



EPS Group
Energy Consultancy and Compliance Services

Project No: 16083

London Borough of Haringey Energy Statement

New Dwelling, Land to the Rear of 47 Cranleigh Road, London, N15 3AB

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SAP Calculations – SBEM Calculations – Renewable Energy Statements – Energy Performance Certificates
Air Tightness Testing – Extract Fan Testing – Water Calculations – DEC Assessments – Room Integrity Testing



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Executive Summary

This report has been commissioned in response to the Sustainable and Low Carbon Planning Policy requirements of the London Borough of Haringey in respect to the proposed construction of a new dwelling at Land to the Rear of 47 Cranleigh Road, London, N15 3AB. The methodology used herein is consistent with Approved Document Part L1 2021 of the Building Regulations and The London Plan 2021.

In accordance with the Energy Hierarchy detailed within The London Plan 2021, the proposed development is predicted to emit at least **47.58%** less regulated carbon dioxide than would ordinarily be permitted by the standard requirements of Approved Document L1 2021 of the Building Regulations.

This reduction is achieved through the adoption of energy efficient measures such as enhanced insulation standards, improved lighting efficiencies and the installation of an MCS approved Air Source Heat Pump as a means of providing the dwelling with a low carbon source of heating and hot water.

As the proposed development has not achieved zero carbon on-site, the shortfall in carbon dioxide emissions for the assumed lifetime of the development's services (30 years) will be met through a total cash-in-lieu contribution of **£1,453.50**.

In the circumstances, the proposed development is therefore deemed to comply with the mandatory requirements of Policy *SI 2: Minimising Carbon Dioxide Emissions* of The London Plan 2021 and the London Borough of Haringey's Strategic Policy *SP4: Working Towards a Low Carbon Haringey*.

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1.0 Introduction

- 1.1 EPS Group have been appointed to provide an Energy Statement to support the planning application for the proposed construction of a new dwelling at Land to the Rear of 47 Cranleigh Road, London, N15 3AB.
- 1.2 It is anticipated that the development would fall under the requirements of Approved Document L1 (2021) of the Building Regulations if planning is approved.
- 1.3 The energy consumption of the proposed dwellings has therefore been assessed using the National Calculations Method (NCM) - SAP 10 (Standard Assessment Procedure), in order to determine the predicted annual carbon dioxide (CO₂) emissions of the development and the associated reduction targets.
- 1.4 The following fuel emissions factors have been used within the underlying calculations as defined by the updated National Calculations Method (NCM):

Fuel	CO ₂ emission factor (kgCO ₂ /kWh)
Natural gas	0.210
Grid supplied electricity	0.136
Grid displaced electricity	0.136

- 1.5 This document should be used for planning purposes only and should be reassessed and where necessary, resubmitted at the Building Control stage if alternative building specifications or proposed HVAC systems are adopted as oppose to those outlined within the report.
- 1.6 The SAP calculations underlying this report use a large number of standard operational parameters which may not ultimately match the actual measures adopted within the finalised dwelling. Whilst they provide a 'like for like' comparison for the purpose of this report they are not valid for Building Control purposes or for the actual operation of the development post completion.
- 1.7 The dimensions 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

152. 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

153. 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.

154. 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.

155. 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.

156. *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.*
157. *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.*
158. *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 over the next 20 – 25 years.

Policy SI 2 of The London Plan March 2021 relates to 'Minimising Carbon Dioxide Emissions' and states:

- "A *Major development should be net zero-carbon. This means reducing greenhouse gas emissions in operation and minimising both annual and peak energy demand in accordance with the following energy hierarchy:*
- 1) be lean: use less energy and manage demand during operation*
 - 2) be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly*
 - 3) be green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site*
 - 4) be seen: monitor, verify and report on energy performance.*
- B *Major development proposals should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy.*
- C *A minimum on-site reduction of at least 35 per cent beyond Building Regulations is required for major development. Residential development should achieve 10 per*

cent, and non-residential development should achieve 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, in agreement with the borough, either:

1) through a cash in lieu contribution to the borough's carbon offset fund, or

2) off-site provided that an alternative proposal is identified and delivery is certain.

- D *Boroughs must establish and administer a carbon offset fund. Offset fund payments must be ring-fenced to implement projects that deliver carbon reductions. The operation of offset funds should be monitored and reported on annually.*
- E *Major development proposals should calculate and minimise carbon emissions from any other part of the development, including plant or equipment, that are not covered by Building Regulations, i.e. unregulated emissions.*
- F *Development proposals referable to the Mayor should calculate whole lifecycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions."*

2.3 The London Borough of Haringey

The relevant policy from the London Borough of Haringey's *Local Plan Strategic Policies 2013 – 2026 (formerly the Core Strategy)*, March 2013 is detailed below:

Strategic Policy 4: Working Towards a Low Carbon Haringey (SP4)

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

1. *In line with London Plan policy, the Council will promote and require all new developments to take measures to reduce energy use and carbon emissions during design, construction and occupation, by incorporating the following measures:*
 - a. *From 2011 onwards, all new residential development will achieve a minimum 25% reduction in total (regulated) CO₂ emissions in line with Code for Sustainable Homes Level 4 energy standards, and should aim to achieve Level 6. All new residential development shall be zero carbon from 2016 onwards; and*
 - b. *From 2011 onwards all new non-residential development shall be built to at least BREEAM "very good" standard and should aim to achieve BREEAM "excellent" or the current nationally agreed standard. All new non-residential development shall be zero carbon from 2019.*
2. *The Council will promote low- and zero-carbon energy generation through the following measures:*
 - a. *Requiring all developments to assess, identify and implement, where viable, site-wide and area-wide decentralised energy facilities including the potential to link into a wider network;*

- b. Establishing local networks of decentralised heat and energy facilities by requiring developers to prioritise connection to existing or planned networks where feasible;*
- c. Working with neighbouring boroughs and other partners to explore ways of implementing sub-regional decentralised energy networks including the potential in the Upper Lee Valley Opportunity Area; and*
- d. All new developments are required, where viable, to achieve a reduction in predicted carbon dioxide emissions of 20% from onsite renewable energy regeneration, which can include connections to local sources of decentralised renewable energy."*

2.4 Conclusions

On review of the above policies, it is evident that the development will need to achieve a zero carbon standard as defined within *Policy SI 2* of The London Plan.

This will require a minimum 35% reduction in CO₂ emissions (using SAP 10 emission factors) to be achieved on site by following the Energy Hierarchy which promotes the use of Lean, Clean and Green measures, with 10% from energy efficiency measures. Any remaining carbon emissions may then be offset with a cash-in-lieu contribution to the local council which will be used to secure carbon dioxide savings elsewhere.

3.0 Energy Calculation Methodology

- 3.1 As detailed within Paragraph 1.3, SAP 10 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 specific 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 'Notional' Baseline SAP Calculation was produced as outlined within Section 4.0 in order to determine the amount of annual regulated carbon dioxide (CO₂) emissions that would be permitted for the proposed development under the standard requirements of Approved Document L1 2021.
- 3.4 In response to the Energy Hierarchy of the London Plan 2021, a range of conventional energy efficiency improvements are proposed for the development which have then been modelled within SAP 10 to produce a 'Lean' Energy Calculation 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 low carbon and 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.
- 3.7 Since it is not feasible or economically viable for the proposed dwelling to achieve zero carbon entirely through on-site measures, a cash in lieu payment for the cumulative shortfall was calculated at a rate of £95 / tonne for a period of 30 years. This is in accordance with the London Plan 2021.

4.0 Notional Benchmark Energy Calculations

- 4.1 A Notional Benchmark SAP calculation was produced for the proposed dwelling as a means of determining maximum permitted energy consumption and associated carbon dioxide (CO₂) emissions that would ordinarily be permitted under Approved Document L1 2021 of the Building Regulations.
- 4.2 The calculated Benchmark SAP Calculation is detailed within Table 1 below with the full Target Emission Rate (TER) calculation worksheet provided in Appendix 1 for detailed review.

Table 1: Benchmark Annual Energy Consumption and CO ₂ Emissions (SAP 10)			
Floor Area (m ²)	ADL1 2021 Target Emission Rate (TER)	Annual Regulated CO ₂ Emissions (Kg/Year)	Annual Energy Consumption (kWh / Year)
64.71	15.04	973.15	4,134.95

- 4.3 On review of the above, it is evident that the proposed development would be permitted to emit up to **973.15 KgCO₂/year** under occupancy if it was constructed to the minimum energy performance standards required by Approved Document L1 2021 of the Building Regulations.
- 4.4 In order to comply with the planning policies detailed in Section 2, a minimum on-site saving of **340.60 KgCO₂/year** will need to be achieved by adopting the principles of the Energy Hierarchy of the London Plan, with a minimum of **97.32 KgCO₂/year** from energy efficiency measures. Any remaining emissions may then be offset through a Section 106 payment to the council.
- 4.5 The CO₂ emissions arising from unregulated energy consumption within the dwelling such as that used for cooking, appliances and powering equipment have also been calculated. The emissions arising from these activities which are not subject to Policy SI 2 of the London Plan are summarised within Table 3 below:

Table 2: Non-Regulated Annual CO ₂ Emissions		
Floor Area (m ²)	SAP 2012 Appendix L Calculated Annual CO ₂ Emissions from Cooking & Appliance Use (Kg/m ² /year)	Total Unregulated CO ₂ Emissions Per Dwelling (Kg / Year)
64.71	19.46	1,259.26

- 4.6 As detailed above, the future occupants of the completed development are predicted to consume energy from unregulated activities which will result in additional non-regulated carbon dioxide emissions of 1,259.26 KgCO₂/year.
- 4.7 Whilst it is noted that targeting a reduction in non-regulated CO₂ emissions is outside of the requirement of Policy SI 2 of the London Plan, efforts will be made to reduce the impact of this type of energy consumption by only installing highly efficient energy rated appliances & equipment within the proposed dwelling.

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, HVAC and lighting standards within the proposed dwelling as a means of reducing the overall energy demand by conventional (lean) means:

Table 3: Proposed 'Lean' Fabric, HVAC and Lighting Standards		
Element / Feature	Approved Document L1 2021 Minimal Acceptable Standard	Proposed Development Target
External Wall U-value	0.26 W/m ² K	0.16 W/m²K
Ground Floor U-value	0.18 W/m ² K	0.13 W/m²K
Exposed Floor U-value	0.18 W/m ² K	0.13 W/m²K
Pitched Roof U-value	0.16 W/m ² K	0.11 W/m²K
Windows and Rooflights U-value	1.60 W/m ² K	1.20 W/m²K
Doors U-value	1.60 W/m ² K	1.40 W/m²K
Air Permeability	8.00 m ³ /m ² .h	5.00 m³/m².h
Thermal Bridging	N/A	Use of Concrete Block Association's Xtratherm Full Fill Approved Thermal Bridging Details
Lighting	All fixed lighting to have an efficacy of 75 lm/W	80 lm/W
Heating & Hot Water	-	Electric boilers (100% efficiency) with time and temperature zone controlled underfloor heating
Hot Water Storage	-	150 litre hot water cylinder with a maximum standing loss of 1.89 kWh/day
Ventilation	-	Natural ventilation with intermittent extract fans

- 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 Calculation referenced in Section 4.0.
- 5.3 The results of the Lean SAP Calculation are summarised in Table 4 below with the Dwelling Emission Rate SAP Worksheet detailed in Appendix 2 of this report for detailed review.

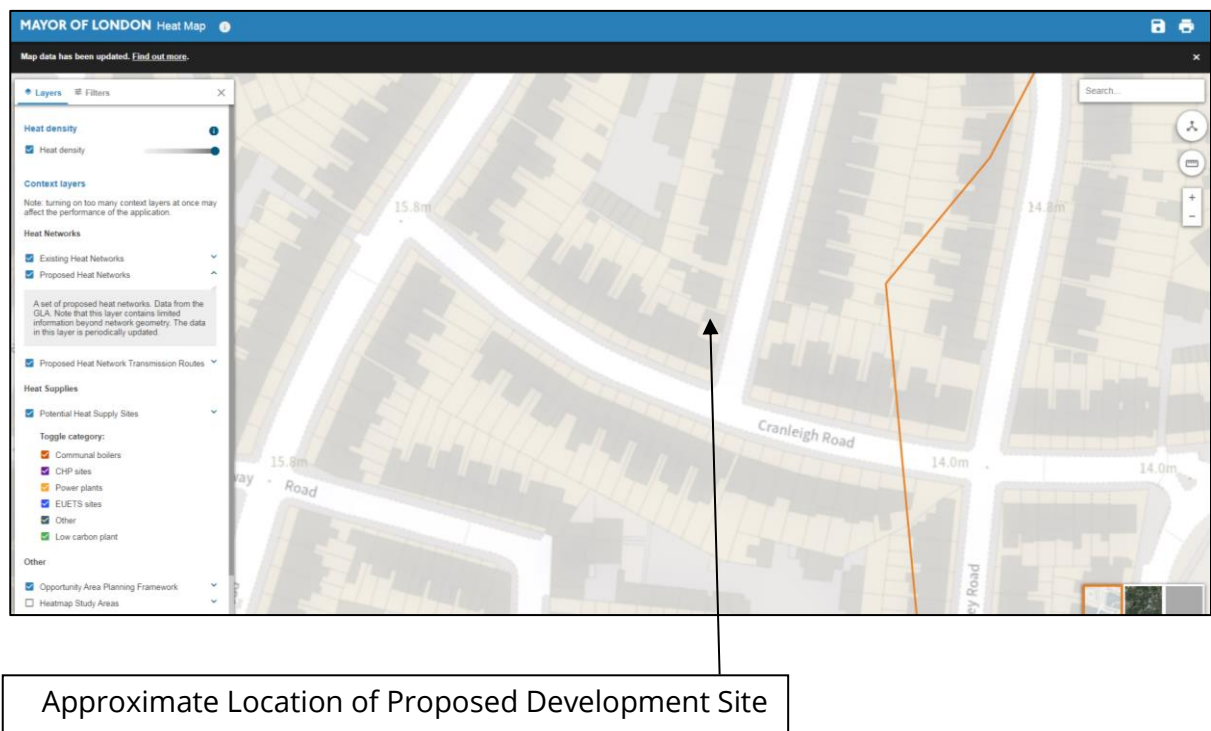
Table 4: 'Lean' Annual Energy Consumption and CO ₂ Emissions (SAP 10)			
Floor Area (m ²)	ADL1 2021 'Lean' Dwelling Emission Rate (DER)	Annual 'Lean' Regulated CO ₂ Emissions (Kg/Year)	Annual 'Lean' Energy Consumption (kWh / Year)
64.71	11.91	770.35	5,192.29

- 5.4 As a result of adopting the recommended 'Lean' energy efficient measures outlined within Table 3, the proposed dwelling will have a reduced annual level of regulated CO₂ emissions of **770.35 KgCO₂/year**. This represents a total reduction of **20.84%** in comparison to the Baseline Carbon Dioxide Emissions detailed within Section 4.0 (the maximum CO₂ emissions permitted by Approved Document L1 2021).

6.0 Proposed Energy Strategy and Performance – Clean Measures

- 6.1 As per the 'Clean' step of the Energy Hierarchy, the feasibility of a connection to a decentralised energy network has been considered.
- 6.2 On consulting the London Heat Map (see below), it is apparent that there is no existing district Energy Network within the immediate vicinity of the proposed development. Whilst there is a proposed Energy Network nearby, it is believed that the small scale nature of the development would make any extension of this proposed Network economically unviable. As such any possible connection to an existing or planned network is deemed to be unfeasible in this instance.

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



- 6.3 It is also noted that the rapid decarbonisation of the national grid means that the carbon savings from gas engine CHP systems are now declining. There is also an increasing amount of evidence to suggest that CHP systems can have an adverse effect on local air quality and as such the use of this technology has been discounted as a viable prospect on the grounds that it can no longer be deemed a long term low carbon solution.

7.0 Review of Low Carbon and Renewable Technologies

7.1 In response to the 'Green' requirement of the Energy Hierarchy a number of different renewable technologies were 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 Smart Export Guarantee 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 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.
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 Smart Export Guarantee scheme. - Minimal on-going costs & maintenance issues following installation. - Easy to integrate into a conventional build specification or retro-fit applications. - The dwelling benefits from a south facing pitched roof space which would provide an optimal location for the installation of PV panels in order to maximise their efficiency and generation capacity.
Site Limitations / Restrictions	- PV panels are not aesthetically pleasing and may detract from the visual appearance of the dwelling. - As a result of the rapid decarbonisation of the national grid, the amount of CO₂ savings with this technology is limited as the CO₂ emission factor for grid displaced electricity is relatively low.
Conclusion	It is not proposed to utilise this technology within the proposed development.

7.4 Solar Thermal

Benefits	- Solar hot water systems can provide an efficient way of contributing to a dwelling's overall hot water requirements. - Minimal on-going costs & maintenance issues following installation. - As with PV, the proposed dwelling benefits from a south facing pitched roof space which would provide an optimal location for the siting of Solar Thermal collectors.
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Site Limitations / Restrictions	- The amount of CO₂ 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 dwelling.
Conclusion	It is not proposed to use this technology 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. - Well suited to the underfloor heating systems that are proposed.
Site Limitations / Restrictions	- Detailed ground surveys required. - Minimal space to facilitate an installation. - High capital installation costs rendering the technology financially unviable.
Conclusion	The technology is not deemed as being suitable for use within the proposed 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. - Well suited to the underfloor heating systems that are proposed.
Site Limitations / Restrictions	- Could potentially require a supplementary immersion heating system for hot water production. - 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 proposed to utilise this technology within the proposed development.

7.7 Biomass Boilers

Benefits	Reliable and proven technology.
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 Upon review of the above technologies, the use of a highly efficient MCS Approved Air Source Heat Pump (ASHP) to zoned underfloor heating is recommended as a means of providing a low carbon source of heating and hot water to the dwelling.

8.0 Proposed Energy Strategy and Performance – Green Measures

- 8.1 Having identified the use of an MCS Approved ASHP as being the most suitable low carbon and renewable technology for use within the development, the 'lean' SAP calculation detailed in Section 5.0 was updated to incorporate an ASHP as opposed to the electric boiler.
- 8.2 The key results of the Proposed (Green) Calculation is summarised in Table 5 below with the full Dwelling Emission Rate SAP Worksheet provided in Appendix 3 for detailed review:

Table 5: Proposed 'Green' Annual Energy Consumption and CO ₂ Emissions (SAP 10)			
Floor Area (m ²)	ADL1 2021 'Green' Dwelling Emission Rate (DER)	Annual 'Green' Regulated CO ₂ Emissions (Kg/Year)	Annual 'Green' Energy Consumption (kWh / Year)
64.71	7.88	509.60	2,759.05

- 8.3 As a result of installing the low carbon and renewable technology specified within Section 7.0 and by also adopting the 'Lean' measures detailed in Section 5.0, it is evident that the proposed dwelling will have a total reduced level of annual regulated CO₂ emissions of **509.60** KgCO₂/year.

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 CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Approved Document L1 2021 of the Building Regulations Compliant Dwelling	0.973	1.259
After energy demand reduction	0.770	1.259
After CHP	0.770	1.259
After renewable energy	0.510	1.259

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	0.203	20.863
Savings from CHP	0.000	0.000
Savings from renewable energy	0.260	26.721
Cumulative On Site Savings	0.463	47.584
Annual savings from off-set payment	0.510	
Cumulative savings for off-set payment	15.300	

- 9.2 It is evident from the above that the proposed dwelling only achieves on-site savings of **47.58%**, which is believed to be the maximum amount of on-site savings that are technically feasible and economically viable.
- 9.3 Therefore the remaining **0.510** tonnes of CO₂ per annum for the assumed lifetime of the residential development's services (30 years) will be met by multiplying the cumulative shortfall by the CO₂ off-set price of £95 per tonne. This will result in a cash-in-lieu contribution of **£1,453.50** for the proposed development.
- 9.4 In the circumstances, the proposed development is deemed to comply with the mandatory requirements of Policy *SI 2: Minimising Carbon Dioxide Emissions* of The London Plan 2021 and the London Borough of Haringey's Strategic Policy *SP4: Working Towards a Low Carbon Haringey*.



Appendix 1:

Baseline TER Calculation (SAP Derived)

Dwelling Reference: 16083 - New Dwelling (Baseline)

Dwelling Type: New Dwelling Design Stage

New Dwelling
Land to Rear of 47 Cranleigh Road
London
N15 3AB

1. Overall dwelling dimensions

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground Floor	30.44 (1a) x 2.5	(2a) =	76.1 (3a)
First Floor	34.27 (1b) x 2.62	(2b) =	89.79 (3b)
Total floor area TFA			64.71 (4)
Dwelling volume			165.89 (5)

2. Ventilation Rate

Chimneys/Flues	0	x 80 =	0	(6a)
Open chimneys	0	x 20 =	0	(6b)
Chimneys / flues attached to closed fire	0	x 10 =	0	(6c)
Flues attached to solid fuel boiler	0	x 20 =	0	(6d)
Flues attached to other heater	0	x 35 =	0	(6e)
Number of blocked chimneys	0	x 20 =	0	(6f)
Number of intermittent extract fans	3	x 10 =	30	(7a)
Number of passive vents	0	x 10 =	0	(7b)
Number of flueless gas fires	0	x 40 =	0	(7c)
Air changes per hour				
Number of storeys in the dwelling (ns)		0.18	0.18	(8)
Infiltration due to chimneys, flues, fans, PSVs, etc		0	0	(9)
Additional infiltration		0	0	(10)
Structural infiltration		0	0	(11)
Suspended wooden ground floor		0	0	(12)
No draught lobby		0	0	(13)
Percentage of windows and doors draught proofed		0	0	(14)
Window infiltration		0	0	(15)
Infiltration rate		0	0	(16)
Air permeability value, AP50, (m ³ /h/m ²)		5	5	(17)
Air permeability value, AP4, (m ³ /h/m ²)		0	0	(17a)
Air permeability value)		0.43	0.43	(18)
Number of sides on which dwelling is sheltered		2	2	(19)

Shelter factor													0.85	(20)
Infiltration rate incorporating shelter factor													0.37	(21)
Infiltration rate modified for monthly wind speed														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	(22)
Monthly average wind speed from Table U2														
	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7	52.5	(22)
Wind Factor														
	1.28	1.25	1.23	1.1	1.08	0.95	0.95	0.93	1	1.08	1.13	1.18	13.13	(22a)
Adjusted infiltration rate (allowing for shelter and wind speed)														
	0.47	0.46	0.45	0.4	0.39	0.35	0.35	0.34	0.37	0.39	0.41	0.43	4.81	(22b)
Calculate effective air change rate for the applicable case:														
													0	(23a)
													0	(23b)
													0	(23c)
a) If balanced mechanical ventilation with heat recovery (MVHR)														
	0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If balanced mechanical ventilation without heat recovery (MV)														
	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole house extract ventilation or positive input ventilation from outside														
	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natural ventilation or whole house positive input ventilation from loft														
	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59		(24d)
Effective air change rate														
	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59		(25)
Effective air change rate from PCDB:														
	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59		(25)

3. Heat losses and heat loss parameter

Items in the table below are to be expanded as necessary to allow for all different types of element e.g. 4 wall types. The k-value

ELEMENT	Gross area (m ²)	Openings m ²	Net Area A ,m ²	U-value W/m ² K	A X U (W/K)	k-value kJ/m ² ·K	A X k kJ/K
Solid door						0	(26)
Semi-glazed door						0	(26a)
Window						22.14	(27)
Roof window						1.7	(27a)
Basement floor				0		0	(28)
Ground floor				3348.4		3.96	(28a)
Exposed floor				287.25		0.5	(28b)
Basement wall				0		0	(29)
External wall				5569.2		14.85	(29a)

Roof	392.46	4.8	(30)
Total area of external elements ΣA , m ²		189.75	(31)
Party Wall		0	(32)
Party floor		0	(32a)
Party ceiling		0	(32b)
Internal wall **		0	(33c)
Internal floor		0	(32d)
Internal ceiling floor		0	(32e)
Fabric heat loss, W/K = $\Sigma (A \times U)$		47.94	(33)
Heat capacity Cm = $\Sigma (A \times k)$		9597.31	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m ² K		250	(35)
Linear Thermal bridges: $\Sigma (L \times \Psi)$ calculated using Appendix K		7.75	(36)
Point Thermal bridges: $\Sigma \chi$ (W/K) if significant point thermal bridge present and values available		7.75	(36a)
Total fabric heat loss H = $\Sigma (A \times U) + \Sigma (L \times \Psi) + \Sigma \chi$		55.69	(37)
Ventilation heat loss calculated monthly			
33.34 33.11 32.88 31.81 31.61 30.68 30.68 30.51 31.04 31.61 32.02 32.44			(38)
Heat transfer coefficient, W/K			
89.03 88.79 88.57 87.5 87.3 86.37 86.37 86.2 86.73 87.3 87.7 88.13			(39)
Heat loss parameter (HLP), W/m ² K			
1.38 1.37 1.37 1.35 1.35 1.33 1.33 1.33 1.34 1.35 1.36 1.36			(40)
Number of days in month (Table 1a)			
31 28 31 30 31 30 31 31 30 31 30 31			(41)

4. Water heating energy requirement

Assumed occupancy, N	2.11	(42)
Hot water usage in litres per day for mixer showers, Vd,shower (from Appendix J)		
81.97 80.74 78.95 75.51 72.98 70.15 68.54 70.33 72.28 75.31 78.82 81.66		(42a)
Hot water usage in litres per day for baths, Vd,bath (from Appendix J)		
25.76 25.38 24.84 23.85 23.1 22.28 21.83 22.37 22.95 23.83 24.85 25.67		(42b)
Hot water usage in litres per day for other uses, Vd,other (from Appendix J)		
36.25 34.93 33.61 32.3 30.98 29.66 29.66 30.98 32.3 33.61 34.93 36.25		(42c)
Annual average hot water usage in litres per day Vd,average (from Appendix J)	132.63	(43)
Hot water usage in litres per day for each month Vd,m = (42a) + (42b) + (42c)		
143.99 141.05 137.4 131.65 127.06 122.09 120.04 123.67 127.52 132.76 138.6 143.58	1589.42	(44)
Energy content of hot water used = $4.18 \times Vd,m \times nm \times DTm / 3600$ kWh/month (from Appendix J)		
228.04 200.86 211.18 180.23 171.04 150.12 145.17 153.13 157.25 180.15 197.46 224.82	2199.46	(45)
Distribution loss (46) = $0.15 \times (45)$		
34.21 30.13 31.68 27.03 25.66 22.52 21.78 22.97 23.59 27.02 29.62 33.72		(46)
Storage volume (litres) including any solar or WWHRS storage within same vessel	0	(47)
Water storage loss (or HIU loss)		

a) If manufacturer's declared loss factor is known (kWh/day):	1.89	(48)
Temperature factor from Table 2b	0.54	(49)
Energy lost from water storage, kWh/day (48) x (49) =	1.02	(50)
b) If manufacturer's declared loss factor is not known :		
Hot water storage loss factor from Table 2 (kWh/litre/day)	0	(51)
Volume factor from Table 2a	0	(52)
Temperature factor from Table 2b	0	(53)
Energy lost from water storage, kWh/day	0	(54)
Enter (50) or (54) in (55)	1.02	(55)
Water storage (or HIU) loss calculated for each month (56) = (55) x (41)		
31.64 28.58 31.64 30.62 31.64 30.62 31.64 31.64 30.62 31.64 30.62 31.64		(56)
If the vessel contains dedicated solar storage or dedicated WWHRS storage,		
(57)m = (56)m $\square$ [(47) - Vs] $\div$ (47), else (57)m = (56)m		
where Vs is Vww from Appendix G3 or (H12) from Appendix H (as applicable).		
31.64 28.58 31.64 30.62 31.64 30.62 31.64 31.64 30.62 31.64 30.62 31.64		(57)
Primary circuit loss for each month from Table 3		
modified by factor from Table H4 if there is solar water heating and a cylinder thermostat, although not for DHW-only heat networks)		
0 0 0 0 0 0 0 0 0 0 0 0		(59)
Combi loss for each month from Table 3a, 3b or 3c (enter 0 if not a combi boiler)		
0 0 0 0 0 0 0 0 0 0 0 0		(61)
Total heat required for water heating calculated for each month (62) = 0.85 x (45) + (46) + (57) + (59) + (61)		
259.68 229.43 242.82 210.85 202.68 180.74 176.81 184.77 187.87 211.79 228.08 256.46 2571.98		(62)
CWWHRS DHW input calculated using Appendix G (negative quantity) (enter 0 if no WWHRS contribution to water heating)		
0 0 0 0 0 0 0 0 0 0 0 0		(63a)
PV diverter DHW input calculated using Appendix G (negative quantity) (enter 0 if no PV diverter contribution)		
0 0 0 0 0 0 0 0 0 0 0 0		(63b)
Solar DHW input calculated using Appendix H (negative quantity) (enter 0 if no solar contribution to water heating)		
0 0 0 0 0 0 0 0 0 0 0 0		(63c)
FGHRS DHW input calculated using Appendix G (negative quantity) (enter 0 if no FGHRS contribution to water heating)		
0 0 0 0 0 0 0 0 0 0 0 0		(63d)
Output from water heater for each month, kWh/month (64) = (62) + (63a) + (63b) + (63c) + (63d)		
259.68 229.43 242.82 210.85 202.68 180.74 176.81 184.77 187.87 211.79 228.08 256.46 2571.98		(64)
Output from water heater for each month, kWh/month (64) = (62) + (63a) + (63b) + (63c) + (63d)		
0 0 0 0 0 0 0 0 0 0 0 0		(64a)
Heat gains from water heating, kWh/month 0.25 x [0.85 x (45) + (61) + (64a)] + 0.8 x [(46) + (57) + (59)]		
101.13 89.65 95.53 84.42 82.18 74.41 73.58 76.23 76.78 85.21 90.15 100.06		(65)
include (57) m in calculation of (65) m only if hot water store is in the dwelling or hot water is from heat network		

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

Metabolic gains (Table 5), watts

126.67 126.67 126.67 126.67 126.67 126.67 126.67 126.67 126.67 126.67 126.67 126.67	(66)
---	------

Lighting gains (calculated in Appendix L, equation L12 or L12a), also see Table 5

25.94 23.04 18.74 14.18 10.6 8.95 9.67 12.57 16.87 21.43 25.01 26.66 (67)

Appliances gains (calculated in Appendix L, equation L16 or L16a), also see Table 5

275.6 278.46 271.25 255.91 236.54 218.34 206.18 203.32 210.53 225.87 245.24 263.44 (68)

Cooking gains (calculated in Appendix L, equation L18 or L18a), also see Table 5

49.78 49.78 49.78 49.78 49.78 49.78 49.78 49.78 49.78 49.78 49.78 49.78 (69)

Pumps and fans gains (Table 5a)

3 3 3 3 3 0 0 0 0 3 3 3 (70)

Losses e.g. evaporation (negative values) (Table 5)

-84.45 -84.45 -84.45 -84.45 -84.45 -84.45 -84.45 -84.45 -84.45 -84.45 -84.45 -84.45 (71)

Water heating gains (Table 5)

135.93 133.4 128.4 117.25 110.46 103.35 98.9 102.46 106.64 114.53 125.21 134.49 (72)

Total internal gains

532.47 529.9 513.39 482.35 452.61 422.64 406.75 410.35 426.04 456.83 490.46 519.59 (73)

6. Solar gains

Solar gains in watts, calculated for each month

121.96 235.48 383.94 559.78 689.65 708.46 673.41 575.37 445.96 278.05 151.42 100.77 (83)

Total gains – internal and solar (watts)

654.44 765.38 897.33 1042.13 1142.26 1131.1 1080.16 985.72 872.01 734.88 641.88 620.36 (84)

7. Mean internal temperature (heating season)

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

21 (85)

Utilisation factor for gains for living area, $\eta_{1,m}$ (see Table 9a)

0.98 0.97 0.93 0.82 0.66 0.48 0.35 0.4 0.64 0.89 0.97 0.99 (86)

Mean internal temperature in living area T1 (follow steps 3 and 4 in Table 9c)

19.92 20.11 20.39 20.69 20.86 20.92 20.93 20.93 20.88 20.63 20.22 19.89 (87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

19.78 19.78 19.79 19.8 19.8 19.81 19.81 19.82 19.81 19.8 19.8 19.79 (88)

Roof

Utilisation factor for gains for rest of dwelling, $\eta_{2,m}$ (see Table 9a)

0.98 0.96 0.91 0.78 0.59 0.39 0.26 0.3 0.55 0.85 0.96 0.98 (89)

Roof

Mean internal temperature in the rest of dwelling T2

18.56 18.79 19.14 19.49 19.66 19.72 19.72 19.73 19.69 19.44 18.94 18.53 (90)

Living area fraction

0.42 (91)

Mean internal temperature (for the whole dwelling)

19.13 19.35 19.66 19.99 20.16 20.22 20.23 20.23 20.19 19.94 19.48 19.1 (92)

Adjusted mean internal temperature:

18.98 19.2 19.51 19.84 20.01 20.07 20.08 20.08 20.04 19.79 19.33 18.95 (93)

8. Space heating requirement

Utilisation factor for gains,

0.98	0.95	0.9	0.78	0.6	0.41	0.28	0.32	0.57	0.85	0.96	0.98	(94)
------	------	-----	------	-----	------	------	------	------	------	------	------	------

Useful gains, mGm , W

638.09	729.79	807.7	812.38	686.94	466.97	299.86	315.87	493.91	624.44	613.4	607.61	(95)
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Monthly average external temperature from Table U1

4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature

1307.25	1269.38	1152.59	957.55	725.68	472.59	300.57	317.21	515.38	802.07	1072.52	1300	(97)
---------	---------	---------	--------	--------	--------	--------	--------	--------	--------	---------	------	------

Space heating requirement for each month

497.85	362.6	256.6	104.52	28.82	0	0	0	0	132.16	330.56	515.14	(98a)
--------	-------	-------	--------	-------	---	---	---	---	--------	--------	--------	-------

Solar space heating calculated using Appendix H (negative quantity)

0	0	0	0	0	0	0	0	0	0	0	0	(98b)
---	---	---	---	---	---	---	---	---	---	---	---	-------

Space heating requirement for each month after solar contribution

497.85	362.6	256.6	104.52	28.82	0	0	0	0	132.16	330.56	515.14	(98c)
Space heating requirement in kWh/m ² /year												34.43 (99)

8c. Space Cooling requirement

Heat loss rate,

0	0	0	0	0	0	0	0	0	0	0	0	(100)
---	---	---	---	---	---	---	---	---	---	---	---	-------

Utilisation factor for loss

0	0	0	0	0	0	0	0	0	0	0	0	(101)
---	---	---	---	---	---	---	---	---	---	---	---	-------

Useful loss, mLm (watts)

0	0	0	0	0	0	0	0	0	0	0	0	(102)
---	---	---	---	---	---	---	---	---	---	---	---	-------

Gains

0	0	0	0	0	0	0	0	0	0	0	0	(103)
---	---	---	---	---	---	---	---	---	---	---	---	-------

Space cooling requirement for month, whole dwelling, continuous (kWh)

0	0	0	0	0	0	0	0	0	0	0	0	(104)
---	---	---	---	---	---	---	---	---	---	---	---	-------

Cooled fraction

												0 (105)
--	--	--	--	--	--	--	--	--	--	--	--	---------

Intermittency factor

0	0	0	0	0	0	0	0	0	0	0	0	(106)
---	---	---	---	---	---	---	---	---	---	---	---	-------

Space cooling requirement for month

0	0	0	0	0	0	0	0	0	0	0	0	(107)
Space cooling requirement in kWh/m ² /year												0 (108)

8f. Space heating requirement

Fabric Energy Efficiency,	0	0	(109)
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9a. Energy requirements – Individual heating systems including micro-CHP

Fraction of space heat from secondary/supplementary system,	0												0	(201)		
Fraction of space heat from main system(s),													1	(202)		
Fraction of main heating from main system 2,													0	(203)		
Fraction of total space heat from main system 1,													1	(204)		
Fraction of total space heat from main system 2,													0	(205)		
Efficiency of main space heating system 1 (in %),													100	(206)		
Efficiency of main space heating system 2 (in %),													0	(207)		
Efficiency of secondary/supplementary heating system, %,													0	(208)		
Cooling System Seasonal Energy Efficiency Ratio,	0												0	(209)		
Space heating requirement (calculated above),																
	0	0	0	0	0	0	0	0	0	0	0	0	0	(210)		
Space heating fuel (main heating system 1), kWh/month	0												0			
	497.85	362.6	256.6	104.52	28.82	0	0	0	0	132.16	330.56	515.14		(211)		
Space heating fuel (main heating system 2), kWh/month	0												0			
	0	0	0	0	0	0	0	0	0	0	0	0		(213)		
Space heating fuel (secondary), kWh/month	0												0			
	0	0	0	0	0	0	0	0	0	0	0	0		(215)		
Output from water heater),	0												100	(216)		
Efficiency of water heater																
	100	100	100	100	100	100	100	100	100	100	100	100		(217)		
Fuel for water heating																
	259.68	229.43	242.82	210.85	202.68	180.74	176.81	184.77	187.87	211.79	228.08	256.46	2571.98	(219)		
Space Cooling																
	0	0	0	0	0	0	0	0	0	0	0	0		(221)		
Annual totals													kWh/year	kWh/year		
Space heating fuel used, main system 1													2228.27	(211)		
Space heating fuel used, main system 2													0	(213)		
Space heating fuel used, secondary													0	(215)		
Water heating fuel used													2571.98	(219)		
Electricity for instantaneous electric shower(s)													0	(64a)		
Space cooling fuel used													0	(221)		
Electricity for pumps, fans and electric keep-hot																
Mechanical vent fans - balanced, extract or positive input from outside	0												0	0	(230a)	
warm air heating system fans													0	(230b)		
Heating circulation pump or water pump within warm air heating unit													41	(230c)		
Oil boiler auxiliary (oil pump, flue fan, etc; excludes circulation pump)													0	(230d)		
Gas boiler auxiliary (flue fan, etc; excludes circulation pump)													0	(230e)		
Maintaining electric keep-hot facility for gas combi boiler													0	(230f)		
Pump for solar water heating													0	(230g)		
Pump for storage WWHRS													0	(230h)		
Total electricity for the above													41	(231)		
Electricity for lighting													183.23	(232)		

Energy saving/generation technologies (Appendices M, N) - Energy used in dwelling

Electricity generated by PVs (Appendix M) (negative quantity)

0 0 0 0 0 0 0 0 0 0 0 0 0 (233a)

Electricity generated by wind turbines (Appendix M) (negative quantity)

0 0 0 0 0 0 0 0 0 0 0 0 0 (234a)

Electricity generated by hydro-electric generators

0 0 0 0 0 0 0 0 0 0 0 0 0 (235a)

Electricity used or net electricity generated by micro-CHP

0 0 0 0 0 0 0 0 0 0 0 0 0 (235c)

Energy saving/generation technologies (Appendices M, N) - Energy exported

Electricity generated by PVs (Appendix M) (negative quantity)

0 0 0 0 0 0 0 0 0 0 0 0 0 (233b)

Electricity generated by wind turbines (Appendix M) (negative quantity)

0 0 0 0 0 0 0 0 0 0 0 0 0 (234b)

Electricity generated by hydro-electric generators

0 0 0 0 0 0 0 0 0 0 0 0 0 (235b)

Electricity used or net electricity generated by micro-CHP

0 0 0 0 0 0 0 0 0 0 0 0 0 (235d)

Appendix Q items: annual energy

Appendix Q, <item 1 description>

Fuel kWh/year

energy saved 0 (236a)

energy used 0 (237a)

Total delivered energy for all uses 5024.48

10a. Fuel costs – Individual heating systems including micro-CHP

Fuel required	kWh/year	Fuel price	Fuel cost £/year	
Space heating - main system 1 (electric off-peak tariff				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		367.44	(240a)
Low-rate fraction	0		367.44	(240b)
High-rate cost	0		0	(240c)
Low-rate cost	0		0	(240d)
Space heating - main system 1 cost (other fuel)	0		0	(240e)
Space heating - main system 2 (electric off-peak tariff				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		367.44	(241a)
Low-rate fraction	0		367.44	(241b)
High-rate cost	0		0	(241c)
Low-rate cost	0		0	(241d)
Space heating - main system 2 cost (other fuel)	0		0	(241e)
Space heating - secondary (electric off-peak tariff)				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		367.44	(242a)

Low-rate fraction	0	367.44	(242b)
High-rate cost	0	0	(242c)
Low-rate cost	0	0	(242d)
Space heating - secondary cost (other fuel)	0	0	(242e)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0	0	(243)
Low-rate fraction	0	0	(242b)
High-rate cost	0	0	(242c)
Low-rate cost	0	0	(242d)
Water heating cost (other fuel)	0	424.12	(247)
(for a DHW-only heat network use (342a) or (342b) instead of (247))			
Energy For instantaneous electric shower(s)	0	0	(247a)
Space cooling	0	0	(248)
Pumps, fans And electric keep-hot	0	6.76	(249)
Energy For lighting	0	30.22	(250)
Additional standing charges	0	0	(251)
Energy saving/generation technologies	0	0	(252)
Appendix Q, <item 1 description>	Fuel	kWh/year	
energy saved Or generated	0	0	(253)
energy used	0	0	(254)
Total energy cost	0	828.54	(255)
11a. SAP rating – Individual heating systems including micro-CHP			
Energy cost deflator	0	0	(256)
Energy cost factor (ECF)	0	0	(257)
SAP rating	0	0	(258)

11a. SAP rating – Individual heating systems including micro-CHP

Energy cost deflator	0.36	(256)
Energy cost factor (ECF)	2.72	(257)
SAP rating	55.93	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy KWh/year	Emission factor kg	Emissions kg CO2/year	
Space heating - main system 1			349.03	(261)
Space heating - main system 2			0	(262)
Space heating - secondary			0	(263)
Energy for water heating			363.07	(264)
Energy for instantaneous electric shower(s)			0	(264a)

Space and water heating		0	(265)
Space cooling		0	(266)
Electricity for pumps, fans and electric keep		5.69	(267)
Electricity for lighting		26.45	(268)
energy saved or generated	0	0	(269b)
Appendix Q items			
energy saved	0	0	
energy used	0	0	
energy saved	0	0	(270b)
energy used		0	(271b)
Total CO ₂ , kg/year		744.24	(272)
Dwelling CO ₂ Emission Rate		11.5	(273)
EI rating		91	(274)

13a. Primary Energy – Individual heating systems including micro-CHP

	Energy KWh/year	Emission factor kg	Emissions kg CO ₂ /year	
Space heating - main system 1			3520.39	(275)
Space heating - main system 2			0	(276)
Space heating - secondary			0	(277)
Energy for water heating			3914.51	(278)
Energy for instantaneous electric shower(s)			0	(278a)
Space and water heating			0	(279)
Space cooling			0	(280)
Electricity for pumps, fans and electric keep			62.02	(281)
Electricity for lighting			281.05	(282)
energy saved or generated	0		0	
Appendix Q items				
energy saved	0		0	
energy used	0		0	
energy saved	0		0	(284b)
energy used			0	(285b)
Total PE, kWh/year			7777.97	(286)
Dwelling PE Rate			120.2	(287)



Appendix 2:

Lean DER Calculation (SAP Derived)

Dwelling Reference: 16083 - New Dwelling (Lean)

Dwelling Type: New Dwelling Design Stage

New Dwelling
Land to Rear of 47 Cranleigh Road
London
N15 3AB

1. Overall dwelling dimensions

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground Floor	30.44 (1a) x 2.5	(2a) =	76.1 (3a)
First Floor	34.27 (1b) x 2.62	(2b) =	89.79 (3b)
Total floor area TFA			64.71 (4)
Dwelling volume			165.89 (5)

2. Ventilation Rate

Chimneys/Flues	0	x 80 =	0	(6a)
Open chimneys	0	x 20 =	0	(6b)
Chimneys / flues attached to closed fire	0	x 10 =	0	(6c)
Flues attached to solid fuel boiler	0	x 20 =	0	(6d)
Flues attached to other heater	0	x 35 =	0	(6e)
Number of blocked chimneys	0	x 20 =	0	(6f)
Number of intermittent extract fans	3	x 10 =	30	(7a)
Number of passive vents	0	x 10 =	0	(7b)
Number of flueless gas fires	0	x 40 =	0	(7c)
Air changes per hour				
Number of storeys in the dwelling (ns)		0.18	0.18	(8)
Infiltration due to chimneys, flues, fans, PSVs, etc		0	0	(9)
Additional infiltration		0	0	(10)
Structural infiltration		0	0	(11)
Suspended wooden ground floor		0	0	(12)
No draught lobby		0	0	(13)
Percentage of windows and doors draught proofed		0	0	(14)
Window infiltration		0	0	(15)
Infiltration rate		0	0	(16)
Air permeability value, AP50, (m ³ /h/m ²)		5	5	(17)
Air permeability value, AP4, (m ³ /h/m ²)		0	0	(17a)
Air permeability value)		0.43	0.43	(18)
Number of sides on which dwelling is sheltered		2	2	(19)

Shelter factor													0.85	(20)
Infiltration rate incorporating shelter factor													0.37	(21)
Infiltration rate modified for monthly wind speed														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	(22)
Monthly average wind speed from Table U2														
	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7	52.5	(22)
Wind Factor														
	1.28	1.25	1.23	1.1	1.08	0.95	0.95	0.93	1	1.08	1.13	1.18	13.13	(22a)
Adjusted infiltration rate (allowing for shelter and wind speed)														
	0.47	0.46	0.45	0.4	0.39	0.35	0.35	0.34	0.37	0.39	0.41	0.43	4.81	(22b)
Calculate effective air change rate for the applicable case:														
													0	(23a)
													0	(23b)
													0	(23c)
a) If balanced mechanical ventilation with heat recovery (MVHR)														
	0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If balanced mechanical ventilation without heat recovery (MV)														
	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole house extract ventilation or positive input ventilation from outside														
	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natural ventilation or whole house positive input ventilation from loft														
	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59		(24d)
Effective air change rate														
	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59		(25)
Effective air change rate from PCDB:														
	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59		(25)

3. Heat losses and heat loss parameter

Items in the table below are to be expanded as necessary to allow for all different types of element e.g. 4 wall types. The k-value

ELEMENT	Gross area (m ²)	Openings m ²	Net Area A, m ²	U-value W/m ² K	A X U (W/K)	k-value kJ/m ² ·K	A X k kJ/K
Solid door						0	(26)
Semi-glazed door						0	(26a)
Window						22.14	(27)
Roof window						1.7	(27a)
Basement floor				0		0	(28)
Ground floor				3348.4		3.96	(28a)
Exposed floor				287.25		0.5	(28b)
Basement wall				0		0	(29)
External wall				5569.2		14.85	(29a)

Roof	392.46	4.8	(30)
Total area of external elements ΣA , m ²		189.75	(31)
Party Wall		0	(32)
Party floor		0	(32a)
Party ceiling		0	(32b)
Internal wall **		0	(33c)
Internal floor		0	(32d)
Internal ceiling floor		0	(32e)
Fabric heat loss, W/K = $\Sigma (A \times U)$		47.94	(33)
Heat capacity Cm = $\Sigma (A \times k)$		9597.31	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m ² K		250	(35)
Linear Thermal bridges: $\Sigma (L \times \Psi)$ calculated using Appendix K		7.75	(36)
Point Thermal bridges: $\Sigma \chi$ (W/K) if significant point thermal bridge present and values available		7.75	(36a)
Total fabric heat loss H = $\Sigma (A \times U) + \Sigma (L \times \Psi) + \Sigma \chi$		55.69	(37)
Ventilation heat loss calculated monthly			
33.34 33.11 32.88 31.81 31.61 30.68 30.68 30.51 31.04 31.61 32.02 32.44			(38)
Heat transfer coefficient, W/K			
89.03 88.79 88.57 87.5 87.3 86.37 86.37 86.2 86.73 87.3 87.7 88.13			(39)
Heat loss parameter (HLP), W/m ² K			
1.38 1.37 1.37 1.35 1.35 1.33 1.33 1.33 1.34 1.35 1.36 1.36			(40)
Number of days in month (Table 1a)			
31 28 31 30 31 30 31 31 30 31 30 31			(41)

4. Water heating energy requirement

Assumed occupancy, N	2.11	(42)
Hot water usage in litres per day for mixer showers, Vd,shower (from Appendix J)		
81.97 80.74 78.95 75.51 72.98 70.15 68.54 70.33 72.28 75.31 78.82 81.66		(42a)
Hot water usage in litres per day for baths, Vd,bath (from Appendix J)		
25.76 25.38 24.84 23.85 23.1 22.28 21.83 22.37 22.95 23.83 24.85 25.67		(42b)
Hot water usage in litres per day for other uses, Vd,other (from Appendix J)		
36.25 34.93 33.61 32.3 30.98 29.66 29.66 30.98 32.3 33.61 34.93 36.25		(42c)
Annual average hot water usage in litres per day Vd,average (from Appendix J)	132.63	(43)
Hot water usage in litres per day for each month Vd,m = (42a) + (42b) + (42c)		
143.99 141.05 137.4 131.65 127.06 122.09 120.04 123.67 127.52 132.76 138.6 143.58	1589.42	(44)
Energy content of hot water used = $4.18 \times Vd,m \times nm \times DTm$ / 3600 kWh/month (from Appendix J)		
228.04 200.86 211.18 180.23 171.04 150.12 145.17 153.13 157.25 180.15 197.46 224.82	2199.46	(45)
Distribution loss (46) = $0.15 \times (45)$		
34.21 30.13 31.68 27.03 25.66 22.52 21.78 22.97 23.59 27.02 29.62 33.72		(46)
Storage volume (litres) including any solar or WWHRS storage within same vessel	0	(47)
Water storage loss (or HIU loss)		

a) If manufacturer's declared loss factor is known (kWh/day):	1.89	(48)
Temperature factor from Table 2b	0.54	(49)
Energy lost from water storage, kWh/day (48) x (49) =	1.02	(50)
b) If manufacturer's declared loss factor is not known :		
Hot water storage loss factor from Table 2 (kWh/litre/day)	0	(51)
Volume factor from Table 2a	0	(52)
Temperature factor from Table 2b	0	(53)
Energy lost from water storage, kWh/day	0	(54)
Enter (50) or (54) in (55)	1.02	(55)
Water storage (or HIU) loss calculated for each month (56) = (55) x (41)		
31.64 28.58 31.64 30.62 31.64 30.62 31.64 31.64 30.62 31.64 30.62 31.64		(56)
If the vessel contains dedicated solar storage or dedicated WWHRS storage,		
(57)m = (56)m $\square$ [(47) - Vs] $\div$ (47), else (57)m = (56)m		
where Vs is V _{ww} from Appendix G3 or (H12) from Appendix H (as applicable).		
31.64 28.58 31.64 30.62 31.64 30.62 31.64 31.64 30.62 31.64 30.62 31.64		(57)
Primary circuit loss for each month from Table 3		
modified by factor from Table H4 if there is solar water heating and a cylinder thermostat, although not for DHW-only heat networks)		
0 0 0 0 0 0 0 0 0 0 0 0		(59)
Combi loss for each month from Table 3a, 3b or 3c (enter 0 if not a combi boiler)		
0 0 0 0 0 0 0 0 0 0 0 0		(61)
Total heat required for water heating calculated for each month (62) = 0.85 x (45) + (46) + (57) + (59) + (61)		
259.68 229.43 242.82 210.85 202.68 180.74 176.81 184.77 187.87 211.79 228.08 256.46 2571.98		(62)
CWWHRS DHW input calculated using Appendix G (negative quantity) (enter 0 if no WWHRS contribution to water heating)		
0 0 0 0 0 0 0 0 0 0 0 0		(63a)
PV diverter DHW input calculated using Appendix G (negative quantity) (enter 0 if no PV diverter contribution)		
0 0 0 0 0 0 0 0 0 0 0 0		(63b)
Solar DHW input calculated using Appendix H (negative quantity) (enter 0 if no solar contribution to water heating)		
0 0 0 0 0 0 0 0 0 0 0 0		(63c)
FGHRS DHW input calculated using Appendix G (negative quantity) (enter 0 if no FGHRS contribution to water heating)		
0 0 0 0 0 0 0 0 0 0 0 0		(63d)
Output from water heater for each month, kWh/month (64) = (62) + (63a) + (63b) + (63c) + (63d)		
259.68 229.43 242.82 210.85 202.68 180.74 176.81 184.77 187.87 211.79 228.08 256.46 2571.98		(64)
Output from water heater for each month, kWh/month (64) = (62) + (63a) + (63b) + (63c) + (63d)		
0 0 0 0 0 0 0 0 0 0 0 0		(64a)
Heat gains from water heating, kWh/month 0.25 x [0.85 x (45) + (61) + (64a)] + 0.8 x [(46) + (57) + (59)]		
101.13 89.65 95.53 84.42 82.18 74.41 73.58 76.23 76.78 85.21 90.15 100.06		(65)
include (57) m in calculation of (65) m only if hot water store is in the dwelling or hot water is from heat network		

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

Metabolic gains (Table 5), watts

126.67 126.67 126.67 126.67 126.67 126.67 126.67 126.67 126.67 126.67 126.67 126.67	(66)
---	------

Lighting gains (calculated in Appendix L, equation L12 or L12a), also see Table 5

25.94 23.04 18.74 14.18 10.6 8.95 9.67 12.57 16.87 21.43 25.01 26.66 (67)

Appliances gains (calculated in Appendix L, equation L16 or L16a), also see Table 5

275.6 278.46 271.25 255.91 236.54 218.34 206.18 203.32 210.53 225.87 245.24 263.44 (68)

Cooking gains (calculated in Appendix L, equation L18 or L18a), also see Table 5

49.78 49.78 49.78 49.78 49.78 49.78 49.78 49.78 49.78 49.78 49.78 49.78 (69)

Pumps and fans gains (Table 5a)

3 3 3 3 3 0 0 0 0 3 3 3 (70)

Losses e.g. evaporation (negative values) (Table 5)

-84.45 -84.45 -84.45 -84.45 -84.45 -84.45 -84.45 -84.45 -84.45 -84.45 -84.45 -84.45 (71)

Water heating gains (Table 5)

135.93 133.4 128.4 117.25 110.46 103.35 98.9 102.46 106.64 114.53 125.21 134.49 (72)

Total internal gains

532.47 529.9 513.39 482.35 452.61 422.64 406.75 410.35 426.04 456.83 490.46 519.59 (73)

6. Solar gains

Solar gains in watts, calculated for each month

121.96 235.48 383.94 559.78 689.65 708.46 673.41 575.37 445.96 278.05 151.42 100.77 (83)

Total gains – internal and solar (watts)

654.44 765.38 897.33 1042.13 1142.26 1131.1 1080.16 985.72 872.01 734.88 641.88 620.36 (84)

7. Mean internal temperature (heating season)

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

21 (85)

Utilisation factor for gains for living area, $\eta_{1,m}$ (see Table 9a)

0.98 0.97 0.93 0.82 0.66 0.48 0.35 0.4 0.64 0.89 0.97 0.99 (86)

Mean internal temperature in living area T1 (follow steps 3 and 4 in Table 9c)

19.92 20.11 20.39 20.69 20.86 20.92 20.93 20.93 20.88 20.63 20.22 19.89 (87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

19.78 19.78 19.79 19.8 19.8 19.81 19.81 19.82 19.81 19.8 19.8 19.79 (88)

Roof

Utilisation factor for gains for rest of dwelling, $\eta_{2,m}$ (see Table 9a)

0.98 0.96 0.91 0.78 0.59 0.39 0.26 0.3 0.55 0.85 0.96 0.98 (89)

Roof

Mean internal temperature in the rest of dwelling T2

18.56 18.79 19.14 19.49 19.66 19.72 19.72 19.73 19.69 19.44 18.94 18.53 (90)

Living area fraction

0.42 (91)

Mean internal temperature (for the whole dwelling)

19.13 19.35 19.66 19.99 20.16 20.22 20.23 20.23 20.19 19.94 19.48 19.1 (92)

Adjusted mean internal temperature:

18.98 19.2 19.51 19.84 20.01 20.07 20.08 20.08 20.04 19.79 19.33 18.95 (93)

8. Space heating requirement

Utilisation factor for gains,

0.98	0.95	0.9	0.78	0.6	0.41	0.28	0.32	0.57	0.85	0.96	0.98	(94)
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Useful gains, mGm , W

638.09	729.79	807.7	812.38	686.94	466.97	299.86	315.87	493.91	624.44	613.4	607.61	(95)
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Monthly average external temperature from Table U1

4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
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Heat loss rate for mean internal temperature

1307.25	1269.38	1152.59	957.55	725.68	472.59	300.57	317.21	515.38	802.07	1072.52	1300	(97)
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Space heating requirement for each month

497.85	362.6	256.6	104.52	28.82	0	0	0	0	132.16	330.56	515.14	(98a)
--------	-------	-------	--------	-------	---	---	---	---	--------	--------	--------	-------

Solar space heating calculated using Appendix H (negative quantity)

0	0	0	0	0	0	0	0	0	0	0	0	(98b)
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Space heating requirement for each month after solar contribution

497.85	362.6	256.6	104.52	28.82	0	0	0	0	132.16	330.56	515.14	(98c)
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Space heating requirement in kWh/m ² /year												34.43	(99)
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8c. Space Cooling requirement

Heat loss rate,

0	0	0	0	0	0	0	0	0	0	0	0	(100)
---	---	---	---	---	---	---	---	---	---	---	---	-------

Utilisation factor for loss

0	0	0	0	0	0	0	0	0	0	0	0	(101)
---	---	---	---	---	---	---	---	---	---	---	---	-------

Useful loss, mLm (watts)

0	0	0	0	0	0	0	0	0	0	0	0	(102)
---	---	---	---	---	---	---	---	---	---	---	---	-------

Gains

0	0	0	0	0	0	0	0	0	0	0	0	(103)
---	---	---	---	---	---	---	---	---	---	---	---	-------

Space cooling requirement for month, whole dwelling, continuous (kWh)

0	0	0	0	0	0	0	0	0	0	0	0	(104)
---	---	---	---	---	---	---	---	---	---	---	---	-------

Cooled fraction

												0	(105)
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Intermittency factor

0	0	0	0	0	0	0	0	0	0	0	0	(106)
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Space cooling requirement for month

0	0	0	0	0	0	0	0	0	0	0	0	(107)
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Space cooling requirement in kWh/m ² /year												0	(108)
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8f. Space heating requirement

Fabric Energy Efficiency,												0	(109)
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9a. Energy requirements – Individual heating systems including micro-CHP

Fraction of space heat from secondary/supplementary system,	0												0	(201)		
Fraction of space heat from main system(s),													1	(202)		
Fraction of main heating from main system 2,													0	(203)		
Fraction of total space heat from main system 1,													1	(204)		
Fraction of total space heat from main system 2,													0	(205)		
Efficiency of main space heating system 1 (in %),													100	(206)		
Efficiency of main space heating system 2 (in %),													0	(207)		
Efficiency of secondary/supplementary heating system, %,													0	(208)		
Cooling System Seasonal Energy Efficiency Ratio,	0												0	(209)		
Space heating requirement (calculated above),																
	0	0	0	0	0	0	0	0	0	0	0	0	0	(210)		
Space heating fuel (main heating system 1), kWh/month	0												0			
	497.85	362.6	256.6	104.52	28.82	0	0	0	0	132.16	330.56	515.14		(211)		
Space heating fuel (main heating system 2), kWh/month	0												0			
	0	0	0	0	0	0	0	0	0	0	0	0		(213)		
Space heating fuel (secondary), kWh/month	0												0			
	0	0	0	0	0	0	0	0	0	0	0	0		(215)		
Output from water heater),	0												100	(216)		
Efficiency of water heater																
	100	100	100	100	100	100	100	100	100	100	100	100		(217)		
Fuel for water heating																
	259.68	229.43	242.82	210.85	202.68	180.74	176.81	184.77	187.87	211.79	228.08	256.46	2571.98	(219)		
Space Cooling																
	0	0	0	0	0	0	0	0	0	0	0	0		(221)		
Annual totals													kWh/year	kWh/year		
Space heating fuel used, main system 1													2228.27	(211)		
Space heating fuel used, main system 2													0	(213)		
Space heating fuel used, secondary													0	(215)		
Water heating fuel used													2571.98	(219)		
Electricity for instantaneous electric shower(s)													0	(64a)		
Space cooling fuel used													0	(221)		
Electricity for pumps, fans and electric keep-hot																
Mechanical vent fans - balanced, extract or positive input from outside	0												0	0	(230a)	
warm air heating system fans													0	(230b)		
Heating circulation pump or water pump within warm air heating unit													41	(230c)		
Oil boiler auxiliary (oil pump, flue fan, etc; excludes circulation pump)													0	(230d)		
Gas boiler auxiliary (flue fan, etc; excludes circulation pump)													0	(230e)		
Maintaining electric keep-hot facility for gas combi boiler													0	(230f)		
Pump for solar water heating													0	(230g)		
Pump for storage WWHRS													0	(230h)		
Total electricity for the above													41	(231)		
Electricity for lighting													183.23	(232)		

Energy saving/generation technologies (Appendices M, N) - Energy used in dwelling

Electricity generated by PVs (Appendix M) (negative quantity)

0	0	0	0	0	0	0	0	0	0	0	0	0	0	(233a)
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Electricity generated by wind turbines (Appendix M) (negative quantity)

0	0	0	0	0	0	0	0	0	0	0	0	0	0	(234a)
---	---	---	---	---	---	---	---	---	---	---	---	---	---	--------

Electricity generated by hydro-electric generators

0	0	0	0	0	0	0	0	0	0	0	0	0	0	(235a)
---	---	---	---	---	---	---	---	---	---	---	---	---	---	--------

Electricity used or net electricity generated by micro-CHP

0	0	0	0	0	0	0	0	0	0	0	0	0	0	(235c)
---	---	---	---	---	---	---	---	---	---	---	---	---	---	--------

Energy saving/generation technologies (Appendices M, N) - Energy exported

Electricity generated by PVs (Appendix M) (negative quantity)

0	0	0	0	0	0	0	0	0	0	0	0	0	0	(233b)
---	---	---	---	---	---	---	---	---	---	---	---	---	---	--------

Electricity generated by wind turbines (Appendix M) (negative quantity)

0	0	0	0	0	0	0	0	0	0	0	0	0	0	(234b)
---	---	---	---	---	---	---	---	---	---	---	---	---	---	--------

Electricity generated by hydro-electric generators

0	0	0	0	0	0	0	0	0	0	0	0	0	0	(235b)
---	---	---	---	---	---	---	---	---	---	---	---	---	---	--------

Electricity used or net electricity generated by micro-CHP

0	0	0	0	0	0	0	0	0	0	0	0	0	0	(235d)
---	---	---	---	---	---	---	---	---	---	---	---	---	---	--------

Appendix Q items: annual energy

Appendix Q, <item 1 description>

Fuel kWh/year

energy saved	0	(236a)
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energy used	0	(237a)
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Total delivered energy for all uses	5024.48	
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10a. Fuel costs – Individual heating systems including micro-CHP

Fuel required	kWh/year	Fuel price	Fuel cost £/year	
Space heating - main system 1 (electric off-peak tariff				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		367.44	(240a)
Low-rate fraction	0		367.44	(240b)
High-rate cost	0		0	(240c)
Low-rate cost	0		0	(240d)
Space heating - main system 1 cost (other fuel)	0		0	(240e)
Space heating - main system 2 (electric off-peak tariff				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		367.44	(241a)
Low-rate fraction	0		367.44	(241b)
High-rate cost	0		0	(241c)
Low-rate cost	0		0	(241d)
Space heating - main system 2 cost (other fuel)	0		0	(241e)
Space heating - secondary (electric off-peak tariff)				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		367.44	(242a)

Low-rate fraction	0	367.44	(242b)
High-rate cost	0	0	(242c)
Low-rate cost	0	0	(242d)
Space heating - secondary cost (other fuel)	0	0	(242e)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0	0	(243)
Low-rate fraction	0	0	(242b)
High-rate cost	0	0	(242c)
Low-rate cost	0	0	(242d)
Water heating cost (other fuel)	0	424.12	(247)
(for a DHW-only heat network use (342a) or (342b) instead of (247))			
Energy For instantaneous electric shower(s)	0	0	(247a)
Space cooling	0	0	(248)
Pumps, fans And electric keep-hot	0	6.76	(249)
Energy For lighting	0	30.22	(250)
Additional standing charges	0	0	(251)
Energy saving/generation technologies	0	0	(252)
Appendix Q, <item 1 description>	Fuel	kWh/year	
energy saved Or generated	0	0	(253)
energy used	0	0	(254)
Total energy cost	0	828.54	(255)
11a. SAP rating – Individual heating systems including micro-CHP			
Energy cost deflator	0	0	(256)
Energy cost factor (ECF)	0	0	(257)
SAP rating	0	0	(258)

11a. SAP rating – Individual heating systems including micro-CHP

Energy cost deflator	0.36	(256)
Energy cost factor (ECF)	2.72	(257)
SAP rating	55.93	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy KWh/year	Emission factor kg	Emissions kg CO2/year	
Space heating - main system 1			349.03	(261)
Space heating - main system 2			0	(262)
Space heating - secondary			0	(263)
Energy for water heating			363.07	(264)
Energy for instantaneous electric shower(s)			0	(264a)

Space and water heating		0	(265)
Space cooling		0	(266)
Electricity for pumps, fans and electric keep		5.69	(267)
Electricity for lighting		26.45	(268)
energy saved or generated	0	0	(269b)
Appendix Q items			
energy saved	0	0	
energy used	0	0	
energy saved	0	0	(270b)
energy used		0	(271b)
Total CO ₂ , kg/year		744.24	(272)
Dwelling CO ₂ Emission Rate		11.5	(273)
EI rating		91	(274)

13a. Primary Energy – Individual heating systems including micro-CHP

	Energy KWh/year	Emission factor kg	Emissions kg CO ₂ /year	
Space heating - main system 1			3520.39	(275)
Space heating - main system 2			0	(276)
Space heating - secondary			0	(277)
Energy for water heating			3914.51	(278)
Energy for instantaneous electric shower(s)			0	(278a)
Space and water heating			0	(279)
Space cooling			0	(280)
Electricity for pumps, fans and electric keep			62.02	(281)
Electricity for lighting			281.05	(282)
energy saved or generated	0		0	
Appendix Q items				
energy saved	0		0	
energy used	0		0	
energy saved	0		0	(284b)
energy used			0	(285b)
Total PE, kWh/year			7777.97	(286)
Dwelling PE Rate			120.2	(287)



Appendix 3:

Proposed Green DER Calculation (SAP Derived)

Dwelling Reference: 16083 - New Dwelling (Green)

Dwelling Type: New Dwelling Design Stage

New Dwelling
Land to Rear of 47 Cranleigh Road
London
N15 3AB

1. Overall dwelling dimensions

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground Floor	30.44 (1a) x 2.5	(2a) =	76.1 (3a)
First Floor	34.27 (1b) x 2.62	(2b) =	89.79 (3b)
Total floor area TFA			64.71 (4)
Dwelling volume			165.89 (5)

2. Ventilation Rate

Chimneys/Flues	0	x 80 =	0	(6a)
Open chimneys	0	x 20 =	0	(6b)
Chimneys / flues attached to closed fire	0	x 10 =	0	(6c)
Flues attached to solid fuel boiler	0	x 20 =	0	(6d)
Flues attached to other heater	0	x 35 =	0	(6e)
Number of blocked chimneys	0	x 20 =	0	(6f)
Number of intermittent extract fans	3	x 10 =	30	(7a)
Number of passive vents	0	x 10 =	0	(7b)
Number of flueless gas fires	0	x 40 =	0	(7c)
Air changes per hour				
Number of storeys in the dwelling (ns)		0.18	0.18	(8)
Infiltration due to chimneys, flues, fans, PSVs, etc		0	0	(9)
Additional infiltration		0	0	(10)
Structural infiltration		0	0	(11)
Suspended wooden ground floor		0	0	(12)
No draught lobby		0	0	(13)
Percentage of windows and doors draught proofed		0	0	(14)
Window infiltration		0	0	(15)
Infiltration rate		0	0	(16)
Air permeability value, AP50, (m ³ /h/m ²)		5	5	(17)
Air permeability value, AP4, (m ³ /h/m ²)		0	0	(17a)
Air permeability value)		0.43	0.43	(18)
Number of sides on which dwelling is sheltered		2	2	(19)

Shelter factor													0.85	(20)
Infiltration rate incorporating shelter factor													0.37	(21)
Infiltration rate modified for monthly wind speed														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	(22)
Monthly average wind speed from Table U2														
	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7	52.5	(22)
Wind Factor														
	1.28	1.25	1.23	1.1	1.08	0.95	0.95	0.93	1	1.08	1.13	1.18	13.13	(22a)
Adjusted infiltration rate (allowing for shelter and wind speed)														
	0.47	0.46	0.45	0.4	0.39	0.35	0.35	0.34	0.37	0.39	0.41	0.43	4.81	(22b)
Calculate effective air change rate for the applicable case:														
													0	(23a)
													0	(23b)
													0	(23c)
a) If balanced mechanical ventilation with heat recovery (MVHR)														
	0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If balanced mechanical ventilation without heat recovery (MV)														
	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole house extract ventilation or positive input ventilation from outside														
	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natural ventilation or whole house positive input ventilation from loft														
	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59		(24d)
Effective air change rate														
	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59		(25)
Effective air change rate from PCDB:														
	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59		(25)

3. Heat losses and heat loss parameter

Items in the table below are to be expanded as necessary to allow for all different types of element e.g. 4 wall types. The k-value

ELEMENT	Gross area (m ²)	Openings m ²	Net Area A, m ²	U-value W/m ² K	A X U (W/K)	k-value kJ/m ² ·K	A X k kJ/K
Solid door						0	0 (26)
Semi-glazed door						0	0 (26a)
Window						22.14	(27)
Roof window						1.7	(27a)
Basement floor				0		0	(28)
Ground floor				3348.4		3.96	(28a)
Exposed floor				287.25		0.5	(28b)
Basement wall				0		0	(29)
External wall				5569.2		14.85	(29a)

Roof	392.46	4.8	(30)
Total area of external elements ΣA , m ²		189.75	(31)
Party Wall		0	(32)
Party floor		0	(32a)
Party ceiling		0	(32b)
Internal wall **		0	(33c)
Internal floor		0	(32d)
Internal ceiling floor		0	(32e)
Fabric heat loss, W/K = $\Sigma (A \times U)$		47.94	(33)
Heat capacity Cm = $\Sigma (A \times k)$		9597.31	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m ² K		250	(35)
Linear Thermal bridges: $\Sigma (L \times \Psi)$ calculated using Appendix K		7.75	(36)
Point Thermal bridges: $\Sigma \chi$ (W/K) if significant point thermal bridge present and values available		7.75	(36a)
Total fabric heat loss H = $\Sigma (A \times U) + \Sigma (L \times \Psi) + \Sigma \chi$		55.69	(37)
Ventilation heat loss calculated monthly			
33.34 33.11 32.88 31.81 31.61 30.68 30.68 30.51 31.04 31.61 32.02 32.44			(38)
Heat transfer coefficient, W/K			
89.03 88.79 88.57 87.5 87.3 86.37 86.37 86.2 86.73 87.3 87.7 88.13			(39)
Heat loss parameter (HLP), W/m ² K			
1.38 1.37 1.37 1.35 1.35 1.33 1.33 1.33 1.34 1.35 1.36 1.36			(40)
Number of days in month (Table 1a)			
31 28 31 30 31 30 31 31 30 31 30 31			(41)

4. Water heating energy requirement

Assumed occupancy, N	2.11	(42)
Hot water usage in litres per day for mixer showers, Vd,shower (from Appendix J)		
81.97 80.74 78.95 75.51 72.98 70.15 68.54 70.33 72.28 75.31 78.82 81.66		(42a)
Hot water usage in litres per day for baths, Vd,bath (from Appendix J)		
25.76 25.38 24.84 23.85 23.1 22.28 21.83 22.37 22.95 23.83 24.85 25.67		(42b)
Hot water usage in litres per day for other uses, Vd,other (from Appendix J)		
36.25 34.93 33.61 32.3 30.98 29.66 29.66 30.98 32.3 33.61 34.93 36.25		(42c)
Annual average hot water usage in litres per day Vd,average (from Appendix J)	132.63	(43)
Hot water usage in litres per day for each month Vd,m = (42a) + (42b) + (42c)		
143.99 141.05 137.4 131.65 127.06 122.09 120.04 123.67 127.52 132.76 138.6 143.58	1589.42	(44)
Energy content of hot water used = $4.18 \times Vd,m \times nm \times DTm$ / 3600 kWh/month (from Appendix J)		
228.04 200.86 211.18 180.23 171.04 150.12 145.17 153.13 157.25 180.15 197.46 224.82	2199.46	(45)
Distribution loss (46) = $0.15 \times (45)$		
34.21 30.13 31.68 27.03 25.66 22.52 21.78 22.97 23.59 27.02 29.62 33.72		(46)
Storage volume (litres) including any solar or WWHRS storage within same vessel	0	(47)
Water storage loss (or HIU loss)		

a) If manufacturer's declared loss factor is known (kWh/day):	1.89	(48)
Temperature factor from Table 2b	0.54	(49)
Energy lost from water storage, kWh/day (48) x (49) =	1.02	(50)
b) If manufacturer's declared loss factor is not known :		
Hot water storage loss factor from Table 2 (kWh/litre/day)	0	(51)
Volume factor from Table 2a	0	(52)
Temperature factor from Table 2b	0	(53)
Energy lost from water storage, kWh/day	0	(54)
Enter (50) or (54) in (55)	1.02	(55)
Water storage (or HIU) loss calculated for each month (56) = (55) x (41)		
31.64 28.58 31.64 30.62 31.64 30.62 31.64 31.64 30.62 31.64 30.62 31.64		(56)
If the vessel contains dedicated solar storage or dedicated WWHRS storage,		
(57)m = (56)m $\square$ [(47) - Vs] $\div$ (47), else (57)m = (56)m		
where Vs is V _{ww} from Appendix G3 or (H12) from Appendix H (as applicable).		
31.64 28.58 31.64 30.62 31.64 30.62 31.64 31.64 30.62 31.64 30.62 31.64		(57)
Primary circuit loss for each month from Table 3		
modified by factor from Table H4 if there is solar water heating and a cylinder thermostat, although not for DHW-only heat networks)		
23.26 21.01 23.26 22.51 23.26 22.51 23.26 23.26 22.51 23.26 22.51 23.26		(59)
Combi loss for each month from Table 3a, 3b or 3c (enter 0 if not a combi boiler)		
0 0 0 0 0 0 0 0 0 0 0 0		(61)
Total heat required for water heating calculated for each month (62) = 0.85 x (45) + (46) + (57) + (59) + (61)		
282.94 250.45 266.08 233.36 225.95 203.25 200.07 208.03 210.38 235.06 250.59 279.72 2845.87		(62)
CWWHRS DHW input calculated using Appendix G (negative quantity) (enter 0 if no WWHRS contribution to water heating)		
0 0 0 0 0 0 0 0 0 0 0 0		(63a)
PV diverter DHW input calculated using Appendix G (negative quantity) (enter 0 if no PV diverter contribution)		
0 0 0 0 0 0 0 0 0 0 0 0		(63b)
Solar DHW input calculated using Appendix H (negative quantity) (enter 0 if no solar contribution to water heating)		
0 0 0 0 0 0 0 0 0 0 0 0		(63c)
FGHRS DHW input calculated using Appendix G (negative quantity) (enter 0 if no FGHRS contribution to water heating)		
0 0 0 0 0 0 0 0 0 0 0 0		(63d)
Output from water heater for each month, kWh/month (64) = (62) + (63a) + (63b) + (63c) + (63d)		
282.94 250.45 266.08 233.36 225.95 203.25 200.07 208.03 210.38 235.06 250.59 279.72 2845.87		(64)
Output from water heater for each month, kWh/month (64) = (62) + (63a) + (63b) + (63c) + (63d)		
0 0 0 0 0 0 0 0 0 0 0 0		(64a)
Heat gains from water heating, kWh/month 0.25 x [0.85 x (45) + (61) + (64a)] + 0.8 x [(46) + (57) + (59)]		
119.74 106.46 114.14 102.43 100.79 92.42 92.19 94.84 94.79 103.82 108.16 118.67		(65)
include (57) m in calculation of (65) m only if hot water store is in the dwelling or hot water is from heat network		

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

Metabolic gains (Table 5), watts

126.67 126.67 126.67 126.67 126.67 126.67 126.67 126.67 126.67 126.67 126.67 126.67	(66)
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Lighting gains (calculated in Appendix L, equation L12 or L12a), also see Table 5

25.94 23.04 18.74 14.18 10.6 8.95 9.67 12.57 16.87 21.43 25.01 26.66 (67)

Appliances gains (calculated in Appendix L, equation L16 or L16a), also see Table 5

275.6 278.46 271.25 255.91 236.54 218.34 206.18 203.32 210.53 225.87 245.24 263.44 (68)

Cooking gains (calculated in Appendix L, equation L18 or L18a), also see Table 5

49.78 49.78 49.78 49.78 49.78 49.78 49.78 49.78 49.78 49.78 49.78 49.78 (69)

Pumps and fans gains (Table 5a)

3 3 3 3 3 0 0 0 0 3 3 3 (70)

Losses e.g. evaporation (negative values) (Table 5)

-84.45 -84.45 -84.45 -84.45 -84.45 -84.45 -84.45 -84.45 -84.45 -84.45 -84.45 -84.45 (71)

Water heating gains (Table 5)

160.95 158.42 153.41 142.26 135.47 128.36 123.91 127.47 131.65 139.55 150.22 159.51 (72)

Total internal gains

557.48 554.91 538.4 507.36 477.62 447.65 431.77 435.36 451.06 481.84 515.47 544.61 (73)

6. Solar gains

Solar gains in watts, calculated for each month

121.96 235.48 383.94 559.78 689.65 708.46 673.41 575.37 445.96 278.05 151.42 100.77 (83)

Total gains – internal and solar (watts)

679.45 790.39 922.34 1067.14 1167.27 1156.12 1105.17 1010.73 897.02 759.9 666.89 645.37 (84)

7. Mean internal temperature (heating season)

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

21 (85)

Utilisation factor for gains for living area, $\eta_{1,m}$ (see Table 9a)

0.98 0.97 0.92 0.81 0.65 0.47 0.34 0.39 0.63 0.88 0.97 0.99 (86)

Mean internal temperature in living area T1 (follow steps 3 and 4 in Table 9c)

19.95 20.13 20.41 20.7 20.86 20.92 20.93 20.93 20.89 20.64 20.24 19.92 (87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

19.78 19.78 19.79 19.8 19.8 19.81 19.81 19.82 19.81 19.8 19.8 19.79 (88)

Roof

Utilisation factor for gains for rest of dwelling, $\eta_{2,m}$ (see Table 9a)

0.98 0.95 0.9 0.77 0.58 0.39 0.25 0.29 0.53 0.84 0.96 0.98 (89)

Roof

Mean internal temperature in the rest of dwelling T2

18.6 18.83 19.16 19.5 19.66 19.72 19.72 19.73 19.7 19.46 18.98 18.56 (90)

Living area fraction

0.42 (91)

Mean internal temperature (for the whole dwelling)

19.17 19.37 19.69 20.01 20.17 20.22 20.23 20.23 20.2 19.96 19.51 19.13 (92)

Adjusted mean internal temperature:

19.17 19.37 19.69 20.01 20.17 20.22 20.23 20.23 20.2 19.96 19.51 19.13 (93)

8. Space heating requirement

Utilisation factor for gains,

0.97	0.95	0.9	0.78	0.6	0.41	0.28	0.33	0.57	0.84	0.95	0.98	(94)
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Useful gains, mGm , W

660.92	751.23	826.53	827.61	700.09	479.72	312.73	328.68	506.85	641.39	634.93	630.75	(95)
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Monthly average external temperature from Table U1

4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
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Heat loss rate for mean internal temperature

1323.41	1285.26	1167.9	971.76	739.13	485.61	313.54	330.17	528.66	816.73	1088.23	1316.05	(97)
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Space heating requirement for each month

492.89	358.87	253.98	103.79	29.05	0	0	0	0	130.45	326.37	509.86	(98a)
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Solar space heating calculated using Appendix H (negative quantity)

0	0	0	0	0	0	0	0	0	0	0	0	(98b)
---	---	---	---	---	---	---	---	---	---	---	---	-------

Space heating requirement for each month after solar contribution

492.89	358.87	253.98	103.79	29.05	0	0	0	0	130.45	326.37	509.86	(98c)
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	-------

Space heating requirement in kWh/m ² /year												34.08	(99)
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8c. Space Cooling requirement

Heat loss rate,

0	0	0	0	0	0	0	0	0	0	0	0	(100)
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Utilisation factor for loss

0	0	0	0	0	0	0	0	0	0	0	0	(101)
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Useful loss, mLm (watts)

0	0	0	0	0	0	0	0	0	0	0	0	(102)
---	---	---	---	---	---	---	---	---	---	---	---	-------

Gains

0	0	0	0	0	0	0	0	0	0	0	0	(103)
---	---	---	---	---	---	---	---	---	---	---	---	-------

Space cooling requirement for month, whole dwelling, continuous (kWh)												(104)
---	--	--	--	--	--	--	--	--	--	--	--	-------

0	0	0	0	0	0	0	0	0	0	0	0	(104)
---	---	---	---	---	---	---	---	---	---	---	---	-------

Cooled fraction												0	(105)
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Intermittency factor													(106)
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0	0	0	0	0	0	0	0	0	0	0	0	(106)
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Space cooling requirement for month							0					0	(107)
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0	0	0	0	0	0	0	0	0	0	0	0	(107)
---	---	---	---	---	---	---	---	---	---	---	---	-------

Space cooling requirement in kWh/m ² /year												0	(108)
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8f. Space heating requirement

Fabric Energy Efficiency,								0				0	(109)
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9a. Energy requirements – Individual heating systems including micro-CHP

Fraction of space heat from secondary/supplementary system,	0												0	(201)	
Fraction of space heat from main system(s),													1	(202)	
Fraction of main heating from main system 2,													0	(203)	
Fraction of total space heat from main system 1,													1	(204)	
Fraction of total space heat from main system 2,													0	(205)	
Efficiency of main space heating system 1 (in %),													219.3	(206)	
Efficiency of main space heating system 2 (in %),													0	(207)	
Efficiency of secondary/supplementary heating system, %,													0	(208)	
Cooling System Seasonal Energy Efficiency Ratio,	0												0	(209)	
Space heating requirement (calculated above),															
	0	0	0	0	0	0	0	0	0	0	0	0	0	(210)	
Space heating fuel (main heating system 1), kWh/month	0												0		
	224.76	163.64	115.81	47.33	13.25	0	0	0	0	59.48	148.82	232.5		(211)	
Space heating fuel (main heating system 2), kWh/month	0												0		
	0	0	0	0	0	0	0	0	0	0	0	0		(213)	
Space heating fuel (secondary), kWh/month	0												0		
	0	0	0	0	0	0	0	0	0	0	0	0		(215)	
Output from water heater),	0												190.4	(216)	
Efficiency of water heater															
	190.4	190.4	190.4	190.4	190.4	190.4	190.4	190.4	190.4	190.4	190.4	190.4	190.4	(217)	
Fuel for water heating															
	148.6	131.54	139.75	122.56	118.67	106.75	105.08	109.26	110.49	123.45	131.61	146.91	1494.68	(219)	
Space Cooling															
	0	0	0	0	0	0	0	0	0	0	0	0		(221)	
Annual totals															
								kWh/year	kWh/year						
Space heating fuel used, main system 1													1005.59	(211)	
Space heating fuel used, main system 2													0	(213)	
Space heating fuel used, secondary													0	(215)	
Water heating fuel used													1494.68	(219)	
Electricity for instantaneous electric shower(s)													0	(64a)	
Space cooling fuel used													0	(221)	
Electricity for pumps, fans and electric keep-hot															
Mechanical vent fans - balanced, extract or positive input from outside								0	0					0	(230a)
warm air heating system fans													0	(230b)	
Heating circulation pump or water pump within warm air heating unit													0	(230c)	
Oil boiler auxiliary (oil pump, flue fan, etc; excludes circulation pump)													0	(230d)	
Gas boiler auxiliary (flue fan, etc; excludes circulation pump)													0	(230e)	
Maintaining electric keep-hot facility for gas combi boiler													0	(230f)	
Pump for solar water heating													0	(230g)	
Pump for storage WWHRS													0	(230h)	
Total electricity for the above													0	(231)	
Electricity for lighting													183.23	(232)	

Energy saving/generation technologies (Appendices M, N) - Energy used in dwelling

Electricity generated by PVs (Appendix M) (negative quantity)

0	0	0	0	0	0	0	0	0	0	0	0	0	0	(233a)
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Electricity generated by wind turbines (Appendix M) (negative quantity)

0	0	0	0	0	0	0	0	0	0	0	0	0	0	(234a)
---	---	---	---	---	---	---	---	---	---	---	---	---	---	--------

Electricity generated by hydro-electric generators

0	0	0	0	0	0	0	0	0	0	0	0	0	0	(235a)
---	---	---	---	---	---	---	---	---	---	---	---	---	---	--------

Electricity used or net electricity generated by micro-CHP

0	0	0	0	0	0	0	0	0	0	0	0	0	0	(235c)
---	---	---	---	---	---	---	---	---	---	---	---	---	---	--------

Energy saving/generation technologies (Appendices M, N) - Energy exported

Electricity generated by PVs (Appendix M) (negative quantity)

0	0	0	0	0	0	0	0	0	0	0	0	0	0	(233b)
---	---	---	---	---	---	---	---	---	---	---	---	---	---	--------

Electricity generated by wind turbines (Appendix M) (negative quantity)

0	0	0	0	0	0	0	0	0	0	0	0	0	0	(234b)
---	---	---	---	---	---	---	---	---	---	---	---	---	---	--------

Electricity generated by hydro-electric generators

0	0	0	0	0	0	0	0	0	0	0	0	0	0	(235b)
---	---	---	---	---	---	---	---	---	---	---	---	---	---	--------

Electricity used or net electricity generated by micro-CHP

0	0	0	0	0	0	0	0	0	0	0	0	0	0	(235d)
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Appendix Q items: annual energy

Appendix Q, <item 1 description>

Fuel kWh/year

energy saved	0	(236a)
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energy used	0	(237a)
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Total delivered energy for all uses	2683.51	
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10a. Fuel costs – Individual heating systems including micro-CHP

Fuel required	kWh/year	Fuel price	Fuel cost £/year
Space heating - main system 1 (electric off-peak tariff			
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		165.82 (240a)
Low-rate fraction	0		165.82 (240b)
High-rate cost	0		0 (240c)
Low-rate cost	0		0 (240d)
Space heating - main system 1 cost (other fuel)	0		0 (240e)
Space heating - main system 2 (electric off-peak tariff			
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		165.82 (241a)
Low-rate fraction	0		165.82 (241b)
High-rate cost	0		0 (241c)
Low-rate cost	0		0 (241d)
Space heating - main system 2 cost (other fuel)	0		0 (241e)
Space heating - secondary (electric off-peak tariff)			
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		165.82 (242a)

Low-rate fraction	0	165.82	(242b)
High-rate cost	0	0	(242c)
Low-rate cost	0	0	(242d)
Space heating - secondary cost (other fuel)	0	0	(242e)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0	0	(243)
Low-rate fraction	0	0	(242b)
High-rate cost	0	0	(242c)
Low-rate cost	0	0	(242d)
Water heating cost (other fuel)	0	246.47	(247)
(for a DHW-only heat network use (342a) or (342b) instead of (247))			
Energy For instantaneous electric shower(s)	0	0	(247a)
Space cooling	0	0	(248)
Pumps, fans And electric keep-hot	0	0	(249)
Energy For lighting	0	30.22	(250)
Additional standing charges	0	92	(251)
Energy saving/generation technologies	0	0	(252)
Appendix Q, <item 1 description>	Fuel	kWh/year	
energy saved Or generated	0	0	(253)
energy used	0	0	(254)
Total energy cost	0	534.51	(255)
11a. SAP rating – Individual heating systems including micro-CHP			
Energy cost deflator	0	0	(256)
Energy cost factor (ECF)	0	0	(257)
SAP rating	0	0	(258)

11a. SAP rating – Individual heating systems including micro-CHP

Energy cost deflator	0.36	(256)
Energy cost factor (ECF)	1.75	(257)
SAP rating	71.57	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy KWh/year	Emission factor kg	Emissions kg CO2/year	
Space heating - main system 1			157.51	(261)
Space heating - main system 2			0	(262)
Space heating - secondary			0	(263)
Energy for water heating			313.88	(264)
Energy for instantaneous electric shower(s)			0	(264a)

Space and water heating		471.4	(265)
Space cooling		0	(266)
Electricity for pumps, fans and electric keep		0	(267)
Electricity for lighting		26.45	(268)
energy saved or generated	0	0	(269b)
Appendix Q items			
energy saved	0	0	
energy used	0	0	
energy saved	0	0	(270b)
energy used		0	(271b)
Total CO ₂ , kg/year		497.84	(272)
Dwelling CO ₂ Emission Rate		7.69	(273)
EI rating		94	(274)

13a. Primary Energy – Individual heating systems including micro-CHP

	Energy KWh/year	Emission factor kg	Emissionsr kg CO ₂ /year	
Space heating - main system 1			1588.7	(275)
Space heating - main system 2			0	(276)
Space heating - secondary			0	(277)
Energy for water heating			1688.99	(278)
Energy for instantaneous electric shower(s)			0	(278a)
Space and water heating			3277.69	(279)
Space cooling			0	(280)
Electricity for pumps, fans and electric keep			0	(281)
Electricity for lighting			281.05	(282)
energy saved or generated	0		0	
Appendix Q items				
energy saved	0		0	
energy used	0		0	
energy saved	0		0	(284b)
energy used			0	(285b)
Total PE, kWh/year			3558.74	(286)
Dwelling PE Rate			55	(287)