Energy Consultancy and Compliance Services

Project No: 9913/10305

London Borough of Camden

Energy and Sustainability Statement

Construction of 5 No. New Flats via Proposed Two Storey Extension with Roof Extension to 130 Chalton Street, London, NW1 1RW

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Executive Summary

This report has been commissioned to support the planning application to construct 5 No. New Flats (1 x 2 Bed, 2 x 1 Bed, 2 x Studio) through a two storey extension with roof extension at 130 Chalton Street, London, NW1 1RW.

The Energy and Sustainability Statement outlines an overall commitment to reducing energy consumption under occupancy through the adoption of energy efficient measures such as enhanced insulation standards, improved heating and lighting efficiencies and the installation of renewable technologies. The methodology used herein is consistent with Approved Document Part L1A (2013) of the Building Regulations and The London Plan 2016.

The report clearly demonstrates that the proposed build specification will ensure that the overall development has a reduced energy demand in comparison to the minimum requirements of Part L1A (2013) of the Building Regulations.

Furthermore, through the installation of solar photovoltaic panels with an overall capacity of 3.30 kWp, the proposed development is predicted to emit at least **26.09%** less regulated carbon dioxide than would ordinarily be permitted by the standard requirements of Part L (2013) of the Building Regulations. The development will also achieve a **21.86%** saving in regulated carbon emissions exclusively through on-site renewable technologies.

The development will also incorporate measures to mitigate future climate change by limiting the risk of summertime overheating and through installing water saving sanitary ware and water outlets

In the circumstances, the proposed development is therefore deemed to comply with policies *CC1*, *CC2* and *CC3* of the *Camden Local Plan (2017).*

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1.0 Introduction

1.1 EPS Group have been appointed to provide an Energy & Sustainability Statement to support the planning application to construct 5 No. New Flats (1 x 2 Bed, 2 x 1 Bed, 2 x Studio) through a two storey extension with roof extension at 130 Chalton Street, London, NW1 1RW.

1.2 It is anticipated that the proposed flats will need to comply with the requirements of Approved Document Part L1A 2013 of the Building Regulations if planning is permitted.

1.3 The proposed development's energy consumption has therefore been assessed using the National Calculations Method (NCM) - SAP 2012 (Standard Assessment Procedure) to determine the predicted annual regulated carbon dioxide (CO_2) emissions of the development and the associated reduction targets.

1.4 The following fuel emissions factors have been utilised within the supporting calculations as defined by the updated National Calculations Method (NCM):

Table 1: NCM Fuel Emission Factors	
Fuel	**CO_2 emission factor ($kgCO_2/kWh$)**
Natural gas	0.216
Grid supplied electricity	0.519
Grid displaced electricity	0.519

1.5 This document should be used for planning purposes only and should be re-assessed and resubmitted at the Building Control stage if alternative building specifications or proposed systems are followed to those outlined within the report.

1.6 It is also highlighted that the SAP calculations utilised within the report rely on a number of standard operational parameters which may not ultimately match the actual measures adopted within the finalised building. Whilst they provide a 'like for like' comparison for the purpose of this report, they are not valid for Building Control applications or for the actual operation of the development post completion.

1.7 The dimensions for all units that are referenced within this report are based upon SAP measurement conventions which may result in slight differences with other dimensions quoted elsewhere.

2.0 Planning Policy Context

2.1 National

The National Planning Policy Framework (NPPF) outlines the Government's planning policies for England and how these are expected to be applied by local authorities. Section 14 of this document details how local policies should address climate change through the promotion of energy efficiency and the adoption of low carbon and renewable technologies. It states:

"14.0 Meeting the challenge of climate change, flooding and coastal change

148. The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure.

Planning for climate change

149. Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure.

150. New development should be planned for in ways that:

a) avoid 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

b) can help 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.

151. To help increase the use and supply of renewable and low carbon energy and heat, plans should:

a) 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);

b) consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and

c) identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.

152. Local planning authorities should support community-led initiatives for renewable and low carbon energy, including developments outside areas identified in local plans or other strategic policies that are being taken forward through neighbourhood planning.

153. In determining planning applications, local planning authorities should expect new development to:

a) comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and

b) take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

154. When determining planning applications for renewable and low carbon development, local planning authorities should:

a) not require applicants to demonstrate the overall need for renewable or low carbon energy, and recognise that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions; and

b) approve the application if its impacts are (or can be made) acceptable. Once suitable areas for renewable and low carbon energy have been identified in plans, local planning authorities should expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas."

2.2 The London Plan

The London Plan is the overall strategic plan for London detailing a fully integrated economic, environmental, transport and social framework for the development of the city until 2031.

Policy 5.2 of The London Plan March 2016 (Consolidated with Alterations Since 2011) relates to *'Minimising Carbon Dioxide Emissions'* and states:

"A. Development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:

1. Be lean: use less energy

2. Be clean: supply energy efficiently

3. Be green: use renewable energy

B. The Mayor will work with boroughs and developers to ensure that major developments meet the following targets for carbon dioxide emissions reduction in buildings. These targets are expressed as minimum improvements over the Target Emission Rate (TER) outlined in the national Building Regulations leading to zero carbon residential buildings from 2016 and zero carbon non-domestic buildings from 2019.

Residential

Year	*Improvement on 2010 Building Regulations**	
	Residential buildings	*Non-domestic buildings*
2010 – 2013	*25 per cent*	*25 per cent*
2013 – 2016	*40 per cent*	*40 per cent*
2016 – 2019	*Zero carbon*	*As per building regulations requirements*

(*Please reference additional April 2014 guidance detailed below)

C. Major development proposals should include a detailed energy assessment to demonstrate how the targets for carbon dioxide emissions reduction outlined above are to be met within the framework of the energy hierarchy.

D. As a minimum, energy assessments should include the following details:

a) Calculation of the energy demand and carbon dioxide emissions covered by Building Regulations and, separately, the energy demand and carbon dioxide emissions from any other part of the development, including plant or equipment, that are not covered by the Building Regulations (see paragraph 5.22) at each stage of the energy hierarchy.

b) Proposals to reduce carbon dioxide emissions through the energy efficient design of the site, buildings and services.

c) Proposals to further reduce carbon dioxide emissions

d) Proposals to further reduce carbon dioxide emissions through the use of on-site renewable energy technologies.

e) The carbon dioxide reduction targets should be met on-site. Where it is clearly demonstrated that the specific targets cannot be fully achieved on-site, any shortfall may be provided off-site or through a cash in lieu contribution to the relevant borough to be ring fenced to secure delivery of carbon dioxide savings elsewhere."

April 2014 Update to Energy Planning Guidance

Following the introduction of Approved Documents Part L1A and L2A 2013 of the Building Regulations on April 6th 2014, The Greater London Authority issued updated guidance on Energy Planning.

This document states:

"As outlined in the Sustainable, Design and Construction SPG, from 6 April 2014 the Mayor will apply a 35 per cent carbon reduction target beyond Part L 2013 of the Building Regulations - this is deemed to be broadly equivalent to the 40 per cent target beyond Part L 2010 of the Building Regulations, as specified in Policy 5.2 of the London Plan for 2013-–2016."

2.3 London Borough of Camden

The relevant policies from the *Camden Local Plan (2017*) are detailed below:

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

"The Council will require development to be resilient to climate change.

All development should adopt appropriate climate change adaptation measures such as:

a. the protection of existing green spaces and promoting new appropriate green infrastructure;

b. not increasing, and wherever possible reducing, surface water runoff through increasing permeable surfaces and use of Sustainable Drainage Systems;

c. incorporating bio-diverse roofs, combination green and blue roofs and green walls where appropriate; and

d. measures to reduce the impact of urban and dwelling overheating, including application of the cooling hierarchy. Any development involving 5 or more residential *units or 500 sqm or more of any additional floorspace is required to demonstrate the above in a Sustainability Statement.*

Sustainable design and construction measures The Council will promote and measure sustainable design and construction by:

e. ensuring development schemes demonstrate how adaptation measures and sustainable development principles have been incorporated into the design and proposed implementation;

f. encourage new build residential development to use the Home Quality Mark and Passivhaus design standards; e.g. encouraging conversions and extensions of 500 sqm of residential floorspace or above or five or more dwellings to achieve "excellent" in BREEAM domestic refurbishment; and

h. expecting non-domestic developments of 500 sqm of floorspace or above to achieve "excellent" in BREEAM assessments and encouraging zero carbon in new development from 2019"

Policy CC3 Water and flooding

"The Council will seek to ensure that development does not increase flood risk and reduces the risk of flooding where possible.

We will require development to:

a. incorporate water efficiency measures;

b. avoid harm to the water environment and improve water quality;

c. consider the impact of development in areas at risk of flooding (including drainage);

d. incorporate flood resilient measures in areas prone to flooding;

e. utilise Sustainable Drainage Systems (SuDS) in line with the drainage hierarchy to achieve a greenfield run-off rate where feasible; and

f. not locate vulnerable development in flood-prone areas.

Where an assessment of flood risk is required, developments should consider surface water flooding in detail and groundwater flooding where applicable.

The Council will protect the borough's existing drinking water and foul water infrastructure, including the reservoirs at Barrow Hill, Hampstead Heath, Highgate and Kidderpore"

Further guidance on how compliance with the above policies can be achieved is provided by within Camden's Special Guidance Document entitled *Energy efficiency and adaptation (March 2019).*

The following exerts are of particular relevance to this Energy & Sustainability Statement:

"5. Renewable energy technologies

KEY MESSAGES

- *There are a variety of renewable energy technologies that can be installed to supplement a development's energy needs.*
- *Developments are to target a 20% reduction in carbon dioxide emissions from on-site renewable energy technologies.*

5.1 All developments should consider the feasibility of on-site renewable energy generation. Renewable energy generation should only be considered once the earlier stages of the energy hierarchy have been followed and energy demand has been reduced as far as possible.

5.2 In areas of poor air quality, there is an expectation of zero emission buildings. Developers should look to prioritise the installation of renewable energy technologies with no polluting emissions. These can be air, ground, or water heat pumps and potentially efficient direct electric 'point of use' heaters to supply a hot water load, unless found to be unfeasible.

5.3 As per paragraph 8.11 of the Local Plan, developments (including refurbishments) of 5 or more dwellings and/or 500 sqm or more of any gross internal floorspace must demonstrate a 20% 'Be Green' stage carbon dioxide reduction from renewables. Where feasible the renewables target should be fully met or exceeded, regardless of whether overall carbon dioxide reduction targets have already been met (those for minor new build residential and major applications specified in Table 1) through earlier stages of the energy hierarchy."

"7. Energy reduction

KEY MESSAGES

- *All development in Camden is expected to reduce carbon dioxide emissions through the application of the energy hierarchy.*
- *All new build major development to demonstrate compliance with London Plan targets for carbon dioxide emissions.*
- *Deep refurbishments (i.e. refurbishments assessed under Building Regulations Part L1A/L2A) should also meet the London Plan carbon reduction targets for new buildings.*
- *All new build residential development (of 1 – 9 dwellings) must meet 19% carbon dioxide reduction; and*
- *Developments of five or more dwellings and/or more than 500sqm of any gross internal floorspace to achieve 20% reduction in carbon dioxide emissions from on-site renewable energy generation*

7.1 The carbon reduction targets for developments in Camden are outlined in Table 2a and 2b below. This will be updated in line with any subsequent updates to the Local Plan, national and London planning policy.

7.2 Part L of the Building Regulations sets out the minimum requirements that buildings must meet relating to the conservation of fuel and power. Developments in Camden are expected to exceed Part L of Building Regulations through the application of the energy hierarchy. Camden's planning policies use Part L calculations as a baseline that should be exceeded. Deep refurbishments (i.e. refurbishments assessed under Building Regulations Part L1A/L2A) should also meet the London Plan carbon reduction targets for new buildings. All other refurbishments should demonstrate quantifiable improvements against the relevant new build baseline, L1A or L2A.

Carbon offsetting

7.3 Where the London Plan carbon dioxide reduction targets cannot be met on-site (Local Plan paragraph 8.12), we may accept the provision of carbon reduction measures elsewhere in the borough, or secure a S106 financial contribution to Camden's Carbon Offset Fund. The Carbon Offset Fund is used to secure the delivery of carbon reduction projects in Camden. Projects will be connected to those identified in the Council's environmental sustainability plan 'Green Action for Change'.

7.4 Camden Council aligns the price per tonne of carbon with the GLA's pricing strategy. Please note: this is subject to change as further viability studies are undertaken. Details of the current pricing strategy are outlined on our website. Any offsetting project managed by the developer will need to demonstrate like-for-like savings and will need to be additional to any planned projects. Funds cannot be used to support other, existing development proposals to meet carbon reduction targets.

Table 2a Energy reduction targets, domestic

Development should comply with these standards / provide this information	Residential New Build (assessed under L1A)			Residential Refurbishment (assessed under L1B)		
	Major (10+ units or >1,000 sqm new floor space)	Medium (5-9 units, >500sq.m and <1,000 sqm new floor space)	Minor All new dwellings (up to 4 units and <500 sqm new floor space)	Major (10+ units or >1,000 sqm)	Medium (5-9 units, >500sq.m and <1,000 sqm)	Minor (up to 4 units and <500 sqm
Energy and carbon reduction targets						
Overall carbon reduction targets:	Zero Carbon (minimum 35% reduction beyond Part L on site) (London Plan 5.2, Local Plan CC1)	19% below Part L of 2013 Building Regulations (Local Plan CC1)	19% below Part L of 2013 Building Regulations (Local Plan CC1)	Greatest possible reduction - meeting Part L1B for retained thermal elements (London Plan 5.4, Local Plan CC1	Greatest possible reduction - meeting Part L1B for retained thermal elements (London Plan 5.4, Local Plan CC1	Greatest possible reduction - meeting Part L1B for retained thermal elements (London Plan 5.4, Local Plan CC1
Reduction in CO_2 from onsite renewables (after all other energy efficiency measures have been incorporated)	20% (London Plan 5.7, Local Plan CC1)	20% (London Plan 5.7, Local Plan CC1)	Incorporate renewables where feasible	20% (London Plan 5.4, 5.7, Local Plan CC1)	20% (London Plan 5.4, 5.7, Local Plan CC1)	20% (London Plan 5.4, 5.7, Local Plan CC1)

2.4 Conclusions

On review of the planning policies and associated guidance documents outlined above, it is evident that the proposed scheme will need to achieve a significant reduction in regulated carbon dioxide emissions (CO_2) by following the principles of the energy hierarchy as detailed within the London Plan.

In particular, a 20% reduction in regulated CO_2 emissions will need to be achieved through the local installation of low carbon or renewable technologies (the green step of the energy hierarchy). In satisfying this stipulation, the development will also comply with the more generalised requirement of policy CC1 which requires a minimum reduction in overall regulated CO_2 emissions of 19% against the requirements of Part L1A 2013 of the Building Regulations.

It is also noted that the proposed scheme will need to take measures to reduce summertime overheating and to ideally avoid the need to provide mechanical cooling. The proposed dwellings will also need to be water efficient whilst also minimising the risks of localised flooding.

3.0 Energy Statement Methodology

3.1 As detailed within Paragraph 1.3, SAP 2012 has been utilised as an appropriate method for calculating the predicted energy consumption and the associated carbon dioxide emissions for the proposed development across a number of different scenarios.

3.2 Where information was unavailable due to the lack of detail ordinarily associated with Building Control specifications, details from previous comparable projects have been utilised. Alternatively, industry standard defaults and assumptions have been adopted and consistently applied across all variant calculations.

3.3 In the first instance a set of 'Notional' Baseline SAP Calculations were produced as outlined within Section 4.0 in order to determine the amount of annual regulated carbon dioxide (CO_2) emissions that would be permitted for the proposed development under the standard requirements of Approved Document Part L1A (2013).

3.4 In response to the Energy Hierarchy of the London Plan 2016, a range of conventional energy efficiency improvements are proposed for the development which have then been modelled within SAP in order to produce a set of 'Lean' Energy Calculations as detailed within Section 5.0.

3.5 In accordance with the 'Clean' step of the Energy Hierarchy, the feasibility of utilising decentralised energy networks or Combined Heat and Power (CHP) was then reviewed as detailed within Section 6.0.

3.6 The suitability of a wide range of renewable technologies have been reviewed for potential inclusion within the development. Supporting calculations are provided within Section 8.0 as a means of quantifying the associated carbon reduction arising from this 'Green' step of the energy hierarchy.

4.0 Notional Benchmark Energy Calculations

4.1 An initial set of SAP calculations were produced for the proposed development as a means of determining the notional benchmark energy consumption and associated carbon dioxide (CO_2) emissions that would ordinarily be expected under Part L1A (2013) of the Building Regulations.

4.2 The CO_2 emissions arising from the predicted unregulated energy consumption within the proposed development were also calculated in order to determine the full CO_2 footprint of the proposed development as per the requirements of the London Plan.

4.3 It is noted that the calculated unregulated carbon emissions are not subject to target reductions required by Policy 5.2 of the London Plan or CC1 & CC2 of the Camden Local Plan.

4.4 The calculated Benchmark SAP Calculations are detailed within Table 2 below with a selection of Target Emission Rate (TER) calculation worksheets provided in Appendix 1 for detailed review (all other instances are available by request).

Table 2: Benchmark Annual Energy Consumption and CO_2 Emissions (SAP 2012)

Dwelling	Floor Area (m^2)	Part L1A Target Emission Rate (TER)	Annual 'Baseline' Regulated Energy Consumption (kWhr / Year)	Annual 'Baseline' Regulated CO_2 Emissions (Kg / Year)	Annual 'Baseline' Unregulated CO_2 Emissions (Kg / Year)
Flat 1	50.49	18.80	3,959.81	949.05	1,039.93
Flat 2	37.94	22.38	3,565.94	848.92	841.16
Flat 3	50.49	19.25	4,066.82	972.16	1,039.93
Flat 4	37.94	22.85	3,649.38	866.94	841.16
Flat 5	68.84	20.38	5,927.64	1,402.69	1,325.23
Total Regulated Baseline CO_2 Emissions (Kg / Year)					**5,039.76**
Total Unregulated Baseline CO_2 Emissions (Kg / Year)					**5,087.41**
Overall (Regulated and Unregulated) Baseline CO_2 Emissions (Kg / Year)					**10,127.17**
Total Regulated Baseline Energy Consumption (kWhr / Year)					**21,169.59**

4.5 On review of the above, it is evident that the proposed development would be permitted to emit up to **5,039.76 $KgCO_2$/year** under occupancy if it was constructed to the minimum energy performance standards required by Part L1A 2013.

5.0 Proposed Energy Strategy and Performance – Lean Measures

5.1 In accordance with the 'Lean' principles of the Energy Hierarchy, it is provisionally proposed to adopt the following minimum fabric, heating and lighting standards within the apartments as a means of reducing the overall energy demand of the development by conventional (lean) means:

Table 3: Proposed 'Lean' Fabric, HVAC and Lighting Standards

Element / Feature	Current Part L1A 2013 Minimal Acceptable Standard	Proposed Development Target
External Wall U-value	0.30 W/m^2K	**0.22 W/m^2K**
Separating Walls to Unheated Access Space	0.30 W/m^2K	**0.22 W/m^2K**
Party Walls	0.20 W/m^2K	**0.00 W/m^2K**
Roof Insulated at Rafter	0.20 W/m^2K	**0.15 W/m^2K**
Flat Roof U-value	0.20 W/m^2K	**0.15 W/m^2K**
Windows & Rooflights	2.00 W/m^2K	**1.40 W/m^2K**
Air Permeability	10 $m^3/m^3.h$	**4.50 $m^3/m^2.h$**
Thermal Bridging	-	**Accredited Construction Details**
Lighting	75% low energy lights	**100% low energy lights**
Heating (Gas Combi)	Min 88% (SEDBUK 2009) Efficient Boiler	**89.6% Efficient Boiler - Ideal Logic Combi ESP1 26**
Heating Controls	Programmer, Thermostat & TRVs	**Delayed Start Thermostat, Programmer and TRVs**
Ventilation	-	**Intermittent Extract Fans to Kitchens & Bathrooms**

5.2 The impact of the above 'Lean' measures on the proposed development's overall annual carbon dioxide emissions was determined by updating the Baseline SAP Calculations referenced in Section 4.0.

5.3 The results of the Lean Calculations are summarised in Table 4 below with a selection of the Dwelling Emission Rate SAP Worksheets provided in Appendix 2 of this report for detailed review (all other instances are available by request):

Table 4: 'Lean' Annual Energy Consumption and CO_2 Emissions (SAP 2012)				
Apartment	**Floor Area (m^2)**	**Part L1A 'Lean' Dwelling Emission Rate (DER)**	**Annual 'Lean' Regulated Energy Consumption (kWhr / Year)**	**Annual 'Lean' Regulated CO_2 Emissions (Kg / Year)**
Flat 1	50.49	17.74	3,713.91	895.78
Flat 2	37.94	21.51	3,415.47	815.99
Flat 3	50.49	18.14	3,808.03	916.10
Flat 4	37.94	21.82	3,470.92	827.96
Flat 5	68.84	19.05	5,505.60	1,311.53
Total Regulated 'Lean' CO_2 Emissions (Kg / Year)				**4,767.36**
Total Regulated 'Lean' Energy Consumption (kWhr / Year)				**19,913.93**

5.4 As a result of adopting the recommended 'Lean' energy efficient measures outlined within paragraph 5.1, the proposed development will have a reduced annual level of regulated CO_2 emissions of **4,767.36 KgCO_2/year.** This represents a total reduction of **5.40%** in comparison to the Baseline Carbon Dioxide Emissions detailed within Section 4.0.

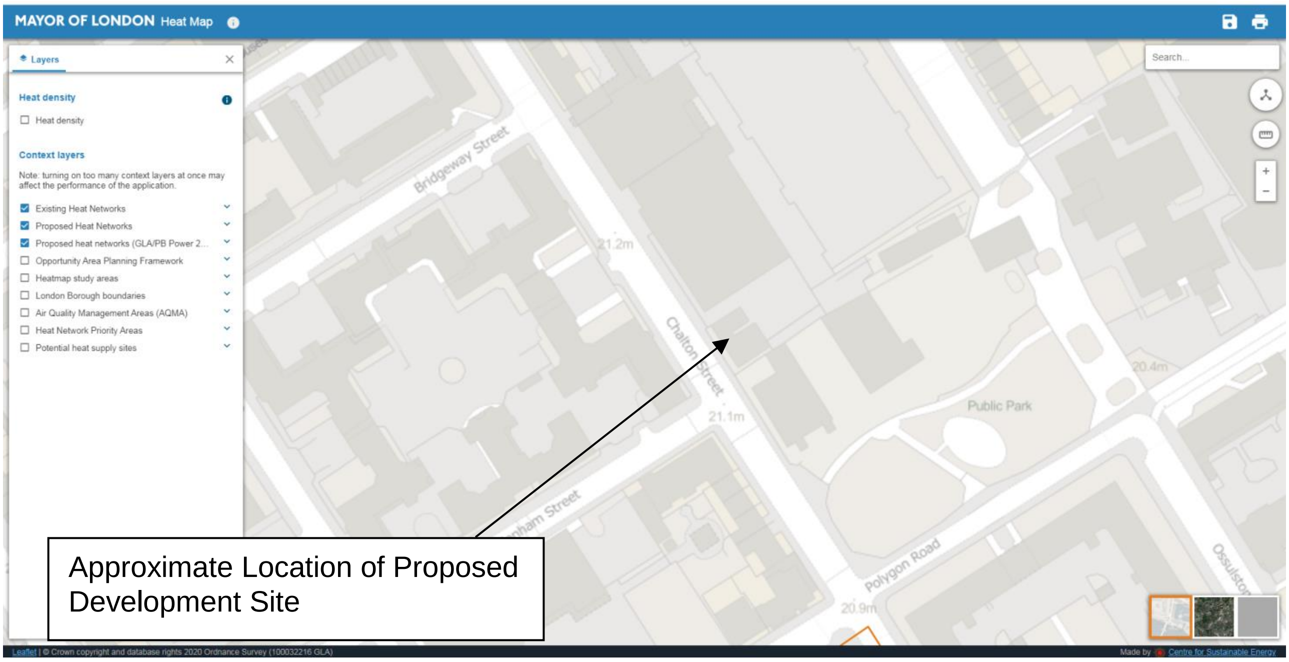
6.0 Proposed Energy Strategy and Performance – Clean Measures

6.1 Where feasible, The London Plan 2016 heavily advocates the use of decentralised energy, including district heating and cooling and Combined Heat and Power (CHP). As well as forming the 'Clean' step of the aforementioned Energy Hierarchy, Policy 5.5 - Decentralised Energy Networks states that:

"The Mayor expects 25 per cent of the heat and power used in London to be generated through the use of localised decentralised energy systems by 2025. In order to achieve this target the Mayor prioritises the development of decentralised heating and cooling networks at the development and area wide levels, including larger scale heat transmission networks."

6.2 On consulting the London Heat Map (see below), it is apparent that there is no existing or potential Energy Network within the immediate vicinity of the proposed development and as such any possible connection to an existing or planned network is unviable in this instance.

Figure 1: Results of the London Heat Map Search within Vicinity of the Development



6.3 Combined Heat and Power (CHP) units conventionally produce electricity at a localised level from mains gas. In generating electricity in this manner, the technology reduces the losses associated with the inefficient transportation of electricity across the national grid, whilst also producing large quantities of heat as a by-product. This heat can then be harvested and used for the provision of localised heating and hot water.

6.4 CHP units are not suitable for all developments as they require sustained heat load demands in order to achieve maximum operating efficiencies. Since there are no economic or sustainability benefits associated with oversizing a CHP installation, a large proportion of smaller developments are often unsuitable for this technology.

6.5 On review of the above circumstances coupled with a growing concern on the detrimental impact that CHP equipment can have on urban air quality, the use of this technology within the development is deemed to be unviable.

7.0 Review of Renewable Technologies

7.1 In response to the 'Green' requirement of the Energy Hierarchy coupled with the specific requirements of policy CC1 of Camden's Local Plan, a number of different renewable technologies have been reviewed in terms of their overall suitability for inclusion within the proposed development.

7.2 Wind Turbine (Column or Roof Mounted)

Benefits	• When installed in optimum positions, wind turbines can generate a large amount of renewable electricity, the surplus of which can be exported at financial gain to the national grid via the Feed-in-Tariff scheme.
Site Limitations / Restrictions	• Not aesthetically pleasing and will not be in keeping with the local area. • The site is too sheltered as a result of its general urban location which would result in unreliable and insufficient outputs. • Require on-going maintenance which future occupants may neglect. • Can produce unacceptable levels of noise to occupants and neighbours. • Strong public resistance to constructing new land based wind turbines
Conclusion	• The technology is not deemed as being suitable for use within the proposed development.

7.3 Solar Photovoltaic

Benefits	• When installed in optimum positions photovoltaic (PV) arrays can generate a large amount of renewable electricity which can be used locally or exported at financial gain to the national grid via the Feed-in-Tariff scheme. • Minimal on-going costs & maintenance issues following installation. • Easy to integrate into a conventional build specification or retro-fit applications • The development has a large flat roof area which could facilitate the horizontal installation of panels as a means of minimising the visual impact of the technology. Alternatively angled array stands could be used to help achieve optimal orientation and pitch to maximise generation efficiencies.
Site Limitations / Restrictions	• PV panels are not ascetically pleasing and may detract from the visual appearance of the building although this can be minimised by installing the panels in a horizontal position as described above. • The adjacent building will cause some overshading to the proposed development's roof which will reduce the generational efficiency of any installed panels
Conclusion	• **It is proposed to use this technology within the development.**

7.4 Solar Thermal

Benefits	• Solar hot water systems can provide an efficient way of contributing to developments overall hot water requirements. • Minimal on-going costs & maintenance issues following installation. • May be eligible for payments under the Renewable Heat Incentive. • As with PV the development benefits from a large flat roof area which could be used to site solar collectors.
Site Limitations / Restrictions	• The amount of CO_2 savings with this technology is restricted as there is no benefit to producing more hot water than is used within a dwelling. • Solar collectors are not aesthetically pleasing and may detract from the visual appearance of the development although this could be mitigated by installing panels horizontally. • Requires the installation of hot water cylinders / thermal stores which would introduce an additional source of energy loss to the dwellings whilst also potentially restricting useable floor space. • The length of pipe runs to thermal stores need to be kept to a minimum.
Conclusion	• The technology is not deemed as being suitable for use within the proposed development.

7.5 Ground Source Heat Pump

Benefits	• High operating efficiencies (CoPs). • Flexible installation options for new build properties including trench and borehole installations • Reliable and proven technology. • Generally low maintenance costs. • No visual impact on the property. • Eligible for payments under the Renewable Heat Incentive.
Site Limitations / Restrictions	• Detailed ground surveys required. • High capital installation costs
Conclusion	• It is not proposed to use this technology within the development.

7.6 Air Source Heat Pump

Benefits	• High operating efficiencies (CoPs). • Reduced visual impact on the property. • Reliable and proven technology. • Generally low maintenance costs.
Site Limitations / Restrictions	• Often require a supplementary immersion heating system. • The external units can result in some noise related problems although this can be limited through the careful selection of particular models with low operating acoustic levels and the potential use of acoustic housing units.
Conclusion	• It is not proposed to use this technology within the development.

7.7 Biomass Boilers

Benefits	• Reliable and proven technology. • Eligible for payments under the Renewable Heat Incentive
Site Limitations / Restrictions	• Require large storage facilities for the fuel. • On-going cleaning, maintenance and management requirements. • Require regular fuel deliveries. • Would contribute to poor urban air quality.
Conclusion	• The technology is not deemed as being suitable for use within the proposed development.

7.8 On review of the above technologies, the use of PV panels is recommended as being the most viable and cost effective technology for use within the proposed development. This will provide a local source of renewable electricity for occupant use as well as providing a significant and affordable reduction in the calculated carbon dioxide emissions.

7.9 It is therefore proposed to install a PV array with a minimum output capacity of 3.30 kWp to the flat roof of the proposed development. The panels will be installed in a horizontal plane so that they cannot be seen from street level.

7.10 It is expected that the proposed PV array will comprise of 11 x 300W panels requiring approx. 18.70m^2 of roof space.

8.0 Proposed Energy Strategy and Performance – Green Measures

8.1 Having identified the use of photovoltaic panels as being the most suitable renewable technology for use within the development, the 'Lean SAP Calculations detailed in Section 5.0 were updated to incorporate the proposed 3.30 kWp PV Array detailed within paragraphs 7.8 – 7.10.

8.2 The key results of the Proposed (Green) Calculations are summarised in Table 5 below with a selection of the Dwelling Emission Rate SAP Worksheets provided in Appendix 3 of this report for detailed review (all other instances are available by request):

Table 5: Proposed 'Green' Annual Energy Consumption and CO_2 Emissions (SAP 2012)				
Apartment	**Floor Area (m^2)**	**Part L1A 'Green' Dwelling Emission Rate (DER)**	**Annual 'Green' Regulated Energy Consumption (kWhr / Year)**	**Annual 'Green' Regulated CO_2 Emissions (Kg / Year)**
Flat 1	50.49	13.50	3301.42	681.69
Flat 2	37.94	17.26	3105.19	654.95
Flat 3	50.49	13.90	3395.54	702.02
Flat 4	37.94	17.58	3160.64	666.93
Flat 5	68.84	14.81	4942.84	1019.46
Total Regulated 'Green' CO_2 Emissions (Kg / Year)				**3,725.05**
Total Regulated 'Green' Energy Consumption (kWhr / Year)				**17,905.63**

8.3 As a result of installing the renewable technologies specified within Section 7.0 and by also adopting the 'Lean' measures detailed in Section 5.0, it is evident that the proposed development will have a total reduced level of annual regulated CO_2 emissions of **3,725.05 $KgCO_2$/year**, this represents a total reduction of **26.09%** beyond the standard requirements of Part L1A 2013 of the Building Regulations**.**

8.4 It is also noted that the development achieves on site CO_2 emissions savings of **21.86%** exclusively from the installation of renewable sources.

9.0 Energy Calculation Summary

9.1 The results of the various Energy Calculations detailed within this report are summarised within the tables below:

Table 6: Carbon Dioxide Emissions after each stage of the Energy Hierarchy		
	Carbon dioxide emissions (Tonnes CO2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	5.040 (A)	5.087
After energy demand reduction	4.767 (B)	5.087
After CHP	4.767 (C)	5.087
After renewable energy	3.725 (D)	5.087

Table 7: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy		
	Regulated Carbon Dioxide savings	
	(Tonnes CO_2 per annum)	%
Savings from energy demand reduction	0.273	5.417
Savings from CHP	0.000	0.000
Savings from renewable energy	1.042	21.86
Cumulative On Site Savings	1.315	26.09

9.2 In the circumstances, the proposed development is therefore deemed to satisfy the requirements of policy *CC1: Policy CC1 Climate change mitigation* of the *Camden Local Plan (2017).*

10.0 Overheating Risk Analysis

10.1 Asides from achieving an increased level of energy performance, the proposed dwellings have been designed to mitigate the risks of summertime overheating by adopting internal layouts that facilitate natural cross ventilation. This should provide a passive cooling mechanism which will be particularly effective given that all units will be on or above the third floor level where occupants will be able to securely leave the windows open throughout the day.

10.2 The Green SAP Calculations referenced within Section 8 were utilised to perform a preliminary Part L1A Summertime Overheating Risk Analysis (as per Criterion 3 of Part L1A 2013).

10.3 The results of the Overheating Check are summarised within Table 8 below, with several example SAP 2012 Overheating Assessments provided within Appendix 4 for detailed review (all other instances are available upon request):

Table 8: Part L1A 2013 Criterion 3: Summertime Overheating Risk Analysis

	Floor Area (m^2)	Calculated Overheating Risk
Flat 1	50.49	Slight
Flat 2	37.94	Slight
Flat 3	50.49	Slight
Flat 4	37.94	Slight
Flat 5	50.49	Slight

10.4 **On review of the above, it is evident that at this stage of design, the proposed dwellings do not appear to be at significant risk of overheating.**

10.5 It is acknowledged that the Overheating Risk associated with Part L1A 2013 is somewhat limited. It is therefore advised to undertake CIBSE TM59 and TM49 dynamic overheating modelling in conjunction with the detailed design process if planning permission for the development is granted.

11.0 Water Management Internal Water Consumption

11.1 It is noted that since the proposed development involves the addition of extra storeys to an existing building there will be no increase in surface water runoff as a result of the proposal. The proposals are therefore unlikely to increase the risk of any localised flooding.

11.2 The internal water consumption of the dwellings will be reduced through the specification of water saving outlets such as reduced volume / dual flush cisterns, reduced bath capacities and by installing taps and showers with reduced flow rates or inline flow restrictors. This will provide a reduced water consumption of less than or equal to 110 litres per person per day in line with the higher technical standard of Part G of the Building Regulations.

11.3 The following provisional specification is proposed for the development's water outlets and sanitary ware which will achieve an internal potable water consumption of **109.27 litres per person per day**. A Water Efficiency Calculation is provided within Appendix 5 of this report for detailed review:

- Toilets = 5l (Full) and 3l (Part)
- Basin taps = 4l/min
- Baths = 170l
- Showers = 8.5l/min
- Kitchen taps = 6l/min

11.4 The proposed development is therefore deemed to satisfy *Policy CC3 Water and flooding of the Camden Local Plan.*

Appendix 1:

Baseline TER Calculations (SAP Derived)

EPS Group
Energy Consultancy and Compliance Services

EPS Group
3C Pelham Court
Pelham Road
Nottingham
0115 7270599
info@epsgroup.co.uk

Project Information

Building type Mid-floor flat

Reference 9913
Date 3 March 2020
Client GBS Architectural Design, Lombard Business Park, 8 Lombard Road, Wimbledon, SW19 3TZ
Project Flat 1, 130 Chalton Street, London, NW1 1RX

SAP 2012 worksheet for notional dwelling - calculation of target emissions

1. Overall dwelling dimensions

	Area (m²)	Av. Storey height (m)	Volume (m³)	
Fourth and other floors	50.49	2.40	121.18	(3a)
Total floor area	50.49			(4)
Dwelling volume (m³)			121.18	(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	2	x 10	20.00	(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	
Infiltration due to chimneys, fans and flues		0.17	(8)
Pressure test, result q50	5.00		(17)
Air permeability		0.42	(18)
Number of sides on which sheltered		3.00	(19)
Shelter factor		0.78	(20)
Infiltration rate incorporating shelter factor		0.32	(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	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18

13.13 (22a)

Adjusted infiltration rate (allowing for shelter and wind speed)

0.41	0.40	0.39	0.35	0.35	0.31	0.31	0.30	0.32	0.35	0.36	0.38

4.22 (22b)

Ventilation : natural ventilation, intermittent extract fans
Effective air change rate

0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(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	
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (SouthWest) W1			1.400	1.33 (1.40)	1.86	(27)
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (SouthWest) W2			1.400	1.33 (1.40)	1.86	(27)
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (SouthWest) W3			1.400	1.33 (1.40)	1.86	(27)
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (SouthEast) W5			0.990	1.33 (1.40)	1.31	(27)
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (SouthEast) W7			0.990	1.33 (1.40)	1.31	(27)
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (SouthEast) W6			1.200	1.33 (1.40)	1.59	(27)
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (SouthWest) W4			1.400	1.33 (1.40)	1.86	(27)
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (NorthEast) W8			1.290	1.33 (1.40)	1.71	(27)
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (NorthEast) W9			0.620	1.33 (1.40)	0.82	(27)
Solid door - Double-glazed, air-filled, low-E, En=0.1, soft coat (NorthEast) Entrance Door			1.940	1.00	1.94	(26)
Walls Seperating Wall to Unheated Corridor			10.73	0.18	1.93	(29)
Walls External Wall			43.38	0.18	7.81	(29)
Party wall			9.38	0.00	0.00	

Total area of external elements Sigma A, m²	66.74	(31)
Fabric heat loss, W/K	25.85	(33)
Thermal mass parameter, kJ/m²K (user-specified TMP)	250.00	(35)
Effect of thermal bridges	7.42	(36)
Total fabric heat loss	33.27	(37)

Ventilation heat loss calculated monthly

23.36	23.23	23.10	22.50	22.38	21.86	21.86	21.76	22.06	22.38	22.61	22.85	(38)

Heat transfer coefficient, W/K

56.63	56.50	56.37	55.77	55.66	55.14	55.14	55.04	55.34	55.66	55.89	56.12

55.77 (39)

Heat loss parameter (HLP), W/m²K

1.12	1.12	1.12	1.10	1.10	1.09	1.09	1.09	1.10	1.10	1.11	1.11

HLP (average) 1.10 (40)

Number of days in month (Table 1a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements kWh/year

Assumed occupancy, N 1.70 (42)

Annual average hot water usage in litres per day Vd,average 74.68 (43)

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

Hot water usage in litres per day for each month

82.15	79.16	76.18	73.19	70.20	67.21	67.21	70.20	73.19	76.18	79.16	82.15	(44)

Energy content of hot water used

121.83	106.55	109.95	95.86	91.98	79.37	73.55	84.40	85.41	99.53	108.65	117.98

Energy content (annual) 1175.05 (45)

Distribution loss

18.27	15.98	16.49	14.38	13.80	11.91	11.03	12.66	12.81	14.93	16.30	17.70	(46)

Hot water storage volume (litres) 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

41.86	36.44	38.82	36.09	35.77	33.15	34.25	35.77	36.09	38.82	39.04	41.86	(61)

Total heat required for water heating calculated for each month

163.69	142.99	148.77	131.95	127.75	112.52	107.80	120.17	121.50	138.35	147.69	159.85	(62)

Output from water heater for each month, kWh/month

163.69	142.99	148.77	131.95	127.75	112.52	107.80	120.17	121.50	138.35	147.69	159.85	(64)

1623.02 (64)

Heat gains from water heating, kWh/month

50.97	44.54	46.26	40.90	39.53	34.68	33.02	37.01	37.42	42.80	45.88	49.70	(65)

5. Internal gains

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

Metabolic gains, Watts

85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	(66)

Lighting gains

13.27	11.78	9.58	7.26	5.42	4.58	4.95	6.43	8.63	10.96	12.79	13.64	(67)

Appliances gains

148.51	150.05	146.16	137.90	127.46	117.65	111.10	109.56	113.44	121.71	132.15	141.95	(68)

Cooking gains

31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	(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)

-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	(71)

Water heating gains

68.51	66.28	62.18	56.80	53.13	48.16	44.38	49.74	51.97	57.53	63.73	66.79	(72)

Total internal gains

281.86	279.68	269.50	253.52	237.58	221.96	211.99	217.30	225.62	241.76	260.24	273.95	(73)

6. Solar gains (calculation for January)

	Area & Flux	g & FF	Shading	Gains
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (SouthWest) W1	0.9 x 1.400 36.79	0.63 x 0.70	0.77	15.7425
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (SouthWest) W2	0.9 x 1.400 36.79	0.63 x 0.70	0.77	15.7425
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (SouthWest) W3	0.9 x 1.400 36.79	0.63 x 0.70	0.77	15.7425
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (SouthEast) W5	0.9 x 0.990 36.79	0.63 x 0.70	0.77	11.1322
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (SouthEast) W7	0.9 x 0.990 36.79	0.63 x 0.70	0.77	11.1322
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (SouthEast) W6	0.9 x 1.200 36.79	0.63 x 0.70	0.77	13.4936
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (SouthWest) W4	0.9 x 1.400 36.79	0.63 x 0.70	0.77	15.7425
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (NorthEast) W8	0.9 x 1.290 11.28	0.63 x 0.70	0.77	4.4482
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (NorthEast) W9	0.9 x 0.620 11.28	0.63 x 0.70	0.77	2.1379
Solid door - Double-glazed, air-filled, low-E, En=0.1, soft coat (NorthEast) Entrance Door	0.9 x 1.940 0.00	0.63 x 0.70	0.77	0.0000
Total solar gains, January				105.31 (83-1)

Solar gains

105.31	181.58	254.25	324.77	372.66	373.88	358.83	322.50	278.58	202.25	126.54	89.87	(83)

Total gains

387.17	461.25	523.75	578.29	610.24	595.84	570.82	539.80	504.20	444.01	386.78	363.82	(84)

Lighting calculations

	Area	g	FF x Shading	
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (SouthWest) W1	0.9 x 1.40	0.80	0.70 x 0.83	0.59
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (SouthWest) W2	0.9 x 1.40	0.80	0.70 x 0.83	0.59
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (SouthWest) W3	0.9 x 1.40	0.80	0.70 x 0.83	0.59
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (SouthEast) W5	0.9 x 0.99	0.80	0.70 x 0.83	0.41
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (SouthEast) W7	0.9 x 0.99	0.80	0.70 x 0.83	0.41
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (SouthEast) W6	0.9 x 1.20	0.80	0.70 x 0.83	0.50
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (SouthWest) W4	0.9 x 1.40	0.80	0.70 x 0.83	0.59

Lighting calculations

	Area	g	FF x Shading	
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (NorthEast) W8	0.9 x 1.29	0.80	0.70 x 0.83	0.54
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (NorthEast) W9	0.9 x 0.62	0.80	0.70 x 0.83	0.26

GL = 4.47 / 50.49 = 0.089
C1 = 0.500
C2 = 0.962
El = 234

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	61.91	62.06	62.20	62.87	63.00	63.59	63.59	63.71	63.36	63.00	62.74	62.47	
alpha	5.13	5.14	5.15	5.19	5.20	5.24	5.24	5.25	5.22	5.20	5.18	5.16	
Utilisation factor for gains for living area	0.99	0.98	0.96	0.90	0.76	0.58	0.42	0.46	0.71	0.93	0.99	1.00	(86)
Mean internal temperature in living area T1	19.95	20.15	20.41	20.71	20.90	20.98	21.00	21.00	20.95	20.69	20.26	19.91	(87)
Temperature during heating periods in rest of dwelling Th2	19.98	19.99	19.99	20.00	20.00	20.01	20.01	20.01	20.00	20.00	20.00	19.99	(88)
Utilisation factor for gains for rest of dwelling	0.99	0.98	0.95	0.87	0.70	0.49	0.33	0.37	0.62	0.90	0.98	0.99	(89)
Mean internal temperature in the rest of dwelling T2	18.60	18.89	19.27	19.67	19.91	20.00	20.01	20.01	19.97	19.66	19.06	18.55	(90)

Living area fraction (26.09 / 50.49) 0.52 (91)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Mean internal temperature (for the whole dwelling)	19.30	19.54	19.86	20.21	20.42	20.51	20.52	20.52	20.48	20.19	19.68	19.25	(92)
Apply adjustment to the mean internal temperature, where appropriate	19.30	19.54	19.86	20.21	20.42	20.51	20.52	20.52	20.48	20.19	19.68	19.25	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains	0.99	0.98	0.95	0.87	0.73	0.54	0.38	0.42	0.66	0.91	0.98	0.99	(94)
Useful gains	383.39	450.81	496.18	504.54	445.62	319.23	215.21	225.24	334.43	401.89	378.71	361.14	(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	849.44	827.13	753.04	630.56	485.51	325.61	216.03	226.63	352.84	533.74	702.98	844.94	(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	346.74	252.89	191.10	90.74	29.68	-	-	-	-	98.10	233.47	359.95	

Total space heating requirement per year (kWh/year) (October to May) 1602.66 (98)
Space heating requirement per m² (kWh/m²/year) 31.74 (99)

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 93.40% (206)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	346.74	252.89	191.10	90.74	29.68	-	-	-	-	98.10	233.47	359.95	(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)	371.24	270.76	204.61	97.15	31.77	-	-	-	-	105.03	249.97	385.39	(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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Water heating requirement	163.69	142.99	148.77	131.95	127.75	112.52	107.80	120.17	121.50	138.35	147.69	159.85	(64)
Efficiency of water heater 80.30 (216)	86.90	86.47	85.68	84.13	82.03	80.30	80.30	80.30	80.30	84.20	86.20	87.03	(217)
Water heating fuel	188.38	165.36	173.63	156.84	155.74	140.12	134.25	149.65	151.31	164.31	171.33	183.66	(219)

Annual totals	kWh/year	
Space heating fuel used, main system 1	1715.91	(211)
Space heating fuel (secondary)	0.00	(215)
Water heating fuel	1934.58	(219)
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)	234.33	(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	3959.81	(238)

10a. Does not apply

11a. Does not apply

12a. Carbon dioxide emissions

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating, main system 1	1715.91	0.216	370.64	(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	1934.58	0.216	417.87	(264)
Space and water heating			788.51	(265)
Electricity for pumps and fans	75.00	0.519	38.93	(267)
Electricity for lighting	234.33	0.519	121.62	(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			949.05	(272)

	kg/m²/year	
Emissions per m² for space and water heating	15.62	(272a)
Emissions per m² for lighting	2.41	(272b)
Emissions per m² for pumps and fans	0.77	(272c)
Target Carbon Dioxide Emission Rate (TER)	18.80	(273)

= (15.6171 x 1.00) + 2.4087 + 0.7709

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Project Information

Building type Top-floor flat

Reference 9913
Date 15 April 2020
Client GBS Architectural Design, Lombard Business Park, 8 Lombard Road, Wimbledon, SW19 3TZ
Project Flat 5, 130 Chalton Street, London, NW1 1RX

SAP 2012 worksheet for notional dwelling - calculation of target emissions

1. Overall dwelling dimensions

	Area (m^2)	Av. Storey height (m)	Volume (m^3)	
Fourth and other floors	68.84	2.40	165.22	(3a)
Total floor area	68.84			(4)
Dwelling volume (m^3)			165.22	(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	2	x 10	20.00	(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	
Infiltration due to chimneys, fans and flues		0.12	(8)
Pressure test, result q50	5.00		(17)
Air permeability		0.37	(18)
Number of sides on which sheltered		1.00	(19)
Shelter factor		0.93	(20)
Infiltration rate incorporating shelter factor		0.34	(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	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18

13.13 (22a)

Adjusted infiltration rate (allowing for shelter and wind speed)

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.40

4.50 (22b)

Ventilation : natural ventilation, intermittent extract fans

Effective air change rate

0.60	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58

(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	
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (NorthEast) W4			3.150	1.33 (1.40)	4.18	(27)
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (NorthEast) W5			0.840	1.33 (1.40)	1.11	(27)
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (NorthEast) W7			1.890	1.33 (1.40)	2.51	(27)
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (SouthWest) W3			1.250	1.33 (1.40)	1.66	(27)
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (SouthWest) W2			1.250	1.33 (1.40)	1.66	(27)
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (SouthWest) W1			1.250	1.33 (1.40)	1.66	(27)
Solid door - Double-glazed, air-filled, low-E, En=0.1, soft coat (NorthEast) Entrance Door			1.940	1.00	1.94	(26)
Walls External Wall			83.25	0.18	14.99	(29)
Walls Seperating Wall to Unheated Corridor			13.77	0.18	2.48	(29)
Flat roofs			64.34	0.13	8.36	(30)
Pitched roofs insulated between rafters			6.21	0.13	0.81	(30)

Total area of external elements Sigma A, m²	179.14	(31)
Fabric heat loss, W/K	41.34	(33)
Thermal mass parameter, kJ/m²K (user-specified TMP)	250.00	(35)
Effect of thermal bridges	8.96	(36)
Total fabric heat loss	50.30	(37)

Ventilation heat loss calculated monthly

32.48	32.28	32.08	31.15	30.97	30.16	30.16	30.01	30.47	30.97	31.33	31.69	(38)

Heat transfer coefficient, W/K

82.78	82.58	82.38	81.45	81.27	80.46	80.46	80.31	80.77	81.27	81.63	82.00

81.45 (39)

Heat loss parameter (HLP), W/m²K

1.20	1.20	1.20	1.18	1.18	1.17	1.17	1.17	1.17	1.18	1.19	1.19

HLP (average) 1.18 (40)

Number of days in month (Table 1a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements kWh/year

Assumed occupancy, N	2.22	(42)
Annual average hot water usage in litres per day Vd,average	86.87	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month	95.56	92.08	88.61	85.13	81.66	78.18	78.18	81.66	85.13	88.61	92.08	95.56		(44)
Energy content of hot water used	141.71	123.94	127.89	111.50	106.99	92.32	85.55	98.17	99.34	115.77	126.38	137.24		
Energy content (annual)													1366.79	(45)
Distribution loss	21.26	18.59	19.18	16.72	16.05	13.85	12.83	14.73	14.90	17.37	18.96	20.59		(46)
Hot water storage volume (litres)													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	48.69	42.38	45.15	41.98	41.61	38.56	39.84	41.61	41.98	45.15	45.41	48.69		(61)
Total heat required for water heating calculated for each month	190.40	166.32	173.04	153.48	148.60	130.88	125.39	139.78	141.32	160.93	171.78	185.93		(62)
Output from water heater for each month, kWh/month	190.40	166.32	173.04	153.48	148.60	130.88	125.39	139.78	141.32	160.93	171.78	185.93		(64)
													1887.86	(64)
Heat gains from water heating, kWh/month	59.29	51.80	53.81	47.57	45.98	40.34	38.41	43.04	43.53	49.78	53.37	57.80		(65)

5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, Watts	110.88	110.88	110.88	110.88	110.88	110.88	110.88	110.88	110.88	110.88	110.88	110.88	(66)
Lighting gains	18.61	16.53	13.44	10.18	7.61	6.42	6.94	9.02	12.11	15.38	17.95	19.13	(67)
Appliances gains	194.57	196.59	191.51	180.67	167.00	154.15	145.56	143.55	148.63	159.47	173.14	185.99	(68)
Cooking gains	34.09	34.09	34.09	34.09	34.09	34.09	34.09	34.09	34.09	34.09	34.09	34.09	(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)	-88.71	-88.71	-88.71	-88.71	-88.71	-88.71	-88.71	-88.71	-88.71	-88.71	-88.71	-88.71	(71)
Water heating gains	79.69	77.09	72.33	66.07	61.80	56.02	51.62	57.85	60.45	66.91	74.13	77.69	(72)
Total internal gains	352.14	349.48	336.54	316.19	295.67	275.86	263.39	269.69	280.46	301.02	324.48	342.08	(73)

6. Solar gains (calculation for January)

	Area & Flux	g & FF	Shading	Gains	
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (NorthEast) W4	0.9 x 3.150 11.28	0.63 x 0.70	0.77	10.8619	
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (NorthEast) W5	0.9 x 0.840 11.28	0.63 x 0.70	0.77	2.8965	
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (NorthEast) W7	0.9 x 1.890 11.28	0.63 x 0.70	0.77	6.5171	
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (SouthWest) W3	0.9 x 1.250 36.79	0.63 x 0.70	0.77	14.0558	
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (SouthWest) W2	0.9 x 1.250 36.79	0.63 x 0.70	0.77	14.0558	
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (SouthWest) W1	0.9 x 1.250 36.79	0.63 x 0.70	0.77	14.0558	
Solid door - Double-glazed, air-filled, low-E, En=0.1, soft coat (NorthEast) Entrance Door	0.9 x 1.940 0.00	0.63 x 0.70	0.77	0.0000	
Total solar gains, January				62.44	(83-1)

Solar gains

62.44	113.10	172.63	243.89	300.54	310.41	294.25	250.15	197.02	129.82	76.02	52.64	(83)

Total gains

414.59	462.58	509.18	560.07	596.21	586.27	557.64	519.83	477.48	430.84	400.50	394.72	(84)

Lighting calculations

	Area	g	FF x Shading	
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (NorthEast) W4	0.9 x 3.15	0.80	0.70 x 0.83	1.32
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (NorthEast) W5	0.9 x 0.84	0.80	0.70 x 0.83	0.35
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (NorthEast) W7	0.9 x 1.89	0.80	0.70 x 0.83	0.79
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (SouthWest) W3	0.9 x 1.25	0.80	0.70 x 0.83	0.52
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (SouthWest) W2	0.9 x 1.25	0.80	0.70 x 0.83	0.52
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (SouthWest) W1	0.9 x 1.25	0.80	0.70 x 0.83	0.52

GL = 4.03 / 68.84 = 0.059
C1 = 0.500
C2 = 1.030
El = 329

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												
57.75	57.89	58.03	58.69	58.82	59.41	59.41	59.53	59.18	58.82	58.57	58.30	
alpha												
4.85	4.86	4.87	4.91	4.92	4.96	4.96	4.97	4.95	4.92	4.90	4.89	
Utilisation factor for gains for living area												
1.00	1.00	0.99	0.97	0.91	0.77	0.61	0.67	0.89	0.98	1.00	1.00	(86)
Mean internal temperature in living area T1												
19.69	19.83	20.07	20.40	20.71	20.92	20.98	20.97	20.82	20.43	20.00	19.67	(87)
Temperature during heating periods in rest of dwelling Th2												
19.92	19.92	19.92	19.93	19.94	19.95	19.95	19.95	19.94	19.94	19.93	19.93	(88)
Utilisation factor for gains for rest of dwelling												
1.00	0.99	0.99	0.96	0.88	0.68	0.48	0.54	0.83	0.97	0.99	1.00	(89)
Mean internal temperature in the rest of dwelling T2												
18.18	18.38	18.73	19.22	19.64	19.89	19.94	19.93	19.79	19.26	18.64	18.15	(90)

Living area fraction (26.80 / 68.84) 0.39 (91)

Mean internal temperature (for the whole dwelling)												
18.77	18.94	19.25	19.68	20.06	20.29	20.34	20.34	20.19	19.71	19.17	18.74	(92)
Apply adjustment to the mean internal temperature, where appropriate												
18.77	18.94	19.25	19.68	20.06	20.29	20.34	20.34	20.19	19.71	19.17	18.74	(93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains												
1.00	0.99	0.98	0.96	0.88	0.72	0.53	0.59	0.84	0.97	0.99	1.00	(94)
Useful gains												
413.00	459.37	501.34	536.11	524.93	419.56	294.51	305.13	402.96	417.79	397.61	393.53	(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												
1197.59	1159.42	1050.30	877.89	679.39	457.65	301.20	316.17	491.89	740.78	985.42	1192.35	(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												
583.74	470.44	408.42	246.08	114.92	-	-	-	-	240.30	423.23	594.32	

Total space heating requirement per year (kWh/year) (October to May) 3081.45 (98)

Space heating requirement per m² (kWh/m²/year) 44.76 (99)

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	93.40%	(206)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	583.74	470.44	408.42	246.08	114.92	-	-	-	-	240.30	423.23	594.32	(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)	624.98	503.68	437.29	263.47	123.04	-	-	-	-	257.28	453.14	636.32	(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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Water heating requirement	190.40	166.32	173.04	153.48	148.60	130.88	125.39	139.78	141.32	160.93	171.78	185.93	(64)
Efficiency of water heater 80.30 (216)	87.69	87.52	87.14	86.23	84.41	80.30	80.30	80.30	80.30	86.06	87.23	87.77	(217)
Water heating fuel	217.14	190.03	198.59	177.98	176.04	162.98	156.15	174.07	176.00	187.00	196.93	211.84	(219)

Annual totals	kWh/year	
Space heating fuel used, main system 1	3299.20	(211)
Space heating fuel (secondary)	0.00	(215)
Water heating fuel	2224.74	(219)
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)	328.71	(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	5927.64	(238)

10a. Does not apply

11a. Does not apply

12a. Carbon dioxide emissions

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating, main system 1	3299.20	0.216	712.63	(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	2224.74	0.216	480.54	(264)
Space and water heating			1193.17	(265)
Electricity for pumps and fans	75.00	0.519	38.93	(267)
Electricity for lighting	328.71	0.519	170.60	(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			1402.69	(272)

	kg/m²/year	
Emissions per m² for space and water heating	17.33	(272a)
Emissions per m² for lighting	2.48	(272b)
Emissions per m² for pumps and fans	0.57	(272c)
Target Carbon Dioxide Emission Rate (TER)	20.38	(273)

= (17.3325 x 1.00) + 2.4782 + 0.5654

Appendix 2:

Lean DER Calculations (SAP Derived)

EPS Group
Energy Consultancy and Compliance Services

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Project Information

Building type	Mid-floor flat		
Reference	9913		
Date	3 March 2020		
Client	GBS Architectural Design Lombard Business Park 8 Lombard Road Wimbledon SW19 3TZ	Project	Flat 1 130 Chalton Street London NW1 1RX

SAP 2012 worksheet for New dwelling as built - calculation of dwelling emissions

1. Overall dwelling dimensions

	Area (m²)	Av. Storey height (m)	Volume (m³)	
Fourth and other floors	50.49	2.40	121.18	(3a)
Total floor area	50.49			(4)
Dwelling volume (m³)			121.18	(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	2	x 10	20.00	(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	
Infiltration due to chimneys, fans and flues		0.17	(8)
Pressure test, result q50	4.50		(17)
Air permeability		0.39	(18)
Number of sides on which sheltered		3.00	(19)
Shelter factor		0.78	(20)
Infiltration rate incorporating shelter factor		0.30	(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	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18

13.13 (22a)

Adjusted infiltration rate (allowing for shelter and wind speed)

0.39	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.30	0.32	0.34	0.36

3.97 (22b)

Ventilation : natural ventilation, intermittent extract fans
Effective air change rate

0.57	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(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=0.1, soft coat (NorthEast) W9			0.910	1.33 (1.40)	1.21			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (NorthEast) W8			1.890	1.33 (1.40)	2.51			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W4			2.040	1.33 (1.40)	2.70			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthEast) W6			1.750	1.33 (1.40)	2.32			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthEast) W7			1.450	1.33 (1.40)	1.92			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthEast) W5			1.450	1.33 (1.40)	1.92			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W3			2.040	1.33 (1.40)	2.70			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W2			2.040	1.33 (1.40)	2.70			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W1			2.040	1.33 (1.40)	2.70			(27)
Solid door Entrance Door			1.940	0.66	1.28			(26)
Walls External Wall			38.46	0.22	8.46	60.00	2307.60	(29)
Walls Seperating Wall to Unheated Corridor			10.73	0.22	2.36	0.00	0.00	(29)
Party wall			9.38	0.00	0.00	70.00	656.60	

Total area of external elements Sigma A, m²	66.74	(31)
Fabric heat loss, W/K	32.80	(33)
Thermal mass parameter, kJ/m²K (user-specified TMP)	250.00	(35)
Effect of thermal bridges	9.62	(36)
Total fabric heat loss	42.42	(37)

Ventilation heat loss calculated monthly

22.96	22.85	22.74	22.20	22.11	21.64	21.64	21.56	21.82	22.11	22.31	22.52	(38)

Heat transfer coefficient, W/K

65.39	65.27	65.16	64.63	64.53	64.06	64.06	63.98	64.24	64.53	64.73	64.94	64.63	(39)

Heat loss parameter (HLP), W/m²K

1.30	1.29	1.29	1.28	1.28	1.27	1.27	1.27	1.27	1.28	1.28	1.29

HLP (average) 1.28 (40)

Number of days in month (Table 1a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements kWh/year

Assumed occupancy, N 1.70 (42)

Annual average hot water usage in litres per day Vd,average 74.68 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month												
82.15	79.16	76.18	73.19	70.20	67.21	67.21	70.20	73.19	76.18	79.16	82.15	(44)
Energy content of hot water used												
121.83	106.55	109.95	95.86	91.98	79.37	73.55	84.40	85.41	99.53	108.65	117.98	

Energy content (annual) 1175.05 (45)

Distribution loss

18.27	15.98	16.49	14.38	13.80	11.91	11.03	12.66	12.81	14.93	16.30	17.70	(46)

store loss determined from EN 13203-2 tests, taken from boiler data record

Hot water storage volume (litres) 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												
3.05	2.75	3.05	2.95	3.05	2.95	3.05	3.05	2.95	3.05	2.95	3.05	(61)
Total heat required for water heating calculated for each month												
124.87	109.30	113.00	98.81	95.02	82.32	76.59	87.44	88.35	102.58	111.59	121.03	(62)
Output from water heater for each month, kWh/month												
124.87	109.30	113.00	98.81	95.02	82.32	76.59	87.44	88.35	102.58	111.59	121.03	(64)

1210.91 (64)

Heat gains from water heating, kWh/month

41.27	36.12	37.32	32.61	31.34	27.13	25.22	28.82	29.13	33.86	36.86	39.99	(65)

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, Watts												
85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	(66)
Lighting gains												
13.24	11.76	9.56	7.24	5.41	4.57	4.94	6.42	8.61	10.94	12.76	13.61	(67)
Appliances gains												
148.51	150.05	146.16	137.90	127.46	117.65	111.10	109.56	113.44	121.71	132.15	141.95	(68)
Cooking gains												
31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	(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)												
-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	(71)
Water heating gains												
55.47	53.74	50.16	45.29	42.13	37.68	33.89	38.74	40.46	45.51	51.20	53.75	(72)
Total internal gains												
268.78	267.12	257.46	242.00	226.57	211.47	201.50	206.29	214.09	229.72	247.68	260.88	(73)

6. Solar gains (calculation for January)

	Area & Flux	g & FF	Shading	Gains	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (NorthEast) W9	0.9 x 0.910 11.28	0.63 x 0.70	0.77	3.1379	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (NorthEast) W8	0.9 x 1.890 11.28	0.63 x 0.70	0.77	6.5171	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W4	0.9 x 2.040 36.79	0.63 x 0.70	0.77	22.9391	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthEast) W6	0.9 x 1.750 36.79	0.63 x 0.70	0.77	19.6782	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthEast) W7	0.9 x 1.450 36.79	0.63 x 0.70	0.77	16.3048	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthEast) W5	0.9 x 1.450 36.79	0.63 x 0.70	0.77	16.3048	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W3	0.9 x 2.040 36.79	0.63 x 0.70	0.77	22.9391	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W2	0.9 x 2.040 36.79	0.63 x 0.70	0.77	22.9391	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W1	0.9 x 2.040 36.79	0.63 x 0.70	0.77	22.9391	
Solid door Entrance Door	0.9 x 1.940 0.00	0.00 x 0.70	0.77	0.0000	
Total solar gains, January				153.70	(83-1)

Solar gains

153.70	265.01	371.12	474.12	544.08	545.88	523.90	470.83	406.65	295.19	184.68	131.16	(83)

Total gains

422.48	532.13	628.58	716.11	770.65	757.35	725.40	677.11	620.74	524.91	432.36	392.04	(84)

Lighting calculations

	Area	g	FF x Shading	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (NorthEast) W9	0.9 x 0.91	0.80	0.70 x 0.83	0.38
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (NorthEast) W8	0.9 x 1.89	0.80	0.70 x 0.83	0.79
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W4	0.9 x 2.04	0.80	0.70 x 0.83	0.85
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthEast) W6	0.9 x 1.75	0.80	0.70 x 0.83	0.73
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthEast) W7	0.9 x 1.45	0.80	0.70 x 0.83	0.61
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthEast) W5	0.9 x 1.45	0.80	0.70 x 0.83	0.61
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W3	0.9 x 2.04	0.80	0.70 x 0.83	0.85
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W2	0.9 x 2.04	0.80	0.70 x 0.83	0.85

Lighting calculations

	Area	g	FF x Shading	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest)	0.9 x 2.04	0.80	0.70 x 0.83	0.85

W1

GL = 6.53 / 50.49 = 0.129

C1 = 0.500

C2 = 0.960

El = 234

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	53.62	53.72	53.81	54.25	54.34	54.73	54.73	54.80	54.58	54.34	54.17	53.99	
alpha	4.57	4.58	4.59	4.62	4.62	4.65	4.65	4.65	4.64	4.62	4.61	4.60	
Utilisation factor for gains for living area	0.99	0.98	0.94	0.86	0.71	0.53	0.39	0.43	0.66	0.91	0.98	0.99	(86)
Mean internal temperature in living area T1	19.78	20.04	20.36	20.69	20.90	20.98	21.00	20.99	20.94	20.65	20.14	19.73	(87)
Temperature during heating periods in rest of dwelling Th2	19.84	19.85	19.85	19.86	19.86	19.87	19.87	19.87	19.86	19.86	19.85	19.85	(88)
Utilisation factor for gains for rest of dwelling	0.99	0.97	0.93	0.82	0.64	0.44	0.29	0.33	0.57	0.87	0.98	0.99	(89)
Mean internal temperature in the rest of dwelling T2	18.76	19.01	19.33	19.63	19.80	19.86	19.86	19.87	19.84	19.60	19.12	18.71	(90)

Living area fraction (26.09 / 50.49) 0.52 (91)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Mean internal temperature (for the whole dwelling)	19.29	19.54	19.86	20.18	20.37	20.44	20.45	20.45	20.41	20.14	19.65	19.24	(92)
Apply adjustment to the mean internal temperature, where appropriate	19.14	19.39	19.71	20.03	20.22	20.29	20.30	20.30	20.26	19.99	19.50	19.09	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains	0.99	0.97	0.92	0.82	0.66	0.47	0.33	0.37	0.61	0.88	0.97	0.99	(94)
Useful gains	417.11	514.75	580.13	589.95	510.77	357.95	236.11	247.89	376.35	459.66	420.47	388.35	(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	970.16	945.98	860.77	719.35	549.62	364.35	236.99	249.41	395.62	606.01	802.37	966.73	(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	411.47	289.79	208.80	93.17	28.91	-	-	-	-	108.88	274.97	430.32	

Total space heating requirement per year (kWh/year) (October to May) 1846.30 (98)

Space heating requirement per m² (kWh/m²/year) 36.57 (99)

8c. Space cooling requirement - not applicable

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	90.50%	(206)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	411.47	289.79	208.80	93.17	28.91	-	-	-	-	108.88	274.97	430.32	(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)	454.66	320.21	230.72	102.95	31.94	-	-	-	-	120.31	303.83	475.49	(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)

<u>Water heating</u>

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Water heating requirement	124.87	109.30	113.00	98.81	95.02	82.32	76.59	87.44	88.35	102.58	111.59	121.03	(64)
Efficiency of water heater 87.30 (216)	89.73	89.60	89.35	88.82	88.03	87.30	87.30	87.30	87.30	88.92	89.55	89.78	(217)
Water heating fuel	139.16	121.99	126.47	111.24	107.95	94.29	87.74	100.16	101.21	115.36	124.61	134.81	(219)

Annual totals	kWh/year	
Space heating fuel used, main system 1	2040.11	(211)
Space heating fuel (secondary)	0.00	(215)
Water heating fuel	1364.99	(219)
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)	233.81	(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	3713.91	(238)

10a. Does not apply

11a. Does not apply

12a. Carbon dioxide emissions

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating, main system 1	2040.11	0.216	440.66	(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	1364.99	0.216	294.84	(264)
Space and water heating			735.50	(265)
Electricity for pumps and fans	75.00	0.519	38.93	(267)
Electricity for lighting	233.81	0.519	121.35	(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			895.78	(272)
			kg/m²/year	
Dwelling Carbon Dioxide Emission Rate (DER)			17.74	(273)

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Project Information

Building type	Top-floor flat		
Reference	9913		
Date	15 April 2020		
Client	GBS Architectural Design	Project	Flat 5 - Lean
	Lombard Business Park		130 Chalton Street
	8 Lombard Road		London
	Wimbledon		NW1 1RX
	SW19 3TZ		

SAP 2012 worksheet for New dwelling as built - calculation of dwelling emissions

1. Overall dwelling dimensions

	Area (m²)	Av. Storey height (m)	Volume (m³)	
Fourth and other floors	68.84	2.40	165.22	(3a)
Total floor area	68.84			(4)
Dwelling volume (m³)			165.22	(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	2	x 10	20.00	(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	
Infiltration due to chimneys, fans and flues		0.12	(8)
Pressure test, result q50	4.50		(17)
Air permeability		0.35	(18)
Number of sides on which sheltered		1.00	(19)
Shelter factor		0.93	(20)
Infiltration rate incorporating shelter factor		0.32	(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	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18

13.13 (22a)

Adjusted infiltration rate (allowing for shelter and wind speed)

0.41	0.40	0.39	0.35	0.34	0.30	0.30	0.30	0.32	0.34	0.36	0.38

4.20 (22b)

Ventilation : natural ventilation, intermittent extract fans

Effective air change rate

0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(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=0.1, soft coat (SouthWest) W1			1.250	1.33 (1.40)	1.66			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W2			1.250	1.33 (1.40)	1.66			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W3			1.250	1.33 (1.40)	1.66			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (NorthEast) W7			1.890	1.33 (1.40)	2.51			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (NorthEast) W5			0.840	1.33 (1.40)	1.11			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (NorthEast) W4			3.150	1.33 (1.40)	4.18			(27)
Solid door Entrance Door			1.940	0.66	1.28			(26)
Walls External Wall			83.25	0.22	18.31	190.00	15817.50	(29)
Walls Seperating Wall to Unheated Corridor			13.77	0.22	3.03	0.00	0.00	(29)
Flat roofs			64.34	0.15	9.65	9.00	579.06	(30)
Pitched roofs insulated between rafters			6.21	0.15	0.93	9.00	55.89	(30)

Total area of external elements Sigma A, m²	179.14	(31)
Fabric heat loss, W/K	45.97	(33)
Thermal mass parameter, kJ/m²K (user-specified TMP)	100.00	(35)
Effect of thermal bridges	8.59	(36)
Total fabric heat loss	54.56	(37)

Ventilation heat loss calculated monthly

31.80	31.63	31.45	30.64	30.49	29.78	29.78	29.65	30.05	30.49	30.80	31.12	(38)

Heat transfer coefficient, W/K

86.36	86.19	86.02	85.20	85.05	84.34	84.34	84.21	84.62	85.05	85.36	85.68

85.20 (39)

Heat loss parameter (HLP), W/m²K

1.25	1.25	1.25	1.24	1.24	1.23	1.23	1.22	1.23	1.24	1.24	1.24

HLP (average) 1.24 (40)

Number of days in month (Table 1a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements kWh/year

Assumed occupancy, N 2.22 (42)

Annual average hot water usage in litres per day Vd,average 86.87 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month												
95.56	92.08	88.61	85.13	81.66	78.18	78.18	81.66	85.13	88.61	92.08	95.56	(44)
Energy content of hot water used												
141.71	123.94	127.89	111.50	106.99	92.32	85.55	98.17	99.34	115.77	126.38	137.24	

Energy content (annual) 1366.79 (45)

Distribution loss

21.26	18.59	19.18	16.72	16.05	13.85	12.83	14.73	14.90	17.37	18.96	20.59	(46)

store loss determined from EN 13203-2 tests, taken from boiler data record

Hot water storage volume (litres) 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												
3.05	2.75	3.05	2.95	3.05	2.95	3.05	3.05	2.95	3.05	2.95	3.05	(61)
Total heat required for water heating calculated for each month												
144.75	126.69	130.94	114.45	110.03	95.27	88.60	101.21	102.29	118.82	129.32	140.28	(62)
Output from water heater for each month, kWh/month												
144.75	126.69	130.94	114.45	110.03	95.27	88.60	101.21	102.29	118.82	129.32	140.28	(64)

1402.65 (64)

Heat gains from water heating, kWh/month

47.88	41.90	43.29	37.81	36.33	31.43	29.21	33.40	33.77	39.26	42.76	46.39	(65)

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, Watts												
110.88	110.88	110.88	110.88	110.88	110.88	110.88	110.88	110.88	110.88	110.88	110.88	(66)
Lighting gains												
18.61	16.53	13.44	10.18	7.61	6.42	6.94	9.02	12.11	15.38	17.95	19.13	(67)
Appliances gains												
194.57	196.59	191.51	180.67	167.00	154.15	145.56	143.55	148.63	159.47	173.14	185.99	(68)
Cooking gains												
34.09	34.09	34.09	34.09	34.09	34.09	34.09	34.09	34.09	34.09	34.09	34.09	(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)												
-88.71	-88.71	-88.71	-88.71	-88.71	-88.71	-88.71	-88.71	-88.71	-88.71	-88.71	-88.71	(71)
Water heating gains												
64.35	62.35	58.18	52.51	48.84	43.66	39.26	44.90	46.90	52.76	59.38	62.36	(72)
Total internal gains												
336.81	334.74	322.39	302.63	282.71	263.50	251.03	256.73	266.91	286.87	309.73	326.74	(73)

6. Solar gains (calculation for January)

	Area & Flux	g & FF	Shading	Gains	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W1	0.9 x 1.250 36.79	0.63 x 0.70	0.77	14.0558	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W2	0.9 x 1.250 36.79	0.63 x 0.70	0.77	14.0558	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W3	0.9 x 1.250 36.79	0.63 x 0.70	0.77	14.0558	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (NorthEast) W7	0.9 x 1.890 11.28	0.63 x 0.70	0.77	6.5171	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (NorthEast) W5	0.9 x 0.840 11.28	0.63 x 0.70	0.77	2.8965	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (NorthEast) W4	0.9 x 3.150 11.28	0.63 x 0.70	0.77	10.8619	
Solid door Entrance Door	0.9 x 1.940 0.00	0.00 x 0.70	0.77	0.0000	
Total solar gains, January				62.44	(83-1)

Solar gains

62.44	113.10	172.63	243.89	300.54	310.41	294.25	250.15	197.02	129.82	76.02	52.64	(83)

Total gains

399.25	447.83	495.03	546.52	583.25	573.90	545.28	506.88	463.93	416.69	385.75	379.38	(84)

Lighting calculations

	Area	g	FF x Shading	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W1	0.9 x 1.25	0.80	0.70 x 0.83	0.52
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W2	0.9 x 1.25	0.80	0.70 x 0.83	0.52
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W3	0.9 x 1.25	0.80	0.70 x 0.83	0.52
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (NorthEast) W7	0.9 x 1.89	0.80	0.70 x 0.83	0.79
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (NorthEast) W5	0.9 x 0.84	0.80	0.70 x 0.83	0.35
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (NorthEast) W4	0.9 x 3.15	0.80	0.70 x 0.83	1.32

GL = 4.03 / 68.84 = 0.059
C1 = 0.500
C2 = 1.030
El = 329

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	22.14	22.19	22.23	22.44	22.48	22.67	22.67	22.71	22.60	22.48	22.40	22.32	
alpha	2.48	2.48	2.48	2.50	2.50	2.51	2.51	2.51	2.51	2.50	2.49	2.49	
Utilisation factor for gains for living area	0.97	0.96	0.94	0.89	0.81	0.69	0.57	0.61	0.79	0.91	0.96	0.97	(86)
Mean internal temperature in living area T1	18.36	18.60	19.03	19.63	20.20	20.64	20.85	20.81	20.45	19.73	18.94	18.31	(87)
Temperature during heating periods in rest of dwelling Th2	19.88	19.88	19.88	19.89	19.89	19.90	19.90	19.90	19.90	19.89	19.89	19.88	(88)
Utilisation factor for gains for rest of dwelling	0.96	0.95	0.93	0.87	0.77	0.62	0.46	0.51	0.73	0.89	0.95	0.97	(89)
Mean internal temperature in the rest of dwelling T2	17.47	17.71	18.14	18.73	19.27	19.67	19.83	19.81	19.52	18.84	18.06	17.43	(90)

Living area fraction (26.80 / 68.84) 0.39 (91)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Mean internal temperature (for the whole dwelling)	17.82	18.06	18.49	19.08	19.64	20.05	20.23	20.20	19.88	19.18	18.41	17.77	(92)
Apply adjustment to the mean internal temperature, where appropriate	17.67	17.91	18.34	18.93	19.49	19.90	20.08	20.05	19.73	19.03	18.26	17.62	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains	0.95	0.94	0.91	0.85	0.76	0.62	0.48	0.52	0.72	0.87	0.93	0.96	(94)
Useful gains	379.92	418.99	448.83	464.89	442.05	356.63	260.97	265.63	336.05	363.86	360.57	362.94	(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	1154.41	1120.95	1018.42	854.75	662.14	446.92	293.12	307.11	476.57	717.41	952.30	1150.13	(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	576.22	471.71	423.78	280.70	163.74	-	-	-	-	263.04	426.04	585.67	

Total space heating requirement per year (kWh/year) (October to May) 3190.90 (98)

Space heating requirement per m² (kWh/m²/year) 46.35 (99)

8c. Space cooling requirement - not applicable

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	90.50%		(206)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	576.22	471.71	423.78	280.70	163.74	-	-	-	-	263.04	426.04	585.67	(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)	636.70	521.23	468.26	310.16	180.93	-	-	-	-	290.65	470.76	647.15	(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)

<u>Water heating</u>

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Water heating requirement	144.75	126.69	130.94	114.45	110.03	95.27	88.60	101.21	102.29	118.82	129.32	140.28	(64)
Efficiency of water heater												87.30	(216)
	89.84	89.80	89.72	89.55	89.19	87.30	87.30	87.30	87.30	89.48	89.73	89.86	(217)
Water heating fuel	161.12	141.07	145.94	127.80	123.37	109.13	101.48	115.94	117.17	132.79	144.12	156.10	(219)

Annual totals	kWh/year	
Space heating fuel used, main system 1	3525.85	(211)
Space heating fuel (secondary)	0.00	(215)
Water heating fuel	1576.04	(219)
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)	328.71	(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	5505.60	(238)

10a. Does not apply

11a. Does not apply

12a. Carbon dioxide emissions

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating, main system 1	3525.85	0.216	761.58	(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	1576.04	0.216	340.43	(264)
Space and water heating			1102.01	(265)
Electricity for pumps and fans	75.00	0.519	38.93	(267)
Electricity for lighting	328.71	0.519	170.60	(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			1311.53	(272)
			kg/m²/year	
Dwelling Carbon Dioxide Emission Rate (DER)			19.05	(273)

Appendix 3:

Proposed Green DER Calculations (SAP Derived)

EPS Group
Energy Consultancy and Compliance Services

EPS Group
3C Pelham Court
Pelham Road
Nottingham
0115 7270599
info@epsgroup.co.uk

Project Information

Building type	Mid-floor flat		
Reference	9913		
Date	15 April 2020		
Client	GBS Architectural Design Lombard Business Park 8 Lombard Road Wimbledon SW19 3TZ	Project	Flat 1 - Green 130 Chalton Street London NW1 1RX

SAP 2012 worksheet for New dwelling as built - calculation of dwelling emissions

1. Overall dwelling dimensions

	Area (m²)	Av. Storey height (m)	Volume (m³)	
Fourth and other floors	50.49	2.40	121.18	(3a)
Total floor area	50.49			(4)
Dwelling volume (m³)			121.18	(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	2	x 10	20.00	(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	
Infiltration due to chimneys, fans and flues		0.17	(8)
Pressure test, result q50	4.50		(17)
Air permeability		0.39	(18)
Number of sides on which sheltered		3.00	(19)
Shelter factor		0.78	(20)
Infiltration rate incorporating shelter factor		0.30	(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	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	13.13	(22a)

Adjusted infiltration rate (allowing for shelter and wind speed)

0.39	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.30	0.32	0.34	0.36	3.97	(22b)

Ventilation : natural ventilation, intermittent extract fans
Effective air change rate

0.57	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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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=0.1, soft coat (SouthWest) W1			2.040	1.33 (1.40)	2.70			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W2			2.040	1.33 (1.40)	2.70			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W3			2.040	1.33 (1.40)	2.70			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthEast) W5			1.450	1.33 (1.40)	1.92			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthEast) W7			1.450	1.33 (1.40)	1.92			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthEast) W6			1.750	1.33 (1.40)	2.32			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W4			2.040	1.33 (1.40)	2.70			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (NorthEast) W8			1.890	1.33 (1.40)	2.51			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (NorthEast) W9			0.910	1.33 (1.40)	1.21			(27)
Solid door Entrance Door			1.940	0.66	1.28			(26)
Walls External Wall			38.46	0.22	8.46	60.00	2307.60	(29)
Walls Seperating Wall to Unheated Corridor			10.73	0.22	2.36	0.00	0.00	(29)
Party wall			9.38	0.00	0.00	70.00	656.60	

Total area of external elements Sigma A, m²	66.74	(31)
Fabric heat loss, W/K	32.80	(33)
Thermal mass parameter, kJ/m²K (user-specified TMP)	250.00	(35)
Effect of thermal bridges	9.62	(36)
Total fabric heat loss	42.42	(37)

Ventilation heat loss calculated monthly

22.96	22.85	22.74	22.20	22.11	21.64	21.64	21.56	21.82	22.11	22.31	22.52	(38)

Heat transfer coefficient, W/K

65.39	65.27	65.16	64.63	64.53	64.06	64.06	63.98	64.24	64.53	64.73	64.94

64.63 (39)

Heat loss parameter (HLP), W/m²K

1.30	1.29	1.29	1.28	1.28	1.27	1.27	1.27	1.27	1.28	1.28	1.29

HLP (average) 1.28 (40)

Number of days in month (Table 1a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements kWh/year

Assumed occupancy, N	1.70	(42)
Annual average hot water usage in litres per day Vd,average	74.68	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	
Hot water usage in litres per day for each month	82.15	79.16	76.18	73.19	70.20	67.21	67.21	70.20	73.19	76.18	79.16	82.15		(44)
Energy content of hot water used	121.83	106.55	109.95	95.86	91.98	79.37	73.55	84.40	85.41	99.53	108.65	117.98		
Energy content (annual)													1175.05	(45)
Distribution loss	18.27	15.98	16.49	14.38	13.80	11.91	11.03	12.66	12.81	14.93	16.30	17.70		(46)

store loss determined from EN 13203-2 tests, taken from boiler data record

Hot water storage volume (litres)	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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	
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	3.05	2.75	3.05	2.95	3.05	2.95	3.05	3.05	2.95	3.05	2.95	3.05		(61)
Total heat required for water heating calculated for each month	124.87	109.30	113.00	98.81	95.02	82.32	76.59	87.44	88.35	102.58	111.59	121.03		(62)
Output from water heater for each month, kWh/month	124.87	109.30	113.00	98.81	95.02	82.32	76.59	87.44	88.35	102.58	111.59	121.03		(64)
													1210.91	(64)
Heat gains from water heating, kWh/month	41.27	36.12	37.32	32.61	31.34	27.13	25.22	28.82	29.13	33.86	36.86	39.99		(65)

5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, Watts	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	(66)
Lighting gains	13.24	11.76	9.56	7.24	5.41	4.57	4.94	6.42	8.61	10.94	12.76	13.61	(67)
Appliances gains	148.51	150.05	146.16	137.90	127.46	117.65	111.10	109.56	113.44	121.71	132.15	141.95	(68)
Cooking gains	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	(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)	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	(71)
Water heating gains	55.47	53.74	50.16	45.29	42.13	37.68	33.89	38.74	40.46	45.51	51.20	53.75	(72)
Total internal gains	268.78	267.12	257.46	242.00	226.57	211.47	201.50	206.29	214.09	229.72	247.68	260.88	(73)

6. Solar gains (calculation for January)

	Area & Flux	g & FF	Shading	Gains	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W1	0.9 x 2.040 36.79	0.63 x 0.70	0.77	22.9391	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W2	0.9 x 2.040 36.79	0.63 x 0.70	0.77	22.9391	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W3	0.9 x 2.040 36.79	0.63 x 0.70	0.77	22.9391	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthEast) W5	0.9 x 1.450 36.79	0.63 x 0.70	0.77	16.3048	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthEast) W7	0.9 x 1.450 36.79	0.63 x 0.70	0.77	16.3048	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthEast) W6	0.9 x 1.750 36.79	0.63 x 0.70	0.77	19.6782	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W4	0.9 x 2.040 36.79	0.63 x 0.70	0.77	22.9391	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (NorthEast) W8	0.9 x 1.890 11.28	0.63 x 0.70	0.77	6.5171	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (NorthEast) W9	0.9 x 0.910 11.28	0.63 x 0.70	0.77	3.1379	
Solid door Entrance Door	0.9 x 1.940 0.00	0.00 x 0.70	0.77	0.0000	
Total solar gains, January				153.70	(83-1)

Solar gains

153.70	265.01	371.12	474.12	544.08	545.88	523.90	470.83	406.65	295.19	184.68	131.16	(83)

Total gains

422.48	532.13	628.58	716.11	770.65	757.35	725.40	677.11	620.74	524.91	432.36	392.04	(84)

Lighting calculations

	Area	g	FF x Shading	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W1	0.9 x 2.04	0.80	0.70 x 0.83	0.85
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W2	0.9 x 2.04	0.80	0.70 x 0.83	0.85
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W3	0.9 x 2.04	0.80	0.70 x 0.83	0.85
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthEast) W5	0.9 x 1.45	0.80	0.70 x 0.83	0.61
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthEast) W7	0.9 x 1.45	0.80	0.70 x 0.83	0.61
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthEast) W6	0.9 x 1.75	0.80	0.70 x 0.83	0.73
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W4	0.9 x 2.04	0.80	0.70 x 0.83	0.85
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (NorthEast) W8	0.9 x 1.89	0.80	0.70 x 0.83	0.79

Lighting calculations

	Area	g	FF x Shading	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (NorthEast) W9	0.9 x 0.91	0.80	0.70 x 0.83	0.38

GL = 6.53 / 50.49 = 0.129
C1 = 0.500
C2 = 0.960
El = 234

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	53.62	53.72	53.81	54.25	54.34	54.73	54.73	54.80	54.58	54.34	54.17	53.99	
alpha	4.57	4.58	4.59	4.62	4.62	4.65	4.65	4.65	4.64	4.62	4.61	4.60	
Utilisation factor for gains for living area	0.99	0.98	0.94	0.86	0.71	0.53	0.39	0.43	0.66	0.91	0.98	0.99	(86)
Mean internal temperature in living area T1	19.78	20.04	20.36	20.69	20.90	20.98	21.00	20.99	20.94	20.65	20.14	19.73	(87)
Temperature during heating periods in rest of dwelling Th2	19.84	19.85	19.85	19.86	19.86	19.87	19.87	19.87	19.86	19.86	19.85	19.85	(88)
Utilisation factor for gains for rest of dwelling	0.99	0.97	0.93	0.82	0.64	0.44	0.29	0.33	0.57	0.87	0.98	0.99	(89)
Mean internal temperature in the rest of dwelling T2	18.76	19.01	19.33	19.63	19.80	19.86	19.86	19.87	19.84	19.60	19.12	18.71	(90)

Living area fraction (26.09 / 50.49) 0.52 (91)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Mean internal temperature (for the whole dwelling)	19.29	19.54	19.86	20.18	20.37	20.44	20.45	20.45	20.41	20.14	19.65	19.24	(92)
Apply adjustment to the mean internal temperature, where appropriate	19.14	19.39	19.71	20.03	20.22	20.29	20.30	20.30	20.26	19.99	19.50	19.09	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains	0.99	0.97	0.92	0.82	0.66	0.47	0.33	0.37	0.61	0.88	0.97	0.99	(94)
Useful gains	417.11	514.75	580.13	589.95	510.77	357.95	236.11	247.89	376.35	459.66	420.47	388.35	(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	970.16	945.98	860.77	719.35	549.62	364.35	236.99	249.41	395.62	606.01	802.37	966.73	(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	411.47	289.79	208.80	93.17	28.91	-	-	-	-	108.88	274.97	430.32	

Total space heating requirement per year (kWh/year) (October to May) 1846.30 (98)
Space heating requirement per m² (kWh/m²/year) 36.57 (99)

8c. Space cooling requirement - not applicable

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	90.50%		(206)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement												
411.47	289.79	208.80	93.17	28.91	-	-	-	-	108.88	274.97	430.32	(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)												
454.66	320.21	230.72	102.95	31.94	-	-	-	-	120.31	303.83	475.49	(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												
124.87	109.30	113.00	98.81	95.02	82.32	76.59	87.44	88.35	102.58	111.59	121.03	(64)
Efficiency of water heater											87.30	(216)
89.73	89.60	89.35	88.82	88.03	87.30	87.30	87.30	87.30	88.92	89.55	89.78	(217)
Water heating fuel												
139.16	121.99	126.47	111.24	107.95	94.29	87.74	100.16	101.21	115.36	124.61	134.81	(219)

Annual totals	kWh/year	
Space heating fuel used, main system 1	2040.11	(211)
Space heating fuel (secondary)	0.00	(215)
Water heating fuel	1364.99	(219)
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)	233.81	(232)
Energy saving/generation technologies		
PVs 0.80 x 0.678 x 950.616 x 0.800	412.491	
PVs 0.80 x 0.000 x 0.000 x 0.500	0.000	
PVs 0.80 x 0.000 x 0.000 x 0.500	0.000	
	412.491	(233)
Appendix Q -		
Energy saved or generated ():	0.000	(236a)
Energy used ():	0.000	(237a)
Total delivered energy for all uses	3301.42	(238)

10a. Does not apply

11a. Does not apply

12a. Carbon dioxide emissions

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating, main system 1	2040.11	0.216	440.66	(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	1364.99	0.216	294.84	(264)
Space and water heating			735.50	(265)
Electricity for pumps and fans	75.00	0.519	38.93	(267)
Electricity for lighting	233.81	0.519	121.35	(268)
Electricity generated - PVs	-412.49	0.519	-214.08	(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			681.69	(272)
			kg/m²/year	
Dwelling Carbon Dioxide Emission Rate (DER)			13.50	(273)

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Project Information

Building type	Top-floor flat		
Reference	9913		
Date	15 April 2020		
Client	GBS Architectural Design Lombard Business Park 8 Lombard Road Wimbledon SW19 3TZ	Project	Flat 5 - Green 130 Chalton Street London NW1 1RX

SAP 2012 worksheet for New dwelling as built - calculation of dwelling emissions

1. Overall dwelling dimensions

	Area (m^2)	Av. Storey height (m)	Volume (m^3)	
Fourth and other floors	68.84	2.40	165.22	(3a)
Total floor area	68.84			(4)
Dwelling volume (m^3)			165.22	(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	2	x 10	20.00	(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	
Infiltration due to chimneys, fans and flues		0.12	(8)
Pressure test, result q50	4.50		(17)
Air permeability		0.35	(18)
Number of sides on which sheltered		1.00	(19)
Shelter factor		0.93	(20)
Infiltration rate incorporating shelter factor		0.32	(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	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18

13.13 (22a)

Adjusted infiltration rate (allowing for shelter and wind speed)

0.41	0.40	0.39	0.35	0.34	0.30	0.30	0.30	0.32	0.34	0.36	0.38

4.20 (22b)

Ventilation : natural ventilation, intermittent extract fans
Effective air change rate

0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57

(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=0.1, soft coat (SouthWest) W1			1.250	1.33 (1.40)	1.66			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W2			1.250	1.33 (1.40)	1.66			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W3			1.250	1.33 (1.40)	1.66			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (NorthEast) W7			1.890	1.33 (1.40)	2.51			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (NorthEast) W5			0.840	1.33 (1.40)	1.11			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (NorthEast) W4			3.150	1.33 (1.40)	4.18			(27)
Solid door Entrance Door			1.940	0.66	1.28			(26)
Walls External Wall			83.25	0.22	18.31	190.00	15817.50	(29)
Walls Seperating Wall to Unheated Corridor			13.77	0.22	3.03	0.00	0.00	(29)
Flat roofs			64.34	0.15	9.65	9.00	579.06	(30)
Pitched roofs insulated between rafters			6.21	0.15	0.93	9.00	55.89	(30)

Total area of external elements Sigma A, m²	179.14	(31)
Fabric heat loss, W/K	45.97	(33)
Thermal mass parameter, kJ/m²K (user-specified TMP)	100.00	(35)
Effect of thermal bridges	8.59	(36)
Total fabric heat loss	54.56	(37)

Ventilation heat loss calculated monthly

31.80	31.63	31.45	30.64	30.49	29.78	29.78	29.65	30.05	30.49	30.80	31.12	(38)

Heat transfer coefficient, W/K

86.36	86.19	86.02	85.20	85.05	84.34	84.34	84.21	84.62	85.05	85.36	85.68

85.20 (39)

Heat loss parameter (HLP), W/m²K

1.25	1.25	1.25	1.24	1.24	1.23	1.23	1.22	1.23	1.24	1.24	1.24

HLP (average) 1.24 (40)

Number of days in month (Table 1a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements kWh/year

Assumed occupancy, N	2.22	(42)
Annual average hot water usage in litres per day Vd,average	86.87	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month	95.56	92.08	88.61	85.13	81.66	78.18	78.18	81.66	85.13	88.61	92.08	95.56	(44)
Energy content of hot water used	141.71	123.94	127.89	111.50	106.99	92.32	85.55	98.17	99.34	115.77	126.38	137.24	

Energy content (annual)	1366.79	(45)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Distribution loss	21.26	18.59	19.18	16.72	16.05	13.85	12.83	14.73	14.90	17.37	18.96	20.59	(46)

store loss determined from EN 13203-2 tests, taken from boiler data record

Hot water storage volume (litres)	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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	3.05	2.75	3.05	2.95	3.05	2.95	3.05	3.05	2.95	3.05	2.95	3.05	(61)
Total heat required for water heating calculated for each month	144.75	126.69	130.94	114.45	110.03	95.27	88.60	101.21	102.29	118.82	129.32	140.28	(62)
Output from water heater for each month, kWh/month	144.75	126.69	130.94	114.45	110.03	95.27	88.60	101.21	102.29	118.82	129.32	140.28	(64)

	1402.65	(64)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat gains from water heating, kWh/month	47.88	41.90	43.29	37.81	36.33	31.43	29.21	33.40	33.77	39.26	42.76	46.39	(65)

5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, Watts	110.88	110.88	110.88	110.88	110.88	110.88	110.88	110.88	110.88	110.88	110.88	110.88	(66)
Lighting gains	18.61	16.53	13.44	10.18	7.61	6.42	6.94	9.02	12.11	15.38	17.95	19.13	(67)
Appliances gains	194.57	196.59	191.51	180.67	167.00	154.15	145.56	143.55	148.63	159.47	173.14	185.99	(68)
Cooking gains	34.09	34.09	34.09	34.09	34.09	34.09	34.09	34.09	34.09	34.09	34.09	34.09	(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)	-88.71	-88.71	-88.71	-88.71	-88.71	-88.71	-88.71	-88.71	-88.71	-88.71	-88.71	-88.71	(71)
Water heating gains	64.35	62.35	58.18	52.51	48.84	43.66	39.26	44.90	46.90	52.76	59.38	62.36	(72)
Total internal gains	336.81	334.74	322.39	302.63	282.71	263.50	251.03	256.73	266.91	286.87	309.73	326.74	(73)

6. Solar gains (calculation for January)

	Area & Flux	g & FF	Shading	Gains	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W1	0.9 x 1.250 36.79	0.63 x 0.70	0.77	14.0558	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W2	0.9 x 1.250 36.79	0.63 x 0.70	0.77	14.0558	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W3	0.9 x 1.250 36.79	0.63 x 0.70	0.77	14.0558	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (NorthEast) W7	0.9 x 1.890 11.28	0.63 x 0.70	0.77	6.5171	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (NorthEast) W5	0.9 x 0.840 11.28	0.63 x 0.70	0.77	2.8965	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (NorthEast) W4	0.9 x 3.150 11.28	0.63 x 0.70	0.77	10.8619	
Solid door Entrance Door	0.9 x 1.940 0.00	0.00 x 0.70	0.77	0.0000	
Total solar gains, January				62.44	(83-1)

Solar gains

62.44	113.10	172.63	243.89	300.54	310.41	294.25	250.15	197.02	129.82	76.02	52.64	(83)

Total gains

399.25	447.83	495.03	546.52	583.25	573.90	545.28	506.88	463.93	416.69	385.75	379.38	(84)

Lighting calculations

	Area	g	FF x Shading	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W1	0.9 x 1.25	0.80	0.70 x 0.83	0.52
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W2	0.9 x 1.25	0.80	0.70 x 0.83	0.52
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (SouthWest) W3	0.9 x 1.25	0.80	0.70 x 0.83	0.52
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (NorthEast) W7	0.9 x 1.89	0.80	0.70 x 0.83	0.79
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (NorthEast) W5	0.9 x 0.84	0.80	0.70 x 0.83	0.35
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (NorthEast) W4	0.9 x 3.15	0.80	0.70 x 0.83	1.32

GL = 4.03 / 68.84 = 0.059
C1 = 0.500
C2 = 1.030
El = 329

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												
22.14	22.19	22.23	22.44	22.48	22.67	22.67	22.71	22.60	22.48	22.40	22.32	
alpha												
2.48	2.48	2.48	2.50	2.50	2.51	2.51	2.51	2.51	2.50	2.49	2.49	
Utilisation factor for gains for living area												
0.97	0.96	0.94	0.89	0.81	0.69	0.57	0.61	0.79	0.91	0.96	0.97	(86)
Mean internal temperature in living area T1												
18.36	18.60	19.03	19.63	20.20	20.64	20.85	20.81	20.45	19.73	18.94	18.31	(87)
Temperature during heating periods in rest of dwelling Th2												
19.88	19.88	19.88	19.89	19.89	19.90	19.90	19.90	19.90	19.89	19.89	19.88	(88)
Utilisation factor for gains for rest of dwelling												
0.96	0.95	0.93	0.87	0.77	0.62	0.46	0.51	0.73	0.89	0.95	0.97	(89)
Mean internal temperature in the rest of dwelling T2												
17.47	17.71	18.14	18.73	19.27	19.67	19.83	19.81	19.52	18.84	18.06	17.43	(90)

Living area fraction (26.80 / 68.84) 0.39 (91)

Mean internal temperature (for the whole dwelling)												
17.82	18.06	18.49	19.08	19.64	20.05	20.23	20.20	19.88	19.18	18.41	17.77	(92)
Apply adjustment to the mean internal temperature, where appropriate												
17.67	17.91	18.34	18.93	19.49	19.90	20.08	20.05	19.73	19.03	18.26	17.62	(93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains												
0.95	0.94	0.91	0.85	0.76	0.62	0.48	0.52	0.72	0.87	0.93	0.96	(94)
Useful gains												
379.92	418.99	448.83	464.89	442.05	356.63	260.97	265.63	336.05	363.86	360.57	362.94	(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												
1154.41	1120.95	1018.42	854.75	662.14	446.92	293.12	307.11	476.57	717.41	952.30	1150.13	(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												
576.22	471.71	423.78	280.70	163.74	-	-	-	-	263.04	426.04	585.67	

Total space heating requirement per year (kWh/year) (October to May) 3190.90 (98)

Space heating requirement per m² (kWh/m²/year) 46.35 (99)

8c. Space cooling requirement - not applicable

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 90.50% (206)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement												
576.22	471.71	423.78	280.70	163.74	-	-	-	-	263.04	426.04	585.67	(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)												
636.70	521.23	468.26	310.16	180.93	-	-	-	-	290.65	470.76	647.15	(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												
144.75	126.69	130.94	114.45	110.03	95.27	88.60	101.21	102.29	118.82	129.32	140.28	(64)
Efficiency of water heater											87.30	(216)
89.84	89.80	89.72	89.55	89.19	87.30	87.30	87.30	87.30	89.48	89.73	89.86	(217)
Water heating fuel												
161.12	141.07	145.94	127.80	123.37	109.13	101.48	115.94	117.17	132.79	144.12	156.10	(219)

Annual totals	kWh/year	
Space heating fuel used, main system 1	3525.85	(211)
Space heating fuel (secondary)	0.00	(215)
Water heating fuel	1576.04	(219)
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)	328.71	(232)
Energy saving/generation technologies		
PVs 0.80 x 0.925 x 950.616 x 0.800	562.765	
PVs 0.80 x 0.000 x 0.000 x 0.500	0.000	
PVs 0.80 x 0.000 x 0.000 x 0.500	0.000	
	562.765	(233)
Appendix Q -		
Energy saved or generated ():	0.000	(236a)
Energy used ():	0.000	(237a)
Total delivered energy for all uses	4942.84	(238)

10a. Does not apply

11a. Does not apply

12a. Carbon dioxide emissions

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating, main system 1	3525.85	0.216	761.58	(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	1576.04	0.216	340.43	(264)
Space and water heating			1102.01	(265)
Electricity for pumps and fans	75.00	0.519	38.93	(267)
Electricity for lighting	328.71	0.519	170.60	(268)
Electricity generated - PVs	-562.76	0.519	-292.07	(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			1019.46	(272)
			kg/m²/year	
Dwelling Carbon Dioxide Emission Rate (DER)			14.81	(273)

Appendix 4:

SAP Derived Summertime Overheating Analysis

SAP 2012 Overheating Assessment for New dwelling as built

Dwelling type	Mid-floor flat
Number of storeys	1
Cross ventilation possible	Yes
Region	Thames Valley
Front of dwelling faces	SouthWest
Overshading	Average or unknown (20-60 % sky blocked)
Overhangs	(as detailed below)
Thermal mass parameter	250.00 (user defined)
Night ventilation	No
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Summer ventilation heat loss coefficient	239.93	(P1)
Transmission heat loss coefficient	42.42	(37)
Summer heat loss coefficient	282.35	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
NorthEast	-	1.00	None
NorthEast	-	1.00	None
SouthWest	-	1.00	None
SouthEast	-	1.00	None
SouthEast	-	1.00	None
SouthEast	-	1.00	None
SouthWest	-	1.00	None
SouthWest	-	1.00	None
SouthWest	-	1.00	None

Solar shading

Orientation	Z blinds	Solar access	Overhangs	Z summer	
NorthEast	1.00	0.90	1.000	0.900	(P8)
NorthEast	1.00	0.90	1.000	0.900	(P8)
SouthWest	1.00	0.90	1.000	0.900	(P8)
SouthEast	1.00	0.90	1.000	0.900	(P8)
SouthEast	1.00	0.90	1.000	0.900	(P8)
SouthEast	1.00	0.90	1.000	0.900	(P8)
SouthWest	1.00	0.90	1.000	0.900	(P8)
SouthWest	1.00	0.90	1.000	0.900	(P8)
SouthWest	1.00	0.90	1.000	0.900	(P8)

Solar gains (calculation for July)

Orientation	Area	Flux	g & FF	Shading	Gains
NorthEast	0.9 x 0.91	91.10	0.63 x 0.70	0.90	30
NorthEast	0.9 x 1.89	91.10	0.63 x 0.70	0.90	62
SouthWest	0.9 x 2.04	113.91	0.63 x 0.70	0.90	83
SouthEast	0.9 x 1.75	113.91	0.63 x 0.70	0.90	71
SouthEast	0.9 x 1.45	113.91	0.63 x 0.70	0.90	59
SouthEast	0.9 x 1.45	113.91	0.63 x 0.70	0.90	59
SouthWest	0.9 x 2.04	113.91	0.63 x 0.70	0.90	83
SouthWest	0.9 x 2.04	113.91	0.63 x 0.70	0.90	83
SouthWest	0.9 x 2.04	113.91	0.63 x 0.70	0.90	83
Total					612

SAP 2012 Overheating Assessment for New dwelling as built

Dwelling type	Top-floor flat
Number of storeys	1
Cross ventilation possible	Yes
Region	Thames Valley
Front of dwelling faces	SouthWest
Overshading	Average or unknown (20-60 % sky blocked)
Overhangs	(as detailed below)
Thermal mass parameter	100.00 (user defined)
Night ventilation	No
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Summer ventilation heat loss coefficient	327.13	(P1)
Transmission heat loss coefficient	54.56	(37)
Summer heat loss coefficient	381.69	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
NorthEast	-	1.00	None
NorthEast	-	1.00	None
NorthEast	-	1.00	None
SouthWest	-	1.00	None
SouthWest	-	1.00	None
SouthWest	-	1.00	None

Solar shading

Orientation	Z blinds	Solar access	Overhangs	Z summer	
NorthEast	1.00	0.90	1.000	0.900	(P8)
NorthEast	1.00	0.90	1.000	0.900	(P8)
NorthEast	1.00	0.90	1.000	0.900	(P8)
SouthWest	1.00	0.90	1.000	0.900	(P8)
SouthWest	1.00	0.90	1.000	0.900	(P8)
SouthWest	1.00	0.90	1.000	0.900	(P8)

Solar gains (calculation for July)

Orientation	Area	Flux	g & FF	Shading	Gains
NorthEast	0.9 x 3.15	91.10	0.63 x 0.70	0.90	103
NorthEast	0.9 x 0.84	91.10	0.63 x 0.70	0.90	27
NorthEast	0.9 x 1.89	91.10	0.63 x 0.70	0.90	62
SouthWest	0.9 x 1.25	113.91	0.63 x 0.70	0.90	51
SouthWest	0.9 x 1.25	113.91	0.63 x 0.70	0.90	51
SouthWest	0.9 x 1.25	113.91	0.63 x 0.70	0.90	51
Total					344

	Jun	Jul	Aug	
Solar gains	363	344	292	(P3)
Internal gains	385	369	377	
Total summer gains	747	713	669	(P5)
Summer gain/loss ratio	1.96	1.87	1.75	(P6)
External temperature (Thames Valley)	15.4	17.8	17.8	
Thermal mass temperature increment (TMP=100.0)	1.30	1.30	1.30	
Threshold temperature	18.66	20.97	20.85	(P7)
Likelihood of high internal temperature	Not sig.	Slight	Slight	

Assessment of likelihood of high internal temperature Slight

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Energy Consultancy and Compliance Services

Appendix 5:

Model Water Consumption Calculation

Water Efficiency Calculator for New Dwellings (V1e)

EPS Group
Energy Consultancy and Compliance Services

Project Details

Adress/Reference	Flat 1, 130 Chalton Street	Case Reference	9913
Number of Bedrooms	1	Occupancy for Calculation Purposes	2

Appliance/Useage Details

Taps (Excluding Kitchen Taps)

Tap Fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type
Bathroom Mixer	4.00	1	4.00
			0.00
			0.00
			0.00
			0.00
			0.00
Total No. of Fittings (No.)		1	
Total Flow (l/s)			4.00
Maximum Flow (l/s)			4.00
Average Flow (l/s)			4.00
Weighted Average Flow (l/s)			2.80
Flow for Calculation (l/s)			**4.00**

Showers

Shower fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type
Bath Shower Mixer	8.50	1	8.50
			0.00
			0.00
			0.00
			0.00
			0.00
Total No. of Fittings (No.)		1	
Total Flow (l/s)			8.50
Maximum Flow (l/s)			8.50
Average Flow (l/s)			8.50
Weighted Average Flow (l/s)			5.95
Flow for Calculation (l/s)			**8.50**

Baths

Bath Type	Capacity to Overflow	Quantity (No.)	Total per Fitting type
Bath	170.00	1	170.00
			0.00
			0.00
			0.00
Total No. of Fittings (No.)		1	
Total Capacity (l)			170.00
Maximum Capacity (l)			170.00
Average Capacity (l)			170.00
Weighted Average Capacity (l)			119.00
Capacity for Calculation (l)			**170.00**

WCs

WC Type	Full Flush Volume	Part Flush Volume	Quantity (No)
Dual Flush Cistern	5.00	3.00	1
Total number of fittings			**1**
Average effective flushing volume			**0.00**

Dishwashers

Dishwasher Type	L per Place Setting	Quantity (No.)	Total per Fitting type
None			0.00
			0.00
Total No. of Fittings (No.)		0	
Total Consumption (l)			1.25
Maximum Consumption (l)			1.25
Average Consumption (l/s)			1.25
Weighted Average Consumption (l)			0.88
Consumption for Calculation (l/s)			**1.25**

Washing Machines

Washing Machine Type	L per Kg Dry Load	Quantity (No.)	Total per Fitting type
			0.00
			0.00
Total No. of Fittings (No.)		0	
Total Consumption (l)			8.17
Maximum Consumption (l)			8.17
Average Consumption (l/s)			8.17
Weighted Average Consumption (l)			5.72
Consumption for Calculation (l/s)			**8.17**

Kitchen Taps

Tap Fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type
Kitchen Mixer	6.00	1	6.00
			0.00
			0.00
Total No. of Fittings (No.)		1	
Total Flow (l/s)			6.00
Maximum Flow (l/s)			6.00
Average Flow (l/s)			6.00
Weighted Average Flow (l/s)			4.20
Flow for Calculation (l/s)			**6.00**

Other Fittings

Waste Disposal Y/N	N
Water softner	
Consumption beyond 4% l/p/d	

Use of grey water and harvested rainwater

Total Grey water from WHB taps (l)	
Total Availble Grey Water Supply (l)	111.69
Possible Demand (l)	66.67
Grey/Rain Installed Capacity (l)	
Figure for Calculation lit/person/day	0.00

Water Use Assessment

Installation Type	Unit	Capacity/ Flow Rate	Use Factor	Fixed use (l/p/day)	**Total Use (l/p/day)**	
WC Single Flush	Volume (l)	0.00	4.42	0.00	0.00	
WC Dual Flush	Full Flush (l)	5.00	1.46	0.00	7.30	
	Pt Flush (l)	3.00	2.96	0.00	8.88	
WC's (Multiple)	Volume (l)	0.00	4.42	0.00	0.00	
Taps Exc. Kitchen	Flow Rate	4.00	1.58	1.58	7.90	
Bath (shower present)	(l/s)	170.00	0.11	0.00	18.70	
Shower (bath present)	(l/s)	8.50	4.37	0.00	37.15	
Bath Only	(l)	0.00	0.50	0.00	0.00	
Shower Only	(l/s)	0.00	5.60	0.00	0.00	
Kitchen Taps	(l/s)	6.00	0.44	10.36	13.00	
Washing Machines	(l/kgdry)	8.17	2.10	0.00	17.16	<< Note - these may be default values.
Dishwashers	(l/place)	1.25	3.60	0.00	4.50	<< You can change them by entering
Waste Disposal	(l/s)	0.00	3.08	0.00	0.00	___the actual applicances in the
Water Softner	(l/s)	0.00	1.00	0.00	0.00	___appropriate sections above
Total Calculated Water Use (l/p/day)					**114.58**	
Grey/RainWater Reused (l)					0.00	
Normalisation Factor	(Factor)				0.91	
Total Consumption CSH (l/p/day)					**104.27**	
External Water Use Allowance (l)					5.00	
Total Comsumption Part G (l/p/day)					**109.27**	

Assesment Result	**PASS**