

FLINT ENERGY

SUSTAINABILITY & ENERGY STATEMENT

2 Sandringham Road, London, N22 6RB

DOCUMENT CONTROL

VERSION	PRODUCED BY	REVIEWED BY	ISSUED BY
1.0	Yogesh V Nadgouda	Charlotte Mellows	Dion Mellows

VERSION	DATE	PROJECT STAGE	STATUS	DESCRIPTION
1.0	19/06/2023	Strategic Design	The issue for Planning Submission	Initial report as per the proposed layout drawings

Contents

1. EXECUTIVE SUMMARY 2

2. INTRODUCTION & SITE CONTEXT 4

3. ROAD TO SUSTAINABILITY 6

 3.1 National-Level Planning Policy..... 6

 3.2 Local Planning Policy 7

4. CONCLUSION FROM SUSTAINABILITY APPRAISAL 8

 4.1 Re-use of Land and Buildings 8

 4.2 Conserve Energy, Water and Other Resources 8

 4.3 Conserve & Enhance the Natural Environment & Biodiversity..... 8

 4.4 Climate Change Adaptation and Resilience 8

 4.5 Climate Change Mitigation & Adaptation measures..... 8

5. GUIDING PRINCIPLES FOR BUILDING SERVICES SYSTEM SELECTION..... 10

 5.1 Assessment and Analysis 10

 5.2 Baseline Emissions 10

 5.3 Lean Measures 10

 5.4 Clean Measures 11

 5.5 Green Measures 11

6. SAP MODEL INPUT PARAMETERS 12

7. SUMMARY OF MODELLING RESULTS 13

 7.1 Building Regulations Part L 2021 13

8. CONCLUSION 14

9. APPENDIX A Renewable Energy Analysis..... 15

 9.1 Photovoltaic Viability Flowchart..... 15

 9.2 Solar Water Heating..... 16

 9.3 Biomass Heating..... 16

 9.4 Ground Source Heating..... 17

 9.5 Air Source Heating 17

10. Appendix B Sap Output sheet..... 18

Table of Tables

Table 1: Carbon Dioxide Emissions for Residential Buildings 3

Table 2: Regulated Residential Carbon Dioxide Savings 3

Table 3: Building Regulations Approved Document L Volume 1, 2021 Notional Building Energy Performance Ratings 10

Table 4: Comparison of SAP Model Input Parameters 12

Table 5: Comparison of SAP Model Input Parameters 12

Table 6: Carbon Dioxide Emissions for Residential Buildings 13

Table 7: Regulated Residential Carbon Dioxide Savings 13

Table of Figures

Figure 1: Domestic Part L 2021 Carbon Emissions 3

Figure 2: Aerial Image of Existing Site 4

Figure 3: Location Plan 4

Figure 4: Block Plans..... 5

Figure 5: The Proposed Gas, Elevations and Sections..... 5

Figure 9: Domestic Part L 2021 Carbon Emissions..... 13

Figure 10: Photovoltaic Solar Electricity Potential in Southern UK 15

Figure 11: AQMA (Air Quality Management Areas) Map..... 16

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 Haringey. The site is located on the land at 2 Sandringham Road, London, N22 6RB. The applicant wishes to redevelop existing garage to provide a family house.

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 (CO₂) 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 'Stanway Little Associates'.

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

The following energy efficiency measures are proposed:

- Low u-values and air permeability rates for the building fabric
- Main gas combi boiler for space heating and water heating
- Time temperature & zone control 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
- 100% Low energy lighting
- Balanced Mechanical Ventilation with Heat recovery
- 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.
- Enhanced 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 solar photovoltaic renewable technology is not proposed for the proposed site. The various low and zero-carbon technologies were investigated and these have been described within this report.

CO₂ 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)	1.07	0.40	1.48
After energy demand reduction (B)	0.87	0.40	1.27
After heat network / CHP (C)	0.87	0.40	1.27
After renewable energy (D)	0.12	0.40	0.53

Table 2: Regulated Residential Carbon Dioxide Savings

SAP 10.2 CO2 PERFORMANCE	Regulated domestic carbon dioxide savings		
		Tonnes CO2 per annum	%
Be Lean: Savings from energy demand reduction	A-B	0.20	18.98%
Be Clean: Savings from heat network / CHP	B-C	0.00	0.00%
Be Green: Savings from renewable energy	C-D	0.75	69.40%
Cumulative on site savings (E)	A-D	0.95	88.38%
Carbon Shortfall (F)	A-E	0.12	-
	(Tonnes CO2)		
Cumulative Savings for offset Payment (G)	-		
Cash-in-Lieu Contribution (£)	-		

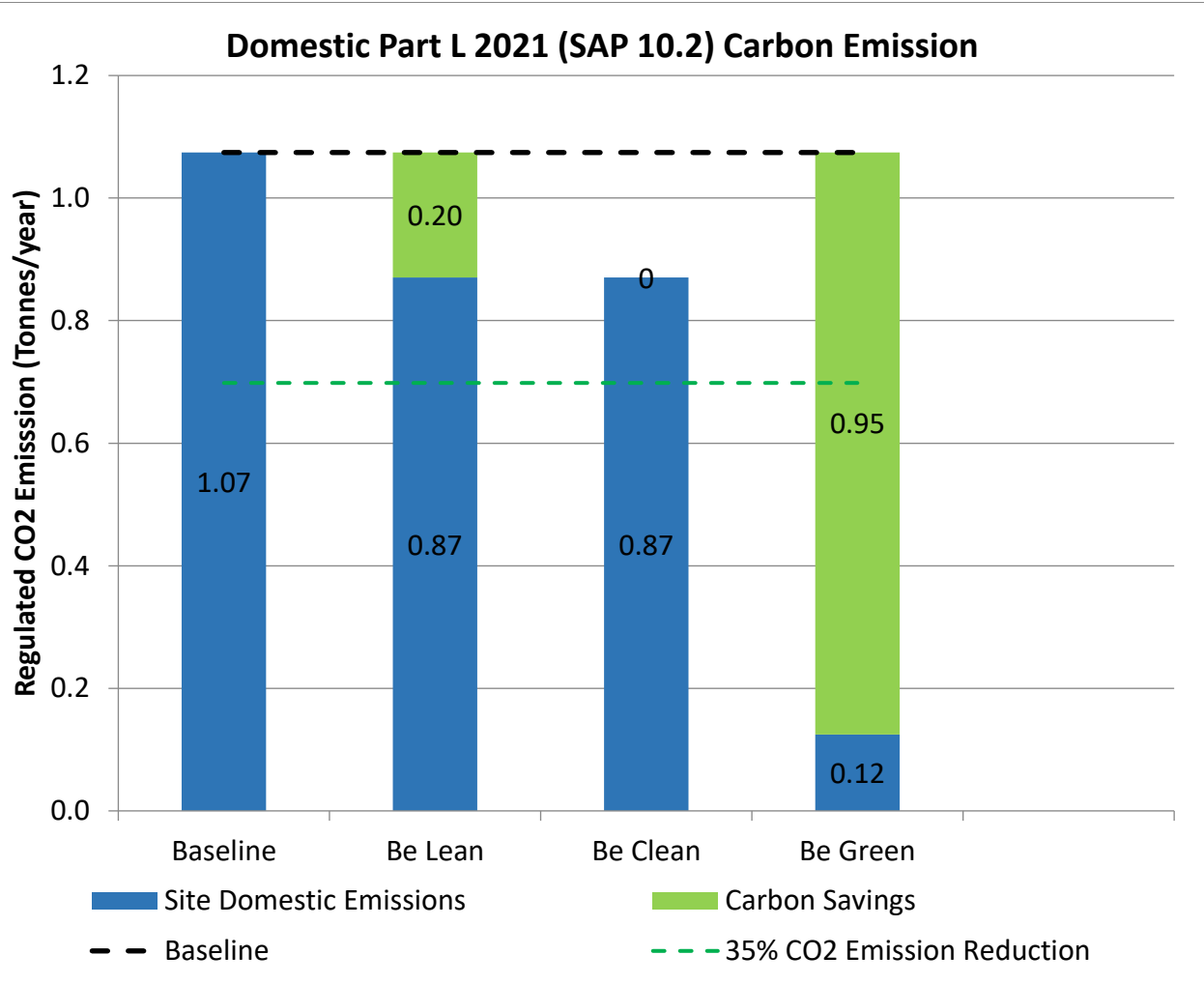


Figure 1: Domestic Part L 2021 Carbon Emissions

- The proposed development achieves a cumulative saving of 0.95 Tonnes of CO2 per annum which is 88.38 % 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 Haringey. The site is located on the land at 2 Sandringham Road, London, N22 6RB. The applicant wishes to redevelop existing garage to provide a family house.

The purpose of this document is to highlight the sustainable and energy-efficiency 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.

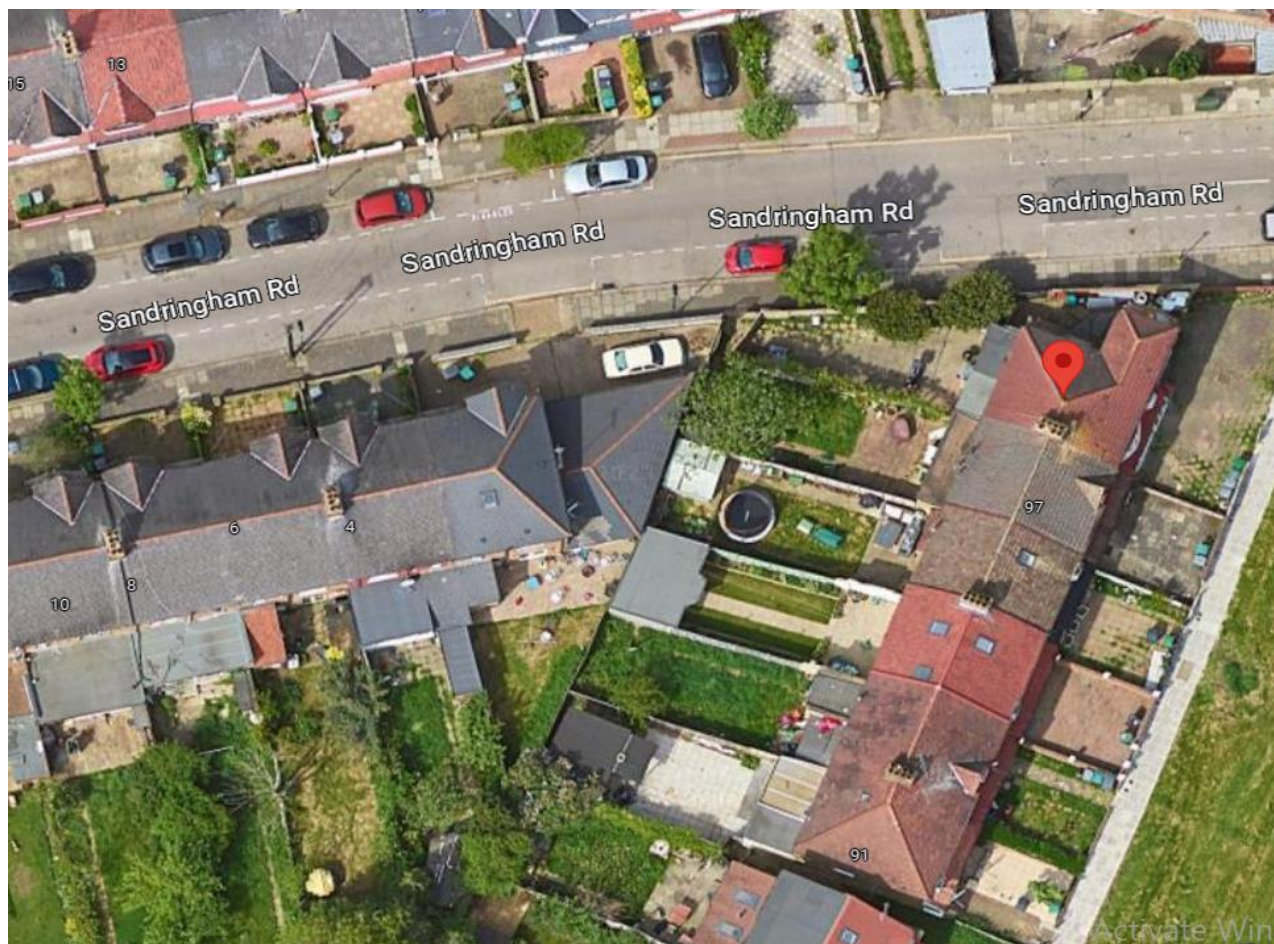


Figure 2: Aerial Image of Existing Site

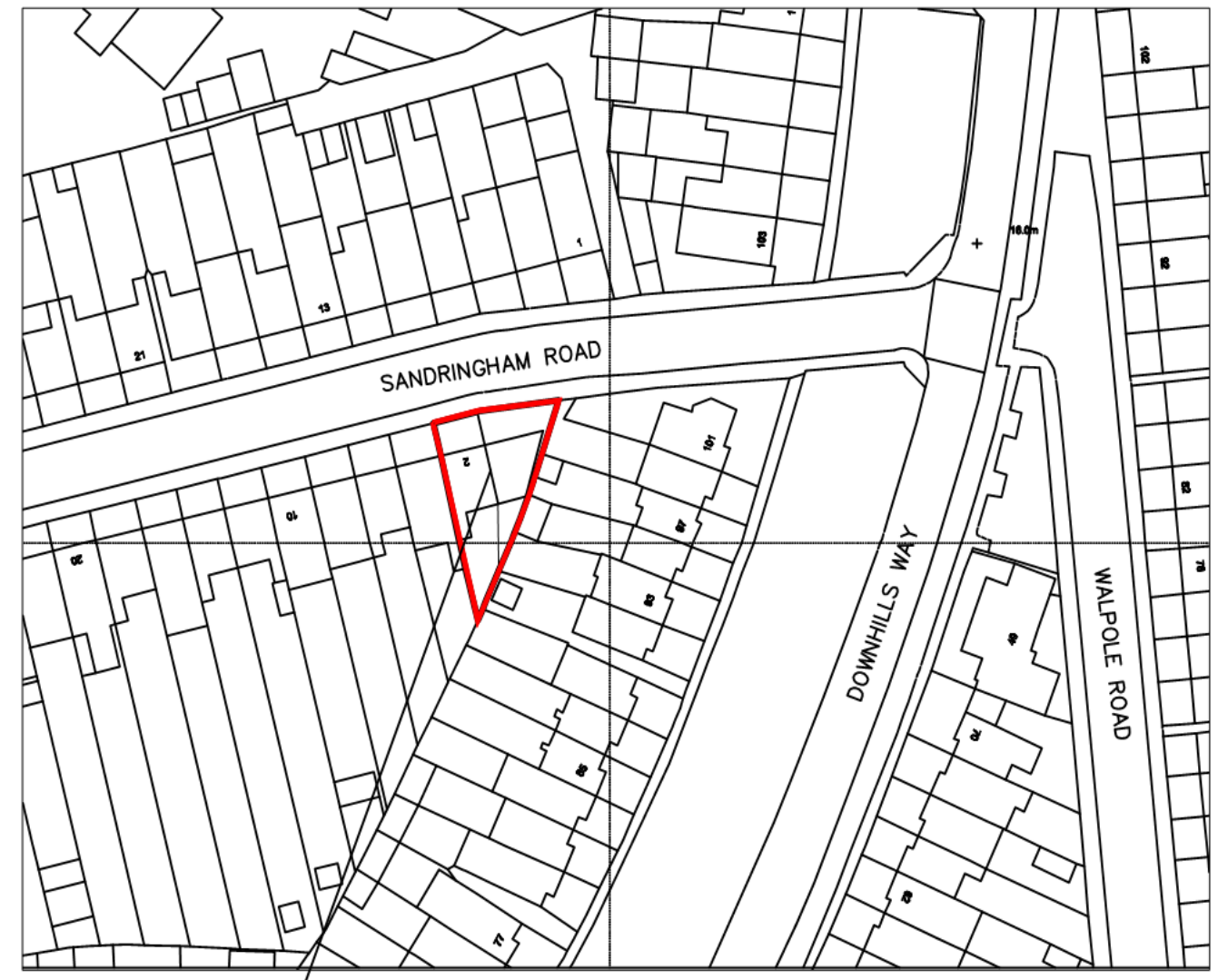


Figure 3: Location Plan

The site is in busy area of Sandringham Road. The site is surrounded by various residential developments. The applicant wishes to redevelop existing garage to provide a family house.



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.

A series of design team meetings commenced in May 2023 and were used to discuss sustainability options and initiatives for the development. The aim was of these meetings was to maximise the contribution of the scheme to sustainable development within the site and local area constraints.

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.

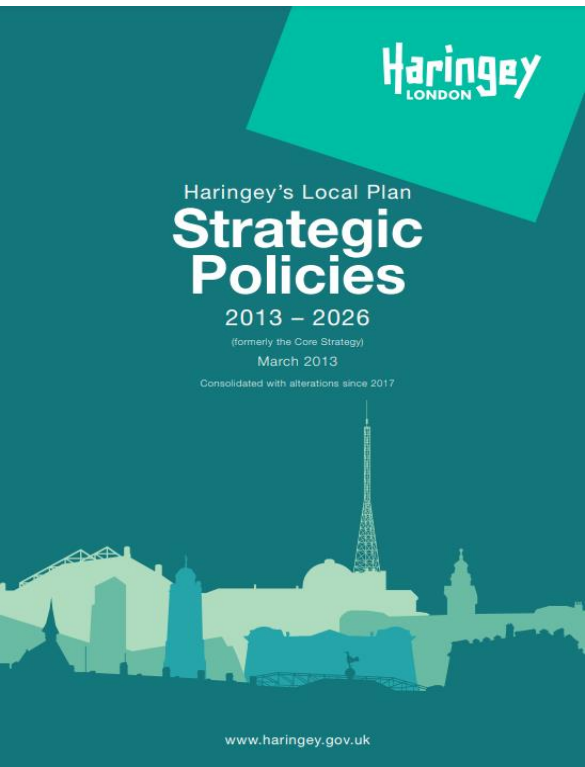
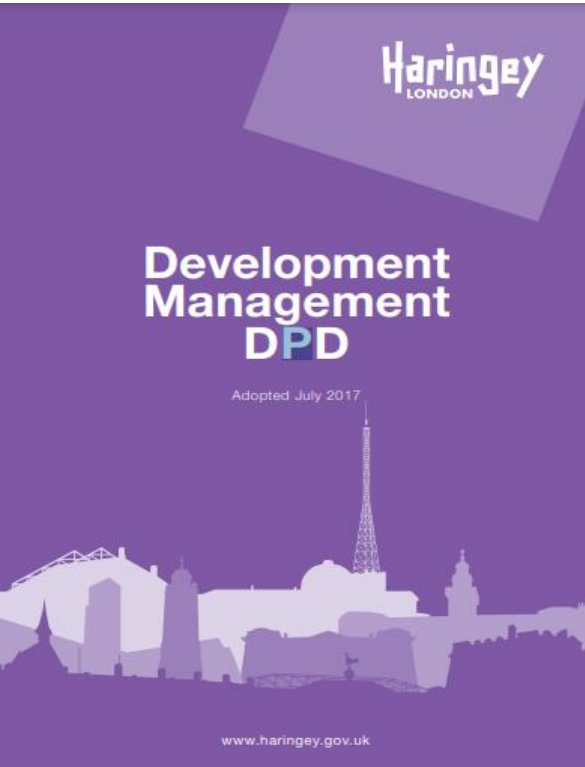


Some of the main objectives of the Governments planning framework concerning sustainability are:

- 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 Governments 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 LOCAL PLANNING POLICY

Haringey's development plan is currently made up of the Strategic Policies, Development Management Policies, Site Allocations and Tottenham Area Action Plan, alongside the London Plan and the North London Waste Plan.



The implications of our actions on the environment are increasingly clear and action is needed at global, national and local levels. Climate change means that in the future London will experience hotter summers and wetter winters. Weather events which are considered as extreme today are likely to become far more frequent. The biggest impact on individuals and communities will be the increasing risk of floods, droughts and heat waves. This will have implications for people’s health, safety and comfort, food production, biodiversity and infrastructure. Risks in London are set out in the Mayor’s Adaptation Strategy. The Local Plan has an important role in reducing Haringey’s environmental impact and achieving sustainable development – meeting our social, environmental and economic needs in ways that protect the environment and do not harm our ability to meet our needs in the future. An Environmentally Sustainable Future is one of the priorities of Haringey’s Sustainable Community Strategy.

SP4: WORKING TOWARDS A LOW CARBON HARINGEY

Over the life time of the Local Plan, reducing energy use in buildings and working towards a low carbon borough will be one of the key challenges facing Haringey. The Council will promote the measures outlined below to reduce carbon emissions from new and existing buildings.

- In line with London Plan policy, the Council will promote and require all new developments to take measures to reduce energy use and carbon emissions during design, construction and occupation, by incorporating the following measures:
 - From 2011 onwards, all new residential development will achieve a minimum 25% reduction in total (regulated) CO₂ emissions in line with Code for Sustainable Homes Level 4 energy standards, and should aim to achieve Level 6. All new residential development shall be zero carbon from 2016 onwards; and
 - From 2011 onwards all new non-residential development shall be built to at least BREEAM "very good" standard and should aim to achieve BREEAM "excellent" or the current nationally agreed standard. All new non-residential development shall be zero carbon from 2019.
- The Council will promote low- and zero-carbon energy generation through the following measures:
 - Requiring all developments to assess, identify and implement, where viable, site-wide and area-wide decentralised energy facilities including the potential to link into a wider network;
 - Establishing local networks of decentralised heat and energy facilities by requiring developers to prioritise connection to existing or planned networks where feasible;
 - Working with neighbouring boroughs and other partners to explore ways of implementing sub-regional decentralised energy networks including the potential in the Upper Lee Valley Opportunity Area; and
 - All new developments are required, where viable, to achieve a reduction in predicted carbon dioxide emissions of 20% from on site renewable energy regeneration, which can include connections to local sources of decentralised renewable energy.

POLICY DM21: SUSTAINABLE DESIGN, LAYOUT AND CONSTRUCTION

A All new development, including building and landscape works, will be expected to consider and implement sustainable design, layout and construction techniques. Proposals should:

- Apply the energy hierarchy to minimise energy use in order to meet, and if possible exceed, minimum carbon dioxide reduction requirements;
- Apply the cooling hierarchy to reduce the potential for overheating and limit reliance on mechanical air conditioning systems;
- Maximise opportunities to enhance biodiversity on-site, including through appropriate landscaping, Sustainable Drainage Systems, living roofs and green walls
- Wherever possible, use building materials with high environmental performance ratings; and
- Seek opportunities for locally sourced labour.

B The Council will support appropriate measures to sustainably retrofit existing homes and non-residential buildings.

C Proposals that fail to demonstrate adequate consideration for sustainable design, layout and construction techniques will be resisted.

D Consideration will be given to the use of carbon offset payments, to be secured by planning obligations, where it can be demonstrated that proposals are unable to meet carbon dioxide emission reduction targets on-site.

4. CONCLUSION FROM SUSTAINABILITY APPRAISAL

The following sections each describe the context of sustainability and then outline the main sustainability features for the proposed development, which will be included where practical.

4.1 RE-USE OF LAND AND BUILDINGS

The reuse of land and buildings are key issues within the Government's policies addressing sustainability. The national policies identify land as a scarce resource and as such, developments should seek to reuse land and empty property wherever possible, and use new land outside of the urban environment as a final option.

4.2 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:

- Low u-values and air permeability rates for the building fabric
- Electric Air source heat pump for space heating and water heating
- Time temperature & zone control 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
- 100% Low energy lighting
- Balanced Mechanical Ventilation with Heat recovery
- 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.

- Enhanced thermal bridging details

4.3 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 conservation area.

4.4 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 CO₂) 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

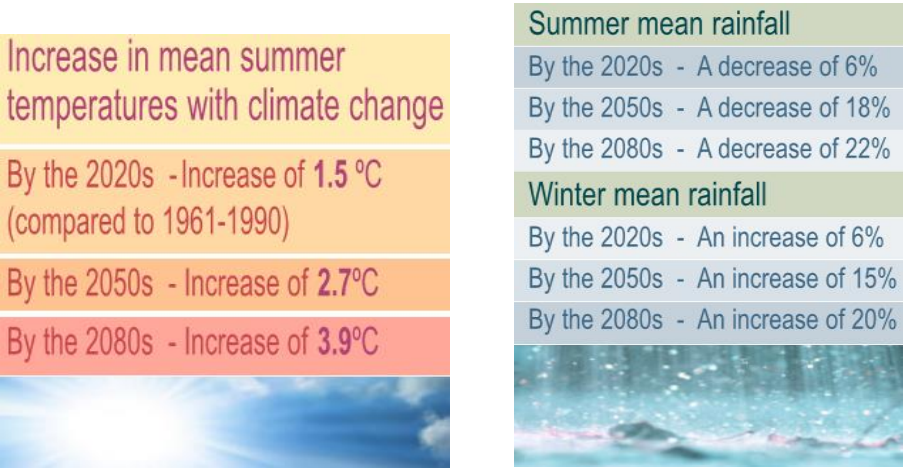
Buildings and spaces built today should respond to climate change issues and adapt to mitigation and adaptation measures. The council through its policies addresses these issues and will require to consider how their developments will function in the future in the context of changing climate

4.5 CLIMATE CHANGE MITIGATION & 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.

5. GUIDING PRINCIPLES FOR BUILDING SERVICES SYSTEM SELECTION

5.1 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 Volume1, 2021 explain 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.

5.2 BASELINE EMISSIONS

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 ADL1A 2013 notional dwelling specification is summarised in Section 5 of ADL1A and detailed in Appendix R of SAP 2012. 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

Element	Value
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 spcaces/6.5 For Flats: kWp=40% of dwelling floor area/(6.5*number of stories in block)

5.3 LEAN MEASURES

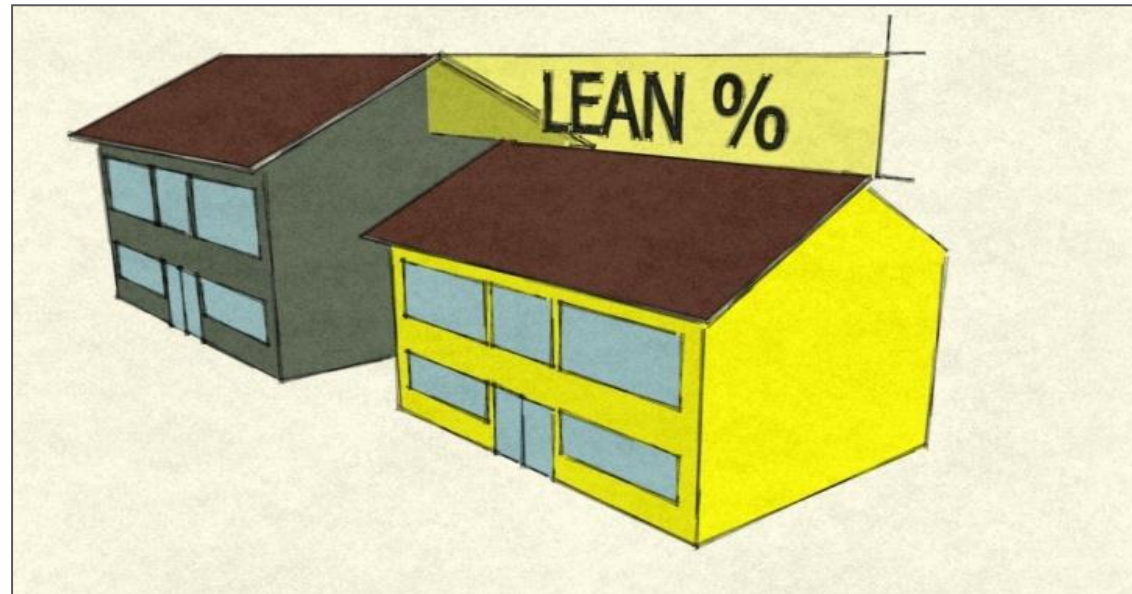
Improvements to the building fabric and building services, in comparison to the Notional performance criteria used to calculate the TER. The preferred ranges of measures are selected and the carbon dioxide emissions for a design with lean measures are calculated.

At this stage, the performance specification should demonstrate compliance with ADL1A, in respect of:

- Criterion 1 - Achieving the TER (Target Emission Rate) and TFEE (Target fabric energy efficiency)
- Criterion 2 - Limitations on design flexibility

- Criterion 3 - Limiting effects of solar heat gains in summer

Due to the limitations of the Standard Assessment Procedure (SAP), some lean measures may be incorporated that have no impact on the reported comparative predicted energy consumption or carbon dioxide emissions, for example, water-efficient showers and taps, and white goods that are 'A-rated for energy efficiency.



The thermal improvements that are considered to the base model to reduce energy demand are as follows:

- Low fabric u-values and air permeability rates. This reduces heat loss throughout the building.
- Thermal, time and zone controls. These are easily used by the occupants, reduces overheating and stop rooms from being heated when not occupied
- Windows will be sized to suit appropriate daylight levels and to reduce space heating demand. Glazing with low 'g' values will reduce overheating and reduce excessive solar gain.
- Low energy lighting- Reduce energy consumed by lighting.
- Use low water use fittings- This reduces the amount of hot water consumed and hence the energy used to produce hot water.

5.4 CLEAN MEASURES

The technical and economic feasibility of the following heating and cooling systems are then considered sequentially

- Connection to existing CCHP/CHP distribution networks
- Site-wide CCHP/CHP or hydrogen fuel cells
- Communal heating and cooling

The highest-ranking option is selected, where feasible. Due to the size of the development, the provision of CCHP/ CHP would not be feasible due to the cost of these systems and the running hours of the site heating demand.

5.5 GREEN MEASURES

This section summarises the renewable energy options reviewed for the scheme. The technologies are assessed using the methodologies outlined in the GLA Toolkit.

The system sizing suggested in this report is suitable only to provide an early indication of energy contribution and carbon dioxide emissions reduction.

The following technologies were evaluated and not considered to be viable for incorporation on this site. Details of this assessment can be found in Appendix A.

- Photovoltaic panel system
- Wind turbines
- Solar thermal heating
- Ground Source Heat Pumps
- Air Source Heat Pumps
- Biomass heating
- Hydrogen fuel cells

6. SAP MODEL INPUT PARAMETERS

The following Tables show the comparison of modelling input parameters. The notional dwelling performance is compared with the actual design dwelling performance. The design dwelling performance is iterated with the 'Be Lean' case and 'Be Green' case. No clean measures are proposed in this report. The difference in input has been mentioned in below Table

Table 4: Comparison of SAP Model Input Parameters

Elements	Notional Dwelling Performance	Dwellings Designed Performance		
		Be Lean Case	Be Clean Case	Be Green Case
External Wall (W/m².K)	0.18	0.18	Not applicable	0.18
Roof (W/m².K)	0.11	0.12		0.15
Floor (W/m².K)	0.13	0.12		0.18
Windows (W/m².K)	1.40	1.20		1.20
Roof light (W/m².K)	1.40	1.20		1.20
Thermal Bridging, Y value	SAP , Table K1	0.05		0.05
Thermal Mass	Medium	Medium		Medium
Air Permeability, m³.hr/m²	5 at 50 Pa	5 at 50 Pa		5 at 50 Pa
Ventilation	Natural	Balanced Mechanical Ventilation with Heat Recovery - Nuaire MRXBOXAB-ECO5		Balanced Mechanical Ventilation with Heat Recovery - Nuaire MRXBOXAB-ECO5
Low Energy Lighting %	Lm=185 X TFA Efficacy = 80lm/W	100% Low Energy Lighting		100% Low Energy Lighting
Space Heating	SEDBUK 2009 Boiler	SAP Table_Main Gas Combi Boiler		SAP Table_Air Source Heat Pump

Table 5: Comparison of SAP Model Input Parameters

Elements	Notional Dwelling Performance	Dwellings Designed Performance		
		Be Lean Case	Be Clean Case	Be Green Case
Heating Controls	Time and temperature zone control with a weather compensator	Time and Temperature Zone Control	Not applicable	Time and Temperature Zone Control
Hot Water Heating	From Main Gas Boiler	From Main Heating 1		From Main Heating 1
Photovoltaic System Units (kWh/year)	Not applicable	Not applicable		Not Proposed

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.

7. SUMMARY OF MODELLING RESULTS

7.1 BUILDING REGULATIONS PART L 2021

Table 6: 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)	1.07	0.40	1.48
After energy demand reduction (B)	0.87	0.40	1.27
After heat network / CHP (C)	0.87	0.40	1.27
After renewable energy (D)	0.12	0.40	0.53

Table 7: Regulated Residential Carbon Dioxide Savings

SAP 10.2 CO2 PERFORMANCE	Regulated domestic carbon dioxide savings		
		Tonnes CO2 per annum	%
Be Lean: Savings from energy demand reduction	A-B	0.20	18.98%
Be Clean: Savings from heat network / CHP	B-C	0.00	0.00%
Be Green: Savings from renewable energy	C-D	0.75	69.40%
Cumulative on site savings (E)	A-D	0.95	88.38%
Carbon Shortfall (F)	A-E	0.12	-
	(Tonnes CO2)		
Cumulative Savings for offset Payment (G)		-	
Cash-in-Lieu Contribution (£)		-	

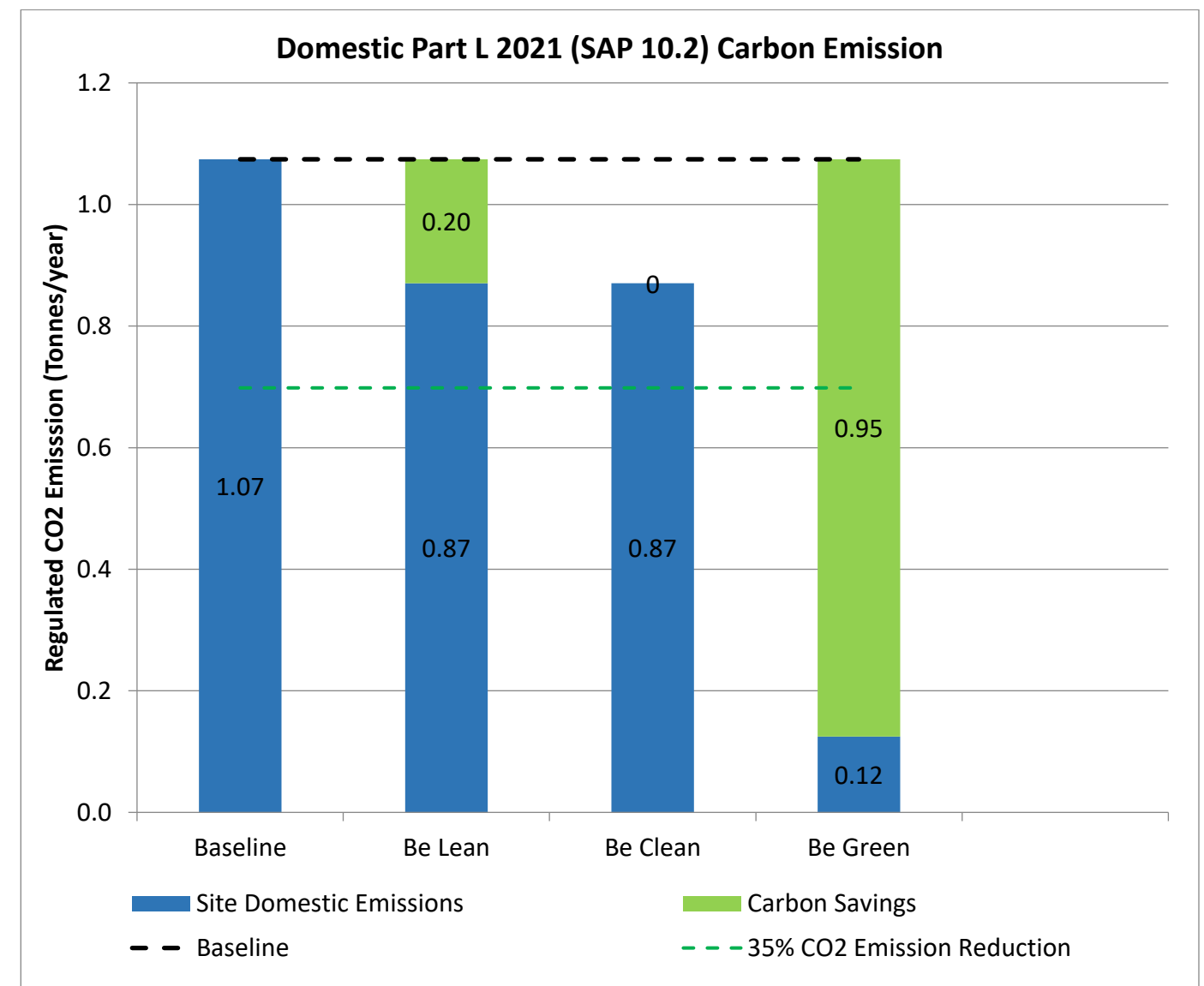


Figure 6: Domestic Part L 2021 Carbon Emissions

- The proposed development achieves a cumulative saving of 0.95 Tonnes of CO2 per annum which is 88.38 % improvement over a baseline Part L 2021 of the building regulation-compliant development.

8. CONCLUSION

This report represents the energy and sustainability statement for a full planning application proposal in the London Borough of Haringey. The site is located on the land at 2 Sandringham Road, London, N22 6RB. The applicant wishes to redevelop existing garage to provide a family house.

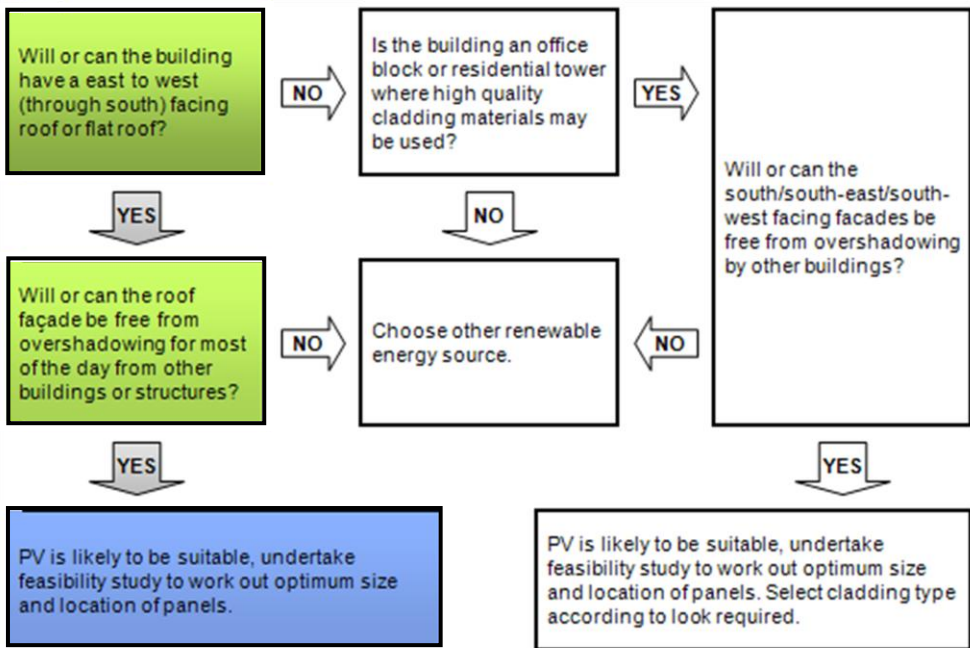
The new residential unit will be compared with the notional dwelling set under the Building Regulations Approved Document Part L 2021 edition. The site is not suitable for an on-site Combined Heat and Power (CHP) system due to the size of the development. The solar photovoltaic renewable technology is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

- SAP10.2 CO2 emission results
 - The proposed development achieves a cumulative saving of **0.95 Tonnes of CO2 per annum** which is **88.38 % 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.

9. APPENDIX A RENEWABLE ENERGY ANALYSIS

9.1 PHOTOVOLTAIC VIABILITY FLOWCHART



Photovoltaic arrays can be either installed as standalone pitched units or incorporated into the building fabric, with both roof and facade integrated products available. The optimum positioning for photovoltaic arrays in the UK is typically a southerly orientation at a 30° pitch, with efficiency decreasing moving away from the configuration.

Array efficiency can also be greatly affected by shading and the shadow path throughout the day must also be considered. Standalone pitched arrays must be spaced to avoid shading between units.

Figure illustrates that London has a global irradiation level of 1200kWh/m² with typical PV conversion efficiencies of crystalline modules of between 9-14%.

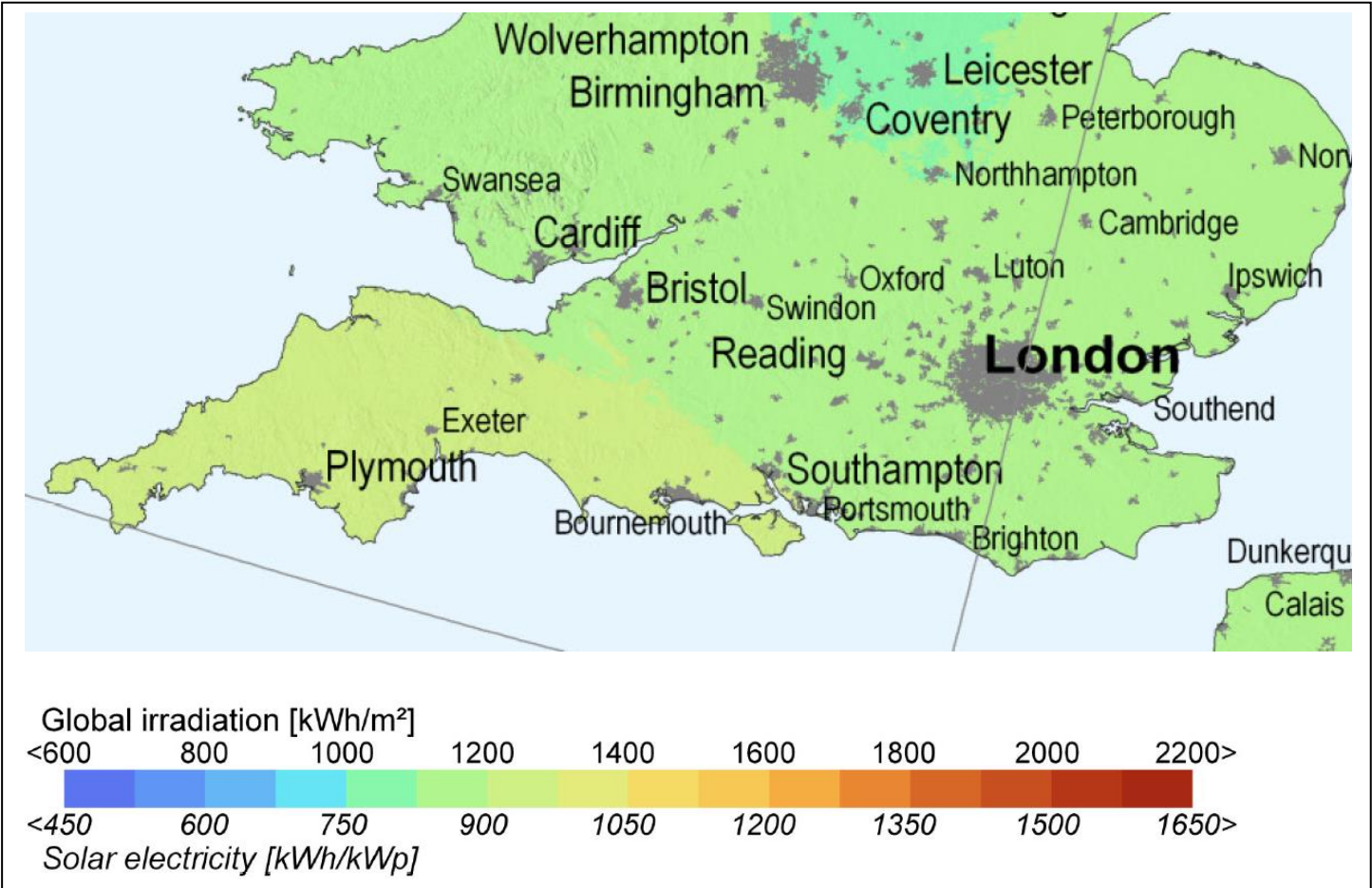
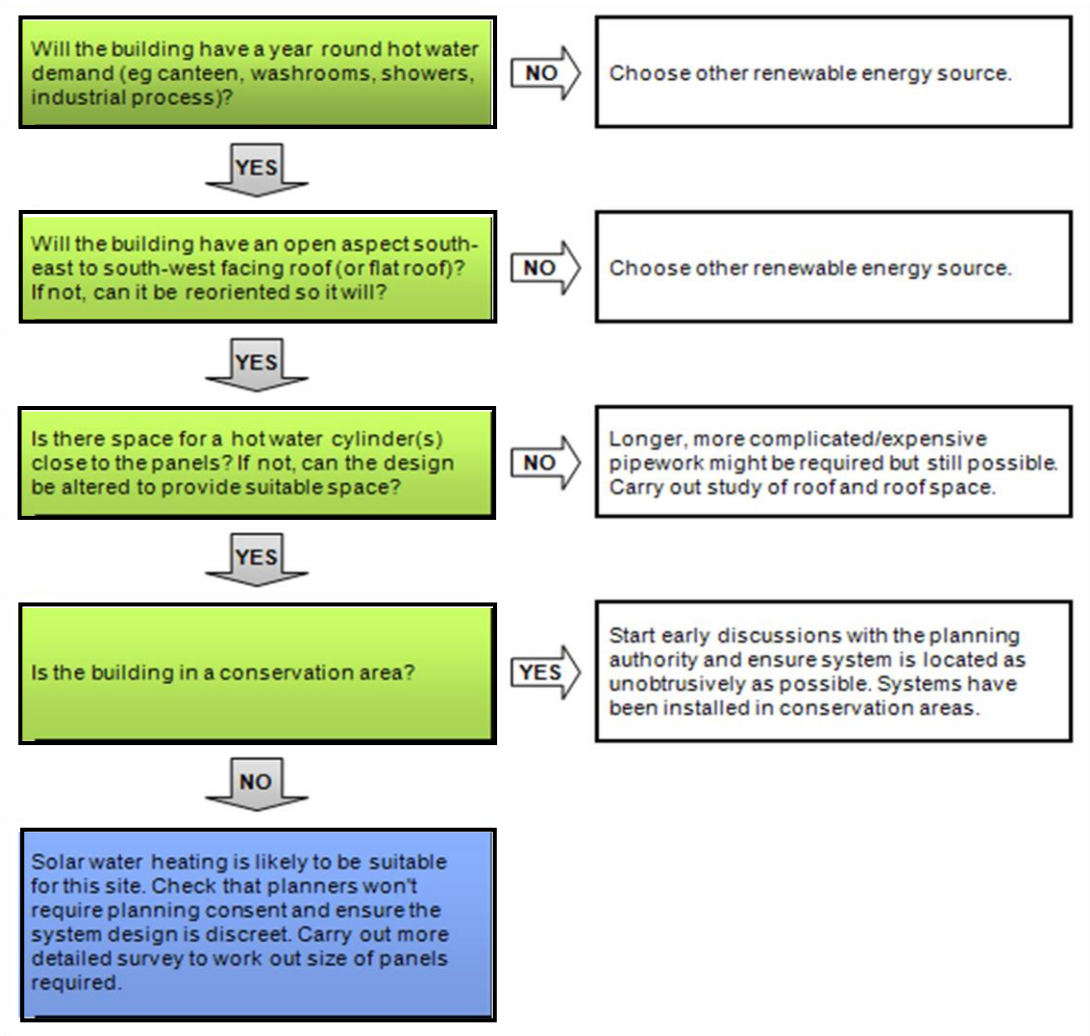


Figure 7: Photovoltaic Solar Electricity Potential in Southern UK

The Photovoltaic (PV) is not proposed for this new domestic development.

9.2 SOLAR WATER HEATING



Solar thermal panels are ideal for contributing to the domestic hot water demand of the building where which is separated from the main space heating. In this development space heating is generated through an efficient Air Source Heat Pump.

9.3 BIOMASS HEATING

Biomass is a fuel that powers the boiler and hence a constant supply and storage of fuel will be required. This will require a loading bay, regular access for the delivery and additional plant room space. Biomass boilers have a much larger footprint than conventional gas boilers and also require backup gas boilers in the event of a breakdown, failure of fuel delivery and maintenance downtime. Biomass wood pellets are delivered by truck, of up to 18-tonne carrying capacity. The smallest

available delivery vehicle for the London region is a 20ft long by 8.6ft wide 4-wheel rigid tanker. Delivery of wood pellets may lead to associated problems with noise and dust. Currently, there are local supplies available; however, consideration will have to be given to the transportation of biomass supply to prevent further carbon dioxide emissions. As the fuel is relatively new, the security of supply and cost of fuel cannot be confirmed. Wood pellets on average cost approximately £250/tonne. Biomass boilers produce high levels of NO_x, SO_x and particulate matter (PM₁₀) in their flue discharge and are discouraged in urban areas due to problems with poor air quality. This is particularly relevant in the centre of London (including the City of London) as this has been designated an air quality management area for particulate matter.

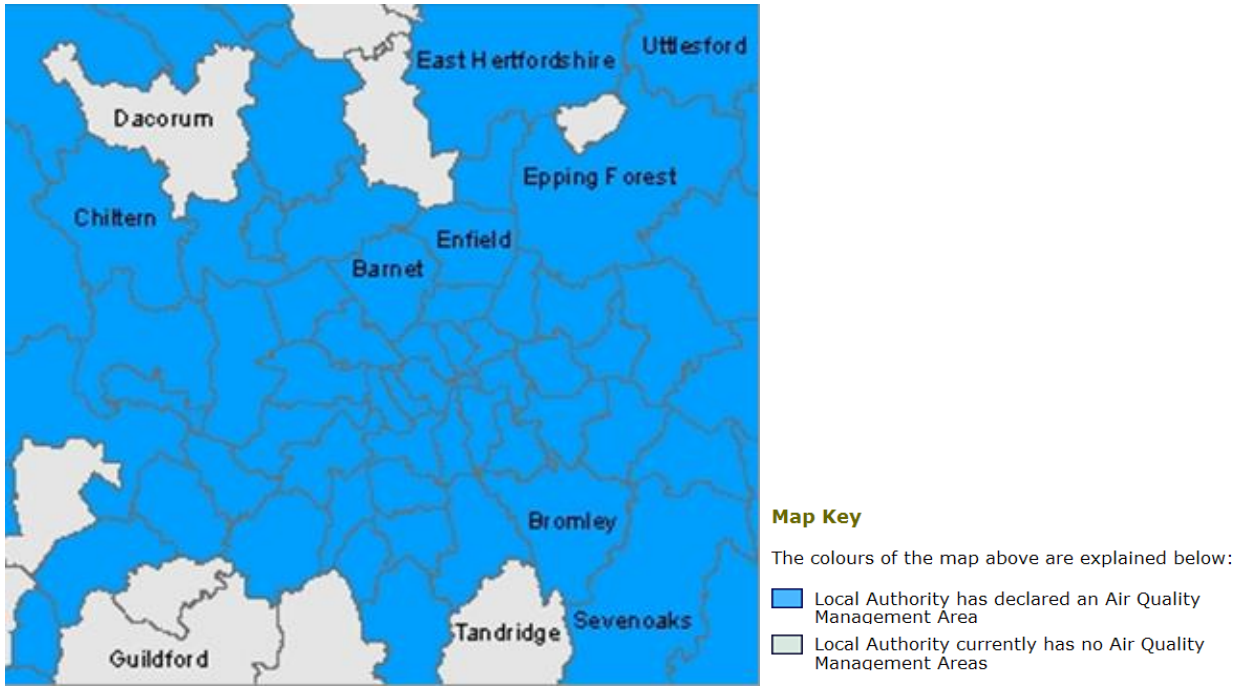


Figure 8: AQMA (Air Quality Management Areas) Map

Due to the heating being provided by an ASHP and the area being residential the potential impacts of the pollutants could be problematic and cause health risks to local tenants.

9.4 GROUND SOURCE HEATING

There are two main types of ground source systems available, they are namely:

- Closed-loop horizontal array
- Open-loop or Closed-loop vertical boreholes

Ground-source heating systems use loops of pipework that draw energy from a heat sink, either a water source or the surrounding earth. The system provides low-grade heat which is well suited for slow-response systems such as underfloor heating.

Horizontal Systems

Horizontal systems are made of lengths of pipework laid in trenches, as shallow as 1.5-2m depth. The site boundary for this development is limited to the building footprint so there is no scope for a horizontal system.

Vertical Systems

Vertical systems use pipework loops, usually buried beneath the building in boreholes, 70-120m in depth. These ideally need balanced heating and cooling demand, which is not the case for this building due to the limited amount of cooling provided (only provided to marketable apartments).

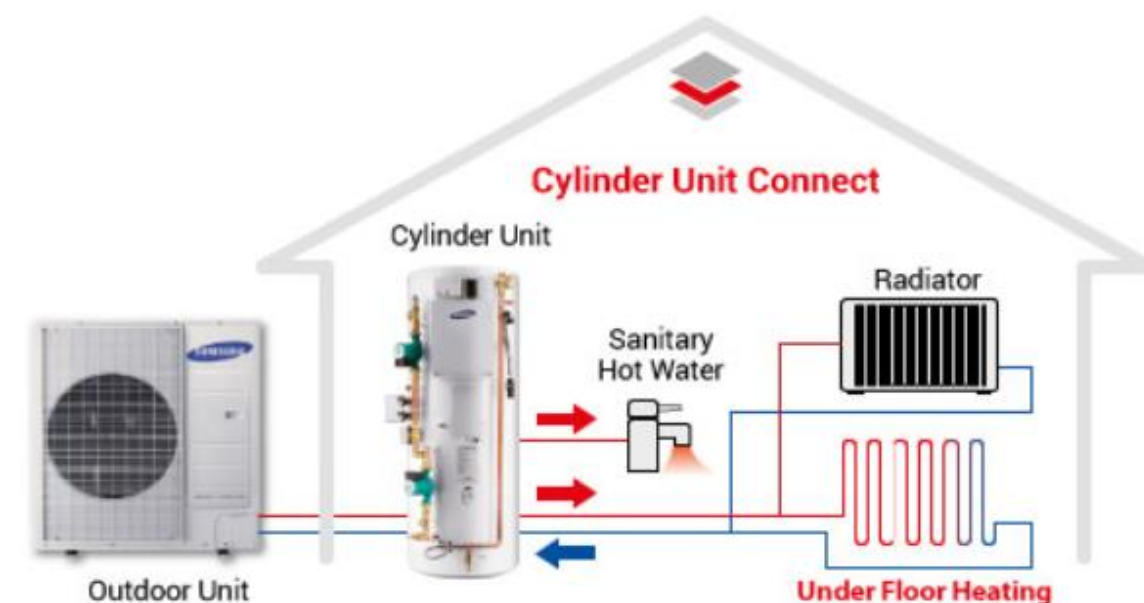
Closed-loop vertical systems are typically located within boreholes outside of the building footprint. The provision of a closed-loop system would require extensive studies of the ground conditions to ensure ground stability and predicted heat exchange rates. Due to the size and footprint of the site vertical boreholes are not deemed suitable for development. Ground source heat pump systems come with a technical risk, where the inaccessible pipework can be subject to collapse. The ground source heat pump is not feasible for this proposed development; however, this is subject to a manufactures survey of the property.

9.5 AIR SOURCE HEATING

An Air Source Heat Pump absorbs heat from the outside air and transfers it to the inside of the building via a vapour compression refrigerant system. This heat is released inside the building as hot air, water-filled radiators, underfloor heating and domestic hot water supply. An ASHP can offer a full central heating solution and domestic water up to 80 deg C. The main components of an ASHP are

- The outdoor heat exchanger coil extracts the heat from ambient air
- The indoor heat exchanger transfers the heat to the inside of the space

ASHP can provide fairly low-cost space heating. A high-efficiency heat pump can provide up to four times as much heat as an electric resistance heater. It uses a small amount of electricity to transfer a large amount of heat. A standard domestic ASHP can extract heat down to about -15 deg C. At colder temperatures, the ASHP is less efficient.



The benefits of ASHP

- Space heating and provide hot water
- Virtually, no maintenance
- Easier to install than Ground Source Heat Pump

ASHP system is proposed for space heating and water heating solutions for this development, however, this is subject to a manufactures survey of the property

10.APPENDIX B SAP OUTPUT SHEET

10.APPENDIX B SAP OUTPUT SHEET

Summary for Input Data

Property Reference	Rev 01_Green Case		Issued on Date	01/06/2023
Assessment Reference	Rev 01_Copy	Prop Type Ref	Flat	
Property	2 Sandringham Road, London, England, N22 6RB			

SAP Rating	81 B	DER	4.66	TER	12.14
Environmental	96 A	% DER < TER			61.61
CO ₂ Emissions (t/year)	0.34	DFEE	35.96	TFEE	41.52
Compliance Check	See BREL	% DFEE < TFEE			13.40
% DPER < TPER	23.21	DPER	48.74	TPER	63.47

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

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

Orientation	North
Property Tenture	ND
Transaction Type	5
Terrain Type	Urban
1.0 Property Type	Flat, Semi-Detached
Position of Flat	Ground-floor flat
Which Floor	0
2.0 Number of Storeys	2
3.0 Date Built	2023
4.0 Sheltered Sides	1
5.0 Sunlight/Shade	Average or unknown
6.0 Thermal Mass Parameter	Enter TMP value
Thermal Mass	250.00 kJ/m ² K
7.0 Electricity Tariff	Standard
Smart electricity meter fitted	Yes
Smart gas meter fitted	Yes

7.0 Measurements	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Basement:	0.00 m	0.00 m ²	0.00 m
Ground floor:	19.74 m	43.41 m ²	2.60 m
1st Storey:	18.78 m	41.99 m ²	2.85 m
2nd Storey:	0.00 m	0.00 m ²	0.00 m
3rd Storey:	0.00 m	0.00 m ²	0.00 m
4th Storey:	0.00 m	0.00 m ²	0.00 m
5th Storey:	0.00 m	0.00 m ²	0.00 m
6th Storey:	0.00 m	0.00 m ²	0.00 m
7th Storey:	0.00 m	0.00 m ²	0.00 m

8.0 Living Area	17.11 m ²
-----------------	----------------------

9.0 External Walls	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Res	Shelter	Openings	Area Calculation Type
	Low External Wall	Cavity Wall	Cavity wall : dense plaster, dense block, filled cavity, any outside structure	0.18	190.00	51.32	39.36	0.00	None	11.96	Enter Gross Area
	+1 External Wall	Cavity Wall	Cavity wall : dense plaster, dense block, filled cavity, any outside structure	0.18	190.00	53.52	44.67	0.00	None	8.85	Enter Gross Area

9.1 Party Walls	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)	Shelter Res	Shelter
	Low Party Wall	Filled Cavity with Edge Sealing	Dense plaster both sides, dense blocks, cavity or cavity fill	0.00	180.00	21.79	0.00	None
	+1 Party Wall	Filled Cavity with Edge Sealing	Dense plaster both sides, dense blocks, cavity or cavity fill	0.00	180.00	21.32	0.00	None

10.0 External Roofs	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Code	Shelter Factor	Calculation Type	Openings
---------------------	-------------	------	--------------	------------------------------	-----------------------------	-----------------------------	-----------------------------	--------------	----------------	------------------	----------

Summary for Input Data



Low External Roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.12	9.00	2.79	0.00	None	0.00	Enter Gross Area	0.00
+1 External Roof	External Flat Roof	Plasterboard, insulated flat roof	0.12	9.00	41.99	0.00	None	0.00	Enter Gross Area	0.00

11.0 Heat Loss Floors

Description	Type	Storey Index	Construction	U-Value (W/m²K)	Shelter Code	Shelter Factor	Kappa (kJ/m²K)	Area (m²)
Low Heatloss Floor	Ground Floor - Solid	Lowest occupied	Slab on ground, screed over insulation	0.12	None	0.00	110.00	43.41

12.0 Opening Types

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

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
Low N1	Glazing	Low External Wall	North	0.58	0
Low N2	Glazing	Low External Wall	North	1.88	0
Low N3	Glazing	Low External Wall	North	0.58	0
Low N4	Glazing	Low External Wall	North	4.87	0
Low S1	Glazing	Low External Wall	South	1.01	0
Low S2	Glazing	Low External Wall	South	1.72	0
Low W1	Glazing	Low External Wall	West	1.32	0
+1 N1	Glazing	+1 External Wall	North	1.83	0
+1 N2	Glazing	+1 External Wall	North	0.88	0
+1 N3	Glazing	+1 External Wall	North	2.57	0
+1 N4	Glazing	+1 External Wall	North	0.88	0
+1 S1	Glazing	+1 External Wall	South	1.83	0
+1 S2	Glazing	+1 External Wall	South	0.86	0

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E1 Steel lintel with perforated steel base plate		13.09	0.00	0.00	Yes
E3 Sill		13.09	0.00	0.00	Yes
E4 Jamb		42.86	0.00	0.00	Yes
E5 Ground floor (normal)		19.74	0.00	0.00	Yes
E6 Intermediate floor within a dwelling		18.78	0.00	0.00	Yes
E14 Flat roof		18.78	0.00	0.00	Yes
E16 Corner (normal)		10.90	0.00	0.00	Yes
E18 Party wall between dwellings		10.90	0.00	0.00	Yes

Y-value W/m²K

Description

18.0 Pressure Testing

Designed AP₅₀ m³/(h.m²) @ 50 Pa

Property Tested?

Test Method

As Built AP₅₀ m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present

Approved Installation

Mechanical Ventilation data Type

Type

MV Reference Number

Configuration

Manufacturer SFP

Duct Type

MVHR Efficiency

Wet Rooms

SFP from Installer Commissioning Certificate

Summary for Input Data



MVHR System Location

Duct Installation Specification

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System

22.0 Lighting

No Fixed Lighting

24.0 Main Heating 1

SAP table	SAP table	
Description	ASHP	
Percentage of Heat	100.00	%
Database Ref. No.	0	
Fuel Type	Electricity	
SAP Code	214	
In Winter	170.00	
In Summer	170.00	
Model Name	TBC	
Manufacturer	TBC	
System Type	TBC	
Controls SAP Code	2210	
Delayed Start Stat	No	
HETAS approved System	No	
Oil Pump Inside	No	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heating Pump Age	2013 or later	
Heat Emitter	Radiators	
Flow Temperature	Enter value	
Flow Temperature Value	35.00	
Boiler Interlock	No	
Combi boiler type	Standard Combi	
Combi keep hot type	Electric, time clock	

25.0 Main Heating 2

26.0 Heat Networks

	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
Solar Panel	No
Water use <= 125 litres/person/day	Yes

Summary for Input Data



Summer Immersion	No
Cold Water Source	From mains
Bath Count	3
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

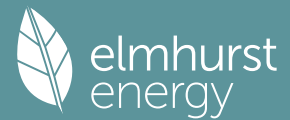
Lower cost measures

None

Further measures to achieve even higher standards

None

Full SAP Calculation Printout



Property Reference	Rev 01_Green Case				Issued on Date	01/06/2023
Assessment Reference	Rev 01_Copy	Prop Type Ref		Flat		
Property	2 Sandringham Road, London, England, N22 6RB					
SAP Rating	81 B	DER	4.66	TER	12.14	
Environmental	96 A	% DER < TER				61.61
CO ₂ Emissions (t/year)	0.34	DFEE	35.96	TFEE	41.52	
Compliance Check	See BREL	% DFEE < TFEE				13.40
% DPER < TPER	23.21	DPER	48.74	TPER	63.47	
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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.4100 (1b)	x 2.6000 (2b)	= 112.8660 (1b) -
First floor	41.9900 (1c)	x 2.8500 (2c)	= 119.6715 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	232.5375 (5)

2. Ventilation rate

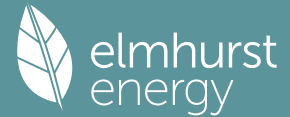
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.2500 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2313 (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	0.2948	0.2891	0.2833	0.2544	0.2486	0.2197	0.2197	0.2139	0.2313	0.2486	0.2602	0.2717 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.2000 (23c)
Effective ac	0.3988	0.3931	0.3873	0.3584	0.3526	0.3237	0.3237	0.3179	0.3352	0.3526	0.3642	0.3757 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Glazing (Uw = 1.20)			20.8100	1.1450	23.8282		(27)
Low Heatloss Floor			43.4100	0.1200	5.2092		(28a)

Full SAP Calculation Printout



Low External Wall	51.3200	11.9600	39.3600	0.1800	7.0848	(29a)
+1 External Wall	53.5200	8.8500	44.6700	0.1800	8.0406	(29a)
Low External Roof	2.7900		2.7900	0.1200	0.3348	(30)
+1 External Roof	41.9900		41.9900	0.1200	5.0388	(30)
Total net area of external elements Aum(A, m2)			193.0300			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	49.5364		(33)
Low Party Wall			21.7900	0.0000	0.0000	(32)
+1 Party Wall			21.3200	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)	9.6515	(36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	59.1879 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	30.6062	30.1626	29.7189	27.5008	27.0571	24.8389	24.8389	24.3953	25.7262	27.0571	27.9444	28.8317 (38)
Average = Sum(39)m / 12 =	89.7942	89.3505	88.9069	86.6887	86.2451	84.0269	84.0269	83.5832	84.9141	86.2451	87.1323	88.0196 (39)
												86.5778
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0515	1.0463	1.0411	1.0151	1.0099	0.9839	0.9839	0.9787	0.9943	1.0099	1.0203	1.0307 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

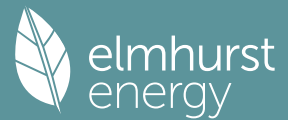
4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5574 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	77.3773	76.2281	74.6099	71.6261	69.3919	66.9145	65.5763	67.1832	68.9329	71.5838	74.6290	77.1157 (42b)
Hot water usage for other uses	40.8202	39.3358	37.8514	36.3671	34.8827	33.3983	33.3983	34.8827	36.3671	37.8514	39.3358	40.8202 (42c)
Average daily hot water use (litres/day)												108.8502 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	118.1974	115.5639	112.4613	107.9931	104.2745	100.3128	98.9746	102.0659	105.3000	109.4352	113.9648	117.9359 (44)
Energy content (annual)	187.1959	164.5615	172.8488	147.8372	140.3736	123.3463	119.7012	126.3789	129.8454	148.5026	162.3638	184.6591 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m =											1807.6142
	28.0794	24.6842	25.9273	22.1756	21.0560	18.5019	17.9552	18.9568	19.4768	22.2754	24.3546	27.6989 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	187.1959	164.5615	172.8488	147.8372	140.3736	123.3463	119.7012	126.3789	129.8454	148.5026	162.3638	184.6591 (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	187.1959	164.5615	172.8488	147.8372	140.3736	123.3463	119.7012	126.3789	129.8454	148.5026	162.3638	184.6591 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											1807.6142 (64)
Electric shower(s)												1808 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month	62.2426	54.7167	57.4722	49.1559	46.6742	41.0126	39.8007	42.0210	43.1736	49.3771	53.9860	61.3991 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	116.1882	128.6369	116.1882	120.0611	116.1882	120.0611	116.1882	116.1882	120.0611	116.1882	120.0611	116.1882 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	230.3561	232.7465	226.7228	213.8991	197.7115	182.4975	172.3335	169.9432	175.9668	188.7905	204.9781	220.1922 (68)
Pumps, fans	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953 (71)
Total internal gains	83.6594	81.4236	77.2476	68.2720	62.7342	56.9620	53.4955	56.4798	59.9633	66.3671	74.9805	82.5257 (72)
	494.5645	507.1678	484.5193	466.5930	440.9946	420.8813	403.3780	403.9720	417.3520	435.7065	464.3805	483.2668 (73)

Full SAP Calculation Printout



6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North				14.0700	10.6334	0.7600		0.0000		0.7700	87.5528 (74)
South				5.4200	46.7521	0.7600		0.0000		0.7700	148.2875 (78)
West				1.3200	19.6403	0.7600		0.0000		0.7700	15.1714 (80)
Solar gains	251.0117	439.8531	642.5466	877.6042	1066.8979	1098.6431	1042.5995	893.6569	721.8419	496.3299	213.5986 (83)
Total gains	745.5762	947.0208	1127.0659	1344.1972	1507.8925	1519.5244	1445.9775	1297.6288	1139.1939	932.0364	696.8654 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)											21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr		Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	66.0461	66.3740	66.7052	68.4121	68.7640	70.5793	70.5793	70.9539	69.8418	68.7640	68.0638	67.3777
alpha	5.4031	5.4249	5.4470	5.5608	5.5843	5.7053	5.7053	5.7303	5.6561	5.5843	5.5376	5.4918
util living area	0.9883	0.9620	0.8956	0.7266	0.5245	0.3533	0.2556	0.2961	0.5084	0.8314	0.9692	0.9914 (86)
MIT	20.0252	20.3251	20.6418	20.9071	20.9855	20.9988	20.9999	20.9997	20.9913	20.8428	20.3987	19.9891 (87)
Th 2	20.0407	20.0450	20.0493	20.0708	20.0751	20.0968	20.0968	20.1011	20.0881	20.0751	20.0665	20.0578 (88)
util rest of house	0.9848	0.9518	0.8716	0.6836	0.4749	0.3037	0.2032	0.2383	0.4438	0.7873	0.9591	0.9888 (89)
MIT 2	19.1726	19.4669	19.7646	20.0071	20.0671	20.0963	20.0967	20.1010	20.0843	19.9677	19.5598	19.1510 (90)
Living area fraction	fLA = Living area / (4) =											0.2004 (91)
MIT	19.3434	19.6389	19.9403	20.1874	20.2511	20.2771	20.2777	20.2811	20.2660	20.1430	19.7279	19.3190 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3434	19.6389	19.9403	20.1874	20.2511	20.2771	20.2777	20.2811	20.2660	20.1430	19.7279	19.3190 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9815	0.9466	0.8685	0.6892	0.4844	0.3136	0.2137	0.2499	0.4565	0.7908	0.9546	0.9861 (94)
Useful gains	731.8026	896.4794	978.8417	926.4798	730.4834	476.5886	308.9861	324.3055	520.0765	737.0735	732.2731	687.2119 (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	1350.8106	1316.9262	1194.9361	978.4928	737.4896	477.0295	309.0225	324.3918	523.5805	823.0361	1100.3002	1330.7650 (97)
Space heating kWh	460.5420	282.5403	160.7742	37.4494	5.2126	0.0000	0.0000	0.0000	0.0000	63.9562	264.9795	478.8035 (98a)
Space heating requirement - total per year (kWh/year)												1754.2577
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	460.5420	282.5403	160.7742	37.4494	5.2126	0.0000	0.0000	0.0000	0.0000	63.9562	264.9795	478.8035 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1754.2577
Space heating per m2										(98c) / (4) =		20.5417 (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 %)												170.0000 (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	460.5420	282.5403	160.7742	37.4494	5.2126	0.0000	0.0000	0.0000	0.0000	63.9562	264.9795	478.8035 (98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating fuel (main heating system)	270.9071	166.2002	94.5731	22.0291	3.0662	0.0000	0.0000	0.0000	0.0000	37.6213	155.8703	281.6491 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	187.1959	164.5615	172.8488	147.8372	140.3736	123.3463	119.7012	126.3789	129.8454	148.5026	162.3638	184.6591 (64)
Efficiency of water heater (217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000 (216)
Fuel for water heating, kWh/month	110.1152	96.8009	101.6758	86.9631	82.5727	72.5566	70.4125	74.3406	76.3796	87.3545	95.5081	108.6230 (219)
Space cooling fuel requirement												

Full SAP Calculation Printout



(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	18.0228	16.2787	18.0228	17.4415	18.0228	17.4415	18.0228	18.0228	17.4415	18.0228	17.4415	18.0228	(231)
Lighting	47.2593	37.9131	34.1366	25.0099	19.3184	15.7833	17.6229	22.9069	29.7538	39.0386	44.0940	48.5728	(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												1031.9163	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												170.0000	
Water heating fuel used												1063.3025	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.7480)													
mechanical ventilation fans (SFP = 0.7480)												212.2044	(230a)
Total electricity for the above, kWh/year												212.2044	(231)
Electricity for lighting (calculated in Appendix L)												381.4094	(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												2688.8325	(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	1031.9163	0.1583	163.3362	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1063.3025	0.1415	150.5031	(264)
Space and water heating			313.8393	(265)
Pumps, fans and electric keep-hot	212.2044	0.1387	29.4354	(267)
Energy for lighting	381.4094	0.1443	55.0492	(268)
Total CO2, kg/year			398.3238	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.6600	(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	1031.9163	1.5859	1636.4980	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1063.3025	1.5234	1619.8421	(278)
Space and water heating			3256.3400	(279)
Pumps, fans and electric keep-hot	212.2044	1.5128	321.0228	(281)
Energy for lighting	381.4094	1.5338	585.0184	(282)
Total Primary energy kWh/year			4162.3813	(286)
Dwelling Primary energy Rate (DPER)			48.7400	(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	43.4100 (1b)	x 2.6000 (2b)	= 112.8660 (1b) -	

Full SAP Calculation Printout



First floor
 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 85.4000 41.9900 (1c) x 2.8500 (2c) = 119.6715 (1c) -
 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 232.5375 (5)

2. Ventilation rate

m3 per hour

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

Air changes per hour
 Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 30.0000 / (5) = 0.1290 (8)
 Pressure test Yes
 Pressure Test Method Blower Door
 Measured/design AP50 5.0000 (17)
 Infiltration rate 0.3790 (18)
 Number of sides sheltered 1 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.9250 (20)
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3506 (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	0.4470	0.4382	0.4295	0.3856	0.3769	0.3331	0.3331	0.3243	0.3506	0.3769	0.3944	0.4119 (22b)
Effective ac	0.5999	0.5960	0.5922	0.5744	0.5710	0.5555	0.5555	0.5526	0.5615	0.5710	0.5778	0.5848 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opening Type (Uw = 1.20)			20.8100	1.1450	23.8282		(27)
Low Heatloss Floor			43.4100	0.1300	5.6433		(28a)
Low External Wall	51.3200	11.9600	39.3600	0.1800	7.0848		(29a)
+1 External Wall	53.5200	8.8500	44.6700	0.1800	8.0406		(29a)
Low External Roof	2.7900		2.7900	0.1100	0.3069		(30)
+1 External Roof	41.9900		41.9900	0.1100	4.6189		(30)
Total net area of external elements Aum(A, m2)			193.0300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.5227		(33)
Low Party Wall			21.7900	0.0000	0.0000		(32)
+1 Party Wall			21.3200	0.0000	0.0000		(32)

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

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	13.0900	0.0500	0.6545
E3 Sill	13.0900	0.0500	0.6545
E4 Jamb	42.8600	0.0500	2.1430
E5 Ground floor (normal)	19.7400	0.1600	3.1584
E6 Intermediate floor within a dwelling	18.7800	0.0000	0.0000
E14 Flat roof	18.7800	0.0800	1.5024
E16 Corner (normal)	10.9000	0.0900	0.9810
E18 Party wall between dwellings	10.9000	0.0600	0.6540

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.7478 (36)

Point Thermal bridges

Total fabric heat loss (33) + (36) + (36a) = 59.2705 (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	46.0350	45.7373	45.4455	44.0749	43.8185	42.6248	42.6248	42.4037	43.0846	43.8185	44.3373	44.8796 (38)
Heat transfer coeff	105.3055	105.0078	104.7160	103.3455	103.0890	101.8953	101.8953	101.6743	102.3551	103.0890	103.6078	104.1501 (39)
Average = Sum(39)m / 12 =												103.3442

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2331	1.2296	1.2262	1.2101	1.2071	1.1932	1.1932	1.1906	1.1985	1.2071	1.2132	1.2196 (40)
HLP (average)												1.2101
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5574 (42)
 Hot water usage for mixer showers

Full SAP Calculation Printout



Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for other uses	77.3773	76.2281	74.6099	71.6261	69.3919	66.9145	65.5763	67.1832	68.9329	71.5838	74.6290	77.1157 (42b)
Average daily hot water use (litres/day)	40.8202	39.3358	37.8514	36.3671	34.8827	33.3983	33.3983	34.8827	36.3671	37.8514	39.3358	40.8202 (42c)
												108.8502 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	118.1974	115.5639	112.4613	107.9931	104.2745	100.3128	98.9746	102.0659	105.3000	109.4352	113.9648	117.9359 (44)
Distribution loss (46)m = 0.15 x (45)m	187.1959	164.5615	172.8488	147.8372	140.3736	123.3463	119.7012	126.3789	129.8454	148.5026	162.3638	184.6591 (45)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss												
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Combi loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
WWHRS	233.7908	206.6472	219.4437	192.9291	186.9685	168.4381	166.2961	172.9738	174.9372	195.0975	207.4556	231.2540 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
12Total per year (kWh/year)	233.7908	206.6472	219.4437	192.9291	186.9685	168.4381	166.2961	172.9738	174.9372	195.0975	207.4556	231.2540 (64)
Electric shower(s)												
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												2356.2316 (64)
Heat gains from water heating, kWh/month												
	99.5185	88.3853	94.7482	85.2293	83.9501	77.0861	77.0766	79.2969	79.2471	86.6530	90.0594	98.6751 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	116.1882	128.6369	116.1882	120.0611	116.1882	120.0611	116.1882	116.1882	120.0611	116.1882	120.0611	116.1882 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	230.3561	232.7465	226.7228	213.8991	197.7115	182.4975	172.3335	169.9432	175.9668	188.7905	204.9781	220.1922 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953 (71)
Water heating gains (Table 5)	133.7615	131.5257	127.3497	118.3741	112.8362	107.0640	103.5976	106.5819	110.0654	116.4691	125.0825	132.6278 (72)
Total internal gains	544.6665	557.2698	534.6214	516.6951	491.0967	470.9834	453.4800	454.0740	467.4541	485.8086	514.4825	533.3689 (73)

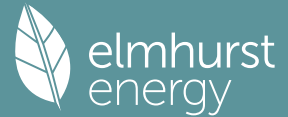
6. Solar gains

[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			14.0700	10.6334	0.6300	0.7000	0.7700	45.7233 (74)				
South			5.4200	46.7521	0.6300	0.7000	0.7700	77.4412 (78)				
West			1.3200	19.6403	0.6300	0.7000	0.7700	7.9231 (80)				
Solar gains	131.0876	229.7075	335.5615	458.3172	557.1734	573.7519	544.4839	466.7005	376.9724	259.2017	158.0789	111.5491 (83)
Total gains	675.7541	786.9773	870.1829	975.0123	1048.2701	1044.7353	997.9639	920.7745	844.4265	745.0103	672.5615	644.9179 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	56.3176	56.4773	56.6346	57.3857	57.5285	58.2024	58.2024	58.3290	57.9410	57.5285	57.2404	56.9424
util living area	4.7545	4.7652	4.7756	4.8257	4.8352	4.8802	4.8802	4.8886	4.8627	4.8352	4.8160	4.7962
	0.9934	0.9858	0.9688	0.9134	0.7897	0.5991	0.4442	0.4987	0.7480	0.9404	0.9862	0.9947 (86)
MIT	19.6556	19.8681	20.1639	20.5531	20.8373	20.9674	20.9937	20.9893	20.9071	20.5384	20.0360	19.6263 (87)

Full SAP Calculation Printout



Th 2	19.8936	19.8964	19.8991	19.9119	19.9143	19.9255	19.9255	19.9276	19.9212	19.9143	19.9094	19.9044 (88)
util rest of house	0.9913	0.9813	0.9586	0.8856	0.7301	0.5090	0.3384	0.3871	0.6618	0.9149	0.9810	0.9930 (89)
MIT 2	18.3510	18.6223	18.9952	19.4744	19.7845	19.9081	19.9236	19.9241	19.8621	19.4702	18.8467	18.3214 (90)
Living area fraction									fLA =	Living area / (4) =		0.2004 (91)
MIT	18.6124	18.8719	19.2294	19.6905	19.9954	20.1203	20.1380	20.1375	20.0715	19.6843	19.0850	18.5829 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6124	18.8719	19.2294	19.6905	19.9954	20.1203	20.1380	20.1375	20.0715	19.6843	19.0850	18.5829 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9877	0.9755	0.9505	0.8789	0.7350	0.5260	0.3596	0.4095	0.6750	0.9082	0.9754	0.9899	(94)
Useful gains	667.4477	767.6930	827.0970	856.9158	770.4988	549.4999	358.9051	377.0413	569.9511	676.6014	656.0074	638.4185	(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	1507.1738	1467.1612	1332.9707	1115.1540	855.1683	562.4926	360.5096	380.0063	611.2141	936.4875	1241.7356	1497.9790	(97)
Space heating kWh	624.7562	470.0426	376.3700	185.9315	62.9941	0.0000	0.0000	0.0000	0.0000	193.3553	421.7243	639.5130	(98a)
Space heating requirement - total per year (kWh/year)												2974.6871	
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	624.7562	470.0426	376.3700	185.9315	62.9941	0.0000	0.0000	0.0000	0.0000	193.3553	421.7243	639.5130	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2974.6871	
Space heating per m2										(98c) / (4) =		34.8324	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													92.3000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	624.7562	470.0426	376.3700	185.9315	62.9941	0.0000	0.0000	0.0000	0.0000	193.3553	421.7243	639.5130	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	676.8757	509.2553	407.7681	201.4426	68.2493	0.0000	0.0000	0.0000	0.0000	209.4857	456.9061	692.8635	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating

Water heating requirement	233.7908	206.6472	219.4437	192.9291	186.9685	168.4381	166.2961	172.9738	174.9372	195.0975	207.4556	231.2540	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.1541	85.8434	85.2585	83.9770	81.8917	79.8000	79.8000	79.8000	79.8000	84.0397	85.6162	86.2176	(217)
Fuel for water heating, kWh/month	271.3636	240.7257	257.3864	229.7404	228.3120	211.0753	208.3911	216.7592	219.2196	232.1493	242.3089	268.2213	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	24.1416	19.3673	17.4381	12.7759	9.8685	8.0626	9.0024	11.7016	15.1992	19.9422	22.5247	24.8126	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-39.5876	-55.6297	-79.7101	-89.3322	-96.0798	-89.5787	-88.4462	-83.5973	-75.0330	-63.4420	-43.4468	-34.2450	(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	-22.9336	-48.1759	-95.6327	-143.4694	-189.5552	-190.4194	-188.2023	-159.4418	-116.9711	-68.8715	-30.6102	-18.1428	(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												3222.8463	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2825.6526	(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)												194.8366	(232)

Full SAP Calculation Printout



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

PV generation	-2110.5545 (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	4218.7811 (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	3222.8463	0.2100	676.7977 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2825.6526	0.2100	593.3871 (264)
Space and water heating			1270.1848 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	194.8366	0.1443	28.1209 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-838.1284	0.1347	-112.8606
PV Unit electricity exported	-1272.4260	0.1259	-160.2331
Total			-273.0937 (269)
Total CO2, kg/year			1037.1413 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.1400 (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	3222.8463	1.1300	3641.8163 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2825.6526	1.1300	3192.9875 (278)
Space and water heating			6834.8038 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	194.8366	1.5338	298.8469 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-838.1284	1.4977	-1255.2456
PV Unit electricity exported	-1272.4260	0.4622	-588.1672
Total			-1843.4128 (283)
Total Primary energy kWh/year			5420.3387 (286)
Target Primary Energy Rate (TPER)			63.4700 (287)

Summary for Input Data

Property Reference	Rev 01	Issued on Date	01/06/2023
Assessment Reference	Rev 01	Prop Type Ref	Flat
Property	2 Sandringham Road, London, England, N22 6RB		

SAP Rating	79 C	DER	13.39	TER	12.58
Environmental	89 B	% DER < TER			-6.44
CO ₂ Emissions (t/year)	0.98	DFEE	35.96	TFEE	41.52
Compliance Check	See BREL	% DFEE < TFEE			13.40
% DPER < TPER	-27.67	DPER	83.99	TPER	65.79

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

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

Orientation	North	
Property Tenture	ND	
Transaction Type	5	
Terrain Type	Urban	
1.0 Property Type	Flat, Semi-Detached	
Position of Flat	Ground-floor flat	
Which Floor	0	
2.0 Number of Storeys	2	
3.0 Date Built	2023	
4.0 Sheltered Sides	1	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	250.00	kJ/m²K
7.0 Electricity Tariff	Standard	
Smart electricity meter fitted	Yes	
Smart gas meter fitted	Yes	

7.0 Measurements	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Basement:	0.00 m	0.00 m ²	0.00 m
Ground floor:	19.74 m	43.41 m ²	2.60 m
1st Storey:	18.78 m	41.99 m ²	2.85 m
2nd Storey:	0.00 m	0.00 m ²	0.00 m
3rd Storey:	0.00 m	0.00 m ²	0.00 m
4th Storey:	0.00 m	0.00 m ²	0.00 m
5th Storey:	0.00 m	0.00 m ²	0.00 m
6th Storey:	0.00 m	0.00 m ²	0.00 m
7th Storey:	0.00 m	0.00 m ²	0.00 m

8.0 Living Area	17.11	m ²
-----------------	-------	----------------

9.0 External Walls	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Res	Shelter	Openings	Area Calculation Type
	Low External Wall	Cavity Wall	Cavity wall : dense plaster, dense block, filled cavity, any outside structure	0.18	190.00	51.32	39.36	0.00	None	11.96	Enter Gross Area
	+1 External Wall	Cavity Wall	Cavity wall : dense plaster, dense block, filled cavity, any outside structure	0.18	190.00	53.52	44.67	0.00	None	8.85	Enter Gross Area

9.1 Party Walls	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)	Shelter Res	Shelter
	Low Party Wall	Filled Cavity with Edge Sealing	Dense plaster both sides, dense blocks, cavity or cavity fill	0.00	180.00	21.79	0.00	None
	+1 Party Wall	Filled Cavity with Edge Sealing	Dense plaster both sides, dense blocks, cavity or cavity fill	0.00	180.00	21.32	0.00	None

10.0 External Roofs	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Code	Shelter Factor	Calculation Type	Openings
---------------------	-------------	------	--------------	------------------------------	-----------------------------	-----------------------------	-----------------------------	--------------	----------------	------------------	----------

Summary for Input Data

Low External Roof	External Plane	Plasterboard, insulated at ceiling level	0.12	9.00	2.79	0.00	None	0.00	Enter Gross Area	0.00
+1 External Roof	External Flat Roof	Plasterboard, insulated flat roof	0.12	9.00	41.99	0.00	None	0.00	Enter Gross Area	0.00

11.0 Heat Loss Floors

Description	Type	Storey Index	Construction	U-Value (W/m²K)	Shelter Code	Shelter Factor	Kappa (kJ/m²K)	Area (m²)
Low Heatloss Floor	Ground Floor - Solid	Lowest occupied	Slab on ground, screed over insulation	0.12	None	0.00	110.00	43.41

12.0 Opening Types

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

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
Low N1	Glazing	Low External Wall	North	0.58	0
Low N2	Glazing	Low External Wall	North	1.88	0
Low N3	Glazing	Low External Wall	North	0.58	0
Low N4	Glazing	Low External Wall	North	4.87	0
Low S1	Glazing	Low External Wall	South	1.01	0
Low S2	Glazing	Low External Wall	South	1.72	0
Low W1	Glazing	Low External Wall	West	1.32	0
+1 N1	Glazing	+1 External Wall	North	1.83	0
+1 N2	Glazing	+1 External Wall	North	0.88	0
+1 N3	Glazing	+1 External Wall	North	2.57	0
+1 N4	Glazing	+1 External Wall	North	0.88	0
+1 S1	Glazing	+1 External Wall	South	1.83	0
+1 S2	Glazing	+1 External Wall	South	0.86	0

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E1 Steel lintel with perforated steel base plate		13.09	0.00	0.00	Yes
E3 Sill		13.09	0.00	0.00	Yes
E4 Jamb		42.86	0.00	0.00	Yes
E5 Ground floor (normal)		19.74	0.00	0.00	Yes
E6 Intermediate floor within a dwelling		18.78	0.00	0.00	Yes
E14 Flat roof		18.78	0.00	0.00	Yes
E16 Corner (normal)		10.90	0.00	0.00	Yes
E18 Party wall between dwellings		10.90	0.00	0.00	Yes

Y-value W/m²K

Description

18.0 Pressure Testing

Designed AP₅₀ m³/(h.m²) @ 50 Pa

Property Tested?

Test Method

As Built AP₅₀ m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present

Approved Installation

Mechanical Ventilation data Type

Type

MV Reference Number

Configuration

Manufacturer SFP

Duct Type

MVHR Efficiency

Wet Rooms

SFP from Installer Commissioning Certificate

Summary for Input Data

MVHR System Location

Duct Installation Specification

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System

22.0 Lighting

No Fixed Lighting

24.0 Main Heating 1

SAP table	SAP table	
Description	Main Gas Boiler	
Percentage of Heat	100.00	%
Database Ref. No.	0	
Fuel Type	Mains gas	
SAP Code	113	
In Winter	84.00	
In Summer	75.00	
Controls SAP Code	2110	
Delayed Start Stat	No	
HETAS approved System	No	
Oil Pump Inside	No	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heating Pump Age	2013 or later	
Heat Emitter	Radiators	
Flow Temperature	Unknown	
Boiler Interlock	No	
Combi boiler type	Standard Combi	
Combi keep hot type	Electric, time clock	

25.0 Main Heating 2

26.0 Heat Networks

	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
Solar Panel	No
Water use <= 125 litres/person/day	No
Summer Immersion	No
Cold Water Source	From mains
Bath Count	3
Supplementary Immersion	No

Summary for Input Data



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

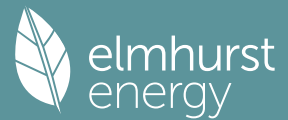
Lower cost measures

None

Further measures to achieve even higher standards

None

Full SAP Calculation Printout



Property Reference	Rev 01	Issued on Date	01/06/2023
Assessment Reference	Rev 01	Prop Type Ref	Flat
Property	2 Sandringham Road, London, England, N22 6RB		
SAP Rating	79 C	DER	13.39
Environmental	89 B	TER	12.58
CO ₂ Emissions (t/year)	0.98	% DER < TER	-6.44
Compliance Check	See BREL	DFEE	35.96
% DPER < TPER	-27.67	TFEE	41.52
		% DFEE < TFEE	13.40
		DPER	83.99
		TPER	65.79
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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.4100 (1b)	x 2.6000 (2b)	= 112.8660 (1b) -
First floor	41.9900 (1c)	x 2.8500 (2c)	= 119.6715 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	232.5375 (5)

2. Ventilation rate

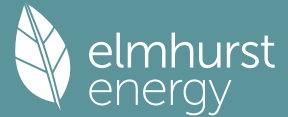
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.2500 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2313 (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	0.2948	0.2891	0.2833	0.2544	0.2486	0.2197	0.2197	0.2139	0.2313	0.2486	0.2602	0.2717 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.2000 (23c)
Effective ac	0.3988	0.3931	0.3873	0.3584	0.3526	0.3237	0.3237	0.3179	0.3352	0.3526	0.3642	0.3757 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Glazing (Uw = 1.20)			20.8100	1.1450	23.8282		(27)
Low Heatloss Floor			43.4100	0.1200	5.2092		(28a)

Full SAP Calculation Printout



Low External Wall	51.3200	11.9600	39.3600	0.1800	7.0848	(29a)
+1 External Wall	53.5200	8.8500	44.6700	0.1800	8.0406	(29a)
Low External Roof	2.7900		2.7900	0.1200	0.3348	(30)
+1 External Roof	41.9900		41.9900	0.1200	5.0388	(30)
Total net area of external elements Aum(A, m2)			193.0300			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	49.5364		(33)
Low Party Wall			21.7900	0.0000	0.0000	(32)
+1 Party Wall			21.3200	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)	9.6515	(36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	59.1879 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	30.6062	30.1626	29.7189	27.5008	27.0571	24.8389	24.8389	24.3953	25.7262	27.0571	27.9444	28.8317	(38)
Average = Sum(39)m / 12 =	89.7942	89.3505	88.9069	86.6887	86.2451	84.0269	84.0269	83.5832	84.9141	86.2451	87.1323	88.0196	(39)
	86.5778												
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0515	1.0463	1.0411	1.0151	1.0099	0.9839	0.9839	0.9787	0.9943	1.0099	1.0203	1.0307	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

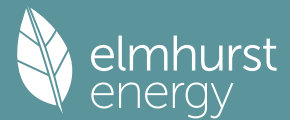
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.5574 (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	81.4498	80.2401	78.5367	75.3959	73.0441	70.4363	69.0277	70.7192	72.5610	75.3514	78.5569	81.1744	(42b)
Hot water usage for other uses	42.9686	41.4061	39.8436	38.2811	36.7186	35.1561	35.1561	36.7186	38.2811	39.8436	41.4061	42.9686	(42c)
Average daily hot water use (litres/day)													114.5791 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	124.4184	121.6462	118.3803	113.6770	109.7627	105.5924	104.1838	107.4378	110.8421	115.1950	119.9630	124.1430	(44)
Energy content (annual)	197.0483	173.2226	181.9461	155.6181	147.7617	129.8382	126.0013	133.0305	136.6794	156.3185	170.9093	194.3780	(45)
Distribution loss (46)m = 0.15 x (45)m	29.5572	25.9834	27.2919	23.3427	22.1643	19.4757	18.9002	19.9546	20.5019	23.4478	25.6364	29.1567	(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	248.0072	219.2500	232.9050	204.9332	198.7206	179.1532	176.9602	183.9894	185.9944	207.2774	220.2243	245.3369	(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	248.0072	219.2500	232.9050	204.9332	198.7206	179.1532	176.9602	183.9894	185.9944	207.2774	220.2243	245.3369	(64)
12Total per year (kWh/year)													2502.7518 (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	78.2583	69.1034	73.2368	64.0718	61.8705	55.5000	54.6352	56.9724	57.7747	64.7156	69.1561	77.3704	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	116.1882	128.6369	116.1882	120.0611	116.1882	120.0611	116.1882	116.1882	120.0611	116.1882	120.0611	116.1882	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	230.3561	232.7465	226.7228	213.8991	197.7115	182.4975	172.3335	169.9432	175.9668	188.7905	204.9781	220.1922	(68)
Pumps, fans	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	(69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Water heating gains (Table 5)	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	(71)
Total internal gains	105.1859	102.8324	98.4366	88.9886	83.1592	77.0833	73.4343	76.5757	80.2426	86.9834	96.0501	103.9925	(72)
	516.0909	528.5765	505.7083	487.3096	461.4197	441.0026	423.3168	424.0679	437.6313	456.3228	485.4501	504.7336	(73)

Full SAP Calculation Printout



6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North				14.0700	10.6334	0.7600		0.0000		0.7700	87.5528 (74)
South				5.4200	46.7521	0.7600		0.0000		0.7700	148.2875 (78)
West				1.3200	19.6403	0.7600		0.0000		0.7700	15.1714 (80)
Solar gains	251.0117	439.8531	642.5466	877.6042	1066.8979	1098.6431	1042.5995	893.6569	721.8419	496.3299	213.5986 (83)
Total gains	767.1026	968.4296	1148.2549	1364.9137	1528.3176	1539.6457	1465.9163	1317.7247	1159.4732	952.6527	718.3322 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)											21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr		Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	66.0461	66.3740	66.7052	68.4121	68.7640	70.5793	70.5793	70.9539	69.8418	68.7640	68.0638	67.3777
alpha	5.4031	5.4249	5.4470	5.5608	5.5843	5.7053	5.7053	5.7303	5.6561	5.5843	5.5376	5.4918
util living area	0.9868	0.9585	0.8893	0.7185	0.5179	0.3487	0.2521	0.2916	0.5000	0.8214	0.9656	0.9902 (86)
MIT	20.0508	20.3472	20.6568	20.9121	20.9864	20.9989	20.9999	20.9997	20.9920	20.8526	20.4213	20.0152 (87)
Th 2	20.0407	20.0450	20.0493	20.0708	20.0751	20.0968	20.0968	20.1011	20.0881	20.0751	20.0665	20.0578 (88)
util rest of house	0.9828	0.9476	0.8644	0.6753	0.4688	0.2998	0.2004	0.2347	0.4362	0.7763	0.9545	0.9872 (89)
MIT 2	18.9590	19.3299	19.7007	19.9938	20.0654	20.0962	20.0967	20.1010	20.0836	19.9468	19.4437	18.9273 (90)
Living area fraction	fLA = Living area / (4) =											0.2004 (91)
MIT	19.1778	19.5337	19.8923	20.1778	20.2500	20.2770	20.2777	20.2811	20.2656	20.1283	19.6396	19.1452 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1778	19.5337	19.8923	20.1778	20.2500	20.2770	20.2777	20.2811	20.2656	20.1283	19.6396	19.1452 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9781	0.9405	0.8598	0.6805	0.4782	0.3096	0.2108	0.2461	0.4488	0.7791	0.9482	0.9833 (94)
Useful gains	750.3181	910.7781	987.2599	928.8131	730.8194	476.6132	308.9884	324.3118	520.3312	742.2585	747.3364	706.3389 (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	1335.9359	1307.5320	1190.6682	977.6558	737.3916	477.0247	309.0223	324.3912	523.5464	821.7685	1092.6023	1315.4739 (97)
Space heating kWh	435.6996	266.6186	151.3358	35.1668	4.8897	0.0000	0.0000	0.0000	0.0000	59.1555	248.5914	453.1964 (98a)
Space heating requirement - total per year (kWh/year)												1654.6538
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	435.6996	266.6186	151.3358	35.1668	4.8897	0.0000	0.0000	0.0000	0.0000	59.1555	248.5914	453.1964 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1654.6538
Space heating per m2	(98c) / (4) =											19.3753 (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 %)												79.0000 (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	435.6996	266.6186	151.3358	35.1668	4.8897	0.0000	0.0000	0.0000	0.0000	59.1555	248.5914	453.1964 (98)
Space heating efficiency (main heating system 1)	79.0000	79.0000	79.0000	79.0000	79.0000	0.0000	0.0000	0.0000	0.0000	79.0000	79.0000	79.0000 (210)
Space heating fuel (main heating system)	551.5185	337.4919	191.5643	44.5149	6.1895	0.0000	0.0000	0.0000	0.0000	74.8803	314.6727	573.6664 (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	248.0072	219.2500	232.9050	204.9332	198.7206	179.1532	176.9602	183.9894	185.9944	207.2774	220.2243	245.3369 (64)
Efficiency of water heater	80.4961	79.6850	78.3044	76.1957	75.1935	75.0000	75.0000	75.0000	75.0000	76.8276	79.5176	75.0000 (216)
Fuel for water heating, kWh/month	244.7923	217.3842	232.3576	204.2347	196.5086	173.1176	168.0017	177.3740	182.2391	203.4665	214.9325	80.6029 (217)
Space cooling fuel requirement												241.1550 (219)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP			
	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	2094.4985	0.2100	439.8447 (261)
Total CO ₂ associated with community systems			0.0000 (373)
Water heating (other fuel)	2455.5638	0.2100	515.6684 (264)
Space and water heating			955.5131 (265)
Pumps, fans and electric keep-hot	956.0784	0.1387	132.6199 (267)
Energy for lighting	381.4094	0.1443	55.0492 (268)
Total CO ₂ , kg/year			1143.1821 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			13.3900 (273)

13a. Primary energy - Individual heating systems including micro-CHP			
	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2094.4985	1.1300	2366.7833 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2455.5638	1.1300	2774.7871 (278)
Space and water heating			5141.5704 (279)
Pumps, fans and electric keep-hot	956.0784	1.5128	1446.3553 (281)
Energy for lighting	381.4094	1.5338	585.0184 (282)
Total Primary energy kWh/year			7172.9442 (286)
Dwelling Primary energy Rate (DPER)			83.9900 (287)

1. Overall dwelling characteristics

Full SAP Calculation Printout



	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.4100 (1b)	x 2.6000 (2b)	= 112.8660 (1b) -
First floor	41.9900 (1c)	x 2.8500 (2c)	= 119.6715 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 232.5375 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 30.0000 / (5) = 0.1290 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3790 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3506 (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	0.4470	0.4382	0.4295	0.3856	0.3769	0.3331	0.3331	0.3243	0.3506	0.3769	0.3944	0.4119 (22b)
Effective ac	0.5999	0.5960	0.5922	0.5744	0.5710	0.5555	0.5555	0.5526	0.5615	0.5710	0.5778	0.5848 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opening Type (Uw = 1.20)			20.8100	1.1450	23.8282		(27)
Low Heatloss Floor			43.4100	0.1300	5.6433		(28a)
Low External Wall	51.3200	11.9600	39.3600	0.1800	7.0848		(29a)
+1 External Wall	53.5200	8.8500	44.6700	0.1800	8.0406		(29a)
Low External Roof	2.7900		2.7900	0.1100	0.3069		(30)
+1 External Roof	41.9900		41.9900	0.1100	4.6189		(30)
Total net area of external elements Aum(A, m ²)			193.0300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 49.5227		(33)
Low Party Wall			21.7900	0.0000	0.0000		(32)
+1 Party Wall			21.3200	0.0000	0.0000		(32)

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

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	13.0900	0.0500	0.6545
E3 Sill	13.0900	0.0500	0.6545
E4 Jamb	42.8600	0.0500	2.1430
E5 Ground floor (normal)	19.7400	0.1600	3.1584
E6 Intermediate floor within a dwelling	18.7800	0.0000	0.0000
E14 Flat roof	18.7800	0.0800	1.5024
E16 Corner (normal)	10.9000	0.0900	0.9810
E18 Party wall between dwellings	10.9000	0.0600	0.6540
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			9.7478 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 59.2705 (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	46.0350	45.7373	45.4455	44.0749	43.8185	42.6248	42.6248	42.4037	43.0846	43.8185	44.3373	44.8796 (38)
Heat transfer coeff	105.3055	105.0078	104.7160	103.3455	103.0890	101.8953	101.8953	101.6743	102.3551	103.0890	103.6078	104.1501 (39)
Average = Sum(39)m / 12 =												103.3442
HLP	1.2331	1.2296	1.2262	1.2101	1.2071	1.1932	1.1932	1.1906	1.1985	1.2071	1.2132	1.2196 (40)
HLP (average)												1.2101
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Full SAP Calculation Printout



Assumed occupancy												2.5574 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths	77.3773	76.2281	74.6099	71.6261	69.3919	66.9145	65.5763	67.1832	68.9329	71.5838	74.6290	77.1157 (42b)
Hot water usage for other uses	40.8202	39.3358	37.8514	36.3671	34.8827	33.3983	33.3983	34.8827	36.3671	37.8514	39.3358	40.8202 (42c)
Average daily hot water use (litres/day)												108.8502 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	118.1974	115.5639	112.4613	107.9931	104.2745	100.3128	98.9746	102.0659	105.3000	109.4352	113.9648	117.9359 (44)
Energy content (annual)	187.1959	164.5615	172.8488	147.8372	140.3736	123.3463	119.7012	126.3789	129.8454	148.5026	162.3638	184.6591 (45)
Distribution loss (46)m = 0.15 x (45)m	28.0794	24.6842	25.9273	22.1756	21.0560	18.5019	17.9552	18.9568	19.4768	22.2754	24.3546	27.6989 (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												
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.4364	50.9589	49.3151	50.9589	49.3151	50.9589 (59)
Total heat required for water heating calculated for each month	238.1548	210.5889	223.8077	197.1523	191.3325	172.6613	170.1376	177.3378	179.1605	199.4615	211.6789	235.6180 (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	238.1548	210.5889	223.8077	197.1523	191.3325	172.6613	170.1376	177.3378	179.1605	199.4615	211.6789	235.6180 (64)
12Total per year (kWh/year)												2407.0917 (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	74.9824	66.2235	70.2120	61.4846	59.4139	53.3414	52.4098	54.7607	55.5024	62.1168	66.3147	74.1389 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	116.1882	128.6369	116.1882	120.0611	116.1882	120.0611	116.1882	116.1882	120.0611	116.1882	120.0611	116.1882 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	230.3561	232.7465	226.7228	213.8991	197.7115	182.4975	172.3335	169.9432	175.9668	188.7905	204.9781	220.1922 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869 (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)	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953 (71)
Water heating gains (Table 5)	100.7827	98.5469	94.3709	85.3953	79.8575	74.0853	70.4432	73.6031	77.0866	83.4904	92.1038	99.6490 (72)
Total internal gains	511.6878	524.2911	501.6426	483.7163	458.1179	438.0046	420.3257	421.0952	434.4753	452.8298	481.5038	500.3901 (73)

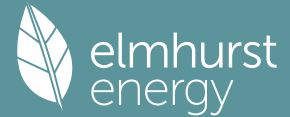
6. Solar gains

[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			14.0700		10.6334		0.6300		0.7000		0.7700		45.7233	(74)
South			5.4200		46.7521		0.6300		0.7000		0.7700		77.4412	(78)
West			1.3200		19.6403		0.6300		0.7000		0.7700		7.9231	(80)
Solar gains	131.0876	229.7075	335.5615	458.3172	557.1734	573.7519	544.4839	466.7005	376.9724	259.2017	158.0789	111.5491	(83)	
Total gains	642.7753	753.9985	837.2041	942.0335	1015.2913	1011.7565	964.8096	887.7958	811.4478	712.0316	639.5827	611.9392	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	56.3176	56.4773	56.6346	57.3857	57.5285	58.2024	58.2024	58.3290	57.9410	57.5285	57.2404	56.9424
alpha	4.7545	4.7652	4.7756	4.8257	4.8352	4.8802	4.8802	4.8886	4.8627	4.8352	4.8160	4.7962
util living area	0.9947	0.9881	0.9730	0.9222	0.8040	0.6155	0.4587	0.5157	0.7672	0.9489	0.9887	0.9958 (86)
MIT	19.6160	19.8300	20.1287	20.5260	20.8231	20.9634	20.9928	20.9877	20.8959	20.5074	19.9976	19.5865 (87)
Th 2	19.8936	19.8964	19.8991	19.9119	19.9143	19.9255	19.9255	19.9276	19.9212	19.9143	19.9094	19.9044 (88)

Full SAP Calculation Printout



util rest of house												
MIT 2	0.9929	0.9842	0.9639	0.8964	0.7459	0.5241	0.3498	0.4011	0.6823	0.9262	0.9844	0.9944 (89)
Living area fraction	18.3008	18.5744	18.9521	19.4441	19.7717	19.9057	19.9233	19.9235	19.8539	19.4350	18.7987	18.2707 (90)
MIT	18.5643	18.8259	19.1878	19.6608	19.9823	20.1176	20.1376	20.1367	fLA = Living area / (4) =			0.2004 (91)
Temperature adjustment									20.0626	19.6498	19.0389	18.5343 (92)
adjusted MIT	18.5643	18.8259	19.1878	19.6608	19.9823	20.1176	20.1376	20.1367	20.0626	19.6498	19.0389	18.5343 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9898	0.9789	0.9562	0.8892	0.7500	0.5412	0.3717	0.4241	0.6946	0.9192	0.9794	0.9918 (94)
Useful gains	636.2274	738.0990	800.5363	837.6737	761.4216	547.5575	358.6116	376.4730	563.6645	654.4939	626.4102	606.8992 (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	1502.1106	1462.3332	1328.6199	1112.0848	853.8171	562.2223	360.4668	379.9250	610.3067	932.9388	1236.9602	1492.9216 (97)
Space heating kWh	644.2171	486.6854	392.8942	197.5760	68.7422	0.0000	0.0000	0.0000	0.0000	207.1630	439.5960	659.2007 (98a)
Space heating requirement - total per year (kWh/year)												3096.0745
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	644.2171	486.6854	392.8942	197.5760	68.7422	0.0000	0.0000	0.0000	0.0000	207.1630	439.5960	659.2007 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3096.0745
Space heating per m2										(98c) / (4) =		36.2538 (99)

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

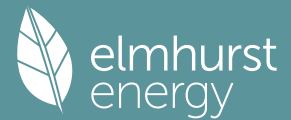
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.4000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (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	644.2171	486.6854	392.8942	197.5760	68.7422	0.0000	0.0000	0.0000	0.0000	207.1630	439.5960	659.2007 (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)	697.2046	526.7158	425.2102	213.8268	74.3964	0.0000	0.0000	0.0000	0.0000	224.2023	475.7532	713.4206 (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	238.1548	210.5889	223.8077	197.1523	191.3325	172.6613	170.1376	177.3378	179.1605	199.4615	211.6789	235.6180 (64)
Efficiency of water heater (217)m	86.4024	86.1146	85.5740	84.3860	82.4071	80.3000	80.3000	80.3000	80.3000	84.4628	85.9095	80.3000 (216)
Fuel for water heating, kWh/month	275.6343	244.5450	261.5371	233.6314	232.1796	215.0203	211.8775	220.8441	223.1139	236.1532	246.3974	272.5112 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	24.1416	19.3673	17.4381	12.7759	9.8685	8.0626	9.0024	11.7016	15.1992	19.9422	22.5247	24.8126 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-39.5876	-55.6297	-79.7101	-89.3322	-96.0798	-89.5787	-88.4462	-83.5973	-75.0330	-63.4420	-43.4468	-34.2450 (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	-22.9336	-48.1759	-95.6327	-143.4694	-189.5552	-190.4194	-188.2023	-159.4418	-116.9711	-68.8715	-30.6102	-18.1428 (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												3350.7300 (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												2873.4450 (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)												194.8366 (232)

Full SAP Calculation Printout



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

PV generation	-2110.5545 (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	4394.4572 (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	3350.7300	0.2100	703.6533 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2873.4450	0.2100	603.4235 (264)
Space and water heating			1307.0768 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	194.8366	0.1443	28.1209 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-838.1284	0.1347	-112.8606
PV Unit electricity exported	-1272.4260	0.1259	-160.2331
Total			-273.0937 (269)
Total CO2, kg/year			1074.0332 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.5800 (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	3350.7300	1.1300	3786.3249 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2873.4450	1.1300	3246.9929 (278)
Space and water heating			7033.3178 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	194.8366	1.5338	298.8469 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-838.1284	1.4977	-1255.2456
PV Unit electricity exported	-1272.4260	0.4622	-588.1672
Total			-1843.4128 (283)
Total Primary energy kWh/year			5618.8527 (286)
Target Primary Energy Rate (TPER)			65.7900 (287)