Rear and Side Dormers to Provide 1x2-Bed Self-Contained Flat

200 Lancaster Road, Enfield EN2 0JH

Energy Statement

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Disclaimer

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1.0 Executive Summary

This Energy Statement has been prepared in support of a planning application for a second floor/loft conversion to the existing building at no. 200 Lancaster Road, Enfield.

The Report assesses the existing baseline situation at the property which comprises a retail unit at ground floor level, and two residential flats above. Onsite energy options are provided for the new residential property above in accordance with the plans submitted with the application.

The proposed conversion been designed to incorporate both passive and active design measures to reduce energy demand. In the new flat the main energy demand is for heating during colder months and hot water year-round. The opportunity also exists to improve the energy efficiency of the existing building through the incorporation of more modern methods, materials and features.

The orientation of the existing building has a significant impact on energy consumption. The proposed flat at second floor level has been designed with substantial window openings in order to maximise solar gain and reduce dependence on artificial lighting during the daytime.

The converted and extended building will involve the provision of a small amount of new external walls and roof, so there is an opportunity to maximise thermal insulation and reduce U-values where possible. Utilising denser materials and higher-grade insulation in insulated cavity brick walls and tiled roofs will reduce thermal movement via conduction and reduce the amount of energy required for heating/cooling. There is also scope to improve the shell of the existing building through additional internal insulation products, particularly in the roof structure.

There is also the ability to reduce heat transference through the incorporation of draught exclusion at the entrance to the apartment, which will be constructed to minimise draughts, but opening windows and roof lights will allow for natural ventilation.

Artificial lighting will be required throughout the apartment, it will be specified and managed to minimise energy usage through good design and choice of energy-efficient fittings. Nevertheless, it will have significant natural lighting due to the provision and orientation of windows and roof lights.

Opportunities also exist to provide energy requirements from more efficient and/or sustainable sources. The following sources have been considered.

- Combined Heat and Power (CHP)
- Combined Cooling Heat and Power (CCHP)
- Ground Source Heat Pumps (GSHPs)
- Air Source Heat Pumps (ASHPs)
- Photovoltaic (PV) panels
- Solar Hot Water (SHW) Panels
- Wind Turbines
- Geothermal Energy
- Biomass Generator
- Biodiesel Generator

Many of these sources have been found to be unsuitable due to the scale, location and characteristics of the uses at the application site. The most suitable is likely to be the provision of an air source heat pump, mounted on the roof of the building serving the residential unit with hot water.

Following the design guidance set out with this energy statement a full SAP calculation was undertaken for the proposed development. A summary table of the SAP energy assessment results can be seen below. The full SAP calculation and Predicted Energy Assessment worksheets can be found within the Appendices.

Table 1 - Summary of Energy Assessment Results

Area (m2)	TER CO2 Emission Rate (kgCO2/m2)	DER CO2 Emission Rate (kgCO2/m2)	TFEE - Target Fabric Energy Efficiency (kWh/m2)	DFEE - Dwelling Fabric Energy Efficiency (kWh/m2)
120.1	25.62	19.80	57.37	57.05

The results show that the Target Emission Rate (TER) of the development would be 25.62 kgCO2/m2 and following the energy hierarchy as described in this report the Dwelling Emission Rate would be 19.80 kgCO2/m2.

This would be a 22.7% improvement over Part L Building Regulations 2013 and therefore the London Borough of Enfield's target reduction of 19% would be satisfied.

2.0 Introduction

EEABS (Elmstead Energy Assessments & Building Services) have been instructed to produce an Energy Statement and corresponding SAP calculations in support of a planning application for Rear and side dormers to provide 1 x 2-bed self-contained flat in the second floor roof space, at 200 Lancaster Road, Enfield.

The property which is the former Holly Bush Inn was converted to form a new Co-op convenience store which opened in December 2014. The accommodation at first floor level was subsequently converted to form two residential units as Permitted Development. The proposed flat will be available for sale/rent and occupied independently.

The report follows the recommendations of the 'Energy Hierarchy' to assess the onsite energy options for the new residential property in accordance with the plans submitted with the application. Standard Assessment Procedure (SAP) calculations have also been carried out using current SAP 2012 software to determine the proposed new dwellings amount of Carbon Emissions.

2.1 Site Description

The premises comprise a detached former public house currently containing a retail unit, with two residential flats above. The pub is understood to have replaced an earlier building on the site which was much older but was demolished in 1927.

The premises are of conventional construction, with brick walls and a concrete-tiled roof supported on timber trusses. At the front, facing Lancaster Road, the retail unit has a glazed shopfront between brick piers with automatic doors and large display windows.

The flats occupying the first floor are both accessed from an enclosed staircase at the side of the building leading to a common lobby at first floor level. Each flat has two bedrooms and an open-plan living/kitchen area with a small bathroom. The loft area is currently accessed via a hatch in the common area.

The site forms part of a commercial centre on Lancaster Road spanning from Lavender Road in the east, to Chase Side in the west. The centre is characterised by small local shops, many with flats above, interspersed with dwellings.

2.2 Proposed Development

The planning application proposes the conversion of the existing loft space to form a single apartment with a floor area of 115sqm comprising an open plan living/kitchen area served by new dormer windows. Two bedrooms and bathrooms would be lit by rooflights on the Lancaster Road elevation.

3.0 Policy Context

Numerous policies that relate to the energy and sustainability of the development have been considered in preparation of this statement.

3.1 National Planning Policy Framework

The National Planning Policy Framework encourages local planning authorities to adopt proactive strategies to mitigate and adapt to climate change. They should plan for new development in ways which reduce greenhouse gas emissions; actively support energy efficiency improvements to existing buildings; and set local sustainability requirements which are consistent with the government's policies and standards.

3.2 The London Plan

The Development Plan comprises the adopted London Plan (2016), a new draft of which was published for consultation in 2018 and subject to an Examination in 2019. Under the Greater London Authority Act 2007, the London Mayor has a statutory duty to contribute towards the mitigation of, and adaptation to, climate change in the UK. The London Plan seeks to achieve an overall reduction in London's carbon dioxide emissions of 60 per cent (below 1990 levels) by 2025.

Policy 5.2 of the London Plan requires development proposals to make the fullest contribution to minimising carbon dioxide emissions through on site methods in accordance with the following energy hierarchy:

- Be lean: use less energy
- Be clean: supply energy efficiently
- Be green: use renewable energy

Policy 5.3 requires the highest standards of sustainable design and construction to be achieved, and development proposals should demonstrate that sustainable design standards are integral to the proposal, including its construction and operation.

3.3 Enfield Development Management Document (DMD)

The Council's Development Management Document was adopted in November 2014. Policy DMD 49 requires new development to achieve the highest sustainable design and construction standards, and Policy DMD51 requires applications to demonstrate how the proposal minimises energy-related CO2 emissions and demonstrate how they have engaged with the energy hierarchy to maximise the energy efficiency of the proposal.

Discussions with Enfield Planning Consultants have produced the following CO2 emission reduction target.

"any conversions resulting in new dwellings demonstrate a 19% improvement in total CO_2 emissions arising from the operation of a development and its services over what is set out in Part L of the Building Regulations 2013."

3.4 Policy Summary

From inspection of the relevant policies for the proposed development we consider that the following targets need to meet in order to comply with Part L Building Regulations, The London Plan, and the Enfield Development Management Document.

- The proposed new dwelling should demonstrate a 19% improvement in total CO_2 emissions over what is set out in Part L of the Building Regulations 2013.
- To show how this 19% reduction has been achieved an Energy Assessment following the Energy Hierarchy has been carried out, informed by preliminary SAP calculations that can be found within the appendices.

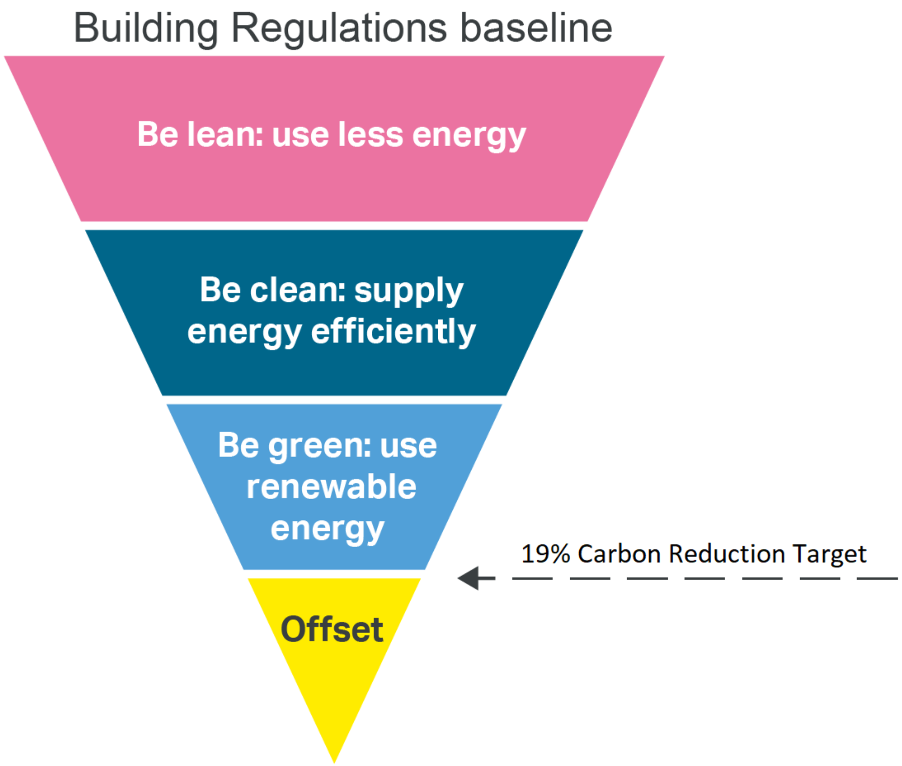

Figure 1 - Energy Hierarchy Diagram

4.0 Energy Assessment Methodology

The following methodology has been used to calculate the predicted CO2 emissions for the development.

4.1 Standard Assessment Procedure (SAP)

The Standard Assessment Procedure (SAP), is the methodology used to assess and compare the energy and environmental performance of dwellings. Its purpose is to provide accurate and reliable assessments of dwelling energy performances that are needed to underpin energy and environmental policy initiatives. Conversely, the scale runs from 100 (Most Efficient) to 0 (Least Efficient).

The ratings provide a measure of a building's overall energy efficiency and its environmental impact, calculated in accordance with a national methodology that considers factors such as insulation, heating and hot water systems, ventilation and fuels used.

We have used Design SAP 2012 software which is approved by Building Regulations to carry out the preliminary SAP calculations.

4.2 Limitations

The appraisals within this strategy are based on the Building Regulations Part L (2013) calculation methodology and should not be understood as a predictive assessment of likely future energy requirements or otherwise.

Occupants may operate their systems differently, and/or the weather may be different from the assumptions made by Part L approved calculation methods, leading to differing energy requirements once the development is in operation.

5.0 Energy Assessment

The following sections describe the design improvements incorporated under each stage of the Energy Hierarchy.

5.1 Be Lean

The following section describe the passive and active design measures that have been considered and implemented within the proposed development.

5.1.1 Passive Design Measures

Passive energy efficiency measures are those which reduce the initial energy demand of the building through passive means, for example wall insulation once installed requires no other means of operation and its performance is also unlikely to deteriorate.

Where possible the development has taken a fabric first approach to reducing the initial energy demand by the following methods:

Orientation and Glazing Location

The orientation of a development can have an impact on energy consumption due to the effects of passive solar heat gain and the provision of natural daylight. Glazing allows natural daylight penetration into a building which can reduce the need for artificial lighting. However, glazing also allows solar heat penetration which could lead to the overheating of internal spaces, which in turn could lead to the increased use of air conditioning/ventilation to reduce the temperature to levels that are comfortable and appropriate, and thus may increase energy consumption.

The proposed flat at second floor (loft) level has been designed with substantial dormer window openings on the south and west elevations in order to maximise solar gain and reduce dependence on artificial lighting during the daytime. This will reduce the need for additional heating, whilst the provision of shades or blinds will help prevent overheating on sunny/warm days. Roof lights on the northern elevation are proposed to boost light levels where possible.

The glazing has a proposed U-value of 1.4 W/m^2.K, a considerable improvement over the limiting value of 2.2 W/m^2.K, helping to reduce the amount of heat loss through the glazing.

Thermal Envelope

The inclusion of high levels of thermal insulation not only helps to reduce the buildings overall energy demand and therefore carbon emissions, it also plays a vital role in securing the occupants thermal comfort. It also helps to reduce the buildings peak heating and cooling loads required meaning that smaller plant equipment can be sized, helping to further improve not only carbon emissions but also the cost of the development.

The proposed conversion necessarily involves the retention of the existing external walls and roof structure, and the provision of a new staircase structure which have the potential for new/additional insulation to reduce thermal movement via conduction. This could help reduce loss of heat in the winter, or heat gain in the summer. U-values measure how effective a material is as an insulator, the lower the value in W/m2k, the greater the insulative property.

The developments walls, floors, roofs, and glazing will provide significant savings over Part L Building Regulations requirements.

Air Permeability

The air permeability of the development is a measure of how much volume of air can penetrate through its fabric. Therefore, a well built, highly sealed building would result in less unwanted heat loss or gain, and therefore provide a more efficient building.

In the proposed apartment, air tightness is important in order to prevent heat loss and the need for excessive input to overcome draughts. External windows will be double glazed and fitted with replaceable seals to prevent draughts. The entrance door will be located on the east side of the extended building, opening into an existing lobby to prevent direct air transference.

Although the building structure is expected to be airtight, the opportunity to open windows in the second floor/roofspace also allows for the escape of rising heat and convective cooling on warm days.

Part L Building Regulations have a maximum limit of 10 $m^3/h.m^2$ that must be achieved, the proposed development will be aiming for a target of 5 $m^3/h.m^2$.

Summary of Passive Design Measures

The table below shows a summary of the passive design measures included for within the development and how they compare against Part L of the Building Regulations.

Table 2 - Summary Table of Passive Design Measures

Parameter	Part L Limiting Value	Development Proposal	% Improvement
U-Values			
Walls	0.35 $W/m^2.K$	0.18 $W/m^2.K$	49%
Floors	No Heat Loss Floors		
Roofs	0.25 $W/m^2.K$	0.15 $W/m^2.K$	40%
Glazing	2.2 $W/m^2.K$	1.4$W/m^2.K$	36%
Air Permeability	10 $m^3/h.m^2$	5 $m^3/h.m^2$	50%

The summary of passive measures shows that the proposed development will be a considerable improvement over the Part L limiting values.

5.1.2 Active Design Measures

Active design measures are those which seek to supply the remaining demand for energy, after the initial demand has been lowered through passive means, in the most efficient way.

The following active design measures have been incorporated within the proposed development:

Heating

Heating to the proposed development is to be provided by an efficient Air Source Heat Pump System (ASHP). More details regarding the use of ASHP technology can be found later in this assessment.

Lighting and Controls

In the new apartment, fixed lighting can be specified during design/construction, and energy efficiency maximised through the use of LED units and dimmable/timer switches. There is much greater scope for natural lighting during the daytime due to the provision and orientation of windows and rooflights.

Fixed Appliances

It is expected that fixed appliances will be limited to heating system and cooker which will be specified to a high Energy Efficiency Rating and should preclude the use of additional/portable heaters. Other appliances such as refrigerators, washer/dryers, dishwashers etc. will remain the responsibility of occupiers, although most modern products are manufactures to a high Energy Efficiency Rating.

5.2 Be Clean

The following sections discuss the infrastructure and clean energy supply measures that have been considered for the Development to further reduce regulated CO2 emissions.

5.2.1 Combined Heat and Power

Combined Heat and Power (CHP) systems generate electricity and usable heat. In their simplest form they employ a turbine (usually gas or sometimes biofuel powered) to drive an alternator to generate electricity, with the waste heat produced during power generation being recovered to provide hot water for space heating and other uses. Combined Cooling Heat and Power (CCHP) works in a similar manner except the waste heat is also used to provide cooling, typically by feeding part of the waste heat through an absorption chiller.

There is insufficient space within the new apartment to incorporate a CHP or CCHP plant. The effective use of Combined Heat and Power (CHP) and Combined Cooling Heat and Power (CCHP) requires a substantial and consistent demand for heat/cooling and electricity. Consequently, the Department of Energy and Climate Change has indicated that the use of CHP/CCHP is preferred for district networks which contain sufficient balanced loads across a day, month and year to enable them to operate efficiently. These are generally high rise residential developments combined with substantial quantities of retail, office and employment space. For the reasons above, the site does not lend itself to the use of CHP/CCHP.

5.3 Be Green

The following sections discuss the low carbon and renewable technologies that have been considered for the development.

5.3.1 Assessment of Renewable Technologies

The table below provides a brief analysis of the different renewables considered for the site and comments on their overall feasibility.

Table 3 - Low Carbon and Renewable Technologies Analysis

Low Carbon or Renewable Technology	Comments	Feasible
Ground Source Heat Pumps	Ground source heat pumps (GSHPs) work by extracting heat from the ground, in the same way that a fridge extracts heat from its interior. A refrigerant, such as a mixture of water and antifreeze, is pumped through a series of underground pipes called ground loops. The heat from the ground is absorbed into the liquid and then passed through a heat exchanger before being used to heat water within a cylinder.	To determine whether GSHPs are viable, a detailed geological survey, including test boreholes, is required to verify the suitability of ground conditions and accurately estimate the potential capacity of a GSHP scheme. Given the limited access to ground level space, there is unlikely to be scope to incorporate a GSHP system in the scheme.
Air Source Heat Pumps	Air Source Heat Pumps (ASHPs) work in a very similar way, except the refrigerant runs in pipes within a compact unit and extracts heat from the outside air. The heat captured from each system is then compressed, increasing the temperature to around 60 degrees centigrade. This can be used as warm air heating or to provide hot water as space heating via radiators or under floor systems.	ASHPs do not require an initial viability study since a standard ASHP can extract heat from air temperatures as low as -15°C. An initial appraisal of the design plans shows there may be space to install such a unit at roof level. ASHPs are considered to be a viable technology for use within the scheme.
Photovoltaic Panels	Photovoltaic (PV) panels work by using the sun's energy to create electricity. Current PV panels contain cells which are made up from layers of semiconducting material such as silicone. When the sunlight hits the cell, an electric field is created across the layers which are then passed through an inverter that converts the electrical current from Direct Current to Alternating Current, ready for use within a building.	Whilst the residential apartment could utilise solar energy, the roof construction, its limited area and the presence of rooflights limit the scope for solar energy technologies.

Solar Hot Water Panels	Solar Hot Water (SHW) Panels also utilise the sun's energy but to heat water rather than generate electricity. Water is pumped through a solar panel, called a collector, and as the sunlight hits the panel, the water inside is heated and then transferred to a hot water cylinder.	Whilst the residential apartment could utilise solar energy, the roof construction, its limited area and the presence of rooflights limit the scope for solar energy technologies.
Wind Turbines	A wind turbine is a device that converts kinetic energy from the wind into mechanical energy, which is then used to produce electricity. Wind turbines will start to generate electricity with wind speeds of around 4m/s and will be at their optimal efficiency at 15m/s. The efficiency of these would also be limited by turbulence created by surrounding buildings. They also give rise to noise and visual disturbance in densely populated areas and are therefore better suited to wholly commercial or rural locations.	Micro wind turbines will generate the most power when turbulence levels in the wind are low. Within the urban environment smooth air flow will almost never occur, however, and there will always be some turbulence. In addition, a life cycle cost analysis conducted by the BRE suggests that there is no financial payback within the expected life of micro-wind turbines. When these factors are considered it is concluded that wind power is unlikely to be viable for use within the scheme.
Geothermal	Geothermal energy is stored in the form of heat beneath the Earth's surface. This energy is carbon free and forms a renewable source that could be used to provide a continuous, uninterrupted supply of heat.	Geothermal energy is not usually recommended for use except for granitic areas such as Cornwall, and the London area has low geothermal potential. The scale of the proposed scheme does not lend itself to geothermal technology.
Biomass	The most common forms of biomass are wood pellets, chips or logs. These are considered a low carbon option as the CO2 emitted when burned is the same amount as the plant absorbed over the months/years that it was growing.	Biomass generators involve emissions which are generally unacceptable in densely populated areas and are therefore better suited to wholly commercial or rural locations. There is also unlikely to be enough space at the site to safely incorporate a furnace and storage hopper for the biomass fuel.
Biodiesel	Biodiesel is a blended form of oil made from vegetable oil crops e.g. rapeseed, soya, palm oil, through a process known as transesterification.	For the same reasons explained in relation to biomass, the site is unlike to be suitable for a biodiesel generator.

From brief assessment of the various renewable technologies available we can see that the use of ASHPs to provide heating would be the most feasible to install.

6.0 Energy Assessment Results

A summary table of the SAP energy assessment results can be seen below. The full SAP calculation and Predicted Energy Assessment worksheets can be found within the Appendices.

Table 4 - Summary of Energy Assessment Results

Area (m2)	TER CO2 Emission Rate (kgCO2/m2)	DER CO2 Emission Rate (kgCO2/m2)	TFEE - Target Fabric Energy Efficiency (kWh/m2)	DFEE - Dwelling Fabric Energy Efficiency (kWh/m2)
120.1	25.62	19.80	57.37	57.05

The results show that the Target Emission Rate (TER) of the development would be 25.62 kgCO2/m2 and following the energy hierarchy as described in this report the Dwelling Emission Rate would be 19.80 kgCO2/m2.

This would be a 22.7% improvement over Part L Building Regulations 2013 and therefore the London Borough of Enfield's target reduction of 19% would be satisfied.

Appendix A - SAP Calculation and Predicted Energy Assessment

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Holly Bush	**Issued on Date**	14/01/2020
Assessment Reference	200C	**Prop Type Ref**	
Property	200c, Lancaster Road, Enfield, middlesex, EN2 0JH		

SAP Rating	80 C	**DER**	19.80	**TER**	25.62
Environmental	82 B	**% DER<TER**	22.72		
CO_2 Emissions (t/year)	2.11	**DFEE**	57.05	**TFEE**	57.37
General Requirements Compliance	Pass	**% DFEE<TFEE**	0.55		

Assessor Details	Mr. Darren Coham, Darren Coham, Tel: 07887912456, darrencoham@hotmail.com	**Assessor ID**	R789-0001
Client			

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Top-floor flat, total floor area 120 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
----------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 25.62 kgCO2/m²
Dwelling Carbon Dioxide Emission Rate (DER) 19.80 kgCO2/m²OK
----------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)57.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)57.1 kWh/m²/yrOK
----------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                Highest
External wall   0.17 (max. 0.30)       0.17 (max. 0.70)          OK
Floor           (no floor)
Roof            0.15 (max. 0.20)       0.15 (max. 0.35)          OK
Openings        1.41 (max. 2.00)       1.50 (max. 3.30)          OK
----------------------------------------------------------------------------------------------------
2a Thermal bridging
Thermal bridging calculated using default y-value of 0.15
----------------------------------------------------------------------------------------------------
3 Air permeability
Air permeability at 50 pascals:        5.00 (design value)
Maximum                                10.0                                               OK
----------------------------------------------------------------------------------------------------
4 Heating efficiency
Main heating system:                   Heat pump with radiators or underfloor - Electric
Mitsubishi ECODAN 8.5kW PUHZ-W85VHA(2)-BS



Secondary heating system:              None
----------------------------------------------------------------------------------------------------
5 Cylinder insulation
Hot water storage                      Measured cylinder loss: 1.20 kWh/day
Permitted by DBSCG 2.03                           OK
Primary pipework insulated:            No primary pipework
----------------------------------------------------------------------------------------------------
6 Controls
Space heating controls:                Time and temperature zone control                  OK


Hot water controls:                    Cylinderstat                                       OK


----------------------------------------------------------------------------------------------------
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                                75%                                                OK
----------------------------------------------------------------------------------------------------
8 Mechanical ventilation
Not applicable
----------------------------------------------------------------------------------------------------
9 Summertime temperature
Overheating risk (Thames Valley):      Slight                                             OK
Based on:
Overshading:                           Average
Windows facing East:                   1.17 m², No overhang
Windows facing South:                  3.54 m², No overhang
Windows facing West:                   3.54 m², No overhang
Air change rate:                       6.00 ach
Blinds/curtains:                       None
----------------------------------------------------------------------------------------------------
10 Key features
None



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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		120.1000 (1b)	x	2.7000 (2b)	=	324.2700	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.1000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	324.2700	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.0617	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3117	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3117	(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	0.3974	0.3896	0.3818	0.3428	0.3351	0.2961	0.2961	0.2883	0.3117	0.3351	0.3506	0.3662	(22b)
Effective ac	0.5790	0.5759	0.5729	0.5588	0.5561	0.5438	0.5438	0.5416	0.5486	0.5561	0.5615	0.5671	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
windows (Uw = 1.40)			8.2500	1.3258	10.9375			(27)
Door			2.1000	1.5000	3.1500			(26)
Roof Lights (Uw = 1.40)			3.9600	1.3258	5.2500			(27a)
External Wall 1	149.3900	10.3500	139.0400	0.1651	22.9607			(29a)
External Roof 1	120.1000	3.9600	116.1400	0.1500	17.4210			(30)
Total net area of external elements Aum(A, m2)			269.4900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.7192			(33)
Party Floor 1			120.1000					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		100.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)		40.4235	(36)
Total fabric heat loss	(33) + (36) =	100.1427	(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	61.9538	61.6258	61.3042	59.7936	59.5110	58.1954	58.1954	57.9517	58.7021	59.5110	60.0827	60.6804	(38)
Heat transfer coeff	162.0966	161.7685	161.4469	159.9363	159.6537	158.3381	158.3381	158.0945	158.8449	159.6537	160.2255	160.8232	(39)
Average = Sum(39)m / 12 =												159.9350	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3497	1.3469	1.3443	1.3317	1.3293	1.3184	1.3184	1.3164	1.3226	1.3293	1.3341	1.3391	(40)
HLP (average)												1.3317	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8637	(42)
Average daily hot water use (litres/day)	102.2129	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.4342	108.3456	104.2571	100.1686	96.0801	91.9916	91.9916	96.0801	100.1686	104.2571	108.3456	112.4342	(44)
Energy conte	166.7366	145.8289	150.4824	131.1942	125.8839	108.6283	100.6601	115.5089	116.8884	136.2222	148.6972	161.4755	(45)
Energy content (annual)										Total = Sum(45)m =		1608.2065	(45)
Distribution loss (46)m = 0.15 x (45)m	25.0105	21.8743	22.5724	19.6791	18.8826	16.2942	15.0990	17.3263	17.5333	20.4333	22.3046	24.2213	(46)

Water storage loss:

Store volume	170.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.2000	(48)
Temperature factor from Table 2b	0.6000	(49)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Enter (49) or (54) in (55)												0.7200	(55)
Total storage loss	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(56)
If cylinder contains dedicated solar storage	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(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)
Total heat required for water heating calculated for each month	189.0566	165.9889	172.8024	152.7942	148.2039	130.2283	122.9801	137.8289	138.4884	158.5422	170.2972	183.7955	(62)
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	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h	189.0566	165.9889	172.8024	152.7942	148.2039	130.2283	122.9801	137.8289	138.4884	158.5422	170.2972	183.7955	(64)
Total per year (kWh/year) = Sum(64)m =												1871.0065	(64)
Heat gains from water heating, kWh/month	73.2959	64.6161	67.8914	60.9021	59.7124	53.3989	51.3255	56.2627	56.1454	63.1499	66.7218	71.5466	(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	143.1850	143.1850	143.1850	143.1850	143.1850	143.1850	143.1850	143.1850	143.1850	143.1850	143.1850	143.1850	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.8716	25.6435	20.8547	15.7884	11.8020	9.9637	10.7662	13.9943	18.7831	23.8494	27.8358	29.6741	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	285.3433	288.3043	280.8427	264.9580	244.9063	226.0606	213.4705	210.5095	217.9711	233.8558	253.9075	272.7532	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3185	37.3185	37.3185	37.3185	37.3185	37.3185	37.3185	37.3185	37.3185	37.3185	37.3185	37.3185	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-114.5480	-114.5480	-114.5480	-114.5480	-114.5480	-114.5480	-114.5480	-114.5480	-114.5480	-114.5480	-114.5480	-114.5480	(71)
Water heating gains (Table 5)	98.5160	96.1549	91.2519	84.5862	80.2586	74.1651	68.9858	75.6219	77.9797	84.8789	92.6692	96.1648	(72)
Total internal gains	478.6865	476.0582	458.9048	431.2880	402.9224	376.1450	359.1780	366.0812	380.6894	408.5396	440.3680	464.5476	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	1.1700	19.6403	0.7600	0.7000	0.7700	8.4718	(76)
South	3.5400	46.7521	0.7600	0.7000	0.7700	61.0167	(78)
West	3.5400	19.6403	0.7600	0.7000	0.7700	25.6328	(80)
North	3.9600	26.0000	0.7600	0.7000	1.0000	49.2972	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	144.4186	269.0321	419.1848	588.5166	710.3424	724.5183	690.7108	598.9799	478.8029	312.0867	177.4197	120.5871	(83)
Total gains	623.1051	745.0904	878.0896	1019.8046	1113.2648	1100.6632	1049.8888	965.0611	859.4922	720.6263	617.7876	585.1346	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.5810	20.6228	20.6638	20.8590	20.8959	21.0695	21.0695	21.1020	21.0023	20.8959	20.8214	20.7440	
alpha	2.3721	2.3749	2.3776	2.3906	2.3931	2.4046	2.4046	2.4068	2.4002	2.3931	2.3881	2.3829	
util living area	0.9762	0.9629	0.9370	0.8846	0.7986	0.6766	0.5529	0.6016	0.7859	0.9184	0.9658	0.9794	(86)
Tweekday	15.9160	16.3406	17.0807	18.0411	18.8875	19.4837	19.7219	19.6861	19.2360	18.1274	16.8553	15.8446	
Tweekend	19.1123	19.3012	19.6321	20.0653	20.4606	20.7559	20.8944	20.8667	20.6184	20.0959	19.5260	19.0787	
24 / 16	9	8	9	8	9	9	9	9	8	9	8	9	
24 / 9	22	20	22	22	22	21	22	22	22	22	22	22	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	(87)
Th 2	19.8021	19.8042	19.8063	19.8161	19.8179	19.8265	19.8265	19.8280	19.8232	19.8179	19.8142	19.8104	(88)
util rest of house	0.9722	0.9567	0.9259	0.8628	0.7568	0.6006	0.4382	0.4902	0.7254	0.8986	0.9590	0.9760	(89)
Tweekday	15.9160	16.3406	17.0807	18.0411	18.8875	19.4837	19.7219	19.6861	19.2360	18.1274	16.8553	15.8446	
Tweekend	15.9160	16.3406	17.0807	18.0411	18.8875	19.4837	19.7219	19.6861	19.2360	18.1274	16.8553	15.8446	
MIT 2	19.8021	19.8042	19.8063	19.8161	19.8179	19.8265	19.8265	19.8280	19.8232	19.8179	19.8142	19.8104	(90)
Living area fraction									fLA = Living area / (4) =			0.4380	(91)
MIT	20.3268	20.3279	20.3291	20.3346	20.3356	20.3404	20.3404	20.3413	20.3386	20.3356	20.3336	20.3314	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3268	20.3279	20.3291	20.3346	20.3356	20.3404	20.3404	20.3413	20.3386	20.3356	20.3336	20.3314	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9741	0.9596	0.9311	0.8730	0.7763	0.6362	0.4917	0.5426	0.7543	0.9080	0.9621	0.9776	(94)
Useful gains	606.9549	714.9715	817.5695	890.2575	864.2528	700.2290	516.2701	523.6637	648.2922	654.3239	594.4000	572.0162	(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	2597.8822	2495.7554	2232.6672	1828.8090	1378.7113	908.9292	592.2530	623.1013	990.9669	1554.3304	2120.3521	2594.2996	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1481.2500	1196.6868	1052.8327	675.7571	382.7571	0.0000	0.0000	0.0000	0.0000	669.6048	1098.6855	1504.5789	(98)
Space heating												8062.1528	(98)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating per m2	(98) / (4) =	67.1287	(99)

8c. Space cooling requirement

Not applicable

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 %)	366.2060	(206)
Efficiency of secondary/supplementary heating system, %	100.0000	(208)
Space heating requirement	2201.5349	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1481.2500	1196.6868	1052.8327	675.7571	382.7571	0.0000	0.0000	0.0000	0.0000	669.6048	1098.6855	1504.5789	(98)
Space heating efficiency (main heating system 1)	366.2060	366.2060	366.2060	366.2060	366.2060	0.0000	0.0000	0.0000	0.0000	366.2060	366.2060	366.2060	(210)
Space heating fuel (main heating system)	404.4854	326.7797	287.4974	184.5292	104.5196	0.0000	0.0000	0.0000	0.0000	182.8492	300.0184	410.8559	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Water heating requirement	189.0566	165.9889	172.8024	152.7942	148.2039	130.2283	122.9801	137.8289	138.4884	158.5422	170.2972	183.7955	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	189.0566	165.9889	172.8024	152.7942	148.2039	130.2283	122.9801	137.8289	138.4884	158.5422	170.2972	183.7955	(219)

Water heating fuel used	1871.0065	(219)
Annual totals kWh/year		
Space heating fuel - main system	2201.5349	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	509.8822	(232)
Total delivered energy for all uses	4582.4236	(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	2201.5349	0.5190	1142.5966	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	1871.0065	0.5190	971.0524	(264)
Space and water heating			2113.6490	(265)
Pumps and fans	0.0000	0.0000	0.0000	(267)
Energy for lighting	509.8822	0.5190	264.6289	(268)
Total CO2, kg/year			2378.2778	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			19.8000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		19.8000	ZC1
Total Floor Area	TFA	120.1000	
Assumed number of occupants	N	2.8637	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.0790	ZC2
CO2 emissions from cooking, equation (L16)		1.5631	ZC3
Total CO2 emissions		35.4421	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		35.4421	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)			Storey height (m)			Volume (m3)	
Ground floor	120.1000	(1b)	x	2.7000	(2b)	=	324.2700	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.1000							(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)		=	324.2700	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1234	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3734	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3734	(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	0.4760	0.4667	0.4574	0.4107	0.4014	0.3547	0.3547	0.3454	0.3734	0.4014	0.4200	0.4387	(22b)
Effective ac	0.6133	0.6089	0.6046	0.5843	0.5805	0.5629	0.5629	0.5596	0.5697	0.5805	0.5882	0.5962	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1000	1.0000	2.1000			(26)
TER Opening Type (Uw = 1.40)			8.2500	1.3258	10.9375			(27)
TER Room Window (Uw = 1.70)			3.9600	1.5918	6.3034			(27a)
External Wall 1	149.3900	10.3500	139.0400	0.1800	25.0272			(29a)
External Roof 1	120.1000	3.9600	116.1400	0.1300	15.0982			(30)
Total net area of external elements Aum(A, m2)			269.4900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		59.4663			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)		13.4745	(36)
Total fabric heat loss	(33) + (36) =	72.9408	(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	65.6287	65.1579	64.6965	62.5289	62.1234	60.2355	60.2355	59.8859	60.9627	62.1234	62.9438	63.8015	(38)
Heat transfer coeff	138.5695	138.0987	137.6372	135.4697	135.0642	133.1763	133.1763	132.8267	133.9035	135.0642	135.8846	136.7423	(39)
Average = Sum(39)m / 12 =												135.4678	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1538	1.1499	1.1460	1.1280	1.1246	1.1089	1.1089	1.1060	1.1149	1.1246	1.1314	1.1386	(40)
HLP (average)												1.1280	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8637	(42)
Average daily hot water use (litres/day)	102.2129	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.4342	108.3456	104.2571	100.1686	96.0801	91.9916	91.9916	96.0801	100.1686	104.2571	108.3456	112.4342	(44)
Energy conte	166.7366	145.8289	150.4824	131.1942	125.8839	108.6283	100.6601	115.5089	116.8884	136.2222	148.6972	161.4755	(45)
Energy content (annual)										Total = Sum(45)m =		1608.2065	(45)
Distribution loss (46)m = 0.15 x (45)m	25.0105	21.8743	22.5724	19.6791	18.8826	16.2942	15.0990	17.3263	17.5333	20.4333	22.3046	24.2213	(46)

Water storage loss:		
Store volume	170.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.5003	(48)
Temperature factor from Table 2b	0.5400	(49)
Enter (49) or (54) in (55)	0.8102	(55)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153	(56)
If cylinder contains dedicated solar storage	25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	215.1143	189.5249	198.8601	178.0113	174.2616	155.4454	149.0378	163.8866	163.7056	184.5999	195.5143	209.8532	(62)
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	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h	215.1143	189.5249	198.8601	178.0113	174.2616	155.4454	149.0378	163.8866	163.7056	184.5999	195.5143	209.8532	(64)
Total per year (kWh/year) = Sum(64)m =												2177.8149	(64)
Heat gains from water heating, kWh/month	94.1421	83.4449	88.7375	81.0758	80.5586	73.5726	72.1716	77.1089	76.3191	83.9960	86.8955	92.3928	(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	143.1850	143.1850	143.1850	143.1850	143.1850	143.1850	143.1850	143.1850	143.1850	143.1850	143.1850	143.1850	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.8716	25.6435	20.8547	15.7884	11.8020	9.9637	10.7662	13.9943	18.7831	23.8494	27.8358	29.6741	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	285.3433	288.3043	280.8427	264.9580	244.9063	226.0606	213.4705	210.5095	217.9711	233.8558	253.9075	272.7532	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3185	37.3185	37.3185	37.3185	37.3185	37.3185	37.3185	37.3185	37.3185	37.3185	37.3185	37.3185	(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)	-114.5480	-114.5480	-114.5480	-114.5480	-114.5480	-114.5480	-114.5480	-114.5480	-114.5480	-114.5480	-114.5480	-114.5480	(71)
Water heating gains (Table 5)	126.5351	124.1740	119.2709	112.6052	108.2776	102.1842	97.0049	103.6409	105.9988	112.8979	120.6882	124.1838	(72)
Total internal gains	509.7055	507.0773	489.9238	462.3071	433.9414	407.1640	390.1970	397.1002	411.7084	439.5587	471.3870	495.5666	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	1.1700	19.6403	0.6300	0.7000	0.7700	7.0227	(76)
South	3.5400	46.7521	0.6300	0.7000	0.7700	50.5797	(78)
West	3.5400	19.6403	0.6300	0.7000	0.7700	21.2482	(80)
North	3.9600	26.0000	0.6300	0.7000	1.0000	40.8648	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	119.7154	223.0135	347.4821	487.8493	588.8364	600.5875	572.5629	496.5228	396.9024	258.7034	147.0716	99.9603	(83)
Total gains	629.4209	730.0907	837.4060	950.1564	1022.7779	1007.7515	962.7600	893.6231	808.6108	698.2621	618.4586	595.5269	(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	60.1884	60.3936	60.5961	61.5656	61.7505	62.6258	62.6258	62.7907	62.2857	61.7505	61.3777	60.9927	
alpha	5.0126	5.0262	5.0397	5.1044	5.1167	5.1751	5.1751	5.1860	5.1524	5.1167	5.0918	5.0662	
util living area	0.9989	0.9975	0.9927	0.9730	0.9093	0.7607	0.5895	0.6505	0.8878	0.9857	0.9977	0.9992	(86)
MIT	19.6830	19.8308	20.0887	20.4389	20.7438	20.9325	20.9855	20.9766	20.8378	20.4372	20.0021	19.6661	(87)
Th 2	19.9572	19.9603	19.9634	19.9781	19.9808	19.9936	19.9936	19.9960	19.9887	19.9808	19.9752	19.9695	(88)
util rest of house	0.9986	0.9966	0.9899	0.9621	0.8715	0.6723	0.4644	0.5246	0.8267	0.9781	0.9968	0.9989	(89)
MIT 2	18.1933	18.4116	18.7896	19.3035	19.7195	19.9465	19.9880	19.9858	19.8503	19.3088	18.6731	18.1773	(90)
Living area fraction									fLA = Living area / (4) =			0.4380	(91)
MIT	18.8457	19.0332	19.3586	19.8008	20.1681	20.3783	20.4249	20.4197	20.2828	19.8030	19.2552	18.8294	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8457	19.0332	19.3586	19.8008	20.1681	20.3783	20.4249	20.4197	20.2828	19.8030	19.2552	18.8294	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9955	0.9877	0.9597	0.8795	0.7085	0.5197	0.5801	0.8472	0.9764	0.9958	0.9985	(94)
Useful gains	628.1530	726.8203	827.1379	911.8815	899.5051	713.9747	500.3082	518.4151	685.0313	681.7729	615.8501	594.6238	(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	2015.5968	1951.7720	1769.8222	1476.7244	1143.7389	769.5349	509.3828	533.9253	827.9023	1242.9968	1651.6991	2000.4547	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1032.2582	823.1675	701.3571	406.6869	181.7099	0.0000	0.0000	0.0000	0.0000	417.5506	745.8113	1045.9382	(98)
Space heating												5354.4797	(98)
Space heating per m2											(98) / (4) =	44.5835	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %)	93.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5726.7163	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1032.2582	823.1675	701.3571	406.6869	181.7099	0.0000	0.0000	0.0000	0.0000	417.5506	745.8113	1045.9382	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	1104.0194	880.3931	750.1146	434.9592	194.3422	0.0000	0.0000	0.0000	0.0000	446.5782	797.6591	1118.6505	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Water heating requirement	215.1143	189.5249	198.8601	178.0113	174.2616	155.4454	149.0378	163.8866	163.7056	184.5999	195.5143	209.8532	(64)
Efficiency of water heater												79.8000	(216)
(217)m	88.4546	88.2846	87.8965	86.9505	84.9255	79.8000	79.8000	79.8000	79.8000	86.9268	88.0479	88.5166	(217)
Fuel for water heating, kWh/month	243.1917	214.6750	226.2434	204.7272	205.1935	194.7937	186.7641	205.3717	205.1448	212.3625	222.0545	237.0777	(219)

Water heating fuel used	2557.5999	(219)
Annual totals kWh/year		
Space heating fuel - main system	5726.7163	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	75.0000	(231)
Electricity for lighting (calculated in Appendix L)	509.8822	(232)
Total delivered energy for all uses	8869.1983	(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	5726.7163	0.2160	1236.9707	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2557.5999	0.2160	552.4416	(264)
Space and water heating			1789.4123	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	509.8822	0.5190	264.6289	(268)
Total CO2, kg/m2/year			2092.9661	(272)
Emissions per m2 for space and water heating			14.8994	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.2034	(272b)
Emissions per m2 for pumps and fans			0.3241	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.8994 * 1.55) + 2.2034 + 0.3241, rounded to 2 d.p.			25.6200	(273)

PREDICTED ENERGY ASSESSMENT

Design SAP
elmhurst energy

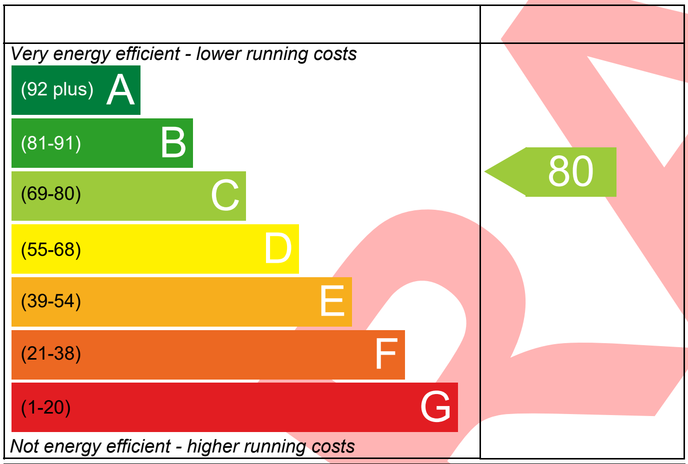
200c, Lancaster Road,
Enfield,
middlesex,
EN2 0JH

Dwelling type:	Flat, Detached
Date of assessment:	14/01/2020
Produced by:	Darren Coham
Total floor area:	120.1 m²

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

The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO_2) emissions.

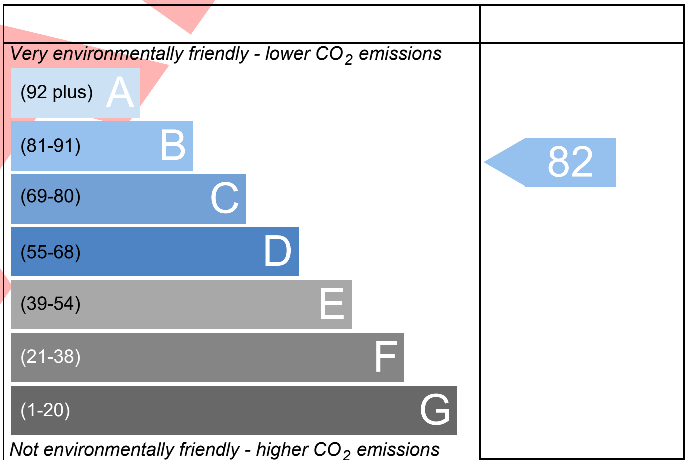
Energy Efficiency Rating



England EU Directive 2002/91/EC

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

Environmental Impact (CO_2) Rating



England EU Directive 2002/91/EC

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

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Holly Bush	Issued on Date	14/01/2020
Assessment Reference	200C	Prop Type Ref	
Property	200c, Lancaster Road, Enfield, middlesex, EN2 0JH		

SAP Rating	80 C	DER	19.80	TER	25.62
Environmental	82 B	% DER<TER	22.72		
CO_2 Emissions (t/year)	2.11	DFEE	57.05	TFEE	57.37
General Requirements Compliance	Pass	% DFEE<TFEE	0.55		

Assessor Details	Mr. Darren Coham, Darren Coham, Tel: 07887912456, darrencoham@hotmail.com	Assessor ID	R789-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Electricity		
Fuel factor	1.55 (electricity)		
Target Carbon Dioxide Emission Rate (TER)	25.62	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	19.80	$kgCO_2/m^2$	Pass
	-5.82 (-22.7%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	57.37	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	57.05	$kWh/m^2/yr$	
	-0.3 (-0.5%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.17 (max. 0.70)	Pass
Roof	0.15 (max. 0.20)	0.15 (max. 0.35)	Pass
Openings	1.41 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated using default y-value of 0.15

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Heat pump with radiators or underfloor - Electric Mitsubishi ECODAN 8.5kW PUHZ-W85VHA(2)-BS	
Secondary heating system	None	

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.20 kWh/day Permitted by DBSCG 2.03	Pass
Primary pipework insulated	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	Pass
Hot water controls	Cylinderstat	Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)	Slight	Pass

Based on:

Overshading	Average
Windows facing East	1.17 m², No overhang
Windows facing South	3.54 m², No overhang
Windows facing West	3.54 m², No overhang
Air change rate	6.00 ach
Blinds/curtains	None

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

10 Key features

None	N/A

	Typical cost	Typical savings per year	Energy efficiency	Environmental impact	Result
Low energy lights			0	0	Already installed
Solar water heating			0	0	Not applicable
Photovoltaic			0	0	Not applicable
Wind turbine			0	0	Not applicable
Totals	**£0**	**£0**	**C 80**	**B 82**	

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.