1.1228	1.1210	1.1265	1.1324	1.1365	1.1409	(40)
HLP (average)												1.1344	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9763	(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													
	85.5103	84.2403	82.4520	79.1546	76.6855	73.9477	72.4689	74.2447	76.1783	79.1078	82.4731	85.2212	(42b)
Hot water usage for other uses													
	45.1107	43.4703	41.8299	40.1895	38.5491	36.9087	36.9087	38.5491	40.1895	41.8299	43.4703	45.1107	(42c)
Average daily hot water use (litres/day)												120.2912	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	130.6210	127.7106	124.2819	119.3441	115.2346	110.8565	109.3776	112.7939	116.3678	120.9378	125.9434	130.3319	(44)
Energy conte	206.8717	181.8582	191.0166	163.3761	155.1280	136.3110	132.2828	139.6624	143.4932	164.1114	179.4295	204.0682	(45)
Energy content (annual)										Total = Sum(45)m =		1997.6090	
Distribution loss (46)m = 0.15 x (45)m													
	31.0307	27.2787	28.6525	24.5064	23.2692	20.4466	19.8424	20.9494	21.5240	24.6167	26.9144	30.6102	(46)
Water storage 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	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	257.8306	227.8856	241.9755	212.6912	206.0869	185.6260	183.2417	190.6213	192.8082	215.0703	228.7446	255.0271	(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													
	257.8306	227.8856	241.9755	212.6912	206.0869	185.6260	183.2417	190.6213	192.8082	215.0703	228.7446	255.0271	(64)
										Total per year (kWh/year) = Sum(64)m =		2597.6090	(64)
12Total per year (kWh/year)												2598	(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													
	81.5246	71.9747	76.2528	66.6513	64.3198	57.6522	56.7238	59.1775	60.0402	67.3068	71.9891	80.5924	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	148.8170	148.8170	148.8170	148.8170	148.8170	148.8170	148.8170	148.8170	148.8170	148.8170	148.8170	148.8170	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	190.5545	210.9710	190.5545	196.9063	190.5545	196.9063	190.5545	190.5545	196.9063	190.5545	196.9063	190.5545	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	352.0135	355.6663	346.4613	326.8651	302.1284	278.8794	263.3476	259.6948	268.8998	288.4960	313.2327	336.4817	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.8817	37.8817	37.8817	37.8817	37.8817	37.8817	37.8817	37.8817	37.8817	37.8817	37.8817	37.8817	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-119.0536	-119.0536	-119.0536	-119.0536	-119.0536	-119.0536	-119.0536	-119.0536	-119.0536	-119.0536	-119.0536	-119.0536	(71)
Water heating gains (Table 5)													
	109.5760	107.1052	102.4903	92.5713	86.4513	80.0724	76.2416	79.5396	83.3892	90.4661	99.9848	108.3231	(72)
Total internal gains													
	722.7890	744.3876	710.1511	686.9878	649.7793	623.5032	597.7888	597.4340	616.8404	640.1616	680.7689	706.0044	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0200	10.6334	0.6300	0.7000	0.7700	3.3147	(74)
East	9.5500	19.6403	0.6300	0.7000	0.7700	57.3222	(76)
West	14.6400	19.6403	0.6300	0.7000	0.7700	87.8740	(80)

Solar gains	148.5108	290.3690	478.5282	699.4959	859.3601	880.7992	838.0977	718.3861	556.9709	344.5712	185.1316	122.1655	(83)

Total gains	871.2998	1034.7565	1188.6793	1386.4837	1509.1394	1504.3024	1435.8864	1315.8201	1173.8113	984.7328	865.9005	828.1699	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.0997	48.2000	48.2987	48.7676	48.8564	49.2738	49.2738	49.3519	49.1122	48.8564	48.6772	48.4912	
alpha	4.2066	4.2133	4.2199	4.2512	4.2571	4.2849	4.2849	4.2901	4.2741	4.2571	4.2451	4.2327	
util living area													
	0.9977	0.9950	0.9877	0.9607	0.8900	0.7461	0.5875	0.6513	0.8748	0.9793	0.9956	0.9982	(86)
MIT	19.1622	19.3678	19.7086	20.1871	20.6044	20.8761	20.9661	20.9478	20.7329	20.1754	19.5884	19.1334	(87)
Th 2	19.9601	19.9620	19.9639	19.9728	19.9745	19.9823	19.9823	19.9837	19.9793	19.9745	19.9711	19.9676	(88)
util rest of house													
	0.9971	0.9936	0.9840	0.9480	0.8527	0.6633	0.4664	0.5308	0.8175	0.9705	0.9941	0.9977	(89)
MIT 2	17.7973	18.0617	18.4974	19.1052	19.6065	19.8979	19.9683	19.9597	19.7645	19.0995	18.3508	17.7655	(90)
Living area fraction											fLA = Living area / (4) =	0.2500	(91)
MIT	18.1385	18.3882	18.8002	19.3757	19.8560	20.1424	20.2177	20.2067	20.0066	19.3685	18.6602	18.1075	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1385	18.3882	18.8002	19.3757	19.8560	20.1424	20.2177	20.2067	20.0066	19.3685	18.6602	18.1075	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9954	0.9903	0.9780	0.9384	0.8476	0.6776	0.4959	0.5592	0.8193	0.9631	0.9911	0.9963	(94)
Useful gains	867.2701	1024.7690	1162.5734	1301.0157	1279.0912	1019.3380	712.0766	735.7849	961.7362	948.4447	858.2133	825.0749	(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													
	2871.3741	2792.8637	2541.6724	2143.8466	1666.0831	1122.6010	732.7582	769.8146	1200.3043	1791.2120	2370.1843	2862.3834	(97)
Space heating kWh													
	1491.0534	1188.1596	1026.0496	606.8383	287.9220	0.0000	0.0000	0.0000	0.0000	627.0189	1088.6191	1515.7575	(98a)
Space heating requirement - total per year (kWh/year)												7831.4183	
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													
	1491.0534	1188.1596	1026.0496	606.8383	287.9220	0.0000	0.0000	0.0000	0.0000	627.0189	1088.6191	1515.7575	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7831.4183	
Space heating per m2											(98c) / (4) =	43.4114	(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 %)												92.4000	(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													
	1491.0534	1188.1596	1026.0496	606.8383	287.9220	0.0000	0.0000	0.0000	0.0000	627.0189	1088.6191	1515.7575	(98)
Space heating efficiency (main heating system 1)													
	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)													
	1613.6942	1285.8870	1110.4433	656.7514	311.6039	0.0000	0.0000	0.0000	0.0000	678.5919	1178.1592	1640.4302	(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													
	257.8306	227.8856	241.9755	212.6912	206.0869	185.6260	183.2417	190.6213	192.8082	215.0703	228.7446	255.0271	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.5182	87.3937	87.1195	86.4958	85.0980	80.3000	80.3000	80.3000	80.3000	86.5331	87.2770	87.5496	(217)
Fuel for water heating, kWh/month													
	294.6023	260.7574	277.7513	245.8976	242.1761	231.1657	228.1964	237.3864	240.1099	248.5412	262.0905	291.2944	(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	39.5935	31.7633	28.5994	20.9531	16.1848	13.2231	14.7643	19.1912	24.9275	32.7062	36.9416	40.6939	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-17.3695	-26.6518	-41.6377	-50.9929	-58.7336	-56.1783	-55.4682	-50.4650	-42.3865	-32.2049	-19.8399	-14.7739	(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	-4.1835	-9.1332	-18.8083	-29.2610	-39.7336	-40.3456	-39.9011	-33.3180	-23.8033	-13.4076	-5.6898	-3.2857	(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	8475.5610 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	80.3000
Water heating fuel used	3059.9690 (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)	319.5418 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-727.5729 (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	11213.4989 (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	8475.5610	0.2100	1779.8678	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3059.9690	0.2100	642.5935	(264)
Space and water heating			2422.4613	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	319.5418	0.1443	46.1198	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-466.7022	0.1329	-62.0163	
PV Unit electricity exported	-260.8707	0.1249	-32.5729	
Total			-94.5892	(269)
Total CO2, kg/year			2385.9211	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.2300	(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	8475.5610	1.1300	9577.3839	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3059.9690	1.1300	3457.7650	(278)
Space and water heating			13035.1489	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	319.5418	1.5338	490.1239	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-466.7022	1.4910	-695.8584	
PV Unit electricity exported	-260.8707	0.4583	-119.5510	
Total			-815.4094	(283)
Total Primary energy kWh/year			12839.9642	(286)
Target Primary Energy Rate (TPER)			71.1700	(287)