EPS Group
Energy Consultancy and Compliance Services

Project No: 16335

London Borough of Merton

Energy Statement

Proposed New Dwellings at Land Between 60 & 66 Alwyne Road, London, SW19 7AE

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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

STROMA CERTIFIED · elmhurst accredited energy assessor · elmhurst energy APPROVED AIRTIGHTNESS SCHEME MEMBER · SAP · THE CODE FOR SUSTAINABLE HOMES · Constructionline Part of Capita plc

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Executive Summary

This report has been commissioned in response to the Sustainable and Low Carbon Planning Policy requirements of Merton London Borough Council in respect to the proposed construction of 3no. new dwellings at Land between 60 & 66 Alwyne Road, London, SW19 7AE. The methodology used herein is consistent with Approved Document L1 2021 of the Building Regulations.

In accordance with the Energy Hierarchy detailed within The London Plan 2021, the proposed development is predicted to emit at least **60.31%** less 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 enhanced insulation standards, improved lighting efficiencies and the installation of an MCS Approved Air Source Heat Pump with underfloor zoned heating in each dwelling This will provide the dwellings with heating and hot water from a low carbon source.

The proposed development is therefore deemed to far exceed the mandatory planning requirements of Policy CS 15 of Merton Council's Core Planning Strategy (July 2011) and moreover the Council's '*Explanatory Note: Approaches to Sustainable Design and Construction (October 2020),* which provides guidance on how developments should comply with the requirements of Policy CS15.

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1.0 Introduction

1.1 EPS Group have been appointed to provide an Energy Statement to respond to the Sustainable and Low Carbon Planning Policy requirements of Merton London Borough Council in respect to the proposed construction of 3no. new dwellings at Land between 60 & 66 Alwyne Road, London, SW19 7AE.

1.2 It is anticipated that the proposed works will need to comply with 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 (CO_2) emissions of the development and the associated reduction targets.

1.4 The following fuel emission factors have been used in the supporting calculations as defined by the updated National Calculations Method (NCM), SAP 10:

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

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

2.0 Planning Policy Context

2.1 National

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

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

152. The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and costal 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 Merton Council

The relevant extracts from the London Borough of Merton Core Planning Strategy (July 2011) are detailed below:

"Policy CS 15 – Climate Change

All minor and major development, including major refurbishment, will be required to demonstrate the following unless developers can robustly justify why full compliance with the policy requirements is not viable:

a. How it makes effective use of resources and materials, minimises water use and CO2 emissions;

b. How development proposals are making the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:

1. Be lean: use less energy
2. Be clean: supply energy efficiently
3. Be green: use renewable energy

c. How it is sited and designed to withstand the long term impacts of climate change, particularly the effect of rising temperatures on mechanical cooling requirements;

d. Regeneration plan in town centre are an excellent opportunity to implement District Heat and Power networks, and all major development would be strongly encourage to be 'Multi

Utility Services Company (MUSCo) ready where viable and actively contribute to the networks where possible;

e. We will require all new development comprising the creation of new dwellings to achieve Code for Sustainable Homes Level 4;

f. All non-domestic development over 500m² which does not qualify for assessment under Code for Sustainable Homes will be expected to be built to a minimum of BREEAM (Building Research Establishment Assessment Method) Very Good standard, and meet CO2 reduction targets in line with the requirements of the London Plan or national policy, whichever is the greater."

Guidance on how developments should comply with the requirements of Policy CS15 is provided within the Council's '*Explanatory Note: Approaches to Sustainable Design and Construction October 2020)*', the relevant sections of which state the following in respect to new dwellings:

*"*Code for Sustainable Homes - In accordance with the Government Ministerial Statement of 25 March 2015, new residential developments in the borough granted planning permission after 25 March 2015 are no longer required to achieve a specified level of the Code for Sustainable Homes. However, Merton will continue to enforce mandatory minimum requirements for energy performance and water efficiency for the delivery of new residential units across the borough as set out in section 4.2 below…*

…4.1 Carbon Emissions Factors (SAP 10)

Developers should note that from January 2019 and until central Government updates Part L of the Building Regulations, in line with GLA guidance, Merton is encouraging planning applicants to use the updated SAP 10 carbon emission factors when estimating CO2 emission performance against London Plan and Merton policies. This will ensure that the assessment of new developments better reflects the actual carbon emissions associated with their expected operation given the decarbonisation of the electricity grid. Developers should continue to use the current Building Regulations methodology (using SAP 2012 emissions factors) for estimating energy performance against Part L 2013 requirements, but with the outputs manually converted using the SAP 10 emission factors for the energy assessment. A carbon emissions reporting spreadsheet has been developed by the GLA for this purpose which should be submitted alongside the energy assessment. It should be noted that the use of the SAP 10 emission factors in this context is for demonstrating performance against planning policy targets and, as such, is separate to Building Regulation compliance. Applications should therefore ensure that compliance with Building Regulations is maintained. Developers should refer to the GLA's Energy Planning Guidance for detailed guidance on using SAP 10. Robust justification will need to be provided if SAP 2012 emissions factors are used. Where SAP 10 is used, the energy statement should clearly state that SAP 10 emissions factors have been used for the purpose of the energy assessment and should only provide the emissions using SAP 10, not SAP 2012. There should be a clear audit trail from the SAP/ BRUKL outputs, to the carbon emissions reporting spreadsheet and the energy statement.

…4.2.1 Minor (1-9 units)

Minor development proposals should provide a sustainability statement (either within the Design and Access Statement or a standalone statement), and all supporting evidence, outlining how the development will make the fullest contribution to minimising carbon dioxide emissions in accordance with the Mayor's energy hierarchy as set out in section 4.2 above. As a minimum, minor schemes will need to achieve no less than a 19% reduction in regulated carbon dioxide emissions (beyond Buildings Regulations Part L 2013) on-site.

However, please note, developers will be expected to demonstrate that on-site savings have been maximised at all stages of the energy hierarchy whether the minimum target has already been achieved or not."

2.3 Conclusions

On review of the above planning policies and moreover the Council's '*Explanatory Note: Approaches to Sustainable Design and Construction October 2020)*', it is evident that there is a need to construct dwellings with an energy performance standard beyond the mandatory requirements of Approved Document Part L1A 2013 of the Building Regulations. This will need to be achieved by following the Energy Hierarchy publicised within the London Plan, which promotes the use of Lean, Clean and Green measures.

It should also be noted that since the Explanatory Note was published, central Government have subsequently updated Part L of the Building Regulations to include SAP 10 carbon emission factors, in June 2022. Furthermore, as part of this update there was also a 31% carbon reduction in comparison to Part L1A 2013 of the Building Regulations.

In view of the above, by targeting compliance with the latest version of Approved Document L1 2021 of the Building Regulations, the proposed development would exceed the equivalent energy performance to Code Level 4 (a reduction in regulated carbon dioxide (CO_2) emissions of at least 19% in comparison to Part L1A 2013) by a further 12%.

3.0 Proposed Energy Strategy and Performance – Lean Measures

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

Table 1: Proposed Design Specification Fabric Insulation, HVAC and Lighting Standards		
Element / Feature	**Current Approved Document L1 2021 Minimal Acceptable Standard**	**Proposed Development Design Target**
External Wall U-Value (including Basement)	0.26 W/m^{2}K	**0.18 W/m^{2}K**
Semi Exposed Wall U-Value (to unheated communal entrance)	0.26 W/m^{2}K	**0.16 W/m^{2}K (including sheltering factors)**
Party Wall U-value	0.20 W/m^{2}K	**0.00 W/m^{2}K**
Ground Floors U-value	0.18 W/m^{2}K	**0.12 – 0.14 W/m^{2}K (plot dependent)**
Flat Roof U-Value	0.16 W/m^{2}K	**0.14 W/m^{2}K**
Pitched Roof U-Value	0.16 W/m^{2}K	**0.14 W/m^{2}K**
Windows & Rooflights U-value	1.60 W/m^{2}K	**1.20 W/m^{2}K**
Entrance doors (to unheated communal entrance)	1.60 W/m^{2}K	**0.97 – 1.20 W/m^{2}K (including sheltering factors)**
Air Permeability	10 m^3/m^2.h	**5.00 m^3/m^2.h**
Thermal Bridging	-	**Concrete Block Association Full Fill Cavity Thermal Bridging Details**
Lighting	All fixed lighting to have an efficacy of 75 lm/W	**80 lm/W**
Hot Water Storage	-	**150 litre storage cylinders with a declared heat loss of 1.89 kWh/day**
Heating Controls	Programmer, Thermostat & TRVs	**Independent Time and Temperature Zone Control**
Ventilation	-	**Natural ventilation with Intermittent Extract Fans**

3.2 The above build standards will ensure that the proposed development has a reduced energy demand in comparison to the minimum requirements of Approved Document L1 2021 of the Building Regulations. This will help to reduce the associated CO_2 emissions arising from occupancy.

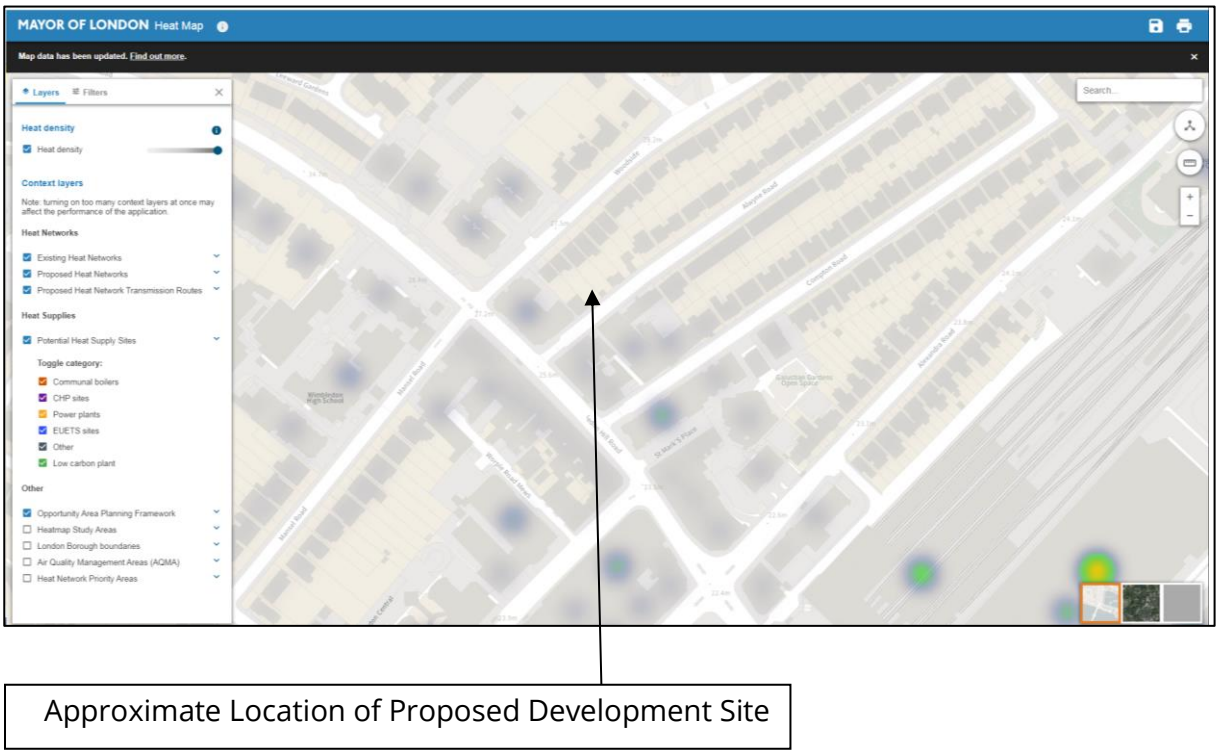
3.3 Whilst the orientations of the proposed dwellings are somewhat dictated by the confines of the existing site, it is noted that the risk of overheating has been reduced by adopting internal layouts that will facilitate natural cross ventilation. This should reduce the likelihood of any future occupants installing mechanical cooling.

4.0 Proposed Energy Strategy and Performance – Clean Measures

4.1 Where feasible, The London Plan 2021 advocates the use of zero or low emission decentralised energy, prioritising connection to district heating and cooling networks and utilising secondary heat sources. In accordance with the 'Clean' step of the aforementioned Energy Hierarchy, developments should look to exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly.

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

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



4.3 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.

5.0 Proposed Energy Strategy and Performance – Green Measures

5.1 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 use within the proposed development.

5.2 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.

5.3 Solar Photovoltaic

Benefits	• 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 proposed building benefits from a large flat roof area that would be suitable for the installation of PV panels.
Site Limitations / Restrictions	• PV panels are not aesthetically pleasing and may detract from the visual appearance of the building but this could be mitigated by setting the panels back from the edge of the building so that they are not visible from street level. • As a result of the rapid decarbonisation of the national grid, the amount of CO_2 savings with this technology is limited as the CO_2 emission factor for grid displaced electricity is relatively low.
Conclusion	• It is not proposed to use this technology within the proposed development.

5.4 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 flat roof would be an ideal location for the siting of the collectors.

Site Limitations / Restrictions	• The amount of CO_2 savings with this technology is restricted as there is no benefit to producing more hot water than is used within a dwelling. • Solar collectors are not aesthetically pleasing and may detract from the visual appearance of the building but as with PV this could be mitigated by setting the collectors back from the edge of the building.
Conclusion	• It is not proposed to use this technology within the proposed development.

5.5 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.
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.

5.6 Air Source Heat Pump

Benefits	• High operating efficiencies (CoPs). • Reduced visual impact on the property. • Reliable and proven technology. • Generally low maintenance costs.
Site Limitations / Restrictions	• Often require a supplementary immersion heating system for the production of hot water. • The external unit 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 an acoustic housing unit.
Conclusion	• **It is proposed to use this technology within the proposed development.**

5.7 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.

5.8 Upon review of the above technologies, the use of highly efficient MCS Approved Air Source Heat Pumps (ASHP) to zoned underfloor heating is recommended as a means of providing a low carbon source of heating and hot water to the dwellings.

6.0 Calculated Energy Performance (Illustrative)

6.1 Having identified the use of MCS Approved Air Source Heat Pumps as being the most suitable renewable technology for use within the development, predictive SAP 2012 calculations were prepared for the dwellings based upon the 'Lean' specifications outlined within Section 3 of this report, coupled with the ASHP proposals detailed within Paragraph 5.8.

6.2 The results of the illustrative SAP Calculations are summarised within Table 2 below with the full calculations detailed for review within the Appendices of this report:

Table 2: Proposed Annual CO_2 Emissions (SAP 10)

Flat	Floor Area (m^2)	Target Emission Rate (TER)	Dwelling Emission Rate (DER)	Annual Baseline CO_2 Emissions (Kg / Year)	Annual Proposed CO_2 Emissions (Kg / Year)
1	66.57	12.62	5.32	840.21	354.12
2	66.57	14.32	5.93	953.04	394.75
3	68.77	15.67	5.68	1,077.78	390.59
Total Annual Baseline CO_2 Emissions (Kg / Year)				**2,871.03**	
Total Annual Proposed CO_2 Emissions (Kg / Year)				**1,139.49**	
Total Annual Percentage Reduction in CO_2 Emissions				**60.31%**	

6.3 Upon review of the above, it is evident that the proposed development will achieve a reduction in regulated CO_2 emissions of **60.31%** in comparison to the current edition of Approved Document L1 2021 of the Building Regulations.

6.4 This improvement far exceeds the mandatory planning requirements of Policy CS 15 of Merton Council's Core Planning Strategy (July 2011) and moreover the Council's '*Explanatory Note: Approaches to Sustainable Design and Construction (October 2020),* which provides guidance on how developments should comply with the requirements of Policy CS15.

EPS Group
Energy Consultancy and Compliance Services

Appendix 1:

Baseline TER Calculations (SAP Derived)

TER WORKSHEET

Dwelling Reference: 16335 - Flat 1
Dwelling Type: New Dwelling Design Stage

Between 60 & 66 Alwyne Road
Woodside
London
SW19 7AF

1. Overall dwelling dimensions

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	34.85 (1a)	x	2.5	(2a) =	87.12	(3a)
Ground Floor	31.72 (1b)	x	2.86	(2b) =	90.72	(3b)
Total floor area TFA					66.57	(4)
Dwelling volume					177.84	(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)	0.17	0.17	(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, (m³/h/m²)	5	5	(17)
Air permeability value, AP4, (m³/h/m²)	0	0	(17a)
Air permeability value)	0.42	0.42	(18)
Number of sides on which dwelling is sheltered	2	2	(19)

Shelter factor													0.85	(20)
Infiltration rate incorporating shelter factor													0.36	(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)														
	0.45	0.44	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42	4.67	(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														
	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59		(24d)
Effective air change rate														
	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59		(25)
Effective air change rate from PCDB:														
	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	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 (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Solid door							2.04	(26)
Semi-glazed door							2.04	(26a)
Window							20.45	(27)
Roof window							1.55	(27a)
Basement floor				0			0	(28)
Ground floor				3833.5			4.18	(28a)
Exposed floor				0			0	(28b)
Basement wall				751.8			2.26	(29)
External wall				726.6			2.12	(29a)

Roof	21.51	0.31	(30)
Total area of external elements ∑A, m²		83.19	(31)
Party Wall		0	(32)
Party floor		0	(32a)
Party ceiling		3203	(32b)
Internal wall **		0	(33c)
Internal floor		0	(32d)
Internal ceiling floor		0	(32e)
Fabric heat loss, W/K = ∑ (A x U)		32.91	(33)
Heat capacity Cm = ∑(A x k)		12565.71	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K		250	(35)
Linear Thermal bridges: ∑ (L x Ψ) calculated using Appendix K		4.98	(36)
Point Thermal bridges: ∑χ (W/K) if significant point thermal bridge present and values available		4.98	(36a)
Total fabric heat loss H = ∑(A × U) + ∑(L × Ψ) +∑χ		37.89	(37)

Ventilation heat loss calculated monthly

35.39	35.15	34.92	33.84	33.64	32.7	32.7	32.52	33.06	33.64	34.05	34.48	(38)

Heat transfer coefficient, W/K

73.28	73.04	72.81	71.73	71.53	70.59	70.59	70.41	70.95	71.53	71.94	72.37	(39)

Heat loss parameter (HLP), W/m²K

1.1	1.1	1.09	1.08	1.07	1.06	1.06	1.06	1.07	1.07	1.08	1.09	(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 2.16 (42)

Hot water usage in litres per day for mixer showers, Vd,shower (from Appendix J)

83.1	81.85	80.03	76.55	73.98	71.12	69.49	71.29	73.27	76.35	79.91	82.78	(42a)

Hot water usage in litres per day for baths, Vd,bath (from Appendix J)

26.11	25.73	25.18	24.17	23.42	22.58	22.13	22.67	23.26	24.16	25.19	26.02	(42b)

Hot water usage in litres per day for other uses, Vd,other (from Appendix J)

36.75	35.41	34.08	32.74	31.41	30.07	30.07	31.41	32.74	34.08	35.41	36.75	(42c)

Annual average hot water usage in litres per day Vd,average (from Appendix J) 134.46 (43)

Hot water usage in litres per day for each month Vd,m = (42a) + (42b) + (42c)

145.96	142.99	139.29	133.46	128.8	123.77	121.69	125.37	129.28	134.58	140.51	145.56	1611.26	(44)

Energy content of hot water used = 4.18 x Vd,m x nm x DTm / 3600 kWh/month (from Appendix J)

231.17	203.62	214.08	182.71	173.4	152.19	147.17	155.24	159.41	182.63	200.18	227.91	2229.69	(45)

Distribution loss (46) = 0.15 x (45)

34.68	30.54	32.11	27.41	26.01	22.83	22.08	23.29	23.91	27.39	30.03	34.19	(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) × (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 [(47) – Vs] ÷ (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)

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 × (45) + (46) + (57) + (59) + (61)

286.07	253.21	268.98	235.84	228.3	205.32	202.07	210.14	212.54	237.53	253.31	282.81	2876.11	(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)

286.07	253.21	268.98	235.84	228.3	205.32	202.07	210.14	212.54	237.53	253.31	282.81	2876.11	(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 × (45) + (61) + (64a)] + 0.8 x [(46) + (57) + (59)]

120.79	107.37	115.1	103.25	101.57	93.11	92.85	95.54	95.51	104.65	109.06	119.7	(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

129.6	129.6	129.6	129.6	129.6	129.6	129.6	129.6	129.6	129.6	129.6	129.6	(66)

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

26.24	23.31	18.96	14.35	10.73	9.06	9.79	12.72	17.07	21.68	25.3	26.97	(67)

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

282.33	285.26	277.88	262.16	242.32	223.68	211.22	208.29	215.67	231.39	251.23	269.88	(68)

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

50.12	50.12	50.12	50.12	50.12	50.12	50.12	50.12	50.12	50.12	50.12	50.12	(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

-86.4	-86.4	-86.4	-86.4	-86.4	-86.4	-86.4	-86.4	-86.4	-86.4	-86.4	-86.4	(71)

Water heating gains (Table 5)

162.35	159.78	154.71	143.41	136.53	129.31	124.8	128.41	132.65	140.65	151.48	160.89	(72)

Total internal gains

567.24	564.68	547.87	516.24	485.9	455.37	439.13	442.74	458.72	490.04	524.33	554.06	(73)

6. Solar gains

Solar gains in watts, calculated for each month

105.35	198.26	321.47	482.81	618.17	647.81	610.36	504.11	376.49	232.63	129.6	87.94	(83)

Total gains – internal and solar (watts)

672.59	762.94	869.33	999.05	1104.07	1103.18	1049.49	946.85	835.2	722.67	653.93	642	(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, ⍰1,m (see Table 9a)

0.98	0.96	0.91	0.78	0.59	0.41	0.3	0.34	0.57	0.85	0.96	0.98	(86)

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

20.25	20.4	20.62	20.83	20.92	20.94	20.94	20.94	20.93	20.79	20.49	20.23	(87)

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

20	20	20.01	20.02	20.02	20.03	20.03	20.04	20.03	20.02	20.02	20.01	(88)

Roof Utilisation factor for gains for rest of dwelling, ⍰2,m (see Table 9a)

0.97	0.95	0.89	0.73	0.53	0.35	0.23	0.27	0.5	0.81	0.95	0.98	(89)

Roof Mean internal temperature in the rest of dwelling T2

19.15	19.33	19.6	19.84	19.93	19.96	19.96	19.96	19.95	19.81	19.46	19.13	(90)

Living area fraction 0.33 (91)

Mean internal temperature (for the whole dwelling)

19.51	19.69	19.93	20.17	20.26	20.28	20.28	20.29	20.27	20.13	19.8	19.49	(92)

Adjusted mean internal temperature:

19.51	19.69	19.93	20.17	20.26	20.28	20.28	20.29	20.27	20.13	19.8	19.49	(93)

8. Space heating requirement

Utilisation factor for gains,

0.97	0.95	0.88	0.74	0.54	0.36	0.25	0.29	0.52	0.82	0.94	0.98	(94)

Useful gains, mGm , W

652.5	721.68	769.1	740.1	599.87	399.98	259.93	273.33	431.07	589.7	617.72	626.08	(95)

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

1114.78	1080.05	978.14	808.32	612.07	401.1	260.04	273.57	437.78	681.78	913.36	1106.49	(97)

Space heating requirement for each month

343.94	240.83	155.53	49.12	9.08	0	0	0	0	68.51	212.86	357.42	(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

343.94	240.83	155.53	49.12	9.08	0	0	0	0	68.51	212.86	357.42	(98c)

Space heating requirement in kWh/m²/year 21.59 (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) (104)

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	0	0	(107)

Space cooling requirement in kWh/m²/year 0 (108)

8f. Space heating requirement

Fabric Energy Efficiency, 0 0 (109)

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		(210)
Space heating fuel (main heating system 1), kWh/month								0					0	
156.83	109.82	70.92	22.4	4.14	0	0	0		0	31.24	97.07	162.98		(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		(217)
Fuel for water heating														
150.25	132.99	141.27	123.86	119.9	107.83	106.13	110.37		111.63	124.75	133.04	148.53	1510.56	(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													655.4	(211)
Space heating fuel used, main system 2													0	(213)
Space heating fuel used, secondary													0	(215)
Water heating fuel used													1510.56	(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													185.38	(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			2351.34	

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		108.07	(240a)
Low-rate fraction	0		108.07	(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		108.07	(241a)
Low-rate fraction	0		108.07	(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		108.07	(242a)

Low-rate fraction	0		108.07	(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		249.09	(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		30.57	(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		387.74	(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)	1.25		(257)
SAP rating	79.72		(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			103.21	(261)
Space heating - main system 2			0	(262)
Space heating - secondary			0	(263)
Energy for water heating			212.89	(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		0	(267)
Electricity for lighting		26.76	(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 CO2, kg/year		342.85	(272)
Dwelling CO2 Emission Rate		5.15	(273)
EI rating		96	(274)

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

	Energy KWh/year	Emission factor kg	Emissionsr kg CO2/year	
Space heating - main system 1			1037.45	(275)
Space heating - main system 2			0	(276)
Space heating - secondary			0	(277)
Energy for water heating			2297.75	(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			0	(281)
Electricity for lighting			284.35	(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			3619.55	(286)
Dwelling PE Rate			54.37	(287)

TER WORKSHEET

Dwelling Reference: 16335 - Flat 2
Dwelling Type: New Dwelling Design Stage

Between 60 & 66 Alwyne Road
Woodside
London
SW19 7AF

1. Overall dwelling dimensions

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	34.85 (1a)	x	2.5	(2a) =	87.12	(3a)
Ground Floor	31.72 (1b)	x	2.86	(2b) =	90.72	(3b)
Total floor area TFA					66.57	(4)
Dwelling volume					177.84	(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)	0.17	0.17	(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, (m³/h/m²)	5	5	(17)
Air permeability value, AP4, (m³/h/m²)	0	0	(17a)
Air permeability value)	0.42	0.42	(18)
Number of sides on which dwelling is sheltered	1	1	(19)

Shelter factor	0.92	(20)
Infiltration rate incorporating shelter factor	0.39	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	
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)													
0.49	0.48	0.47	0.43	0.42	0.37	0.37	0.36	0.39	0.42	0.44	0.46	5.08	(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

0.62	0.62	0.61	0.59	0.59	0.57	0.57	0.56	0.57	0.59	0.59	0.6	(24d)

Effective air change rate

0.62	0.62	0.61	0.59	0.59	0.57	0.57	0.56	0.57	0.59	0.59	0.6	(25)

Effective air change rate from PCDB:

0.62	0.62	0.61	0.59	0.59	0.57	0.57	0.56	0.57	0.59	0.59	0.6	(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 (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Solid door							2.04	(26)
Semi-glazed door							2.04	(26a)
Window							20.45	(27)
Roof window							1.55	(27a)
Basement floor				0			0	(28)
Ground floor				3833.5			4.88	(28a)
Exposed floor				0			0	(28b)
Basement wall				2029.8			6.09	(29)
External wall				2205.6			6.56	(29a)

Roof	21.51	0.31	(30)
Total area of external elements ∑A, m²		129.14	(31)
Party Wall		0	(32)
Party floor		0	(32a)
Party ceiling		3203	(32b)
Internal wall **		0	(33c)
Internal floor		0	(32d)
Internal ceiling floor		0	(32e)
Fabric heat loss, W/K = ∑ (A x U)		41.87	(33)
Heat capacity Cm = ∑(A x k)		13254.96	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K		250	(35)
Linear Thermal bridges: ∑ (L x Ψ) calculated using Appendix K		6.11	(36)
Point Thermal bridges: ∑χ (W/K) if significant point thermal bridge present and values available		6.11	(36a)
Total fabric heat loss H = ∑(A × U) + ∑(L × Ψ) +∑χ		47.98	(37)

Ventilation heat loss calculated monthly

36.5	36.22	35.95	34.67	34.43	33.32	33.32	33.11	33.75	34.43	34.91	35.42	(38)

Heat transfer coefficient, W/K

84.48	84.21	83.93	82.65	82.42	81.3	81.3	81.09	81.73	82.42	82.9	83.41	(39)

Heat loss parameter (HLP), W/m²K

1.27	1.26	1.26	1.24	1.24	1.22	1.22	1.22	1.23	1.24	1.25	1.25	(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 2.16 (42)

Hot water usage in litres per day for mixer showers, Vd,shower (from Appendix J)

83.1	81.85	80.03	76.55	73.98	71.12	69.49	71.29	73.27	76.35	79.91	82.78	(42a)

Hot water usage in litres per day for baths, Vd,bath (from Appendix J)

26.11	25.73	25.18	24.17	23.42	22.58	22.13	22.67	23.26	24.16	25.19	26.02	(42b)

Hot water usage in litres per day for other uses, Vd,other (from Appendix J)

36.75	35.41	34.08	32.74	31.41	30.07	30.07	31.41	32.74	34.08	35.41	36.75	(42c)

Annual average hot water usage in litres per day Vd,average (from Appendix J) 134.46 (43)

Hot water usage in litres per day for each month Vd,m = (42a) + (42b) + (42c)

145.96	142.99	139.29	133.46	128.8	123.77	121.69	125.37	129.28	134.58	140.51	145.56	1611.26	(44)

Energy content of hot water used = 4.18 x Vd,m x nm x DTm / 3600 kWh/month (from Appendix J)

231.17	203.62	214.08	182.71	173.4	152.19	147.17	155.24	159.41	182.63	200.18	227.91	2229.69	(45)

Distribution loss (46) = 0.15 x (45)

34.68	30.54	32.11	27.41	26.01	22.83	22.08	23.29	23.91	27.39	30.03	34.19	(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) × (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 [(47) – Vs] ÷ (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)

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 × (45) + (46) + (57) + (59) + (61)

286.07	253.21	268.98	235.84	228.3	205.32	202.07	210.14	212.54	237.53	253.31	282.81	2876.11	(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)

286.07	253.21	268.98	235.84	228.3	205.32	202.07	210.14	212.54	237.53	253.31	282.81	2876.11	(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 × (45) + (61) + (64a)] + 0.8 x [(46) + (57) + (59)]

120.79	107.37	115.1	103.25	101.57	93.11	92.85	95.54	95.51	104.65	109.06	119.7	(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

129.6	129.6	129.6	129.6	129.6	129.6	129.6	129.6	129.6	129.6	129.6	129.6	(66)

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

26.24	23.31	18.96	14.35	10.73	9.06	9.79	12.72	17.07	21.68	25.3	26.97	(67)

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

282.33	285.26	277.88	262.16	242.32	223.68	211.22	208.29	215.67	231.39	251.23	269.88	(68)

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

50.12	50.12	50.12	50.12	50.12	50.12	50.12	50.12	50.12	50.12	50.12	50.12	(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

-86.4	-86.4	-86.4	-86.4	-86.4	-86.4	-86.4	-86.4	-86.4	-86.4	-86.4	-86.4	(71)

Water heating gains (Table 5)

162.35	159.78	154.71	143.41	136.53	129.31	124.8	128.41	132.65	140.65	151.48	160.89	(72)

Total internal gains

567.24	564.68	547.87	516.24	485.9	455.37	439.13	442.74	458.72	490.04	524.33	554.06	(73)

6. Solar gains

Solar gains in watts, calculated for each month

105.35	198.26	321.47	482.81	618.17	647.81	610.36	504.11	376.49	232.63	129.6	87.94	(83)

Total gains – internal and solar (watts)

672.59	762.94	869.33	999.05	1104.07	1103.18	1049.49	946.85	835.2	722.67	653.93	642	(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, ⍰1,m (see Table 9a)

0.98	0.97	0.93	0.83	0.65	0.46	0.34	0.39	0.64	0.89	0.97	0.99	(86)

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

20.05	20.2	20.45	20.73	20.88	20.93	20.93	20.93	20.9	20.68	20.32	20.02	(87)

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

19.87	19.87	19.87	19.89	19.89	19.9	19.9	19.91	19.9	19.89	19.88	19.88	(88)

Roof Utilisation factor for gains for rest of dwelling, ⍰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

18.78	18.98	19.28	19.61	19.76	19.82	19.82	19.82	19.79	19.57	19.14	18.76	(90)

Living area fraction 0.33 (91)

Mean internal temperature (for the whole dwelling)

19.2	19.39	19.67	19.98	20.13	20.18	20.19	20.19	20.16	19.94	19.53	19.18	(92)

Adjusted mean internal temperature:

19.2	19.39	19.67	19.98	20.13	20.18	20.19	20.19	20.16	19.94	19.53	19.18	(93)

8. Space heating requirement

Utilisation factor for gains,

0.97	0.95	0.91	0.79	0.6	0.41	0.28	0.32	0.57	0.85	0.95	0.98	(94)

Useful gains, mGm , W

655.08	728.43	788.1	786.99	664.1	450.06	291.24	306.32	477.62	614.79	623.72	627.99	(95)

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

1258.86	1219.76	1105.38	915.86	694.98	453.88	291.69	307.25	495.12	769.66	1030.39	1249.37	(97)

Space heating requirement for each month

449.21	330.18	236.06	92.79	22.97	0	0	0	0	115.22	292.8	462.31	(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

449.21	330.18	236.06	92.79	22.97	0	0	0	0	115.22	292.8	462.31	(98c)

Space heating requirement in kWh/m²/year 30.07 (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) (104)

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	0	0	(107)

Space cooling requirement in kWh/m²/year 0 (108)

8f. Space heating requirement

Fabric Energy Efficiency, 0 0 (109)

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		(210)
Space heating fuel (main heating system 1), kWh/month								0					0	
204.84	150.56	107.64	42.31	10.48	0	0	0		0	52.54	133.52	210.81		(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		(217)
Fuel for water heating														
150.25	132.99	141.27	123.86	119.9	107.83	106.13	110.37		111.63	124.75	133.04	148.53	1510.56	(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													912.69	(211)
Space heating fuel used, main system 2													0	(213)
Space heating fuel used, secondary													0	(215)
Water heating fuel used													1510.56	(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													185.38	(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			2608.63	

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		150.5	(240a)
Low-rate fraction	0		150.5	(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		150.5	(241a)
Low-rate fraction	0		150.5	(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		150.5	(242a)

Low-rate fraction	0		150.5	(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		249.09	(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		30.57	(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		430.16	(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)		1.39	(257)
SAP rating		77.5	(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			143.05	(261)
Space heating - main system 2			0	(262)
Space heating - secondary			0	(263)
Energy for water heating			212.89	(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		0	(267)
Electricity for lighting		26.76	(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 CO2, kg/year		382.69	(272)
Dwelling CO2 Emission Rate		5.75	(273)
EI rating		95	(274)

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

	Energy KWh/year	Emission factor kg	Emissionsr kg CO2/year	
Space heating - main system 1			1442.26	(275)
Space heating - main system 2			0	(276)
Space heating - secondary			0	(277)
Energy for water heating			2297.75	(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			0	(281)
Electricity for lighting			284.35	(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			4024.36	(286)
Dwelling PE Rate			60.45	(287)

TER WORKSHEET

Dwelling Reference: 16335 - Flat 3
Dwelling Type: New Dwelling Design Stage

Between 60 & 66 Alwyne Road
Woodside
London
SW19 7AF

1. Overall dwelling dimensions

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground Floor	3.29 (1a)	x	2.89	(2a) =	9.51	(3a)
First Floor	65.48 (1b)	x	2.9	(2b) =	189.89	(3b)
Total floor area TFA					68.77	(4)
Dwelling volume					199.4	(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	2	x	10 =	20	(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)	0.1	0.1	(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, (m³/h/m²)	5	5	(17)
Air permeability value, AP4, (m³/h/m²)	0	0	(17a)
Air permeability value)	0.35	0.35	(18)
Number of sides on which dwelling is sheltered	1	1	(19)

Shelter factor												0.92	(20)
Infiltration rate incorporating shelter factor												0.32	(21)
Infiltration rate modified for monthly wind speed													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	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)														
	0.41	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38	4.25	(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														
	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57		(24d)
Effective air change rate														
	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57		(25)
Effective air change rate from PCDB:														
	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57		(25)

3. Heat losses and heat loss parameter

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 (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Solid door							2.52	(26)
Semi-glazed door							2.52	(26a)
Window							11.59	(27)
Roof window							5.39	(27a)
Basement floor				0			0	(28)
Ground floor				361.9			0.43	(28a)
Exposed floor				25.2			0.16	(28b)
Basement wall				0			0	(29)
External wall				4201.8			12.58	(29a)

Roof	575.82	8.96	(30)
Total area of external elements ∑A, m²		155.49	(31)
Party Wall		0	(32)
Party floor		5238.4	(32a)
Party ceiling		0	(32b)
Internal wall **		0	(33c)
Internal floor		0	(32d)
Internal ceiling floor		0	(32e)
Fabric heat loss, W/K = ∑ (A x U)		41.63	(33)
Heat capacity Cm = ∑(A x k)		12501.02	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K		250	(35)
Linear Thermal bridges: ∑ (L x Ψ) calculated using Appendix K		7.42	(36)
Point Thermal bridges: ∑χ (W/K) if significant point thermal bridge present and values available		7.42	(36a)
Total fabric heat loss H = ∑(A × U) + ∑(L × Ψ) +∑χ		49.05	(37)

Ventilation heat loss calculated monthly

38.52	38.3	38.08	37.08	36.89	36.02	36.02	35.86	36.36	36.89	37.27	37.67	(38)

Heat transfer coefficient, W/K

87.57	87.35	87.14	86.13	85.94	85.07	85.07	84.91	85.41	85.94	86.32	86.72	(39)

Heat loss parameter (HLP), W/m²K

1.27	1.27	1.27	1.25	1.25	1.24	1.24	1.23	1.24	1.25	1.26	1.26	(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 2.22 (42)

Hot water usage in litres per day for mixer showers, Vd,shower (from Appendix J)

84.39	83.12	81.27	77.74	75.13	72.22	70.56	72.4	74.41	77.53	81.14	84.06	(42a)

Hot water usage in litres per day for baths, Vd,bath (from Appendix J)

26.52	26.12	25.57	24.54	23.78	22.93	22.47	23.02	23.62	24.53	25.57	26.43	(42b)

Hot water usage in litres per day for other uses, Vd,other (from Appendix J)

37.32	35.97	34.61	33.25	31.89	30.54	30.54	31.89	33.25	34.61	35.97	37.32	(42c)

Annual average hot water usage in litres per day Vd,average (from Appendix J) 136.54 (43)

Hot water usage in litres per day for each month Vd,m = (42a) + (42b) + (42c)

148.23	145.21	141.45	135.53	130.8	125.68	123.57	127.31	131.28	136.67	142.68	147.81	1636.23	(44)

Energy content of hot water used = 4.18 x Vd,m x nm x DTm / 3600 kWh/month (from Appendix J)

234.75	206.77	217.4	185.54	176.08	154.54	149.45	157.64	161.88	185.46	203.28	231.44	2264.24	(45)

Distribution loss (46) = 0.15 x (45)

35.21	31.02	32.61	27.83	26.41	23.18	22.42	23.65	24.28	27.82	30.49	34.72	(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) × (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 [(47) – Vs] ÷ (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)

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 × (45) + (46) + (57) + (59) + (61)

289.66	256.36	272.3	238.67	230.98	207.67	204.35	212.54	215.01	240.36	256.41	286.34	2910.65	(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)

289.66	256.36	272.3	238.67	230.98	207.67	204.35	212.54	215.01	240.36	256.41	286.34	2910.65	(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 × (45) + (61) + (64a)] + 0.8 x [(46) + (57) + (59)]

121.98	108.42	116.21	104.19	102.47	93.89	93.61	96.34	96.33	105.59	110.09	120.87	(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

132.95	132.95	132.95	132.95	132.95	132.95	132.95	132.95	132.95	132.95	132.95	132.95	(66)

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

26.59	23.62	19.21	14.54	10.87	9.18	9.92	12.89	17.3	21.97	25.64	27.33	(67)

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

290.16	293.17	285.59	269.43	249.04	229.88	217.08	214.07	221.65	237.81	258.2	277.36	(68)

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

50.51	50.51	50.51	50.51	50.51	50.51	50.51	50.51	50.51	50.51	50.51	50.51	(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

-88.64	-88.64	-88.64	-88.64	-88.64	-88.64	-88.64	-88.64	-88.64	-88.64	-88.64	-88.64	(71)

Water heating gains (Table 5)

163.95	161.34	156.19	144.72	137.73	130.4	125.82	129.48	133.79	141.92	152.91	162.47	(72)

Total internal gains

578.53	575.97	558.82	526.52	495.47	464.29	447.65	451.27	467.57	499.52	534.57	564.99	(73)

6. Solar gains

Solar gains in watts, calculated for each month

154.21	277.83	417.23	574.04	691.36	706.65	672.91	582.94	471.49	317.36	187.55	130.1	(83)

Total gains – internal and solar (watts)

732.75	853.79	976.05	1100.56	1186.82	1170.94	1120.56	1034.21	939.07	816.88	722.12	695.09	(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, ⍰1,m (see Table 9a)

0.98	0.96	0.91	0.8	0.64	0.46	0.33	0.38	0.6	0.86	0.96	0.98	(86)

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

20.08	20.26	20.5	20.75	20.88	20.93	20.93	20.93	20.9	20.71	20.35	20.05	(87)

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

19.86	19.86	19.87	19.88	19.88	19.89	19.89	19.89	19.89	19.88	19.88	19.87	(88)

Roof

Utilisation factor for gains for rest of dwelling, ⍰2,m (see Table 9a)

0.97	0.95	0.89	0.76	0.57	0.38	0.25	0.29	0.51	0.81	0.95	0.98	(89)

Roof

Mean internal temperature in the rest of dwelling T2

18.82	19.05	19.34	19.63	19.76	19.8	19.81	19.81	19.79	19.6	19.18	18.79	(90)

Living area fraction 0.27 (91)

Mean internal temperature (for the whole dwelling)

19.17	19.38	19.66	19.94	20.07	20.11	20.12	20.12	20.09	19.91	19.5	19.13	(92)

Adjusted mean internal temperature:

19.17	19.38	19.66	19.94	20.07	20.11	20.12	20.12	20.09	19.91	19.5	19.13	(93)

8. Space heating requirement

Utilisation factor for gains,

0.97	0.94	0.88	0.76	0.58	0.4	0.27	0.3	0.53	0.82	0.94	0.97	(94)

Useful gains, mGm , W

709.54	803.63	861.32	835.52	690.62	465.13	298.67	314.8	498.2	666.51	680.56	676.96	(95)

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

1302.02	1264.88	1146.88	950.55	719.08	468.81	299.09	315.58	511.84	799.89	1070.35	1295.09	(97)

Space heating requirement for each month

440.81	309.96	212.46	82.82	21.18	0	0	0	0	99.23	280.64	459.89	(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

440.81	309.96	212.46	82.82	21.18	0	0	0	0	99.23	280.64	459.89	(98c)

Space heating requirement in kWh/m²/year 27.73 (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) (104)

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	0	0	(107)

Space cooling requirement in kWh/m²/year 0 (108)

8f. Space heating requirement

Fabric Energy Efficiency, 0 0 (109)

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			(210)
Space heating fuel (main heating system 1), kWh/month								0					0	
201.01	141.34	96.88	37.76	9.66	0	0	0	0	45.25	127.97	209.71			(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			(217)
Fuel for water heating														
152.13	134.64	143.01	125.35	121.31	109.07	107.33	111.63	112.93	126.24	134.67	150.39		1528.7	(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			869.58 (211)
Space heating fuel used, main system 2			0 (213)
Space heating fuel used, secondary			0 (215)
Water heating fuel used			1528.7 (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			187.86 (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			2586.14	

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		143.39	(240a)
Low-rate fraction	0		143.39	(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		143.39	(241a)
Low-rate fraction	0		143.39	(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		143.39	(242a)

Low-rate fraction	0		143.39	(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		252.08	(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		30.98	(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		426.46	(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)	1.35		(257)
SAP rating	78.13		(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			136.54	(261)
Space heating - main system 2			0	(262)
Space heating - secondary			0	(263)
Energy for water heating			215.46	(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		0	(267)
Electricity for lighting		27.11	(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 CO2, kg/year		379.11	(272)
Dwelling CO2 Emission Rate		5.51	(273)
EI rating		96	(274)

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

	Energy KWh/year	Emission factor kg	Emissionsr kg CO2/year	
Space heating - main system 1			1375.02	(275)
Space heating - main system 2			0	(276)
Space heating - secondary			0	(277)
Energy for water heating			2325.39	(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			0	(281)
Electricity for lighting			288.15	(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			3988.56	(286)
Dwelling PE Rate			58	(287)

EPS Group
Energy Consultancy and Compliance Services

Appendix 2:

Proposed (Illustrative) DER Calculations (SAP Derived)

DER WORKSHEET

Dwelling Reference: 16335 - Flat 1
Dwelling Type: New Dwelling Design Stage

Between 60 & 66 Alwyne Road
Woodside
London
SW19 7AF

1. Overall dwelling dimensions

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	34.85 (1a)	x	2.5	(2a) =	87.12	(3a)
Ground Floor	31.72 (1b)	x	2.86	(2b) =	90.72	(3b)
Total floor area TFA					66.57	(4)
Dwelling volume					177.84	(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)	0.17	0.17	(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, (m³/h/m²)	5	5	(17)
Air permeability value, AP4, (m³/h/m²)	0	0	(17a)
Air permeability value)	0.42	0.42	(18)
Number of sides on which dwelling is sheltered	2	2	(19)

Shelter factor	0.85	(20)
Infiltration rate incorporating shelter factor	0.36	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	
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)													
0.45	0.44	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42	4.67	(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

0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate

0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

Effective air change rate from PCDB:

0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	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 (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Solid door							2.04	(26)
Semi-glazed door							2.04	(26a)
Window							20.45	(27)
Roof window							1.55	(27a)
Basement floor				0			0	(28)
Ground floor				3833.5			4.18	(28a)
Exposed floor				0			0	(28b)
Basement wall				751.8			2.26	(29)
External wall				726.6			2.12	(29a)

Roof	21.51	0.31	(30)
Total area of external elements ∑A, m²		83.19	(31)
Party Wall		0	(32)
Party floor		0	(32a)
Party ceiling		3203	(32b)
Internal wall **		0	(33c)
Internal floor		0	(32d)
Internal ceiling floor		0	(32e)
Fabric heat loss, W/K = ∑ (A x U)		32.91	(33)
Heat capacity Cm = ∑(A x k)		12565.71	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K		250	(35)
Linear Thermal bridges: ∑ (L x Ψ) calculated using Appendix K		4.98	(36)
Point Thermal bridges: ∑χ (W/K) if significant point thermal bridge present and values available		4.98	(36a)
Total fabric heat loss H = ∑(A × U) + ∑(L × Ψ) +∑χ		37.89	(37)

Ventilation heat loss calculated monthly

	35.39	35.15	34.92	33.84	33.64	32.7	32.7	32.52	33.06	33.64	34.05	34.48	(38)

Heat transfer coefficient, W/K

	73.28	73.04	72.81	71.73	71.53	70.59	70.59	70.41	70.95	71.53	71.94	72.37	(39)

Heat loss parameter (HLP), W/m²K

	1.1	1.1	1.09	1.08	1.07	1.06	1.06	1.06	1.07	1.07	1.08	1.09	(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 2.16 (42)

Hot water usage in litres per day for mixer showers, Vd,shower (from Appendix J)

	83.1	81.85	80.03	76.55	73.98	71.12	69.49	71.29	73.27	76.35	79.91	82.78	(42a)

Hot water usage in litres per day for baths, Vd,bath (from Appendix J)

	26.11	25.73	25.18	24.17	23.42	22.58	22.13	22.67	23.26	24.16	25.19	26.02	(42b)

Hot water usage in litres per day for other uses, Vd,other (from Appendix J)

	36.75	35.41	34.08	32.74	31.41	30.07	30.07	31.41	32.74	34.08	35.41	36.75	(42c)

Annual average hot water usage in litres per day Vd,average (from Appendix J) 134.46 (43)

Hot water usage in litres per day for each month Vd,m = (42a) + (42b) + (42c)

	145.96	142.99	139.29	133.46	128.8	123.77	121.69	125.37	129.28	134.58	140.51	145.56	(44)

Energy content of hot water used = 4.18 x Vd,m x nm x DTm / 3600 kWh/month (from Appendix J)

	231.17	203.62	214.08	182.71	173.4	152.19	147.17	155.24	159.41	182.63	200.18	227.91	(45)

Distribution loss (46) = 0.15 x (45)

	34.68	30.54	32.11	27.41	26.01	22.83	22.08	23.29	23.91	27.39	30.03	34.19	(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) × (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 [(47) – Vs] ÷ (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)

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 × (45) + (46) + (57) + (59) + (61)

286.07 253.21 268.98 235.84 228.3 205.32 202.07 210.14 212.54 237.53 253.31 282.81 2876.11 (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)

286.07 253.21 268.98 235.84 228.3 205.32 202.07 210.14 212.54 237.53 253.31 282.81 2876.11 (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 × (45) + (61) + (64a)] + 0.8 x [(46) + (57) + (59)]

120.79 107.37 115.1 103.25 101.57 93.11 92.85 95.54 95.51 104.65 109.06 119.7 (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

129.6 129.6 129.6 129.6 129.6 129.6 129.6 129.6 129.6 129.6 129.6 129.6 (66)

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

26.24	23.31	18.96	14.35	10.73	9.06	9.79	12.72	17.07	21.68	25.3	26.97	(67)

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

282.33	285.26	277.88	262.16	242.32	223.68	211.22	208.29	215.67	231.39	251.23	269.88	(68)

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

50.12	50.12	50.12	50.12	50.12	50.12	50.12	50.12	50.12	50.12	50.12	50.12	(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

-86.4	-86.4	-86.4	-86.4	-86.4	-86.4	-86.4	-86.4	-86.4	-86.4	-86.4	-86.4	(71)

Water heating gains (Table 5)

162.35	159.78	154.71	143.41	136.53	129.31	124.8	128.41	132.65	140.65	151.48	160.89	(72)

Total internal gains

567.24	564.68	547.87	516.24	485.9	455.37	439.13	442.74	458.72	490.04	524.33	554.06	(73)

6. Solar gains

Solar gains in watts, calculated for each month

105.35	198.26	321.47	482.81	618.17	647.81	610.36	504.11	376.49	232.63	129.6	87.94	(83)

Total gains – internal and solar (watts)

672.59	762.94	869.33	999.05	1104.07	1103.18	1049.49	946.85	835.2	722.67	653.93	642	(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, ⍰1,m (see Table 9a)

0.98	0.96	0.91	0.78	0.59	0.41	0.3	0.34	0.57	0.85	0.96	0.98	(86)

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

20.25	20.4	20.62	20.83	20.92	20.94	20.94	20.94	20.93	20.79	20.49	20.23	(87)

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

20	20	20.01	20.02	20.02	20.03	20.03	20.04	20.03	20.02	20.02	20.01	(88)

Roof

Utilisation factor for gains for rest of dwelling, ⍰2,m (see Table 9a)

0.97	0.95	0.89	0.73	0.53	0.35	0.23	0.27	0.5	0.81	0.95	0.98	(89)

Roof

Mean internal temperature in the rest of dwelling T2

19.15	19.33	19.6	19.84	19.93	19.96	19.96	19.96	19.95	19.81	19.46	19.13	(90)

Living area fraction 0.33 (91)

Mean internal temperature (for the whole dwelling)

19.51	19.69	19.93	20.17	20.26	20.28	20.28	20.29	20.27	20.13	19.8	19.49	(92)

Adjusted mean internal temperature:

19.51	19.69	19.93	20.17	20.26	20.28	20.28	20.29	20.27	20.13	19.8	19.49	(93)

8. Space heating requirement

Utilisation factor for gains,

0.97	0.95	0.88	0.74	0.54	0.36	0.25	0.29	0.52	0.82	0.94	0.98	(94)

Useful gains, mGm , W

652.5	721.68	769.1	740.1	599.87	399.98	259.93	273.33	431.07	589.7	617.72	626.08	(95)

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

1114.78	1080.05	978.14	808.32	612.07	401.1	260.04	273.57	437.78	681.78	913.36	1106.49	(97)

Space heating requirement for each month

343.94	240.83	155.53	49.12	9.08	0	0	0	0	68.51	212.86	357.42	(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

343.94	240.83	155.53	49.12	9.08	0	0	0	0	68.51	212.86	357.42	(98c)

Space heating requirement in kWh/m²/year 21.59 (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) (104)

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	0	0	(107)

Space cooling requirement in kWh/m²/year 0 (108)

8f. Space heating requirement

Fabric Energy Efficiency, 0 0 (109)

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		(210)
Space heating fuel (main heating system 1), kWh/month								0					0	
156.83	109.82	70.92	22.4	4.14	0	0	0		0	31.24	97.07	162.98		(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		(217)
Fuel for water heating														
150.25	132.99	141.27	123.86	119.9	107.83	106.13	110.37		111.63	124.75	133.04	148.53	1510.56	(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													655.4	(211)
Space heating fuel used, main system 2													0	(213)
Space heating fuel used, secondary													0	(215)
Water heating fuel used													1510.56	(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													185.38	(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			2351.34	

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		108.07	(240a)
Low-rate fraction	0		108.07	(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		108.07	(241a)
Low-rate fraction	0		108.07	(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		108.07	(242a)

Low-rate fraction	0		108.07	(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		249.09	(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		30.57	(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		387.74	(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)		1.25	(257)
SAP rating		79.72	(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			103.21	(261)
Space heating - main system 2			0	(262)
Space heating - secondary			0	(263)
Energy for water heating			212.89	(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		0	(267)
Electricity for lighting		26.76	(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 CO2, kg/year		342.85	(272)
Dwelling CO2 Emission Rate		5.15	(273)
EI rating		96	(274)

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

	Energy KWh/year	Emission factor kg	Emissionsr kg CO2/year	
Space heating - main system 1			1037.45	(275)
Space heating - main system 2			0	(276)
Space heating - secondary			0	(277)
Energy for water heating			2297.75	(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			0	(281)
Electricity for lighting			284.35	(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			3619.55	(286)
Dwelling PE Rate			54.37	(287)

DER WORKSHEET

Dwelling Reference: 16335 - Flat 2
Dwelling Type: New Dwelling Design Stage

Between 60 & 66 Alwyne Road
Woodside
London
SW19 7AF

1. Overall dwelling dimensions

	Area(m^2)		Av. Height(m)		Volume(m^3)	
Basement	34.85 (1a)	x	2.5	(2a) =	87.12	(3a)
Ground Floor	31.72 (1b)	x	2.86	(2b) =	90.72	(3b)
Total floor area TFA					66.57	(4)
Dwelling volume					177.84	(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)	0.17	0.17	(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)	0.42	0.42	(18)
Number of sides on which dwelling is sheltered	1	1	(19)

Shelter factor	0.92	(20)
Infiltration rate incorporating shelter factor	0.39	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	
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)													
0.49	0.48	0.47	0.43	0.42	0.37	0.37	0.36	0.39	0.42	0.44	0.46	5.08	(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

0.62	0.62	0.61	0.59	0.59	0.57	0.57	0.56	0.57	0.59	0.59	0.6	(24d)

Effective air change rate

0.62	0.62	0.61	0.59	0.59	0.57	0.57	0.56	0.57	0.59	0.59	0.6	(25)

Effective air change rate from PCDB:

0.62	0.62	0.61	0.59	0.59	0.57	0.57	0.56	0.57	0.59	0.59	0.6	(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 (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Solid door							2.04	(26)
Semi-glazed door							2.04	(26a)
Window							20.45	(27)
Roof window							1.55	(27a)
Basement floor				0			0	(28)
Ground floor				3833.5			4.88	(28a)
Exposed floor				0			0	(28b)
Basement wall				2029.8			6.09	(29)
External wall				2205.6			6.56	(29a)

Roof	21.51	0.31	(30)
Total area of external elements ∑A, m²		129.14	(31)
Party Wall		0	(32)
Party floor		0	(32a)
Party ceiling		3203	(32b)
Internal wall **		0	(33c)
Internal floor		0	(32d)
Internal ceiling floor		0	(32e)
Fabric heat loss, W/K = ∑ (A x U)		41.87	(33)
Heat capacity Cm = ∑(A x k)		13254.96	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K		250	(35)
Linear Thermal bridges: ∑ (L x Ψ) calculated using Appendix K		6.11	(36)
Point Thermal bridges: ∑χ (W/K) if significant point thermal bridge present and values available		6.11	(36a)
Total fabric heat loss H = ∑(A × U) + ∑(L × Ψ) +∑χ		47.98	(37)

Ventilation heat loss calculated monthly

	36.5	36.22	35.95	34.67	34.43	33.32	33.32	33.11	33.75	34.43	34.91	35.42	(38)

Heat transfer coefficient, W/K

	84.48	84.21	83.93	82.65	82.42	81.3	81.3	81.09	81.73	82.42	82.9	83.41	(39)

Heat loss parameter (HLP), W/m²K

	1.27	1.26	1.26	1.24	1.24	1.22	1.22	1.22	1.23	1.24	1.25	1.25	(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 2.16 (42)

Hot water usage in litres per day for mixer showers, Vd,shower (from Appendix J)

	83.1	81.85	80.03	76.55	73.98	71.12	69.49	71.29	73.27	76.35	79.91	82.78	(42a)

Hot water usage in litres per day for baths, Vd,bath (from Appendix J)

	26.11	25.73	25.18	24.17	23.42	22.58	22.13	22.67	23.26	24.16	25.19	26.02	(42b)

Hot water usage in litres per day for other uses, Vd,other (from Appendix J)

	36.75	35.41	34.08	32.74	31.41	30.07	30.07	31.41	32.74	34.08	35.41	36.75	(42c)

Annual average hot water usage in litres per day Vd,average (from Appendix J) 134.46 (43)

Hot water usage in litres per day for each month Vd,m = (42a) + (42b) + (42c)

	145.96	142.99	139.29	133.46	128.8	123.77	121.69	125.37	129.28	134.58	140.51	145.56	1611.26	(44)

Energy content of hot water used = 4.18 x Vd,m x nm x DTm / 3600 kWh/month (from Appendix J)

	231.17	203.62	214.08	182.71	173.4	152.19	147.17	155.24	159.41	182.63	200.18	227.91	2229.69	(45)

Distribution loss (46) = 0.15 x (45)

	34.68	30.54	32.11	27.41	26.01	22.83	22.08	23.29	23.91	27.39	30.03	34.19	(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) × (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 [(47) – Vs] ÷ (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)

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 × (45) + (46) + (57) + (59) + (61)

286.07 253.21 268.98 235.84 228.3 205.32 202.07 210.14 212.54 237.53 253.31 282.81 2876.11 (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)

286.07 253.21 268.98 235.84 228.3 205.32 202.07 210.14 212.54 237.53 253.31 282.81 2876.11 (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 × (45) + (61) + (64a)] + 0.8 x [(46) + (57) + (59)]

120.79 107.37 115.1 103.25 101.57 93.11 92.85 95.54 95.51 104.65 109.06 119.7 (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

129.6 129.6 129.6 129.6 129.6 129.6 129.6 129.6 129.6 129.6 129.6 129.6 (66)

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

26.24	23.31	18.96	14.35	10.73	9.06	9.79	12.72	17.07	21.68	25.3	26.97	(67)

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

282.33	285.26	277.88	262.16	242.32	223.68	211.22	208.29	215.67	231.39	251.23	269.88	(68)

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

50.12	50.12	50.12	50.12	50.12	50.12	50.12	50.12	50.12	50.12	50.12	50.12	(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

-86.4	-86.4	-86.4	-86.4	-86.4	-86.4	-86.4	-86.4	-86.4	-86.4	-86.4	-86.4	(71)

Water heating gains (Table 5)

162.35	159.78	154.71	143.41	136.53	129.31	124.8	128.41	132.65	140.65	151.48	160.89	(72)

Total internal gains

567.24	564.68	547.87	516.24	485.9	455.37	439.13	442.74	458.72	490.04	524.33	554.06	(73)

6. Solar gains

Solar gains in watts, calculated for each month

105.35	198.26	321.47	482.81	618.17	647.81	610.36	504.11	376.49	232.63	129.6	87.94	(83)

Total gains – internal and solar (watts)

672.59	762.94	869.33	999.05	1104.07	1103.18	1049.49	946.85	835.2	722.67	653.93	642	(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, ⍰1,m (see Table 9a)

0.98	0.97	0.93	0.83	0.65	0.46	0.34	0.39	0.64	0.89	0.97	0.99	(86)

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

20.05	20.2	20.45	20.73	20.88	20.93	20.93	20.93	20.9	20.68	20.32	20.02	(87)

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

19.87	19.87	19.87	19.89	19.89	19.9	19.9	19.91	19.9	19.89	19.88	19.88	(88)

Roof Utilisation factor for gains for rest of dwelling, ⍰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

18.78	18.98	19.28	19.61	19.76	19.82	19.82	19.82	19.79	19.57	19.14	18.76	(90)

Living area fraction 0.33 (91)

Mean internal temperature (for the whole dwelling)

19.2	19.39	19.67	19.98	20.13	20.18	20.19	20.19	20.16	19.94	19.53	19.18	(92)

Adjusted mean internal temperature:

19.2	19.39	19.67	19.98	20.13	20.18	20.19	20.19	20.16	19.94	19.53	19.18	(93)

8. Space heating requirement

Utilisation factor for gains,

0.97	0.95	0.91	0.79	0.6	0.41	0.28	0.32	0.57	0.85	0.95	0.98	(94)

Useful gains, mGm , W

655.08	728.43	788.1	786.99	664.1	450.06	291.24	306.32	477.62	614.79	623.72	627.99	(95)

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

1258.86	1219.76	1105.38	915.86	694.98	453.88	291.69	307.25	495.12	769.66	1030.39	1249.37	(97)

Space heating requirement for each month

449.21	330.18	236.06	92.79	22.97	0	0	0	0	115.22	292.8	462.31	(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

449.21	330.18	236.06	92.79	22.97	0	0	0	0	115.22	292.8	462.31	(98c)

Space heating requirement in kWh/m²/year 30.07 (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) (104)

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	0	0	(107)

Space cooling requirement in kWh/m²/year 0 (108)

8f. Space heating requirement

Fabric Energy Efficiency, 0 0 (109)

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		(210)
Space heating fuel (main heating system 1), kWh/month								0					0	
204.84	150.56	107.64	42.31	10.48	0	0	0		0	52.54	133.52	210.81		(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		(217)
Fuel for water heating														
150.25	132.99	141.27	123.86	119.9	107.83	106.13	110.37		111.63	124.75	133.04	148.53	1510.56	(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													912.69	(211)
Space heating fuel used, main system 2													0	(213)
Space heating fuel used, secondary													0	(215)
Water heating fuel used													1510.56	(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													185.38	(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			2608.63	

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		150.5	(240a)
Low-rate fraction	0		150.5	(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		150.5	(241a)
Low-rate fraction	0		150.5	(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		150.5	(242a)

Low-rate fraction	0		150.5	(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		249.09	(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		30.57	(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		430.16	(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)	1.39		(257)
SAP rating	77.5		(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			143.05	(261)
Space heating - main system 2			0	(262)
Space heating - secondary			0	(263)
Energy for water heating			212.89	(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		0	(267)
Electricity for lighting		26.76	(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 CO2, kg/year		382.69	(272)
Dwelling CO2 Emission Rate		5.75	(273)
EI rating		95	(274)

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

	Energy KWh/year	Emission factor kg	Emissionsr kg CO2/year	
Space heating - main system 1			1442.26	(275)
Space heating - main system 2			0	(276)
Space heating - secondary			0	(277)
Energy for water heating			2297.75	(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			0	(281)
Electricity for lighting			284.35	(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			4024.36	(286)
Dwelling PE Rate			60.45	(287)

DER WORKSHEET

Dwelling Reference: 16335 - Flat 3
Dwelling Type: New Dwelling Design Stage

Between 60 & 66 Alwyne Road
Woodside
London
SW19 7AF

1. Overall dwelling dimensions

	Area(m^2)		Av. Height(m)		Volume(m^3)	
Ground Floor	3.29 (1a)	x	2.89	(2a) =	9.51	(3a)
First Floor	65.48 (1b)	x	2.9	(2b) =	189.89	(3b)
Total floor area TFA					68.77	(4)
Dwelling volume					199.4	(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	2	x	10 =	20	(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)	0.1	0.1	(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)	0.35	0.35	(18)
Number of sides on which dwelling is sheltered	1	1	(19)

Shelter factor	0.92	(20)
Infiltration rate incorporating shelter factor	0.32	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	
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)													
0.41	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38	4.25	(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

0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate

0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

Effective air change rate from PCDB:

0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

3. Heat losses and heat loss parameter

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 (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Solid door							2.52	(26)
Semi-glazed door							2.52	(26a)
Window							11.59	(27)
Roof window							5.39	(27a)
Basement floor				0			0	(28)
Ground floor				361.9			0.43	(28a)
Exposed floor				25.2			0.16	(28b)
Basement wall				0			0	(29)
External wall				4201.8			12.58	(29a)

Roof	575.82	8.96	(30)
Total area of external elements ∑A, m²		155.49	(31)
Party Wall		0	(32)
Party floor		5238.4	(32a)
Party ceiling		0	(32b)
Internal wall **		0	(33c)
Internal floor		0	(32d)
Internal ceiling floor		0	(32e)
Fabric heat loss, W/K = ∑ (A x U)		41.63	(33)
Heat capacity Cm = ∑(A x k)		12501.02	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K		250	(35)
Linear Thermal bridges: ∑ (L x Ψ) calculated using Appendix K		7.42	(36)
Point Thermal bridges: ∑χ (W/K) if significant point thermal bridge present and values available		7.42	(36a)
Total fabric heat loss H = ∑(A × U) + ∑(L × Ψ) +∑χ		49.05	(37)

Ventilation heat loss calculated monthly

38.52	38.3	38.08	37.08	36.89	36.02	36.02	35.86	36.36	36.89	37.27	37.67	(38)

Heat transfer coefficient, W/K

87.57	87.35	87.14	86.13	85.94	85.07	85.07	84.91	85.41	85.94	86.32	86.72	(39)

Heat loss parameter (HLP), W/m²K

1.27	1.27	1.27	1.25	1.25	1.24	1.24	1.23	1.24	1.25	1.26	1.26	(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 2.22 (42)

Hot water usage in litres per day for mixer showers, Vd,shower (from Appendix J)

84.39	83.12	81.27	77.74	75.13	72.22	70.56	72.4	74.41	77.53	81.14	84.06	(42a)

Hot water usage in litres per day for baths, Vd,bath (from Appendix J)

26.52	26.12	25.57	24.54	23.78	22.93	22.47	23.02	23.62	24.53	25.57	26.43	(42b)

Hot water usage in litres per day for other uses, Vd,other (from Appendix J)

37.32	35.97	34.61	33.25	31.89	30.54	30.54	31.89	33.25	34.61	35.97	37.32	(42c)

Annual average hot water usage in litres per day Vd,average (from Appendix J) 136.54 (43)

Hot water usage in litres per day for each month Vd,m = (42a) + (42b) + (42c)

148.23	145.21	141.45	135.53	130.8	125.68	123.57	127.31	131.28	136.67	142.68	147.81	1636.23	(44)

Energy content of hot water used = 4.18 x Vd,m x nm x DTm / 3600 kWh/month (from Appendix J)

234.75	206.77	217.4	185.54	176.08	154.54	149.45	157.64	161.88	185.46	203.28	231.44	2264.24	(45)

Distribution loss (46) = 0.15 x (45)

35.21	31.02	32.61	27.83	26.41	23.18	22.42	23.65	24.28	27.82	30.49	34.72	(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) × (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 [(47) – Vs] ÷ (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)

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 × (45) + (46) + (57) + (59) + (61)

289.66	256.36	272.3	238.67	230.98	207.67	204.35	212.54	215.01	240.36	256.41	286.34	2910.65	(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)

289.66	256.36	272.3	238.67	230.98	207.67	204.35	212.54	215.01	240.36	256.41	286.34	2910.65	(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 × (45) + (61) + (64a)] + 0.8 x [(46) + (57) + (59)]

121.98	108.42	116.21	104.19	102.47	93.89	93.61	96.34	96.33	105.59	110.09	120.87	(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

132.95	132.95	132.95	132.95	132.95	132.95	132.95	132.95	132.95	132.95	132.95	132.95	(66)

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

26.59	23.62	19.21	14.54	10.87	9.18	9.92	12.89	17.3	21.97	25.64	27.33	(67)

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

290.16	293.17	285.59	269.43	249.04	229.88	217.08	214.07	221.65	237.81	258.2	277.36	(68)

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

50.51	50.51	50.51	50.51	50.51	50.51	50.51	50.51	50.51	50.51	50.51	50.51	(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

-88.64	-88.64	-88.64	-88.64	-88.64	-88.64	-88.64	-88.64	-88.64	-88.64	-88.64	-88.64	(71)

Water heating gains (Table 5)

163.95	161.34	156.19	144.72	137.73	130.4	125.82	129.48	133.79	141.92	152.91	162.47	(72)

Total internal gains

578.53	575.97	558.82	526.52	495.47	464.29	447.65	451.27	467.57	499.52	534.57	564.99	(73)

6. Solar gains

Solar gains in watts, calculated for each month

154.21	277.83	417.23	574.04	691.36	706.65	672.91	582.94	471.49	317.36	187.55	130.1	(83)

Total gains – internal and solar (watts)

732.75	853.79	976.05	1100.56	1186.82	1170.94	1120.56	1034.21	939.07	816.88	722.12	695.09	(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, ⍰1,m (see Table 9a)

0.98	0.96	0.91	0.8	0.64	0.46	0.33	0.38	0.6	0.86	0.96	0.98	(86)

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

20.08	20.26	20.5	20.75	20.88	20.93	20.93	20.93	20.9	20.71	20.35	20.05	(87)

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

19.86	19.86	19.87	19.88	19.88	19.89	19.89	19.89	19.89	19.88	19.88	19.87	(88)

Roof

Utilisation factor for gains for rest of dwelling, ⍰2,m (see Table 9a)

0.97	0.95	0.89	0.76	0.57	0.38	0.25	0.29	0.51	0.81	0.95	0.98	(89)

Roof

Mean internal temperature in the rest of dwelling T2

18.82	19.05	19.34	19.63	19.76	19.8	19.81	19.81	19.79	19.6	19.18	18.79	(90)

Living area fraction 0.27 (91)

Mean internal temperature (for the whole dwelling)

19.17	19.38	19.66	19.94	20.07	20.11	20.12	20.12	20.09	19.91	19.5	19.13	(92)

Adjusted mean internal temperature:

19.17	19.38	19.66	19.94	20.07	20.11	20.12	20.12	20.09	19.91	19.5	19.13	(93)

8. Space heating requirement

Utilisation factor for gains,

0.97	0.94	0.88	0.76	0.58	0.4	0.27	0.3	0.53	0.82	0.94	0.97	(94)

Useful gains, mGm , W

709.54	803.63	861.32	835.52	690.62	465.13	298.67	314.8	498.2	666.51	680.56	676.96	(95)

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

1302.02	1264.88	1146.88	950.55	719.08	468.81	299.09	315.58	511.84	799.89	1070.35	1295.09	(97)

Space heating requirement for each month

440.81	309.96	212.46	82.82	21.18	0	0	0	0	99.23	280.64	459.89	(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

440.81	309.96	212.46	82.82	21.18	0	0	0	0	99.23	280.64	459.89	(98c)

Space heating requirement in kWh/m²/year 27.73 (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) (104)

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	0	0	(107)

Space cooling requirement in kWh/m²/year 0 (108)

8f. Space heating requirement

Fabric Energy Efficiency, 0 0 (109)

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			(210)
Space heating fuel (main heating system 1), kWh/month								0					0	
201.01	141.34	96.88	37.76	9.66	0	0	0	0	45.25	127.97	209.71			(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			(217)
Fuel for water heating														
152.13	134.64	143.01	125.35	121.31	109.07	107.33	111.63	112.93	126.24	134.67	150.39		1528.7	(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													869.58	(211)
Space heating fuel used, main system 2													0	(213)
Space heating fuel used, secondary													0	(215)
Water heating fuel used													1528.7	(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													187.86	(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			2586.14	

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		143.39	(240a)
Low-rate fraction	0		143.39	(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		143.39	(241a)
Low-rate fraction	0		143.39	(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		143.39	(242a)

Low-rate fraction	0		143.39	(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		252.08	(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		30.98	(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		426.46	(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)		1.35	(257)
SAP rating		78.13	(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			136.54	(261)
Space heating - main system 2			0	(262)
Space heating - secondary			0	(263)
Energy for water heating			215.46	(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		0	(267)
Electricity for lighting		27.11	(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 CO2, kg/year		379.11	(272)
Dwelling CO2 Emission Rate		5.51	(273)
EI rating		96	(274)

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

	Energy KWh/year	Emission factor kg	Emissionsr kg CO2/year	
Space heating - main system 1			1375.02	(275)
Space heating - main system 2			0	(276)
Space heating - secondary			0	(277)
Energy for water heating			2325.39	(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			0	(281)
Electricity for lighting			288.15	(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			3988.56	(286)
Dwelling PE Rate			58	(287)