ENERGY & OVERHEATING ASSESSMENT

40 HILLWAY

PROPERTY ADDRESS
40 HILLWAY,
LONDON,
N6 6HH,

DATE
May 23

PREPARED BY
EAL Consult

winner 2020 Home and Garden Awards

EAL Consult
Best Energy Compliance Consultancy - London

BUILD

Quidos
Excellence in Efficiency

Contents

1. EXECUTIVE SUMMARY

This Sustainability statement has been prepared to support the installation of three outdoor air condenser units within acoustic enclosures at No 40 Hillway. The works have already been carried out. Two air conditioning units already exist on site and a third unit is proposed. The strategy highlights how the development promotes sustainability throught both design and operation and summarises the relevant regulatory and planning policies applicable and how the relevant policy targets will be addressed and achieved. The report analyses also whether 40 Hillway has comfort level in accordance with the criteria set out in CIBSE TM59 and TM49 to assess the space against the cooling hierarchy presented in section 6 and confirm whether an active cooling system will be required.

The strategy reponds to the UK Planning and regulatory framework, the National Planning Policy Framework 2021, the New London Plan and Camden Local Plan 2017.

This statement outlines an overall commitment to reducing energy consumption under occupancy through the adoption of a 'Fabric First' principle, which will seek enhanced insulation standards and improved heating and lighting efficiencies in comparison to the standard requirements of Approved Document Part L 2013.

Where an existing building is being assessed the dwelling emission rates (DER) of the notional flats and proposed flats are compared to determine the level of improvement. This is in line with Building Regulations 2013 Part L1B for Existing Buildings.

The report also demonstrates that the dwelling, by incorporating the measures above, can achieve an average carbon emission reduction of **38.7%** on Notional Dewelling emission.

Table 1. Carbon Emission Rate

Dwelling	Notional DER	Lean DER (without active cooling)	Lean DER (with active cooling)
40 Hillway	59.31	36.36	36.37

SAP methodology and Building regulations Part L 2013 have been used in the assessment

Table 2. Carbon Dioxide emissions after each stage of the Energy Hierarchy

	Carbon dioxide emissions (Tonnes CO2 per annum) – without Active cooling		Carbon dioxide emissions (Tonnes CO2 per annum) – with Active cooling	
	Regulated	**Total**	**Regulated**	**Total**
Building Regs Notional Development	11.26	13.51	11.26	13.51
After Energy demand Reduction	6.90	8.28	6.90	8.28

Table 3. Carbon Dioxide Savings from each stage of the Energy Hierarchy

	With Active cooling		Without Active cooling	
	Regulated Carbon dioxide savings (Tonnes CO_2)	% Improvement	Regulated Carbon dioxide savings (Tonnes CO_2)	% Improvement
Savings from energy efficiency measures	4.35	**38.7%**	4.35	**38.7%**

The results show that the carbon dioxide savings are similar for both options, with or without active cooling, and therefore it can be concluded that the use of active cooling does not lead to the increase of carbon emissions.

The reported improvements, that exceed Part L requirements, are also deemed to be at the limit of financial viability for this minor development.

2. INTRODUCTION

Site description
The development is located at 40 Hillway, London, N6 6HH.

Methodology
This energy assessment outlines the energy demand from the development together with the associated CO_2 emissions, using the present Building Regulations Part L as a baseline. It demonstrates how the emissions from energy use in the development will be reduced through energy efficiency measures.

The proposed scheme is required to achieve carbon emission reduction principles in accordance with the UK Planning and regulatory framework,

The methodology employed to determine the potential CO_2 savings is in accordance with the three-step Energy Hierarchy.

- **Be Lean -** Improve the energy efficiency of the scheme;
- **Be Clean -** Supply as much of the remaining energy requirement with low carbon; technologies such as district heating if available or combined heat and power (CHP); and
- **Be Green -** Offset a proportion of the remaining carbon dioxide emissions by using renewable technologies.

The government approved Standard Assessment Procedure (SAP) methodology software (2013) has been used to determine the CO_2 emissions and energy requirements. It compares CO_2 emissions from regulated energy use (DER) with those of an equivalent dwelling built to Part L 2013 (TER), a notional dwelling of the same size and shape. These calculations do not include emissions from cooking or appliances. As the works have already been completed, Building Regulations Part L 2013 apply.

Opportunities for incorporating features into the development that contribute to the objectives of sustainable development were explored during the design process, to ensure that where possible, the proposals achieve best practice.

3. PLANNING POLICY CONTEXT

National Planning Policy Framework 2021 – emphasised the concept of sustainable development by encouraging local authorities to adopt proactive strategies to mitigate and adapt to climate change. It recommends the move to a low carbon future by:

- Avoiding increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and
- Contributing to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards.
- To help increase the use and supply of renewable and low carbon energy and heat, plans should:
    - provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts);
    - consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and
    - identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for colocating potential heat customers and suppliers.

The London Plan 2021 provides the strategic framework for an integrated socio-economic, transportation and environmental development plan across the capital to 2050. The Plan seeks to ensure new developments are designed to enable the efficient use of energy and support the development of sustainable energy infrastructure to produce energy more efficiently. It sets out a range of policies that apply to new developments.

Policy SI 2 Minimising Greenhouse Gas Emissions:

A. Development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy: a) Be lean: use less energy and manage demand during operation, b) Be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly, c) Be green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site.

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

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

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

E. Major development proposals should calculate and minimise carbon emissions from any other part of the development, including plant or equipment, that are not covered by Building Regulations, i.e. unregulated emissions.
F. Development proposals referable to the Mayor should calculate whole lifecycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions.

9.2.1 The Mayor is committed to London becoming a zero-carbon city. This will require reduction of all greenhouse gases, of which carbon dioxide is the most prominent. London's homes and workplaces are responsible for producing approximately 78 per cent of its greenhouse gas emissions. If London is to achieve its objective of becoming a zero-carbon city by 2050, new development needs to meet the requirements of this policy. Development involving major refurbishment should also aim to meet this policy.

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

Policy SI 4 Managing heat risk

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

Camden Local Plan 2017

Policy CC1 Climate change mitigation

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

We will:

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

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

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

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

Policy CC2 Adapting to climate change

All new developments will be expected to submit a statement demonstrating how the London Plan's 'cooling hierarchy' has informed the building design. Any development that is likely to be at risk of overheating (for example due to large expanses of south or south west facing glazing) will be required to complete dynamic thermal modelling to demonstrate that any risk of overheating has been mitigated.

Active cooling (air conditioning) will only be permitted where dynamic thermal modelling demonstrates there is a clear need for it after all the preferred measures are incorporated in line with the cooling hierarchy.

The cooling hierarchy includes:

- Minimise internal heat generation through energy efficient design;
- Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls;
- Manage the heat within the building through exposed internal thermal mass and high ceilings;
- Passive ventilation;
- Mechanical ventilation; and
- Active cooling

4. ENERGY STRATEGY

The Energy strategy for the proposed development is based on the Building Regulations Part L. It adopts a set of principles to guide design and decisions regarding energy, balanced with the need to optimise environmental and economic benefits. It incorporates energy efficiency through the approach detailed below.

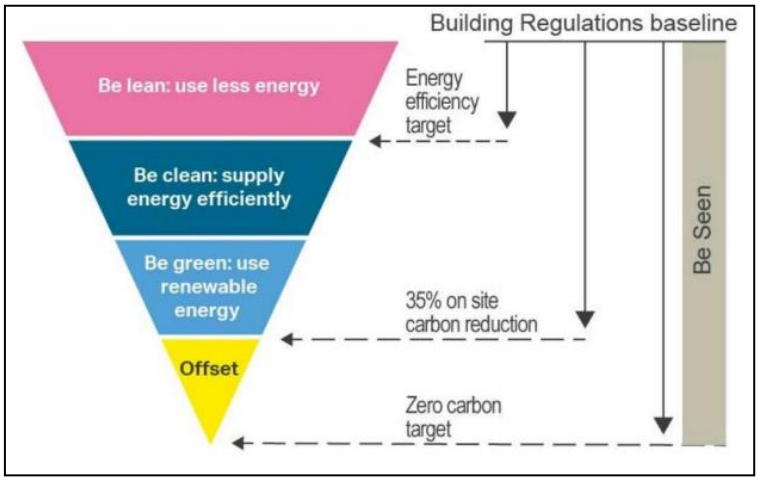

Figure 1. Energy Hierarchy

Be 'Lean' - Demand Reduction

The building fabric performance and engineering systems have been optimised in order to use less energy prior to the inclusion or consideration of Low and Zero Carbon (LZC) Technology.

Passive Design Measures:

Fabric Performance - The fabric performance values aim to reduce unwanted heat loss and heat gains, whilst maintaining a comfortable internal environment.

The table below outlines the U-values for the external walls and reflects the roof and floor upgrade.

Table 3. Fabric energy Efficiency specified

Thermal element	Specification
Wall	0.28/m^2k
Roof	0.18W/m^2k
Floor	0.22 W/m^2k
Doors	1.8 W/m^2k

Space Heating & Cooling - Space heating is provided by radiators.

Efficient Lighting and Controls - Throughout the development natural lighting is optimised. The development incorporates low energy light fittings throughout. All light fittings are low energy lighting and will accommodate LED luminaries only.

Ventilation – There is use of natural ventilation in the building.

Domestic hot water (DHW) system – domestic hot water is provided by the combi-boiler & cylinder.

Be 'Clean' – Supply Energy Efficiently

The Be Clean step of the energy hierarchy refers to the use of 'Clean energy supply'. This includes, but is not limited to, the use of Combined Heat and Power (CHP) and District Heat Networks. Policy TP1 seeks for new development to promote the use of CHP and district heating.

In light of the small-scale nature of the proposed development, it is apparent that the use of CHP is also technically and financially unviable in this instance.

Be 'Green' - Renewable Energy

Once energy demand reduction measures have been applied, methods for generating low and zero carbon energy can be assessed. The following renewable technologies to be considered for the project: Biomass, Water source heat pump, air source heat pump, Wind energy and solar photovoltaic panels.

In the light of the nature of the project, renewable technologies have been considered not feasible for this project as it already achieves a significant reduction in CO2 emissions and the incorporation of renewable technology can be considered at a later stage.

5. SUSTAINABLE DESIGN

The proposed project incorporates sustainable design and construction measures capable of mitigating and adapting to climate change to meet future needs. This section details site-specific initiatives which demonstrate how the development helps to meet the sustainability objectives set out in the National Planning Framework 2021.

Energy Use and Pollution
The design of the development has taken into consideration day lighting to habitable spaces to improve the wellbeing of occupants. Good levels of daylight will offer occupants a pleasant and highly valued connection to the outdoors and plenty of natural light. It will also reduce the use of artificial lighting and therefore energy use. All light fittings are specified as low energy lighting.
No external lighting is required.

Pollution: Air, Noise and Light
The layout of the development and the use of openable windows will create horizontal airflow. However, it is not sufficient to eliminate the overheating and therefore the need for air conditioning. Refer to section 6 for more details.

The development does not increase the air pollution of the area by reducing as a start, its energy consumption, which in turn will reduce emissions that lead to air pollution.
Other measures will include:

a. Use of eco-friendly building materials
b. Non-toxic paints
c. Installation of energy efficient appliances and devices
d. Use of renewable technologies

Light pollution can best be described as artificial light that is allowed to illuminate or intrude upon areas not intended to be lit. Light in the wrong place at the wrong time can be intrusive.
Intrusive light is over bright or poorly directed lights shining onto neighbouring property which affect the neighbours' right to enjoy their property. Therefore, the proposal incorporates lighting measures in order to avoid causing a nuisance.

Water: Water Efficiency
In domestic and non-domestic buildings, the demand for water can be reduced as much as 50% using a variety of simple and innovative strategies that are integrated into the plumbing and mechanical systems. In order to reduce water consumption the proposed development should include efficient fixtures with low flow rates. Total internal water consumption should not exceed 105 litres/person/day.

Flood Risk
The development site is located in a Low Flood Risk Area on the Environment Agency Flood Risk Map.

6. Cooling Strategy

A dynamic overheating analysis has been carried out to identify the overheating risk of the dwelling at 40 Hillway, using dynamic thermal modelling via TM59 & TM49 and The principles set in Building regulations Part O - Overheating.

6.1 Assessment Criteria

CIBSE TM59:2017 (Design methodology for the assessment of overheating risk in homes) defines overheating criteria for residential buildings. The buildings will be predominantly naturally ventilated and hence the relevant TM59 criteria will be used for the assessment.

Naturally Ventilated Buildings: The criteria below can be applied to homes which are naturally ventilated building. The compliance is based on passing both of the following two criteria.

A. **Living rooms, Kitchens and Bedrooms:** The number of hours () during which Δ is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3 per cent of occupied hours. Please refer to CIBSE TM59.
B. **Bedrooms only:** The operative temperature in the bedroom between 10:00pm to 7:00am shall not exceed 26°C for more than 1% of annual hours. (Note: 1% of the annual hours between 22:00 and 07:00 for bedrooms is 32 hours, so 33 or more hours above 26°C will be recorded as a fail).

CIBSE TM49:2014 - In line with guidance from the Greater London Authority, 3 weather files from the CIBSE TM49 document have been used

5.2 Modelling Input

Weather File & Description

- London_GTW_DSY1_2020High50.epw - London Gatwick Weather data: 2020 (high emission) DSY 1 - Moderately warm summer
- London_GTW_DSY2_2020High50.epw - London Gatwick Weather data: featuring short intense warm spell
- London_GTW_DSY3_2020High50.epw - London Gatwick Weather data: featuring long, less intense warm spell

Building Category

- Category II - all units: Normal expectation

Window

- Glazed doors are modelled as 100% openable.
- Internal blinds installed

Lighting Gain

- The internal gains from the lighting are based on CIBSE TM59 5.2

Small Power Gains

The house is modelled to include small power gains that are representative of typical equipment use in an everyday occurrence. There are associated with an assumed usage profile to represent which times of the day such appliances would result in a heat gain into the space. Small power gains include appliances such as TV's, fridge/freezers, toasters, kettles, hairdryers etc.

A list of anticipated heat gains in the dwellings are:

- Kitchen and Living spaces: 250W maximum power consumption
- Bedroom spaces: 150W maximum power consumption

5. 3. Summary of Results – Rev I

Note: the proposed model has been done for the extension only which is an open plan living/kitchen area as proposed – Including latest U-Values for walls – 0.28, Floor 0.22, and Roof 0.18

The table below demonstrate a sample that has been assessed on by CIBSE TM59 Criteria using weather file Gatwick DSY 1:

Table 04: Summary of Results for Bedrooms

Room Name	Criteria A (During The Period May to September)	TM59 Criteria met ?
Dining/Living Room and Kitchen		
Rear Extension		
Open plan living	3.2%	**Fail**

The tables below demonstrate a sample that has been assessed on by CIBSE TM59 Criteria using weather file Gatwick DSY 2:

Table 05: Summary of Results for Dining/living rooms and kitchens

Room Name	Criteria A (During The Period May to September)	TM59 Criteria met ?
Dining/Living Room and Kitchen		
Rear Extension		
Open plan living	3.3%	**Fail**

The tables below demonstrate a sample that has been assessed on by CIBSE TM59 Criteria using weather file Gatwick DSY 3:

Table 06: Summary of Results for Bedrooms

Room Name	Criteria A (During The Period May to September)	TM59 Criteria met ?
Dining/Living Room and Kitchen		
Rear Extension		
Open plan living	3.5%	**Fail**

5.4. Additional Results

CIBSE TM49: 2014 Compliance

DYS1 (1989) Weather Data Results

Room Name	Criteria 1 ≤3.0%	Criteria 2 We≤6	Criteria 3 ΔT ≤4	TM49 Compliance
% of spaces pass	0	0	0	Fail
% of spaces fail	100	100	100	

DYS2 (2003) Weather Data Results

Room Name	Criteria 1 ≤3.0%	Criteria 2 We≤6	Criteria 3 ΔT ≤4	TM49 Compliance
% of spaces pass	0	0	0	Fail
% of spaces fail	100	100	100	

DYS2 (1976) Weather Data Results

Room Name	Criteria 1 ≤3.0%	Criteria 2 We≤6	Criteria 3 ΔT ≤4	TM49 Compliance
% of spaces pass	0	0	0	Fail
% of spaces fail	100	100	100	

5.5. Proposed Ventilation Strategy

Mechanical cooling - to maintain comfortable internal temperatures

CIBSE TM49: 2014 Compliance

DYS1 (1989) Weather Data Results

Room Name	Criteria 1 ≤3.0%	Criteria 2 We≤6	Criteria 3 ΔT ≤4	TM59 Compliance
% of spaces pass	100	100	100	Pass
% of spaces fail	0	0	0	

DYS2 (2003) Weather Data Results

Room Name	Criteria 1 ≤3.0%	Criteria 2 We≤6	Criteria 3 ΔT ≤4	TM59 Compliance
% of spaces pass	**100**	**100**	**100**	**Pass**
% of spaces fail	**0**	**0**	**0**	

DYS2 (1976) Weather Data Results

Room Name	Criteria 1 ≤3.0%	Criteria 2 We≤6	Criteria 3 ΔT ≤4	TM59 Compliance
% of spaces pass	**100**	**100**	**100**	**Pass**
% of spaces fail	**0**	**0**	**0**	

CIBSE TM59: 2014 Compliance

The table below demonstrate a sample that has been assessed on by CIBSE TM59 Criteria using weather file Gatwick DSY 1:

Table 7: Summary of Results for Bedrooms

Room Name	Criteria A (During The Period May to September)	TM59 Criteria met ?
Dining/Living Room and Kitchen		
Rear Extension		
Open plan living	2.3%	**Pass**

The tables below demonstrate a sample that has been assessed on by CIBSE TM59 Criteria using weather file Gatwick DSY 2:

Table 8: Summary of Results for Bedrooms

Room Name	Criteria A (During The Period May to September)	TM59 Criteria met ?
Dining/Living Room and Kitchen		
Rear Extension		
Open plan living	2.5%	**Pass**

The tables below demonstrate a sample that has been assessed on by CIBSE TM59 Criteria using weather file Gatwick DSY 3:

Table 9: Summary of Results for Bedrooms

Room Name	Criteria A (During The Period May to September)	TM59 Criteria met ?
Dining/Living Room and Kitchen		
Open plan living	2.6%	**Pass**

5.6 Cooling strategy:

The following strategy has been defined according the cooling hierarchy in Policy SI4 of the London Plan.

Table 10. Cooling Hierarchy

Cooling Hierarchy category	40 Hillway
1. Reduce the amount of heat entering the building through orientation, shading, high albedo material, fenestration, insulation and the provision of green infrastructure.	The project doesn't have opportunities since it is related to an extension to an existing building.
2. Minimise internal heat generation through energy efficient design	Improved U-values and passive measures have been implemented as outlined in section 4. Hence the modelling results in section 5.4 confirmed it is not enough to recover the heat generated.
3. Manage the heat within the building through exposed internal thermal mass and high ceilings.	As above.
4. Provide passive ventilation	The natural ventilation is not enough to recover the heat generated. This has been demonstrated in the results provided in section 5.4.
5. Provide mechanical ventilation	Mechanical ventilation can be used but it won't be enough to recover the heat generated.
6. Provide active cooling system	The use of air conditioning is proposed for the development. Refer to section 5.5 for results.

7. CONCLUSION

The development has been designed to exceed Part L building regulations requirements. In line with the national and local policies, regulated CO_2 emissions from the development are improved by **38.7%** from the notional emissions once energy efficiency measures, lean measures and active cooling are taken into account.

In order to achieve the required carbon emissions reduction, the report concludes and proposes the use of energy efficient measures outlined in the section 4 of this report. The overheating analysis outlined in section 6 supports the use of air conditioning to provide a comfortable space for the tenant.

The results show that the carbon dioxide savings are similar for both options, with or without active cooling, and therefore it can be concluded that the use of active cooling does not lead to the increase of carbon emissions.

The reported improvements, that exceed Part L requirements, are also deemed to be at the limit of financial viability for this minor development.

8. APPENDIX

I. SAP Calculation

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17 Dobree Avenue
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NW10 2AD
0208 930 5668

Project Information
Building type Semi-detached house

Reference
Date 5 May 2023
Project 40 Hillway
LONDON
N6 6HH

REGULATION COMPLIANCE REPORT - Approved Document L1A, 2012 Edition, England
assessed by program JPA Designer version 6.05.074, printed on 05/05/2023 at 16:29:50

New extension to existing dwelling

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1 TER and DER
Fuel for main heating system: Gas (mains) (fuel factor = 1.00)

Target Carbon Dioxide Emission Rate	TER = 15.88	
Dwelling Carbon Dioxide Emission Rate	DER = 36.37	Fail
Excess emissions = 20.50kg/m² (129.1%)		

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	TFEE = 59.0	
Dwelling Fabric Energy Efficiency (DFEE)	DFEE = 136.2	Fail

2a Thermal bridging
Thermal bridging calculated using default y-value of 0.15

2b Fabric U-values

Element	Average	Highest	
Wall	1.16 (max. 0.30)	1.55 (max. 0.70)	Fail
Floor	0.60 (max. 0.25)	0.73 (max. 0.70)	Fail
Roof	0.17 (max. 0.20)	0.18 (max. 0.35)	OK
Openings	1.96 (max. 2.00)	3.00 (max. 3.30)	OK

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3 Air permeability

Air permeability at 50 pascals:	10.00	OK
Maximum :	10.00	

4 Heating efficiency

Main heating system:

Boiler and underfloor heating, mains gas
Vaillant ecoTEC plus 630 H system A

Source of efficiency: from boiler database
Vaillant ecoTEC plus 630 H system A VU GB 306/5-5 A
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system:

None -

5 Cylinder insulation

Hot water storage

Manufacturer's declared cylinder loss factor (kWh/day)		2.14	
Permitted by DBSCG		2.56	OK
Primary pipework insulated	No		Fail

6 Controls

(Also refer to "Domestic Building Services Compliance Guide" by the DCLG)

Space heating controls	Time and temperature zone control	OK
	Cylinderstat - Yes	OK
	Independent timer for DHW - Yes	OK
Boiler Interlock	Yes	OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings: 100.0%
Minimum: 75.0% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): OK
Not significant OK

Based on:

Thermal mass parameter :	245.72
Overshading :	Average or unknown (20-60 % sky blocked)

Orientation : West

Ventilation rate :	8.00

Blinds/curtains :

None with blinds/shutters closed 0.00% of daylight hours

10 Key features

Fixed cooling system

EAL CONSULT
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17 Dobree Avenue
LONDON
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0208 930 5668

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Building type Semi-detached house

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SAP 2012 worksheet for Existing dwelling - calculation of energy ratings

1. Overall dwelling dimensions

	Area (m^2)	Av. Storey height (m)	Volume (m^3)	
Ground floor (1)	73.31	2.76	202.34	(3a)
Ground floor (2)	24.73	2.39	59.10	(3b)
First floor	69.13	2.92	201.86	(3c)
Second floor	22.65	2.60	58.89	(3d)
	189.82			**(4)**
			522.19	**(5)**

2. Ventilation rate

	main + seondary + other heating		m³ per hour	
Number of chimneys	0 + 0 + 0	x 40	0.00	(6a)
Number of open flues	0 + 0 + 0	x 20	0.00	(6b)
Number of intermittent fans	3	x 10	30.00	(7a)
Number of passive vents	0	x 10	0.00	(7b)
Number of flueless gas fires	0	x 40	0.00	(7c)

			Air changes per hour	
			0.06	**(8)**
(ns)	3			(9)
			0.20	**(10)**
			0.35	**(11)**
			0.00	**(13)**
		100.00		**(14)**
			0.05	**(15)**
Infiltration rate			0.66	(16)
Air permeability			0.66	(18)
			2.00	**(19)**
			0.85	**(20)**
Infiltration rate incorporating shelter factor			0.56	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70

52.50 (22)

Wind Factor

1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18

13.13 (22a)

Adjusted infiltration rate (allowing for shelter and wind speed)

0.71	0.70	0.68	0.61	0.60	0.53	0.53	0.52	0.56	0.60	0.63	0.66

7.33 (22b)

Ventilation : natural ventilation, intermittent extract fans

Effective air change rate

0.75	0.74	0.73	0.69	0.68	0.64	0.64	0.63	0.66	0.68	0.70	0.72	(25)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-value kJ/m²K	A x K kJ/K	
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (East) REAR			**4.430**	**1.94 (2.10)**	8.58			(27)
Window - Triple-glazed, air-filled, low-E, En=0.1, soft coat (East) REAR			**1.370**	**1.68 (1.80)**	2.30			(27)
Solid door FRONT			**2.340**	**3.00**	7.02			(26)
Full glazed door - Triple-glazed, air-filled, low-E, En=0.1, soft coat (East) REAR			**6.830**	**1.80**	12.29			(26)
Full glazed door - Triple-glazed, air-filled, low-E, En=0.1, soft coat (East) REAR			**6.830**	**1.80**	12.29			(26)
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.1, soft coat (n/a) ROOF			**4.330**	**1.68 (1.80)**	7.27			(27)
Walls ROOF VOID WALL			12.79	0.22 (Ru=0.90)	2.86	18.00	230.22	(29)
Walls EXTERNAL #WINDOWS & DOORS #PROPOSED			51.51	0.28	14.42	150.00	7726.50	(29)
Walls EXTERNAL #WINDOWS & DOORS			146.79	1.55	227.52	135.00	19816.65	(29)
Ground floors EXISTING, UNDERGROUND			73.31	0.73	53.52	110.00	8064.10	(28)
Ground floors PROPOSED, UNDERGROUND			24.73	0.22	5.44	110.00	2720.30	(28)
Flat roofs DORMER ROOF			13.61	0.18	2.45	9.00	122.49	(30)
Flat roofs GF REAR #ROOFLIGHTS			23.90	0.18	4.30	9.00	215.10	(30)
Pitched roofs with integrated insulation ROOF VOID ABOVE FF TO SF			46.48	0.15 (Ru=0.90)	7.20	9.00	418.32	(30)
Pitched roofs insulated between rafters MAIN ROOF			9.04	0.16	1.45	9.00	81.36	(30)
Party wall SOLID			26.50	0.50	13.25	180.00	4770.00	
Internal floor SF			22.65	0.00	0.00	18.00	407.70	
Internal floor FF			69.13	0.00	0.00	18.00	1244.34	
Internal ceiling FF			22.65	0.00	0.00	9.00	203.85	

4. Water heating energy requirements **kWh/year**

Assumed occupancy, N 2.99 (42)

Annual average hot water usage in litres per day Vd,average 110.72 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month												
121.79	117.36	112.93	108.50	104.07	99.64	99.64	104.07	108.50	112.93	117.36	121.79	(44)
Energy content of hot water used												
180.61	157.96	163.00	142.11	136.36	117.67	109.03	125.12	126.61	147.56	161.07	174.91	

Energy content (annual) 1742.00 (45)

Distribution loss												
27.09	23.69	24.45	21.32	20.45	17.65	16.36	18.77	18.99	22.13	24.16	26.24	(46)

0.00 (50)

Hot water cylinder loss factor (kWh/day) 0.0000 (51)

Volume factor 0.0000 (52)

Temperature factor 0.0000 (53)

Energy lost from store (kWh/day) 0.00 (55)

Total storage loss												
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(56)
Net storage loss												
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(57)
Primary loss												
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)
Combi loss calculated for each month												
50.96	46.03	50.96	49.32	50.96	49.14	50.78	50.96	49.32	50.96	49.32	50.96	(61)
Total heat required for water heating calculated for each month												
231.57	203.99	213.96	191.42	187.32	166.81	159.81	176.08	175.93	198.51	210.38	225.87	(62)
Output from water heater for each month, kWh/month												
231.57	203.99	213.96	191.42	187.32	166.81	159.81	176.08	175.93	198.51	210.38	225.87	(64)

2341.65 (64)

Heat gains from water heating, kWh/month												
72.79	64.03	66.94	59.58	58.08	51.41	48.95	54.34	54.43	61.80	65.88	70.90	(65)

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, Watts												
179.32	179.32	179.32	179.32	179.32	179.32	179.32	179.32	179.32	179.32	179.32	179.32	(66)
Lighting gains												
203.04	180.34	146.66	111.03	83.00	70.07	75.71	98.42	132.09	167.72	195.76	208.68	(67)
Appliances gains												
539.20	544.80	530.70	500.68	462.79	427.18	403.39	397.79	411.89	441.91	479.80	515.41	(68)
Cooking gains												
55.92	55.92	55.92	55.92	55.92	55.92	55.92	55.92	55.92	55.92	55.92	55.92	(69)
Pumps and fans gains												
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evaporation (negative values)												
-119.55	-119.55	-119.55	-119.55	-119.55	-119.55	-119.55	-119.55	-119.55	-119.55	-119.55	-119.55	(71)
Water heating gains												
97.84	95.28	89.97	82.75	78.06	71.40	65.79	73.04	75.59	83.07	91.51	95.29	(72)
Total internal gains												
958.77	939.11	886.02	813.16	742.54	687.34	663.58	687.94	738.27	811.39	885.75	938.08	(73)

6. Solar gains (calculation for January)

	Area & Flux	g & FF	Shading	Gains	
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (East) REAR	0.9 x 4.430	19.64	0.72 x 0.70	0.77	30.3889	
Window - Triple-glazed, air-filled, low-E, En=0.1, soft coat (East) REAR	0.9 x 1.370	19.64	0.57 x 0.80	0.77	8.5029	
Solid door FRONT	0.9 x 2.340	0.00	0.00 x 0.70	0.77	0.0000	
Full glazed door - Triple-glazed, air-filled, low-E, En=0.1, soft coat (East) REAR	0.9 x 6.830	19.64	0.57 x 0.80	0.77	42.3903	
Full glazed door - Triple-glazed, air-filled, low-E, En=0.1, soft coat (East) REAR	0.9 x 6.830	19.64	0.57 x 0.80	0.77	42.3903	
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.1, soft coat (n/a) ROOF	0.9 x 4.330	26.00	0.63 x 0.80	1.00	51.0663	
Total solar gains, January					174.74	(83-1)

Solar gains

174.74	347.99	586.98	875.69	1089.24	1121.81	1065.24	904.52	689.25	416.70	219.02	142.95	(83)
Total gains												
1133.51	1287.10	1473.00	1688.85	1831.78	1809.15	1728.83	1592.46	1427.52	1228.09	1104.77	1081.03	(84)

7. Mean internal temperature

Temperature during heating periods in the living area, Th1 (°C) 21.00 (85)

Heating system responsiveness 1.00

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau											
22.48	22.55	22.61	22.93	22.99	23.27	23.27	23.32	23.16	22.99	22.87	22.74
alpha											
2.50	2.50	2.51	2.53	2.53	2.55	2.55	2.55	2.54	2.53	2.52	2.52
Utilisation factor for gains for living area											
1.00	0.99	0.99	0.98	0.95	0.90	0.83	0.86	0.95	0.98	0.99	1.00 (86)
Mean internal temperature in living area T1											
17.84	18.03	18.45	19.05	19.69	20.27	20.62	20.55	20.06	19.25	18.46	17.83 (87)
Temperature during heating periods in rest of dwelling Th2											
19.48	19.49	19.49	19.51	19.52	19.53	19.53	19.54	19.53	19.52	19.51	19.50 (88)
Utilisation factor for gains for rest of dwelling											
0.99	0.99	0.99	0.97	0.93	0.85	0.70	0.75	0.92	0.98	0.99	1.00 (89)
Mean internal temperature in the rest of dwelling T2											
16.65	16.84	17.26	17.88	18.50	19.08	19.37	19.33	18.88	18.08	17.28	16.64 (90)

Living area fraction (19.20 / 189.82) 0.10 (91)

Mean internal temperature (for the whole dwelling)

16.77	16.96	17.38	18.00	18.62	19.20	19.50	19.45	19.00	18.20	17.40	16.76 (92)
Apply adjustment to the mean internal temperature, where appropriate											
17.37	17.56	17.98	18.60	19.22	19.80	20.10	20.05	19.60	18.80	18.00	17.36 (93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains											
0.99	0.99	0.98	0.96	0.93	0.86	0.76	0.80	0.92	0.97	0.99	0.99 (94)
Useful gains											
1125.02	1273.20	1446.02	1628.31	1700.85	1556.99	1313.57	1273.05	1311.23	1196.35	1092.98	1073.95 (95)
Monthly average external temperature											
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20 (96)
Heat loss rate for mean internal temperature											
7530.9	7275.1	6575.9	5479.7	4240.7	2893.7	1947.86	2029.8	3074.4	4621.3	6178.2	7499.3 (97)
Fraction of month for heating											
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00
Space heating requirement for each month, kWh/month											
4766.0	4033.3	3816.6	2773.0	1889.63	-	-	-	-	2548.1	3661.3	4780.5

Total space heating requirement per year (kWh/year) (October to May) 28268.48 (98)

Space heating requirement per m² (kWh/m²/year) 148.92 (99)

8c. Space cooling requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
External temperaturers													
	-	-	-	-	-	14.60	16.60	16.40	-	-	-	-	
Heat loss rate W													
	-	-	-	-	-	5234.5	4120.8	4222.6	-	-	-	-	(100)
Utilisation factor for loss													
	-	-	-	-	-	0.35	0.41	0.38	-	-	-	-	(101)
Useful loss W													
	-	-	-	-	-	1830.93	1704.25	1588.47	-	-	-	-	(102)
Internal gains W													
	0.00	0.00	0.00	0.00	0.00	684.34	660.58	684.94	0.00	0.00	0.00	0.00	
Solar gains W													
	0.00	0.00	0.00	0.00	0.00	1244.89	1182.42	1005.17	0.00	0.00	0.00	0.00	
Gains W													
	-	-	-	-	-	1929.23	1843.00	1690.11	-	-	-	-	(103)
Fraction of month for cooling													
	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	(103a)
Space heating kWh													
	-	-	-	-	-	717.67	162.27	148.15	-	-	-	-	(98)
Space cooling kWh													
	-	-	-	-	-	70.78	103.23	75.62	-	-	-	-	(104)
Total												249.63	(104)
Cooled fraction												0.22	(105)
Intermittency factor													
	-	-	-	-	-	0.25	0.25	0.25	-	-	-	-	(106)
Space cooling requirement for month													
	-	-	-	-	-	3.89	5.68	4.16	-	-	-	-	
Space cooling (June to August)												13.73	(107)
Space cooling requirement per m² (kWh/m²/year)												0.07	(108)

9a. Energy requirements

kWh/year

No secondary heating system selected

Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main heating system	66.00%	(206)
Cooling system energy efficiency ratio	0.00%	(209)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement												
4766.0	4033.3	3816.6	2773.0	1889.63	-	-	-	-	2548.1	3661.3	4780.5	(98)
Appendix Q - monthly energy saved (main heating system 1)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(210)
Space heating fuel (main heating system 1)												
7221.2	6111.0	5782.8	4201.5	2863.1	-	-	-	-	3860.8	5547.5	7243.2	(211)
Appendix Q - monthly energy saved (main heating system 2)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(212)
Space heating fuel (main heating system 2)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(213)
Appendix Q - monthly energy saved (secondary heating system)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(214)
Space heating fuel (secondary)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(215)
Water heating												
Water heating requirement												
231.57	203.99	213.96	191.42	187.32	166.81	159.81	176.08	175.93	198.51	210.38	225.87	(64)
Efficiency of water heater												57.00 (216)
65.52	65.50	65.45	65.33	65.07	57.00	57.00	57.00	57.00	65.26	65.44	65.53	(217)
Water heating fuel												
353.43	311.42	326.90	292.99	287.85	292.64	280.37	308.91	308.65	304.21	321.50	344.66	(219)

Annual totals	kWh/year	
Space heating fuel used, main system 1	42831.03	(211)
Space heating fuel (secondary)	0.00	(215)
Water heating fuel	3733.54	(219)
Space cooling fuel used	0.00	(221)

-	-	-	-	-	0.00	0.00	0.00	-	-	-	-	(221)

Electricity for pumps, fans and electric keep-hot central heating pump	30.00	(230c)
Total electricity for the above, kWh/year	30.00	(231)
Electricity for lighting (0.00% fixed LEL)	1434.31	(232)
Energy saving/generation technologies		
Appendix Q -		
Energy saved or generated ():	0.000	(236a)
Energy used ():	0.000	(237a)
Total delivered energy for all uses	48028.87	(238)

10a. Fuel costs using Table 12 prices

	kWh/year	Fuel price p/kWh	£/year	
Space heating - main system 1	42831.026	3.480	1490.52	(240)
Space heating - main system 2	0.000	0.000	0.00	(241)
Water heating cost	3733.54	3.480	129.93	(247)
Space cooling	0.000	13.190	0.00	(248)
Mech vent fans cost	0.000	13.190	0.00	(249)
Pump/fan energy cost	30.000	13.190	3.96	(249)
Energy for lighting	1434.310	13.190	189.19	(250)
Additional standing charges			120.00	(251)
Electricity generated - PVs	0.000	0.000	0.00	(252)
Appendix Q -				
Energy saved or generated ():	0.000	0.000	0.00	(253)
Energy used ():	0.000	0.000	0.00	(254)
Total energy cost			1933.59	(255)

11a. SAP rating

	0.42	**(256)**
	3.46	**(257)**
SAP value	51.75	
	52	(258)
SAP band	**E**	

12a. Carbon dioxide emissions

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating, main system 1	42831.03	0.216	9251.50	(261)
Space heating, main system 2	0.00	0.000	0.00	(262)
Space heating, secondary	0.00	0.519	0.00	(263)
Water heating	3733.54	0.216	806.44	(264)
Space and water heating			10057.95	(265)
Space cooling	0.00	0.519	0.00	(266)
Electricity for pumps and fans	30.00	0.519	15.57	(267)
Electricity for lighting	1434.31	0.519	744.41	(268)
Electricity generated - PVs	0.00	0.519	0.00	(269)
Electricity generated - µCHP	0.00	0.000	0.00	(269)
Appendix Q -				
Energy saved ():	0.00	0.000	0.00	(270)
Energy used ():	0.00	0.000	0.00	(271)
Total CO2, kg/year			10817.92	(272)

	kg/m²/year	
CO2 emissions per m²	**56.99**	(273)
EI value	41.98	(273a)
EI rating	**42**	(274)
EI band	**E**	

Calculation of stars for heating and DHW

Main heating energy efficiency	(3.48 / 0.6600) x (1 + (0.29 x 0.00)) = 5.2727, stars = 4
Main heating environmental impact	(0.2160 / 0.6600) x (1 + (0.29 x 0.00)) = 0.3273, stars = 4
Water heating energy efficiency	3.48 / 0.6259 = 5.5598, stars = 3
Water heating environmental impact	0.2160 / 0.6259 = 0.3451, stars = 3

EAL CONSULT
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17 Dobree Avenue
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Project Information
Building type Semi-detached house

Reference
Date 5 May 2023
Project 40 Hillway
LONDON
N6 6HH

REGULATION COMPLIANCE REPORT - Approved Document L1A, 2012 Edition, England
assessed by program JPA Designer version 6.05.074, printed on 05/05/2023 at 16:29:50

Existing dwelling

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1 TER and DER
Fuel for main heating system: Gas (mains) (fuel factor = 1.00)

Target Carbon Dioxide Emission Rate	TER = 16.04	
Dwelling Carbon Dioxide Emission Rate	DER = 59.31	Fail

Excess emissions = 43.27kg/m² (269.8%)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	TFEE = 59.0	
Dwelling Fabric Energy Efficiency (DFEE)	DFEE = 139.0	Fail

2a Thermal bridging
Thermal bridging calculated using default y-value of 0.15

2b Fabric U-values

Element	Average	Highest	
Wall	1.16 (max. 0.30)	1.55 (max. 0.70)	Fail
Party Wall	0.50 (max. 0.20)	-	Fail
Floor	0.60 (max. 0.25)	0.73 (max. 0.70)	Fail
Roof	0.17 (max. 0.20)	0.18 (max. 0.35)	OK
Openings	1.96 (max. 2.00)	3.00 (max. 3.30)	OK

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3 Air permeability

Air permeability at 50 pascals:	10.00	OK
Maximum :	10.00	

4 Heating efficiency

Main heating system:

Boiler and radiators, mains gas
Vaillant Combicompact

Source of efficiency: from boiler database
Vaillant Combicompact vcw280h
Efficiency: 65.0% SEDBUK2009
Minimum: 88.0% Fail

Secondary heating system:

None -

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

(Also refer to "Domestic Building Services Compliance Guide" by the DCLG)

Space heating controls	Programmer, no thermostat	Fail
Hot water controls	No cylinder	
Boiler Interlock	Yes	OK
Hot water controls	No cylinder	

7 Low energy lights

Percentage of fixed lights with low-energy fittings: 0.0%
Minimum: 75.0% Fail

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): OK
Not significant OK

Based on:

Thermal mass parameter :	245.72
Overshading :	Average or unknown (20-60 % sky blocked)

Orientation : West

Ventilation rate :	8.00

Blinds/curtains :

None with blinds/shutters closed 0.00% of daylight hours

10 Key features

Fixed cooling system

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SAP 2012 worksheet for New extension to existing dwelling - calculation of energy ratings

1. Overall dwelling dimensions

	Area (m^2)	Av. Storey height (m)	Volume (m^3)	
Ground floor (1)	73.31	2.76	202.34	(3a)
Ground floor (2)	24.73	2.39	59.10	(3b)
First floor	69.13	2.92	201.86	(3c)
Second floor	22.65	2.60	58.89	(3d)
	189.82			**(4)**
			522.19	**(5)**

2. Ventilation rate

	main + seondary + other heating		m^3 per hour	
Number of chimneys	0 + 0 + 0	x 40	0.00	(6a)
Number of open flues	0 + 0 + 0	x 20	0.00	(6b)
Number of intermittent fans	3	x 10	30.00	(7a)
Number of passive vents	0	x 10	0.00	(7b)
Number of flueless gas fires	0	x 40	0.00	(7c)

			Air changes per hour	
			0.06	**(8)**
(ns)	3			(9)
			0.20	**(10)**
			0.35	**(11)**
			0.00	**(13)**
		100.00		**(14)**
			0.05	**(15)**
Infiltration rate			0.66	(16)
Air permeability			0.66	(18)
			2.00	**(19)**
			0.85	**(20)**
Infiltration rate incorporating shelter factor			0.56	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70

52.50 (22)

Wind Factor

1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18

13.13 (22a)

Adjusted infiltration rate (allowing for shelter and wind speed)

0.71	0.70	0.68	0.61	0.60	0.53	0.53	0.52	0.56	0.60	0.63	0.66

7.33 (22b)

Ventilation : natural ventilation, intermittent extract fans

Effective air change rate

0.75	0.74	0.73	0.69	0.68	0.64	0.64	0.63	0.66	0.68	0.70	0.72	(25)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-value kJ/m²K	A x K kJ/K	
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (East) REAR			**4.430**	**1.94 (2.10)**	8.58			(27)
Window - Triple-glazed, air-filled, low-E, En=0.1, soft coat (East) REAR			**1.370**	**1.68 (1.80)**	2.30			(27)
Solid door FRONT			**2.340**	**3.00**	7.02			(26)
Full glazed door - Triple-glazed, air-filled, low-E, En=0.1, soft coat (East) REAR			**6.830**	**1.80**	12.29			(26)
Full glazed door - Triple-glazed, air-filled, low-E, En=0.1, soft coat (East) REAR			**6.830**	**1.80**	12.29			(26)
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.1, soft coat (n/a) ROOF			**4.330**	**1.68 (1.80)**	7.27			(27)
Walls ROOF VOID WALL			12.79	0.22 (Ru=0.90)	2.86	18.00	230.22	(29)
Walls EXTERNAL #WINDOWS & DOORS #PROPOSED			51.51	0.28	14.42	150.00	7726.50	(29)
Walls EXTERNAL #WINDOWS & DOORS			146.79	1.55	227.52	135.00	19816.65	(29)
Ground floors EXISTING, UNDERGROUND			73.31	0.73	53.52	110.00	8064.10	(28)
Ground floors PROPOSED, UNDERGROUND			24.73	0.22	5.44	110.00	2720.30	(28)
Flat roofs DORMER ROOF			13.61	0.18	2.45	9.00	122.49	(30)
Flat roofs GF REAR #ROOFLIGHTS			23.90	0.18	4.30	9.00	215.10	(30)
Pitched roofs with integrated insulation ROOF VOID ABOVE FF TO SF			46.48	0.15 (Ru=0.90)	7.20	9.00	418.32	(30)
Pitched roofs insulated between rafters MAIN ROOF			9.04	0.16	1.45	9.00	81.36	(30)
Party wall SOLID			26.50	0.00	0.00	180.00	4770.00	
Internal floor SF			22.65	0.00	0.00	18.00	407.70	
Internal floor FF			69.13	0.00	0.00	18.00	1244.34	
Internal ceiling FF			22.65	0.00	0.00	9.00	203.85	

4. Water heating energy requirements

kWh/year

Assumed occupancy, N 2.99 (42)

Annual average hot water usage in litres per day Vd,average 110.72 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month												
121.79	117.36	112.93	108.50	104.07	99.64	99.64	104.07	108.50	112.93	117.36	121.79	(44)
Energy content of hot water used												
180.61	157.96	163.00	142.11	136.36	117.67	109.03	125.12	126.61	147.56	161.07	174.91	

Energy content (annual) 1742.00 (45)

Distribution loss												
27.09	23.69	24.45	21.32	20.45	17.65	16.36	18.77	18.99	22.13	24.16	26.24	(46)

Cylinder volume, l 250.00 (47)

Manufacturer's declared cylinder loss factor (kWh/day) 2.14 (48)

Temperature Factor 0.5400 (49)

Energy lost from hot water cylinder (kWh/day) 1.16 (55)

Total storage loss												
35.82	32.36	35.82	34.67	35.82	34.67	35.82	35.82	34.67	35.82	34.67	35.82	(56)
Net storage loss												
35.82	32.36	35.82	34.67	35.82	34.67	35.82	35.82	34.67	35.82	34.67	35.82	(57)
Primary loss												
43.31	39.12	43.31	41.92	43.31	41.92	43.31	43.31	41.92	43.31	41.92	43.31	(59)
Total heat required for water heating calculated for each month												
259.75	229.44	242.14	218.69	215.49	194.25	188.17	204.26	203.20	226.69	237.65	254.05	(62)
Output from water heater for each month, kWh/month												
259.75	229.44	242.14	218.69	215.49	194.25	188.17	204.26	203.20	226.69	237.65	254.05	(64)

2673.77 (64)

Heat gains from water heating, kWh/month												
123.36	109.70	117.51	108.52	108.65	100.39	99.56	104.91	103.37	112.37	114.82	121.47	(65)

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, Watts												
179.32	179.32	179.32	179.32	179.32	179.32	179.32	179.32	179.32	179.32	179.32	179.32	(66)
Lighting gains												
101.52	90.17	73.33	55.52	41.50	35.04	37.86	49.21	66.05	83.86	97.88	104.34	(67)
Appliances gains												
539.20	544.80	530.70	500.68	462.79	427.18	403.39	397.79	411.89	441.91	479.80	515.41	(68)
Cooking gains												
55.92	55.92	55.92	55.92	55.92	55.92	55.92	55.92	55.92	55.92	55.92	55.92	(69)
Pumps and fans gains												
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evaporation (negative values)												
-119.55	-119.55	-119.55	-119.55	-119.55	-119.55	-119.55	-119.55	-119.55	-119.55	-119.55	-119.55	(71)
Water heating gains												
165.81	163.25	157.94	150.72	146.03	139.43	133.82	141.01	143.56	151.04	159.48	163.26	(72)
Total internal gains												
925.22	916.91	880.66	825.61	769.01	720.34	693.76	706.70	740.19	795.50	855.85	901.71	(73)

6. Solar gains (calculation for January)

	Area & Flux	g & FF	Shading	Gains	
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (East) REAR	0.9 x 4.430	19.64	0.72 x 0.70	0.77	30.3889	
Window - Triple-glazed, air-filled, low-E, En=0.1, soft coat (East) REAR	0.9 x 1.370	19.64	0.57 x 0.80	0.77	8.5029	
Solid door FRONT	0.9 x 2.340	0.00	0.00 x 0.70	0.77	0.0000	
Full glazed door - Triple-glazed, air-filled, low-E, En=0.1, soft coat (East) REAR	0.9 x 6.830	19.64	0.57 x 0.80	0.77	42.3903	
Full glazed door - Triple-glazed, air-filled, low-E, En=0.1, soft coat (East) REAR	0.9 x 6.830	19.64	0.57 x 0.80	0.77	42.3903	
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.1, soft coat (n/a) ROOF	0.9 x 4.330	26.00	0.63 x 0.80	1.00	51.0663	
Total solar gains, January					174.74	(83-1)

Solar gains

174.74	347.99	586.98	875.69	1089.24	1121.81	1065.24	904.52	689.25	416.70	219.02	142.95	(83)
Total gains												
1099.96	1264.90	1467.64	1701.30	1858.25	1842.15	1759.00	1611.23	1429.45	1212.20	1074.87	1044.66	(84)

7. Mean internal temperature

Temperature during heating periods in the living area, Th1 (°C) 21.00 (85)

Heating system responsiveness 0.75

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau												
23.01	23.08	23.15	23.48	23.54	23.83	23.83	23.89	23.72	23.54	23.41	23.28	
alpha												
2.53	2.54	2.54	2.57	2.57	2.59	2.59	2.59	2.58	2.57	2.56	2.55	
Utilisation factor for gains for living area												
1.00	0.99	0.99	0.98	0.95	0.90	0.82	0.86	0.95	0.99	0.99	1.00	(86)
Mean internal temperature in living area T1												
18.55	18.70	19.01	19.47	19.94	20.38	20.63	20.58	20.21	19.61	19.02	18.54	(87)
Temperature during heating periods in rest of dwelling Th2												
18.77	18.77	18.78	18.80	18.80	18.82	18.82	18.82	18.81	18.80	18.79	18.78	(88)
Utilisation factor for gains for rest of dwelling												
0.99	0.99	0.98	0.96	0.92	0.80	0.58	0.64	0.89	0.97	0.99	1.00	(89)
Mean internal temperature in the rest of dwelling T2												
15.70	15.92	16.38	17.05	17.73	18.32	18.59	18.56	18.12	17.26	16.39	15.70	(90)

Living area fraction (19.20 / 189.82) 0.10 (91)

Mean internal temperature (for the whole dwelling)

15.99	16.20	16.64	17.30	17.95	18.53	18.79	18.76	18.33	17.50	16.66	15.99	(92)
Apply adjustment to the mean internal temperature, where appropriate												
15.99	16.20	16.64	17.30	17.95	18.53	18.79	18.76	18.33	17.50	16.66	15.99	(93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains												
0.99	0.99	0.98	0.95	0.89	0.77	0.57	0.63	0.87	0.96	0.99	0.99	(94)
Useful gains												
1090.11	1247.95	1432.48	1616.59	1660.95	1422.84	1005.80	1022.62	1237.00	1167.53	1060.35	1036.56	(95)
Monthly average external temperature												
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate for mean internal temperature												
6582.9	6343.3	5677.6	4635.4	3442.2	2135.7	1192.43	1280.39	2309.2	3796.8	5289.9	6558.2	(97)
Fraction of month for heating												
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	
Space heating requirement for each month, kWh/month												
4086.6	3424.1	3158.4	2173.5	1325.21	-	-	-	-	1956.18	3045.3	4108.1	

Total space heating requirement per year (kWh/year) (October to May) 23277.36 (98)

Space heating requirement per m² (kWh/m²/year) 122.63 (99)

8c. Space cooling requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
External temperaturers												
-	-	-	-	-	14.60	16.60	16.40	-	-	-	-	
Heat loss rate W												
-	-	-	-	-	5110.0	4022.7	4121.9	-	-	-	-	(100)
Utilisation factor for loss												
-	-	-	-	-	0.36	0.43	0.39	-	-	-	-	(101)
Useful loss W												
-	-	-	-	-	1857.41	1725.29	1602.32	-	-	-	-	(102)
Internal gains W												
0.00	0.00	0.00	0.00	0.00	717.34	690.76	703.70	0.00	0.00	0.00	0.00	
Solar gains W												
0.00	0.00	0.00	0.00	0.00	1244.89	1182.42	1005.17	0.00	0.00	0.00	0.00	
Gains W												
-	-	-	-	-	1962.22	1873.18	1708.88	-	-	-	-	(103)
Fraction of month for cooling												
0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	(103a)
Space heating kWh												
-	-	-	-	-	392.92	44.28	6.04	-	-	-	-	(98)
Space cooling kWh												
-	-	-	-	-	75.47	110.03	79.27	-	-	-	-	(104)
Total											264.77	(104)
Cooled fraction											0.22	(105)
Intermittency factor												
-	-	-	-	-	0.25	0.25	0.25	-	-	-	-	(106)
Space cooling requirement for month												
-	-	-	-	-	4.15	6.05	4.36	-	-	-	-	
Space cooling (June to August)											14.56	(107)
Space cooling requirement per m² (kWh/m²/year)											0.08	(108)

9a. Energy requirements

											kWh/year	
No secondary heating system selected												
Fraction of space heat from main system(s)									1.0000			(202)
Efficiency of main heating system									90.40%			(206)
Cooling system energy efficiency ratio									4.05%			(209)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement												
4086.6	3424.1	3158.4	2173.5	1325.21	-	-	-	-	1956.18	3045.3	4108.1	(98)
Appendix Q - monthly energy saved (main heating system 1)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(210)
Space heating fuel (main heating system 1)												
4520.6	3787.7	3493.8	2404.4	1465.94	-	-	-	-	2163.9	3368.6	4544.3	(211)
Appendix Q - monthly energy saved (main heating system 2)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(212)
Space heating fuel (main heating system 2)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(213)
Appendix Q - monthly energy saved (secondary heating system)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(214)
Space heating fuel (secondary)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(215)
Water heating												
Water heating requirement												
259.75	229.44	242.14	218.69	215.49	194.25	188.17	204.26	203.20	226.69	237.65	254.05	(64)
Efficiency of water heater												79.70 (216)
89.68	89.64	89.54	89.30	88.73	79.70	79.70	79.70	79.70	89.16	89.53	89.70	(217)
Water heating fuel												
289.63	255.94	270.41	244.89	242.85	243.73	236.10	256.28	254.95	254.26	265.44	283.22	(219)

Annual totals	kWh/year	
Space heating fuel used, main system 1	25749.30	(211)
Space heating fuel (secondary)	0.00	(215)
Water heating fuel	3097.72	(219)
Space cooling fuel used	3.60	(221)

-	-	-	-	-	1.02	1.49	1.08	-	-	-	-	(221)

Electricity for pumps, fans and electric keep-hot		
central heating pump	30.00	(230c)
boiler with a fan-assisted flue	45.00	(230e)
Total electricity for the above, kWh/year	75.00	(231)
Electricity for lighting (100.00% fixed LEL)	717.15	(232)
Energy saving/generation technologies		
Appendix Q -		
Energy saved or generated ():	0.000	(236a)
Energy used ():	0.000	(237a)
Total delivered energy for all uses	29642.77	(238)

10a. Fuel costs using Table 12 prices

	kWh/year	Fuel price p/kWh	£/year	
Space heating - main system 1	25749.297	3.480	896.08	(240)
Space heating - main system 2	0.000	0.000	0.00	(241)
Water heating cost	3097.72	3.480	107.80	(247)
Space cooling	3.596	13.190	0.47	(248)
Mech vent fans cost	0.000	13.190	0.00	(249)
Pump/fan energy cost	75.000	13.190	9.89	(249)
Energy for lighting	717.155	13.190	94.59	(250)
Additional standing charges			120.00	(251)
Electricity generated - PVs	0.000	0.000	0.00	(252)
Appendix Q -				
Energy saved or generated ():	0.000	0.000	0.00	(253)
Energy used ():	0.000	0.000	0.00	(254)
Total energy cost			1228.84	(255)

11a. SAP rating

	0.42	**(256)**
	2.20	**(257)**
SAP value	69.34	
	69	(258)
SAP band	**C**	

12a. Carbon dioxide emissions

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating, main system 1	25749.30	0.216	5561.85	(261)
Space heating, main system 2	0.00	0.000	0.00	(262)
Space heating, secondary	0.00	0.519	0.00	(263)
Water heating	3097.72	0.216	669.11	(264)
Space and water heating			6230.96	(265)
Space cooling	3.60	0.519	1.87	(266)
Electricity for pumps and fans	75.00	0.519	38.93	(267)
Electricity for lighting	717.15	0.519	372.20	(268)
Electricity generated - PVs	0.00	0.519	0.00	(269)
Electricity generated - µCHP	0.00	0.000	0.00	(269)
Appendix Q -				
Energy saved ():	0.00	0.000	0.00	(270)
Energy used ():	0.00	0.000	0.00	(271)
Total CO2, kg/year			6643.95	(272)

	kg/m²/year	
CO2 emissions per m²	**35.00**	(273)
EI value	62.09	(273a)
EI rating	**62**	(274)
EI band	**D**	

Calculation of stars for heating and DHW

Main heating energy efficiency	(3.48 / 0.9040) x (1 + (0.29 x 0.25)) = 4.1287, stars = 4
Main heating environmental impact	(0.2160 / 0.9040) x (1 + (0.29 x 0.25)) = 0.2563, stars = 4
Water heating energy efficiency	3.48 / 0.8617 = 4.0383, stars = 4
Water heating environmental impact	0.2160 / 0.8617 = 0.2507, stars = 4