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Energy Statement

St William Homes LLP

Clarendon Gas Works

Final

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Executive Summary

The purpose of this Energy Statement is to address Condition 50 of the hybrid planning consent (HGY/2017/3117) for the proposed Clarendon Gas Works development in the London Borough of Haringey.

Condition 50 requires an updated Energy Strategy to be submitted prior to any Reserved Matters applications. This Energy Statement will provide the updated energy strategy to clear Condition 50 of planning consent HG/2017/3117.

This energy strategy has been formulated following the London Plan (2016) Policy 5.2 and therefore the Energy Hierarchy: **Be Lean**, **Be Clean** and **Be Green**. The objective in the formulation of the strategy is to maximise the reductions in CO₂ emissions through the application of this Hierarchy with a cost-effective approach that is technically appropriate. In line with GLA Guidance this Energy Statement will demonstrate constancy with the Outline Consent and accompanying Energy Strategy; In addition to energy efficiency measures this provided for a gas CHP led heat network.

This Energy Statement considers a portion of the development within the Outline Consent, the Eastern Quarter. This is comprised of 439 new dwellings, and 2,505m² of new non-domestic developments. The development has been assessed under Approved Document Part L 1A (2013) and Part L 2A (2013) in this Energy Statement.

London Plan (2016) Policy 5.2 requires the equivalent of a reduction in Regulated CO₂ emissions by 35% beyond a determined 2013 baseline case on site. The Energy Statement consented under the 2017 hybrid application aligns with this 35% target.

A range of **Be Lean** energy efficiency measures are proposed for the dwellings. This is in line with the London Plan Energy Hierarchy. They enable the proposed elements to meet or exceed the baseline cases through energy efficiency alone.

In accordance with the Energy Hierarchy, the feasibility of decentralised energy production as a **Be Clean** measure has also been carefully examined. In line with the Outline Consent the Eastern Quarter buildings will connect into the consented site wide heat network. The initial heat source is located in Block A4. This achieves the carbon reductions required in line with Policy 5.2 of the London Plan.

In accordance with the Energy Hierarchy, the relevant **Be Green** renewable energy generating technologies have been evaluated. Given that the required energy reduction has been provided through the use of a site wide heating network, no further technologies were required to be applied. This aligns with the outline Consent.

The proposed design for the development will enable it to reduce its CO₂ emissions in line with London Plan requirements (35%) over the overall baseline case. This represents a high level of sustainable design.

The Tables below demonstrates the reduction in Regulated and Total CO₂ reductions after each stage of the Energy Hierarchy showing energy policy requirements have been achieved.

Domestic Carbon Dioxide Emissions and Savings after each stage of the Energy Hierarchy		
Stage	Carbon Dioxide Emissions (Tonnes CO ₂ per Annum)	
	Regulated	Unregulated
Baseline: Part L 2013 Compliant Development	420	519
After <i>Be Lean</i> Measures	420	519
After <i>Be Clean</i> Measures	273	519
After <i>Be Green</i> Measures	273	519
Stage	Regulated Carbon Dioxide Savings	
	Tonnes CO ₂ per Annum	Percentage
Savings from <i>Be Lean</i> Measures	1	0%
Savings from <i>Be Clean</i> Measures	147	35%
Savings from <i>Be Green</i> Measures	0	0%
Cumulative On-Site Savings	147	35%

Non-Domestic Carbon Dioxide Emissions and Savings after each stage of the Energy Hierarchy

Stage	Carbon Dioxide Emissions (Tonnes CO ₂ per Annum)	
	Regulated	Unregulated
Baseline: Part L 2013 Compliant Development	103	88
After <i>Be Lean</i> Measures	96	88
After <i>Be Clean</i> Measures	87	88
After <i>Be Green</i> Measures	67	88
Stage	Regulated Carbon Dioxide Savings	
	Tonnes CO ₂ per Annum	Percentage
Savings from <i>Be Lean</i> Measures	6	6%
Savings from <i>Be Clean</i> Measures	9	9%
Savings from <i>Be Green</i> Measures	20	20%
Cumulative On-Site Savings	36	35%

Site Wide Carbon Dioxide Emissions and Cumulative Savings

	Regulated Carbon Dioxide Emissions (Tonnes CO ₂ per Annum)	Regulated Carbon Dioxide Savings	
		Tonnes CO ₂ per Annum	Percentage
Baseline: Part L 2013 Compliant Development	523	-	-
After <i>Be Lean</i> Measures	516	7	1%
After <i>Be Clean</i> Measures	360	156	30%
After <i>Be Green</i> Measures	340	20	6%
Cumulative On-Site Savings		183	35%

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1. INTRODUCTION

- 1.1 This Energy Statement has been prepared by Hodkinson Consultancy, a specialist energy and environmental consultancy for planning and development, appointed by St William Homes LLP. This statement is to demonstrate the proposed development at Clarendon Gas Work, in the London Borough of Haringey can achieve the requirements in Condition 50 of the Planning Permission.
- 1.2 This Energy Statement applies to Blocks D1-D4 and E1-E3 known as the 'Eastern Quarter' which currently consists of 439 new dwellings, 2,505 m² of new non-domestic developments.
- 1.3 The formulation of the energy statement is on the basis that it targets a viable reduction in carbon dioxide (CO₂) emissions through the application of the London Plan Energy Hierarchy with an affordable, deliverable and technically appropriate strategy and conforms to the Outline Consent.
- 1.4 This statement establishes a baseline assessment of the energy demands and associated CO₂ emissions for Clarendon Gas Works. It reflects the Approved Document Part L 1A (2013) and Part L 2A (2013) baseline for new build dwellings and non-domestic construction respectively.
- 1.5 The report will then follow The London Plan Energy Hierarchy approach of **Be Lean, Be Clean** and **Be Green** to enable the maximum viable reductions in Regulated and Total CO₂ emissions over these baselines.

2. DEVELOPMENT OVERVIEW

- 2.1 The development of Clarendon Gas Works is to take place within the London Borough of Haringey.

Outline Consent Development description

- 2.2 The Eastern Quarter benefits from an Outline Consent and sits within the wider Clarendon Gas Works site, which is consented to provide:

"103,150sqm Class C3 Residential; 7,168sqm to 7,500sqm Class B1 Business Use; 1,500sqm to 3,950sqm Class A1-A4; and up to 2,500sqm Class D2 Leisure Use; Buildings up to 103.90m AOD; associated cycle and car parking provision; new basement level; energy centre; new public square, public realm works and landscaping; vehicular access and new servicing arrangements; associated highway works; and facilitating works."

- 2.3 Figure 1 illustrates the site location, and the developments layout.



Figure 1: Clarendon Gas Works site location (Panter Hudspith architects, © OpenStreetMap Contributors)

Development description

- 2.4** The Development of the Eastern Quarter, blocks D1-D4 and E1-3, for which this Energy Strategy is based upon consist of c.439 Domestic units and 2,505m² of non-domestic A1 and B1 class use and 883m² of residence facilities (C3 use).
- 2.5** The Eastern Quarter is the proposed location of the DEN2 Energy Centre box that St. William are providing the Council for their use. Summary details of this are set out within this Energy Statement.
- 2.6** A site plan for the Eastern Quarter is shown in Figure 2 and can be seen in Appendix A.

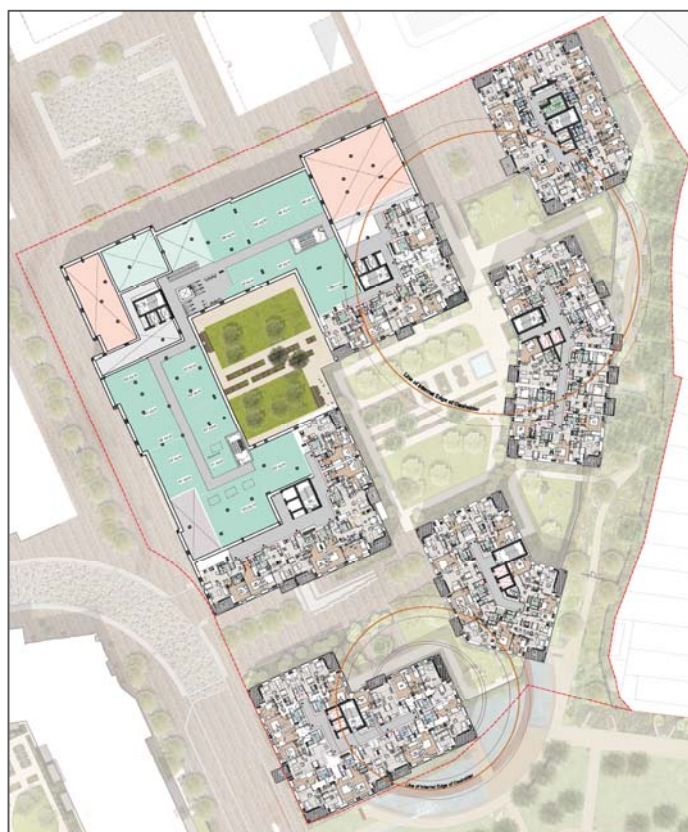


Figure 2: Site Plan of the Eastern Quarter at Clarendon Gas Works (Panter Hudspith Architects)

Masterplan Consented Energy Strategy

2.7 A summary of the approved Energy Strategy for the Outline consent is as follows:

- > Meet Part L (2013) through energy efficiency;
- > Connection to the sitewide gas-CHP led district heating network to achieve a 35% CO₂ reduction;
- > No provision of renewable energy technologies or carbon offset payments;
- > Provision of DEN2 'box' to Haringey Council for development into an Energy Centre of the Wood Green Heat Network;
- > Subject to the requirements of the S106, potential connection to the Wood Green Heat Network.

3. PLANNING POLICY

Condition 50

- 3.1 Condition 50 of Planning Permission (HGY/2017/3117) states:

“PRIOR TO SUBMISSION OF RMA – Updated Energy Strategy

Notwithstanding the submitted details and prior to the submission of any reserved matters, excluding demolition and site preparation works, an updated energy strategy shall be submitted to and approved in writing by the local planning authority. The Energy Strategy shall, unless otherwise agreed by the local planning authority, be based on connection of all residential and non-residential buildings to a district energy and heating network. Details of the site wide heating and hot water facilities, the phasing of delivery, and associated network infrastructure will be submitted for approval to the Council. The strategy shall explore all reasonable options for improving the energy efficiency of the building and reducing carbon dioxide emissions in accordance with the energy hierarchy set out in London Plan policy 5.2 ‘Minimising carbon dioxide emissions’. The Strategy will comply with the targets and measures set out in London Plan (2016) Policy 5.2 and will be submitted using the format set out in the GLA guidance on Energy Strategies. The development shall be carried out strictly in accordance with the details approved.”

- 3.2 The Condition cites the London Plan (2016) Policy 5.2. This, additional relevant London Plan Policy and GLA guidance on preparing energy statements is iterated below for clarity.

The London Plan (2016)

- 3.3 It is noted that as Condition 50 specifically references the London Plan (2016), the draft London Plan does not apply in this instance.
- 3.4 The following outlines key policies set out in the current London Plan which are relevant to the proposed development and this Energy Statement.
- 3.5 **Policy 5.2 – Minimising Carbon Dioxide Emissions** requires that all residential and non-residential major developments to achieve a specific improvement. The London Plan Sustainable Design and Construction SPG (2014) updates this target stating that the Mayor will adopt an onsite carbon dioxide improvement target beyond Part L 2013 of 35%.
- 3.6 **Policy 5.3 – Sustainable Design and Construction** states that the highest standards of sustainable design and construction should be achieved in London to improve the environmental performance

of new developments. Major development should meet the minimum standards outlined in the London Plan Supplementary Planning Guidance and this should be clearly demonstrated.

- 3.7 Policy 5.6 – Decentralised Energy** requires that all developments should evaluate the feasibility of Combined Heat and Power (CHP) systems and examine the opportunities to extend the system beyond the site boundary to adjacent sites.
- 3.8 Policy 5.7 – Renewable Energy** states that within the framework of the Energy Hierarchy, major development proposals should provide a reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation, where feasible.
- 3.9 Policy 5.8 – Innovative Energy Technologies** encourages the more widespread use of innovative energy technologies to reduce use of fossil fuels and carbon dioxide emissions.
- 3.10 Policy 5.9 – Overheating and cooling** encourages the design of places and spaces to avoid overheating and excessive heat generation, and to reduce overheating due to the impacts of climate change and the urban heat island effect on an area wide basis.
- 3.11** It is to be noted that Condition 49 of the Outline consent requires the overheating assessment to be submitted prior to above ground works being undertaken. This document is not therefore not presented in this Energy Statement.

GLA Energy Assessment Guidance (2018)

- 3.12** The Greater London Authorities' (GLAs) guidance on preparing energy assessments details what should be included within an energy assessment.
- 3.13** Within the document it states energy assessments:

“should demonstrate consistency with the Outline strategy.”

Summary of Project Requirements

- 3.14** The following are the energy related project requirements:
- > To follow the Outline consent Energy Strategy which used the **Energy Hierarchy**, '**Be lean**' (energy efficiency, '**Be Clean**' (heating infrastructure), and '**Be Green**' (renewable energy technologies);
 - > To meet the requirements of Part L (2013) through energy efficiency alone ('**Be Lean**');

- > To meet a 35% Regulated CO₂ reduction over Part L (2013), achieved through connection to the gas-CHP led Clarendon Gas Works Heat Network (***Be Clean***);

3.15 This Energy Strategy covers the overall specification for the Eastern Quarter. It therefore provides a compliant energy strategy for future development within the Outline Consent.

4. BASELINE EMISSIONS ASSESSMENT

Methodology

- 4.1** This statement first establishes a baseline assessment of the energy demands and associated CO₂ emissions for the build types.
- 4.2** The report will then follow The London Plan Energy Hierarchy approach of **Be Lean, Be Clean** and **Be Green**, to enable the maximum viable reductions in Regulated and Total CO₂ emissions over the baselines.
- 4.3** The estimated annual energy demand for the Development has been calculated using Standard Assessment Procedure (SAP 2012) and Simplified Building Energy Model (SBEM 2013) methodology. SAP calculates the domestic Regulated energy demands associated with hot water, space heating and fixed electrical items. The unregulated dwelling energy demands for appliances and cooking are taken from calculation procedures within SAP chapter 16. SBEM calculates the non-domestic Regulated energy demands associated with hot water, space heating and fixed electrical items. The unregulated non-domestic energy demands are taken from additional SBEM output (BRUKL) documents.
- 4.4** 15 representative 1, 2, 3 and 4 bed dwellings have been modelled which include ground floor, upper floor (with exposed floors), mid floor, and top floor apartments all with a range of orientations.
- 4.5** Representative areas and use types have been used for the non-domestic energy assessment. It should be noted that the non-domestic components (excluding the resident facilities) will be designed to be shell and core only.

CO₂ Baselines for Building Types

- 4.6** Table 1 shows the Regulated and Total CO₂ baseline cases. Summary CO₂ baselines, Dwelling Target Emission Rate (TER) Worksheets and can be found in Appendices B and C respectively.

Table 1: Regulated CO₂ Baseline Cases

Carbon dioxide emissions TCO _{2,a}						
	Domestic		Non-domestic		Total	
	Regulated	Unregulated	Regulated	Unregulated	Regulated	Unregulated
Baseline	420	519	103	88	523	1,130

5. 'BE LEAN': ENERGY EFFICIENCY MEASURES

- 5.1 In line with the London Plan Energy Hierarchy, the following '**Be Lean**' measures (energy efficiency) are proposed to achieve the calculated baseline.
- 5.2 The Outline Consent requires Part L (2013) to be achieved through '**Be Lean**' measures.

Domestic

Insulation Standards

- 5.3 Following an iterative approach, the following thermal envelope average area weighted U-values, were determined to meet the policy requirements. These values, or similar, will be applied to meet or exceed the U-values required by Part L (2013) Building Regulations:
- > External wall U-value of 0.24 W/m².K;
 - > Ground floor U-value of 0.14 W/m².K;
 - > Exposed floor U-value of 0.08 W/m².K;
 - > Roof U-value of 0.14 W/m².K;
 - > Windows with a U-value of 1.19W/m².K;
 - > Party walls and corridor walls U-value of 0.00 W/m².K (fully filled and sealed), considering the corridor as heated;
- 5.4 These values represent a good level of sustainable design and construction which surpasses the notional building.

Air Tightness and Ventilation

- 5.5** Air tightness standards will conform to, and exceed, Approved Document Part L requirements. By reducing air leakage loss and convective bypass of insulation, an improvement of design air permeability rate from $10\text{m}^3/\text{hm}^2$ to less than $4\text{m}^3/\text{hm}^2$ will further reduce space heating requirements.
- 5.6** It is proposed that the dwellings will utilise Part L& F compliant centralised Mechanical Extract Ventilation (cMEV) systems. This system extracts stale air or pollutants (such as moisture) continuously, fresh air is then drawn into the dwelling through controlled background ventilators. These mechanisms are illustrated in Figure 3

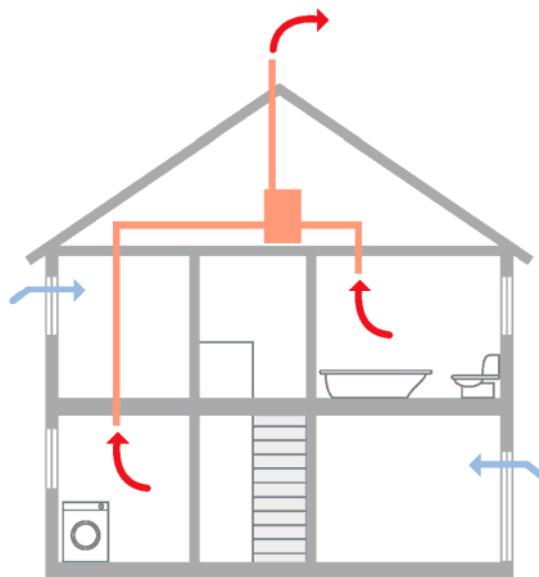


Figure 3: Centralised Mechanical Extract Ventilation System

- 5.7** The selected cMEV units will typically have low Specific Fan Powers (SFP) between $0.16\text{--}0.20\text{ W/l/s}$.
- 5.8** Additionally, all dwellings, where safe, will have openable windows and therefore the ability to naturally ventilate should the occupant desire. Convective ventilation and night purging of heat will therefore be facilitated.

Thermal Bridging

- 5.9** In well insulated buildings, as much as 30% of heat loss can occur through thermal bridges, which occur when highly conductive elements (e.g. metal studs) in the wall construction enable a low resistance escape route for heat.

- 5.10** Part L1A now places increased importance on addressing heat losses through thermal bridging. As such, the Applicant is committed to developing a building fabric where these are minimised as far as practicable.
- 5.11** It is proposed that for this development on the basis of a concrete frame and steel walls that a mix of default, accredited, and bespoke thermal bridges would be targeted. This is based on our experience and availability to alter constructions accordingly.
- 5.12** Significant and prevalent thermal bridges will be reduced through good design. Where bespoke thermal bridge heat loss values (psi-Values) are used, they will be assessed to allow the Psi-value to be used within the SAP calculations.
- 5.13** Where technically valid several thermal bridge junctions, such as dwelling corners and window surrounds, will be able to claim the Psi-value associated with Accredited Constructions Details (ACDs).
- 5.14** The following thermal bridge junctions between various elements have been assumed to be bespoke on the basis they can economically and technically be targeted. These go beyond standard practice and help to ensure a lean building design. These include between:
- > E7 party wall between dwellings 0.09-0.11 W/mK;
 - > E18 Party wall between dwellings 0.037W/mK;
 - > Balconies reduced significantly from a default of 1.0 to 0.3W/mK for cast in, and 0.43W/mK for bolt on balconies;
- 5.15** The Above values have been calculated for Phase 1 of the development and are intended to be used for future phases.
- 5.16** The targeted thermal bridge psi values will be fully determined during detail design.

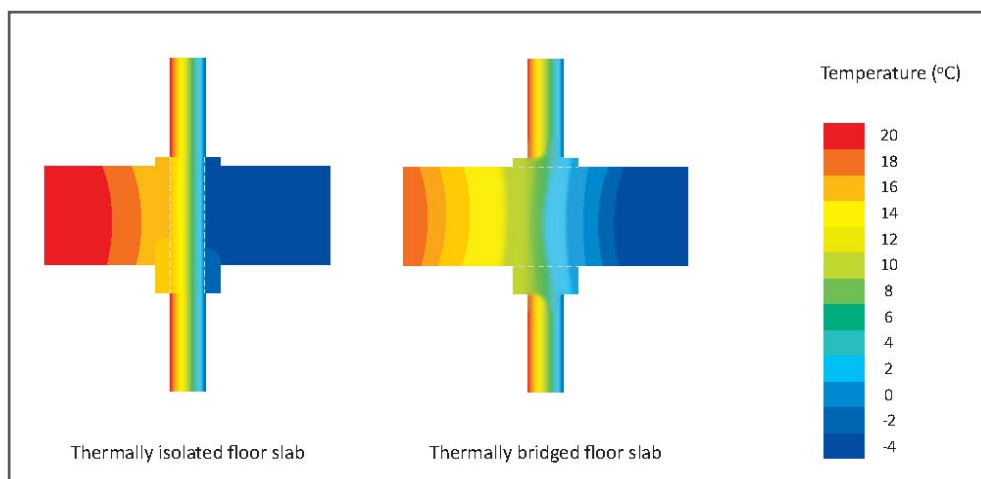


Figure 4: Thermal Bridging (SCI P380 2012)

- 5.17 Figure 4 illustrates the benefits of reducing thermal bridges; reducing heat loss and ensuring higher internal surface temperatures.

Space Heating & Hot Water

- 5.18 The space heating requirement of all build elements will be reduced by the fabric, air tightness and ventilation measures detailed above.
- 5.19 It is intended to take advantage of winter solar gain to reduce the space heating demands of the homes.
- 5.20 The combination of the above measures will create highly energy efficient homes.
- 5.21 The strategy will make use of communal heating utilising, among other technologies, conventional gas boilers. Therefore, in line with GLA guidance on Preparing Energy Statements the end energy strategy boiler efficiency has been used at the **Be Lean** Stage.
- 5.22 The boiler gross seasonal efficiency for the energy centre has been assessed to have an efficiency of 95% (e.g. Wessex Modumax). This forms part of the current DEN1 plantroom design which is within areas of the development that already benefit from Detailed Planning Consent.
- 5.23 The space heating systems will include time and zoning controls where appropriate and low loss dwelling metered heat interface units. This will allow the occupants to have a flexible and efficient way of controlling heating throughout the dwelling.

Limiting the Risk of Summer Overheating

- 5.24 Minimising the risk of summer overheating is important to ensure that homes are adapted to climate change and remain comfortable to occupy in the future.
- 5.25 In line with the Cooling Hierarchy within London Plan Policy 5.9, it is proposed to reduce the need for active cooling as far as possible and will not require the installation of mechanical cooling. All dwellings will therefore be subject to measures to minimise the risk of summer overheating to an acceptable level.
- 5.26 This will be done through the specification of passive measures such as low fabric U-values and ventilation systems capable of maintaining airflow through the dwelling, and solar control glazing which reduces the passage of solar radiation and therefore heat gains in peak summer months.
- 5.27 A g-factor of 0.45 has been used for the glazing for the dwelling.
- 5.28 Some units benefit from overhangs and balcony shading. These act effectively in mitigating any overheating risk while maintaining good levels of daylight.

- 5.29** Open-able windows will be used across the development and will enable convective-ventilation and night purging. These concepts are illustrated in Figure 5.

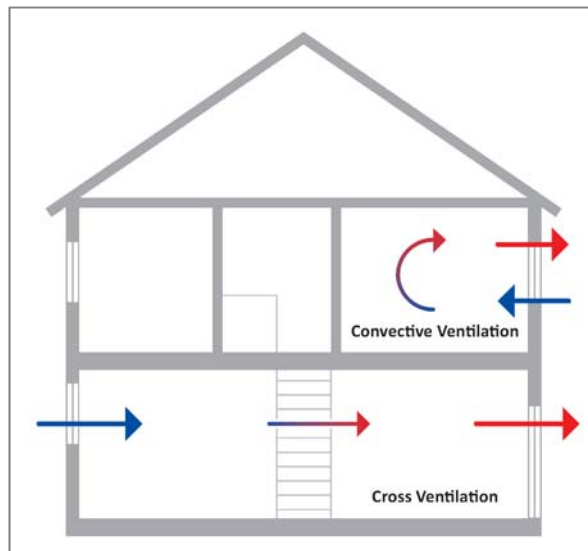


Figure 5: Natural Ventilation

- 5.30** The design of the development will aim that no dwelling will have a high risk of summer overheating and will adopt appropriate measures to ensure this is delivered.
- 5.31** In line with GLA Policy 5.9, the cooling hierarchy, the development has considered a range of passive and active mitigation measures to respond to climate change.
- 5.32** An overheating model and report will be submitted to the Council for approval prior to the commencement of any superstructure work to clear Condition 49. This report will detail how the design limits the risk of risk of summer overheating within dwellings.

Lighting and Appliances

- 5.33** It is very challenging to design and construct living spaces to reduce the unregulated electricity demands, because this is almost entirely dependent on the occupant of a home and can vary substantially. However, the Applicant is committed to ensuring that all efforts are made to enable the residents to minimise their unregulated electricity consumption and will ensure all appliances supplied to the apartments are of a high standard of energy efficiency.
- 5.34** Low energy lighting, >40 lumens per Watt, will be installed throughout the new build flats.

Non-Domestic

Insulation Standards

- 5.35** For the non-domestic areas U-values will be improved beyond the limiting U-values detailed in Part L2B. Example targeted values for all Non-Domestic areas are:
- > External wall U-values of 0.24 W/m²K;
 - > Ground and exposed floor U-values of 0.14 W/m²K;
 - > Flat roof U-values of 0.14 W/m²K;
 - > Whole window and glazed door U-value of 1.40 W/m²K;

Air Tightness and Ventilation

- 5.36** Non-domestic areas are considered as shells for this application (except for the residential facilities). We have considered that they can reasonably be provided with a balanced supply and extract mechanical ventilation system with a heat exchanger. This system would have a central air handling unit which would require a specific fan power (SFP) of 1.50 W/l/s and a heat recovery efficiency of at least 85%, any terminal units such as fan coil units would be expected to have a specific fan power of 0.3 W/l/s.
- 5.37** Air tightness standards will conform to, and exceed, Approved Document Part L requirements. By reducing air leakage loss and convective bypass of insulation, an improvement of design air permeability rate from 10m³/hm² to less than 5m³/hm² will further reduce space heating requirements.

Space Heating and Hot Water

- 5.38** All non-domestic development will have connection points to heat from an energy centre. This is discussed further with relation to decentralised energy in *Be Clean*.

Cooling and Limiting the Risk of Summer Overheating

- 5.39** The specification of passive measures such as low fabric U-values and ventilation systems capable of maintaining airflow reduces the demand on the mechanical cooling systems.
- 5.40** Low g-factors will reduce unwanted solar heat gains in peak summer months.

Cooling

- 5.41** Cooling is only considered for the non-domestic areas where there is a significant need as a result of the space use. However, cooling will be designed to maximise natural cooling before using energy therefore peak shaving. Table 2 shows the cooling demand calculated using the NCM.

Table 2: Cooling Demands

	Notional (MJ/m ²)	Actual (MJ/m ²)
Café	466.2	325.7
Office	117.6	78.6
Resident Facilities	92.4	69
Restaurant	428.4	292.5
Retail	209.1	121.9
Retail Units	215	134.6

- 5.42** To allow the occupant to efficiently use the systems a central time control with local temperature control should be installed. Sub-metering with alarm for out of range values for the HVAC and Lighting should also be considered.

Lighting

- 5.43** Energy efficient lighting is proposed to be installed on the site. This will help reduce the occupant's electrical energy bills. The lighting will be well designed and utilise luminaires which are LED or equivalently efficient.
- 5.44** It would be expected that non-domestic lighting will be provided with energy efficient lighting design, with a lamp efficacy greater than 100lm/W (can be lower for display lighting). This will also be accompanied with various automatic, manual and photoelectric dimming lighting controls, with a low parasitic power. These will help to reduce the energy consumption associated with lighting.
- 5.45** Zoning of lighting circuits also allows greater benefit to be made of natural daylight in the areas where it is available, without compromising light levels further away from windows.

CO₂ Emissions Following *Be Lean* Measures

- 5.46 Table 3 describes the energy demand for the development, based on the Building Regulations methodology.

Table 3: Energy demand for development after demand reduction measures

Energy demand for site by building use		
Energy demand use	Domestic	Non-Domestic
	kWh/yr	kWh/yr
Space heating	739,000	30
Hot water	691,000	320
Lighting	119,000	145
Auxiliary	16,000	1258
Cooling	-	160
Unregulated electricity	1,003,000	369
Unregulated gas	-	-

- 5.47 In achieving energy efficiency savings, the dwellings in the development also demonstrate compliance with the Target Fabric Energy Efficiency (TFEE). This is a mandatory requirement to demonstrate compliance with Approved Document Part L 1A and is demonstrated in Table 4 below.

Table 4: Summary table reporting on Fabric Energy Efficiency for dwellings

Summary report on FEE			
	Target Fabric Energy Efficiency (TFEE)	Design Fabric Energy Efficiency (DFEE)	Improvement
	kWh/yr	kWh/yr	%
Area Weighted	38.7	36.9	4.6%

- 5.48 Table 5 below outlines the reduction in CO₂ emissions following the inclusion of all the above energy efficiency measures for each of the energy strategies. All build types achieve or exceed the baseline assessment through *Be Lean* measures alone.

Table 5: CO₂ reductions following Be Lean measures

Carbon dioxide emissions (TCO ₂ ,a)			
	Domestic Regulated	Non-domestic Regulated	Total
New Builds – Baseline	420	103	1,130
After Be Lean	420	93	1,123
Development cumulative Total Reduction over Base case	0%	6%	1%

5.49 Summary CO₂ calculations, **Be Lean** SBEM outputs (BRUKLs), and **Be Lean** Dwelling Emission Rate (DER) Worksheets and can be found in Appendix B, D and E respectively.

6. BE CLEAN: DECENTRALISED ENERGY

6.1 In line with Policy 5.6 of the London Plan, the feasibility of decentralised heating networks as a **Be Clean** measure has been evaluated. This is the next step in the Energy Hierarchy after **Be Lean**. The London Plan outlines the following order of preference: -

- > Connection to existing heating or cooling networks
- > Site wide CHP network
- > Communal heating and cooling

6.2 Condition 50 requires the energy strategy of the development to be based on connection of all residential and non-residential buildings to a district energy and heating network.

Connection to Existing Heat Network

6.3 An existing Heat Network to service the Clarendon Gas Works development is in development as is temporary heat supply from DEN1 in the Southern Quarter of the site. An example of the Networks Layout is shown in Figure 6. The Eastern Quarter (circled) will house sub-stations for connection apparatus (heat exchanger plates etc.)

6.4 The heat network and DEN1 are consented under the detailed component of the hybrid masterplan consent. Alteration to the heat network strategy (e.g. type of plant) is not therefore within the scope of this Energy Statement or subsequent Reserved Matters Applications.

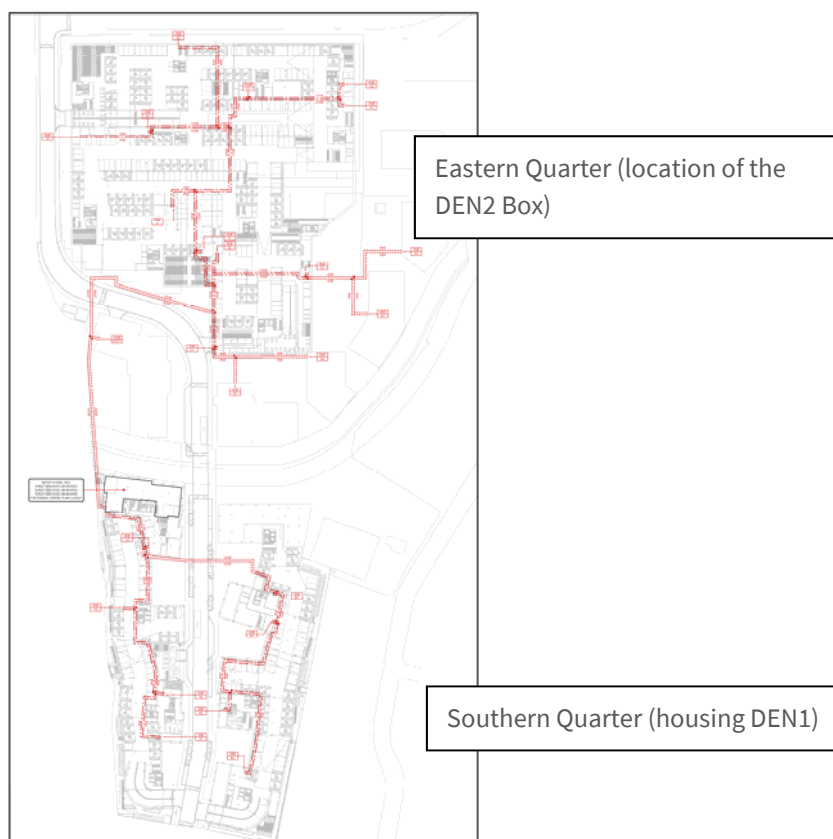


Figure 6: Clarendon Gas Works indicative District Heating Distribution Layout (Chapman BDSP)

- 6.5** 100% of heat will come from the Heat Network, currently this will be provided for by DEN1 in the Southern Quarter. DEN1 Energy Centre is expected to enable a 75% provision of low carbon heat via an optimised CHP with a Heat to Power ratio of 1.22 with an efficiency greater than 87%.
- 6.6** Subject to the S106 agreement, the whole of Clarendon Gas Works may connect to a more extensive Heat Network via the DEN2 Box to be delivered by Haringey Council.

CO₂ Emissions Following *Be Clean* Measures

6.7 Table 6, below, outlines the total reduction in CO₂ emissions following connection to the energy centre. The results show that for the domestic areas Policy 5.2 of the London Plan, 35% improvement in carbon emissions, have been achieved.

Table 6: Regulated CO₂ reductions showing improvements of *Be Clean* over *Be Lean* measures

Carbon dioxide emissions (TCO ₂ .a)			
	Domestic Regulated	Non-domestic Regulated	Total
New Builds – Baseline	420	103	523
After <i>Be Lean</i>	420	96	516
After <i>Be Clean</i>	273	87	360
Development cumulative Total Reduction over <i>Base case</i>	35%	15%	31%
Development Total Reduction over <i>Be Lean</i> case			30%

6.8 Summary CO₂ emissions for the *Be Clean* case can be seen in Appendix G. *Be Clean* DER worksheets and SBEM BRUKLs can be seen in Appendix H and I respectively.

7. DEN 2 BOX PROVISION

- 7.1** The Eastern Quarter is the location of the DEN2 box that the S106 requires St. William to provide to the Council for their fit-out as an Energy Centre for a Wood Green heat network. This is consented under the masterplan consent.
- 7.2** This section outlines the key S106 requirements as they relate to the DEN2 box design and the proposals for delivering this. This is a summary of detailed discussions held between St William and Haringey Borough Council. These discussions are beyond the scope of an Energy Statement.

S106 Requirements

- 7.3** The S106 provide the following key requirements for the DEN2 box:
- > To be at least 900m² in area;
 - > To have 6m clear height within, with localised area of 9m (allows for thermal stores;
 - > To be provided with suitable personnel and equipment access.
- 7.4** There are additional detailed requirements within the S106.

Location Principles

- 7.5** The Council's Wood Green heat network is predominantly to serve loads north and east of the CGW site. It is therefore logical that the DEN2 box is provided within the north-eastern portion of the CGW development.
- 7.6** As DEN2 will be fitted-out and operated by the Council (or those contracted by the Council), it is logical for access to be provided directly from offsite as opposed to through the CGW site.

DEN2 Location

- 7.7** It has therefore been determined that the basement beneath Block D4 is the optimal location of DEN2. This is illustrated in Figure 7 below. This shows the location of the DEN2 box in relation to the CGW site layout. DEN2 is adjacent to Brook Road.



Figure 7: Clarendon Gas Works showing location of DEN2 Box

7.8 Figure 8, below, provides the current basement layout around Block D4, clearly identifying DEN2.

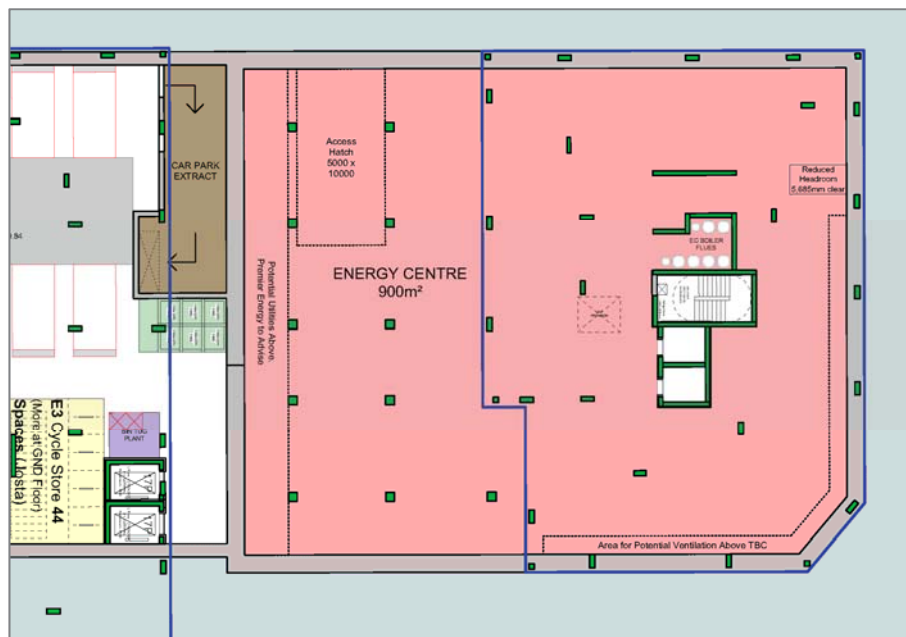


Figure 8: Eastern Quarter Current Basement (Panther Hudspith Architects)

DEN2 Design

- 7.9** Key items of the DEN2 box design are described below in relation to the S106 requirements. Detailed discussions are taking place with Haringey Borough Council on these and other items so as to demonstrate that the DEN2 box being provided is fit-for-purpose and meets all the detailed requirements of the S106. This includes calculations that prove that the design is capable of delivering the DEN2 fit-out by the Council. Such detail is outside the scope of an Energy Statement. The key items only are therefore outlined here.
- 7.10** **DEN2 Area:** DEN2 is clearly identified in Figure 8 as being 900m² in area. This meets the S106 requirements. Furthermore, it is a relatively uniform shape, which is efficient from an M&E design perspective. In addition to the 900m² at basement level, a ground floor welfare room is also provided.
- 7.11** **DEN2 Height:** A section through DEN2 is provided in Figure 9. This shows the height as generally 6m, with an area of ~240m² extending to 9m. This meets the requirements of the S106.



Figure 9: Current Section of DEN2 Box

- 7.12** **Flues:** A flue shaft is clearly shown on the architectural drawings and is accessible through the ground floor welfare room.
- 7.13** **DEN2 Personnel Access:** This is currently shown as provided through the ground floor welfare room. This space is suitable for installation of a lift by the council should they wish to do so.
- 7.14** **DEN2 Equipment Access:** A 10m x 5m gatic-type hatch is shown within the courtyard between Blocks D4 & E3. This is directly above the DEN2 box. An illustrative DEN2 plant layout is being

provided to the Council as part of detailed S106 DEN2 discussions. This ensures there is sufficient space for plant replacement movements within DEN2.

7.15 Ventilation: The architectural drawings of Block D4 show the provisions made for ventilation of DEN2.

7.16 Air Quality: A dispersion model has been undertaken for DEN2 based on an indicative design to ensure that the location in Block D4 is compliant from an air quality perspective; It is.

8. BE GREEN: RENEWABLE ENERGY TECHNOLOGIES

- 8.1 The final part of the London Plan Energy Hierarchy is **Be Green** which examines the feasibility of renewable energy technologies for Clarendon Gas Works.
- 8.2 In line with Policy 5.2, the development has already achieved the required 35% reduction in carbon emissions following the stated hierarchy. Policy 5.7 highlights that renewable technologies should be considered as the third step of the energy hierarchy. As a result, renewable technologies are not required for the purposes of the energy strategy to meet policy.
- 8.3 No renewables (other than heat pumps for non-domestic areas) form part of the Outline Consent Energy Strategy.
- 8.4 This section does however provide details to demonstrate the feasibility of renewable energy technologies. For technologies to be feasible, they must be complementary for the CHP engine specified at '**Be Clean**' stage.

Biomass Boiler

- 8.5 Biomass boilers generate heat on a renewable basis as they are run on biomass fuel which can be considered virtually carbon neutral.
- 8.6 The London Plan's energy hierarchy requires considering CHP before any other technologies. Biomass boilers directly compete with CHP.

Heat Pumps

- 8.7 Air Source Heat Pumps (ASHP) are a more economical alternative to Ground Source Heat Pump (GSHP) as they do not require ground works. They are more suited to non-domestic applications and have therefore been considered for the non-domestic areas.
- 8.8 To provide efficient cooling to non-domestic areas cooling equipment will be specified with high Energy Efficiency Ratios (EER) and Seasonal Energy Efficiency Ratios (SEER). These are considered in the '**Be Green**' section.
- 8.9 Given the commercial units are shell only; when they are fitted out by their subsequent owners, they may choose to install cooling. If this is the case, then it would be likely that they would utilise a reversible heat pump solution that provides heating too. As a result, it is proposed that during fit out they would likely use a heat pump with a **SEER of 6 and EER of 3.5**.

Wind Turbines

- 8.10 Urban rooftop wind turbines do not generally perform sufficiently to well to warrant their installation, due to the low and turbulent wind conditions present. They are therefore likely to remain technically unfeasible.
- 8.11 It has therefore been concluded that wind turbines are not a suitable technology for this site.

Solar Thermal Panels

- 8.12 Solar thermal panels generate heat for hot water.
- 8.13 The benefits of solar thermal panels are constrained by the seasonal variation in solar radiation. This means that solar thermal panels can only deliver a maximum of 60% of the annual hot water demand. This would still require all of the proposed conventional fuel heating infrastructure to be in place to meet times when DHW generation is not possible using this technology.
- 8.14 This technology would be in direct competition with the proposed CHP. It has therefore been concluded that solar thermal panels are not a suitable technology for this site.

Photovoltaic (PV) Panels

- 8.15 PV panels generate electricity from solar radiation. The generating potential of PV panels is not dependent on development demand, but on available roof space for installation and ensuring that they are not overshadowed.
- 8.16 As an electricity generating technology, PV panels generally operate during the day. This energy can be used on site, in the locality or sold back to the national grid. This means that the technology would directly offset the energy that would otherwise be drawn from the national grid.
- 8.17 However, it is not proposed to install any due to following of the energy hierarchy to maximise CO₂ reductions in the most appropriate manner. This reflects Policy 5.7 (B) of the London Plan which states provision of renewables is '*within the framework of the energy hierarchy*', which firmly requires energy efficiency (**'Be Lean'**) and community heating (**'Be Clean'**) measures to be prioritised.
- 8.18 In this instance, where the applicant is providing the DEN2 Box to the Council for their use in the Wood Green heat network, this Energy Strategy seeks to provide substantially more CO₂ reductions in the Local area at the **'Be Clean'** stage and in doing so, provide greater benefit than providing **'Be Green'** measures
- 8.19 Given that the required CO₂ reductions required in line with Policy 5.2 have been achieved at the second stage of the energy hierarchy, application of this technology is not required to achieve a carbon reduction.

CO₂ Emissions Following *Be Green* Measures

8.20 It should be noted that the combination of *Be Lean* and *Be Clean* measures enable the development to meet the requirements of London Plan Policy 5.2. Table 7 below demonstrates this.

Table 7: Regulated CO₂ reductions following *Be Green* measures over *Be Lean* and *Clean* measures

Carbon dioxide emissions (TCO ₂ .a)			
	Domestic Regulated	Non-domestic Regulated	Total
New Builds – Baseline	420	103	523
After <i>Be Lean</i>	420	96	516
After <i>Be Clean</i>	273	87	360
After <i>Be Green</i>	273	67	340
Development cumulative Total Reduction over <i>Base case</i>	35%	35%	35%
Development Total Reduction over <i>Be Clean</i> case			6%

9. ZERO CARBON

9.1 In line with the Outline Consent and S106 Agreement, 'Zero Carbon' offset payments are not to be levied at the Clarendon Gas Works development. This is due to St. William's provision of the DEN2 Box to the Council in lieu of this.

10. SUMMARY

- 10.1** The purpose of this Energy Statement is to address Condition 50 of the hybrid planning consent (HGY/2017/3117) for the proposed Clarendon Gas Works development in the London Borough of Haringey.
- 10.2** Condition 50 requires an updated Energy Strategy to be submitted prior to any Reserved Matters applications. This Energy Statement will provide the updated energy strategy to clear Condition 50 of planning consent HGY/2017/3117.
- 10.3** This energy strategy has been formulated following the London Plan (2016) Policy 5.2 and therefore the Energy Hierarchy: **Be Lean**, **Be Clean** and **Be Green**. The objective in the formulation of the strategy is to maximise the reductions in CO₂ emissions through the application of this Hierarchy with a cost-effective approach that is technically appropriate. In line with GLA Guidance this Energy Statement will demonstrate constancy with the Outline Consent and accompanying Energy Strategy; In addition to energy efficiency measures this provided for a gas CHP led heat network.
- 10.4** This Energy Statement considers a portion of the development within the Outline Consent, the Eastern Quarter. This is comprised of 439 new dwellings, and 2,505m² of new non-domestic developments. The development has been assessed under Approved Document Part L 1A (2013) and Part L 2A (2013) in this Energy Statement.
- 10.5** London Plan (2016) Policy 5.2 requires the equivalent of a reduction in Regulated CO₂ emissions by 35% beyond a determined 2013 baseline case on site. The Energy Statement consented under the 2017 hybrid application aligns with this 35% target.
- 10.6** A range of **Be Lean** energy efficiency measures are proposed for the dwellings. This is in line with the London Plan Energy Hierarchy. They enable the proposed elements to meet or exceed the baseline cases through energy efficiency alone.
- 10.7** In accordance with the Energy Hierarchy, the feasibility of decentralised energy production as a **Be Clean** measure has also been carefully examined. In line with the Outline Consent the Eastern Quarter buildings will connect into the consented site wide heat network. The initial heat source is located in Block A4. This achieves the carbon reductions required in line with Policy 5.2 of the London Plan.
- 10.8** In accordance with the Energy Hierarchy, the relevant **Be Green** renewable energy generating technologies have been evaluated. Given that the required energy reduction has been provided through the use of a site wide heating network, no further technologies were required to be applied. This aligns with the outline Consent.

- 10.9** The proposed design for the development will enable it to reduce its CO₂ emissions in line with London Plan requirements (35%) over the overall baseline case. This represents a high level of sustainable design.
- 10.10** The Tables below demonstrates the reduction in Regulated and Total CO₂ reductions after each stage of the Energy Hierarchy showing energy policy requirements have been achieved.

Domestic Carbon Dioxide Emissions and Savings after each stage of the Energy Hierarchy		
Stage	Carbon Dioxide Emissions (Tonnes CO ₂ per Annum)	
	Regulated	Unregulated
Baseline: Part L 2013 Compliant Development	420	519
After <i>Be Lean</i> Measures	420	519
After <i>Be Clean</i> Measures	273	519
After <i>Be Green</i> Measures	273	519
Stage	Regulated Carbon Dioxide Savings	
	Tonnes CO ₂ per Annum	Percentage
Savings from <i>Be Lean</i> Measures	1	0%
Savings from <i>Be Clean</i> Measures	147	35%
Savings from <i>Be Green</i> Measures	0	0%
Cumulative On-Site Savings	147	35%

Non-Domestic Carbon Dioxide Emissions and Savings after each stage of the Energy Hierarchy		
Stage	Carbon Dioxide Emissions (Tonnes CO ₂ per Annum)	
	Regulated	Unregulated
Baseline: Part L 2013 Compliant Development	103	88
After <i>Be Lean</i> Measures	96	88
After <i>Be Clean</i> Measures	87	88
After <i>Be Green</i> Measures	67	88
Stage	Regulated Carbon Dioxide Savings	
	Tonnes CO ₂ per Annum	Percentage
Savings from <i>Be Lean</i> Measures	6	6%
Savings from <i>Be Clean</i> Measures	9	9%
Savings from <i>Be Green</i> Measures	20	20%
Cumulative On-Site Savings	36	35%

Site Wide Carbon Dioxide Emissions and Cumulative Savings			
	Regulated Carbon Dioxide Emissions (Tonnes CO ₂ per Annum)	Regulated Carbon Dioxide Savings	
		Tonnes CO ₂ per Annum	Percentage
Baseline: Part L 2013 Compliant Development	523	-	-
After <i>Be Lean</i> Measures	516	7	1%
After <i>Be Clean</i> Measures	360	156	30%
After <i>Be Green</i> Measures	340	20	6%
Cumulative On-Site Savings		183	35%

APPENDICES

Appendix A

Site Plan

Appendix B

Summary CO₂ Emissions Rates & FEE Scores – *Be Lean*

Appendix C

TER Worksheets

Appendix D

BRUKL Outputs – *Be Lean*

Appendix E

DER Worksheets – *Be Lean*

Appendix F

Indicative Heat Network Layout

Appendix G

Summary CO₂ Emissions Rates – *Be Clean*

Appendix H

DER Worksheets – *Be Clean*

Appendix I

BRUKL Outputs – *Be Clean*

Appendix J

Low Carbon and Renewable Energy Technologies Summary

Appendix K

Summary CO₂ Emissions Rates – *Be Green*

Appendix L

BRUKL Outputs – *Be Green*

Appendix A

Site Plan



DRAFT

KEY		PROJECT				panter hudspith architects	
	SITE BOUNDARY	Clarendon Gas Works - Wood Green				11 th Floor - Hannibal House Elephant & Castle, London SE1 6TE t: 020 7701 0575 e: info@panterhudspith.com	
	DETAIL / OUTLINE APPLICATION BOUNDARY	DRAWING Proposed Site Layout Plan - Current				JOB No.	WORKSTAGE
A1	BLOCK REFERENCE					439	C
						DRAWING No.	SIZE
						SK171	A3
						SCALE	
						1:1250	

REV

DESCRIPTION

DRWN BY

CHKD BY

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10/10/17

15/08/17

10/07/17

17/02/17

Landscape and Roof Plans Updated

Building footprints updated and Application Boundaries shown

Building footprints updated

First Issued for Information

J8

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Appendix B

Summary CO₂ Emissions Rates & FEE Scores – *Be Lean*

Appendix B

CO₂ Emissions at Be Lean Stage

Unit Type Description	Unit Floor Area	Individual		Number of Units	Total			Emissions Rate Improvement
		Dwelling Emissions Rate	Target Emissions Rate		Total Floor Area	Dwelling Emissions Rate	Target Emissions Rate	
	m ²	kg CO ₂ /m ² /year	kg CO ₂ /m ² /year		m ²	kg CO ₂ /year	kg CO ₂ /year	-
Domestic								
1 BED - Exposed Floor	50	16.6	17.2	16	802	13,284	13,783	3.6%
1 BED - Mid Floor	50	15.5	15.5	56	2,808	43,484	43,601	0.3%
1 BED - Top Floor	50	19.2	19.1	12	602	11,580	11,483	-0.9%
2 BED - Exposed Floor	64	18.2	18.5	30	1,909	34,723	35,272	1.6%
2 BED - Mid Floor	64	15.9	15.7	182	11,581	184,095	182,149	-1.1%
2 BED - Top Floor	64	19.0	18.7	34	2,163	41,059	40,396	-1.6%
3 BED - Exposed Floor	80	16.6	16.2	2	161	2,666	2,596	-2.7%
3 BED - Mid Floor	80	14.1	14.1	13	1,044	14,761	14,678	-0.6%
3 BED - Top Floor	80	16.9	16.5	2	161	2,708	2,645	-2.4%
4 BED - Exposed Floor	95	15.1	14.5	2	190	2,873	2,766	-3.9%
4 BED - Mid Floor	95	12.7	12.4	13	1,237	15,735	15,358	-2.5%
4 BED - Top Floor	95	15.8	15.7	2	190	3,011	2,980	-1.0%
MANHATTAN - Exposed Floor	40	17.1	18.4	9	363	6,194	6,666	7.1%
MANHATTAN - Mid Floor	40	15.9	16.9	58	2,336	37,065	39,588	6.4%
MANHATTAN - Top Floor	40	19.5	20.1	8	322	6,284	6,492	3.2%
			Subtotal	439	25,869	419,523	420,454	0.2%
Non-Domestic								
Café	279	76.8	80.0	1	279	21,435	22,328	4.0%
Office	1,681	18.1	19.6	1	1,681	30,421	32,942	7.7%
Resident Facilities	936	19.8	20.5	1	936	18,523	19,178	3.4%
Restaurant	130	78.0	80.9	1	130	10,101	10,477	3.6%
Retail	89	39.3	41.0	1	89	3,494	3,645	4.1%
Retail Units	344	36.0	41.3	1	344	12,391	14,215	12.8%
			Subtotal		3,458	96,364	102,784	6.2%
			Total for All Units		29,327	515,887	523,238	1.4%

Fabric Energy Efficiency

Unit Type Description	Unit Floor Area	Individual		Number of Units	Total			Fabric Energy Efficiency Improvement
		Dwelling Fabric Energy Efficiency	Target Fabric Energy Efficiency		Total Floor Area	Dwelling Fabric Energy Efficiency	Target Fabric Energy Efficiency	
	m ²	kWh/m ² /year	kWh/m ² /year		m ²	kWh/year	kWh/year	-
1 BED - Exposed Floor	50	35.2	39.2	16	802	28,258	31,462	10.2%
1 BED - Mid Floor	50	30.8	30.9	56	2,808	86,482	86,643	0.2%
1 BED - Top Floor	50	46.4	48.8	12	602	27,917	29,378	5.0%
2 BED - Exposed Floor	64	46.3	51.6	30	1,909	88,387	98,537	10.3%
2 BED - Mid Floor	64	36.4	37.5	182	11,581	421,667	433,894	2.8%
2 BED - Top Floor	64	50.0	53.0	34	2,163	108,068	114,601	5.7%
3 BED - Exposed Floor	80	43.5	44.7	2	161	6,989	7,182	2.7%
3 BED - Mid Floor	80	33.3	34.2	13	1,044	34,782	35,752	2.7%
3 BED - Top Floor	80	44.7	46.4	2	161	7,183	7,451	3.6%
4 BED - Exposed Floor	95	40.1	40.6	2	190	7,637	7,718	1.0%
4 BED - Mid Floor	95	29.6	29.7	13	1,237	36,547	36,707	0.4%
4 BED - Top Floor	95	43.4	46.4	2	190	8,264	8,830	6.4%
MANHATTAN - Exposed Floor	40	33.8	39.0	9	363	12,241	14,140	13.4%
MANHATTAN - Mid Floor	40	28.5	31.3	58	2,336	66,503	73,071	9.0%
MANHATTAN - Top Floor	40	43.9	48.1	8	322	14,144	15,489	8.7%
			Floor Weighted Average	439	25,869	36.9	38.7	4.6%

Appendix C

TER Worksheets

TER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	05/12/2018
Address	1Bed Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	50.15 (1a) x	2.50 (2a) =	125.38 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 50.15 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) =	125.38 (5)

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent 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
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 20 ÷ (5) = 0.16 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	5.00 (17)
--	--

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)

Number of sides on which the dwelling is sheltered	3 (19)
--	-------------------------------------

Shelter factor	1 - [0.075 x (19)] = 0.78 (20)
----------------	---

Infiltration rate incorporating shelter factor	(18) x (20) = 0.32 (21)
--	--

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70 (22)

Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18 (22a)
-----------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	---

Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.40	0.40	0.39	0.35	0.34	0.30	0.30	0.29	0.32	0.34	0.36	0.37 (22b)
---	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	---

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	N/A (23a)
---	--

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A (23c)
--	--

d) natural ventilation or whole house positive input ventilation from loft	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57 (24d)
--	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	---

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57 (25)
--	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	--

3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K
Window		9.00	x	1.33	=	11.93	(27)
Exposed floor	50.15	x	0.13	=	6.52		(28b)
Party wall	55.09	x	0.00	=	0.00		(32)
External wall	11.31	x	0.18	=	2.04		(29a)
Total area of external elements ΣA, m ²	70.46						(31)
Fabric heat loss, W/K = Σ(A x U)					(26)...(30) + (32) =	20.49	(33)
Heat capacity Cm = Σ(A x κ)					(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)
Thermal mass parameter (TMP) in kJ/m ² K						250.00	(35)
Thermal bridges: Σ(L x Ψ) calculated using Appendix K						7.31	(36)
Total fabric heat loss						(33) + (36) =	27.80 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	24.07	23.94	23.81	23.21	23.09	22.57	22.57	22.47	22.77	23.09	23.32	23.56 (38)
Heat transfer coefficient, W/K (37)m + (38)m	51.87	51.74	51.61	51.00	50.89	50.36	50.36	50.27	50.57	50.89	51.12	51.36
Average = Σ(39)1...12/12 =	51.00 (39)											

Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	1.03	1.03	1.03	1.02	1.01	1.00	1.00	1.00	1.01	1.01	1.02	1.02
Average = Σ(40)1...12/12 =	1.02 (40)											

Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00 (40)
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4. Water heating energy requirement

Assumed occupancy, N	1.69 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	74.44 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	81.89	78.91	75.93	72.96	69.98	67.00	67.00	69.98	72.96	75.93	78.91	81.89
Σ(44)1...12 =	893.34 (44)											

Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	121.44	106.21	109.60	95.55	91.69	79.12	73.31	84.13	85.13	99.21	108.30	117.61
Σ(45)1...12 =	1171.31 (45)											

Distribution loss 0.15 x (45)m	18.22	15.93	16.44	14.33	13.75	11.87	11.00	12.62	12.77	14.88	16.25	17.64 (46)
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Storage volume (litres) including any solar or WWHRs storage within same vessel	1.00 (47)
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Water storage loss:	
a) If manufacturer's declared loss factor is known (kWh/day)	0.21 (48)
Temperature factor from Table 2b	0.54 (49)
Energy lost from water storage (kWh/day) (48) x (49)	0.12 (50)
Enter (50) or (54) in (55)	0.12 (55)

Water storage loss calculated for each month (55) x (41)m	3.57	3.23	3.57	3.46	3.57	3.46	3.57	3.57	3.46	3.57	3.46	3.57 (56)
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If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - Vs] ÷ (47), else (56)	3.57	3.23	3.57	3.46	3.57	3.46	3.57	3.57	3.46	3.57	3.46	3.57 (57)
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Primary circuit loss for each month from Table 3

	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													
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m													
	148.27	130.45	136.43	121.52	118.52	105.09	100.15	110.96	111.10	126.05	134.27	144.44	(62)
Solar DHW input calculated using Appendix G or Appendix H													
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
Output from water heater for each month (kWh/month) (62)m + (63)m													
	148.27	130.45	136.43	121.52	118.52	105.09	100.15	110.96	111.10	126.05	134.27	144.44	
	$\Sigma(64)1...12 =$											1487.25	(64)
Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]													
	61.85	54.71	57.91	52.55	51.95	47.08	45.84	49.44	49.08	54.46	56.78	60.57	(65)

5. Internal gains													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)													
	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.45	11.94	9.71	7.35	5.50	4.64	5.01	6.52	8.75	11.11	12.97	13.82	(67)
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	147.62	149.16	145.30	137.08	126.70	116.95	110.44	108.91	112.77	120.99	131.36	141.11	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	(69)
Pump and fan gains (Table 5a)													
	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evaporation (Table 5)													
	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	(71)
Water heating gains (Table 5)													
	83.13	81.41	77.84	72.98	69.83	65.39	61.62	66.45	68.17	73.19	78.87	81.41	(72)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
	295.62	293.92	284.26	268.83	253.45	238.40	228.49	233.30	241.10	256.71	274.61	287.76	(73)

6. Solar gains												
	Access factor Table 6d		Area m ²		Solar flux W/m ²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
SouthEast	0.77	x	9.00	x	36.79	x 0.9 x	0.63	x	0.70	=	101.20	(77)
Solar gains in watts $\Sigma(74)m...(82)m$												
	101.20	172.38	235.86	292.25	327.34	324.97	313.31	287.13	255.39	190.52	121.22	86.61 (83)
Total gains - internal and solar (73)m + (83)m												
	396.82	466.31	520.13	561.08	580.79	563.38	541.80	520.42	496.49	447.23	395.83	374.37 (84)

7. Mean internal temperature (heating season)													
Temperature during heating periods in the living area from Table 9, Th1(°C)												21.00	(85)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains for living area n1,m (see Table 9a)													
0.99	0.98	0.95	0.88	0.75	0.56	0.41	0.44	0.67	0.91	0.98	0.99	(86)	
Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)													
20.10	20.28	20.52	20.77	20.93	20.99	21.00	21.00	20.97	20.76	20.38	20.06	(87)	

Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)													
	20.05	20.06	20.06	20.07	20.07	20.08	20.08	20.08	20.08	20.07	20.07	20.06	(88)
Utilisation factor for gains for rest of dwelling n2,m													
	0.99	0.98	0.94	0.85	0.69	0.49	0.32	0.35	0.59	0.88	0.98	0.99	(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)													
	18.87	19.13	19.47	19.81	20.01	20.07	20.08	20.08	20.05	19.82	19.29	18.82	(90)
Living area fraction	Living area ÷ (4) =											0.66	(91)
Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2													
	19.67	19.89	20.16	20.44	20.61	20.67	20.68	20.68	20.65	20.44	20.01	19.63	(92)
Apply adjustment to the mean internal temperature from Table 4e where appropriate													
	19.67	19.89	20.16	20.44	20.61	20.67	20.68	20.68	20.65	20.44	20.01	19.63	(93)

8. Space heating requirement													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, η_m													
	0.99	0.97	0.94	0.87	0.73	0.53	0.38	0.41	0.64	0.89	0.98	0.99	(94)
Useful gains, $\eta_m G_m$, W (94)m x (84)m													
	392.40	454.46	490.36	486.39	422.18	301.22	205.02	214.33	319.07	398.55	386.15	371.20	(95)
Monthly average external temperature from Table U1													
	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate for mean internal temperature, L_m , W [(39)m x ((93)m - (96)m)]													
	797.38	775.38	704.82	588.57	453.42	305.85	205.57	215.22	331.43	500.71	659.78	792.61	(97)
Space heating requirement, kWh/month $0.024 \times [(97)m - (95)m] \times (41)m$													
	301.30	215.66	159.56	73.57	23.25	0.00	0.00	0.00	0.00	76.01	197.01	313.53	
	$\sum(98)1...5, 10...12 =$											1359.88	(98)
Space heating requirement kWh/m ² /year	$(98) \div (4) =$											27.12	(99)

9a. Energy requirements - individual heating systems including micro-CHP													
Space heating													
Fraction of space heat from secondary/supplementary system (table 11)												0.00	(201)
Fraction of space heat from main system(s)											1 - (201) =	1.00	(202)
Fraction of space heat from main system 2												0.00	(202)
Fraction of total space heat from main system 1											(202) x [1 - (203)] =	1.00	(204)
Fraction of total space heat from main system 2											(202) x (203) =	0.00	(205)
Efficiency of main system 1 (%)												93.50	(206)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating fuel (main system 1), kWh/month													
	322.25	230.65	170.65	78.68	24.86	0.00	0.00	0.00	0.00	81.30	210.71	335.32	
	$\Sigma(211)1...5, 10...12 =$											1454.42	(211)

Water heating													
Efficiency of water heater													
	86.67	86.15	85.23	83.52	81.38	79.80	79.80	79.80	79.80	83.51	85.84	86.83	(217)
Water heating fuel, kWh/month													
	171.08	151.43	160.07	145.49	145.64	131.69	125.50	139.05	139.23	150.93	156.43	166.35	
	$\sum(219a)1...12 =$											1782.89	(219)

Annual totals												
Space heating fuel - main system 1												1454.42
Water heating fuel												1782.89

Electricity for pumps, fans and electric keep-hot (Table 4f)

central heating pump or water pump within warm air heating unit

30.00

(230c)

boiler flue fan

45.00

(230e)

Total electricity for the above, kWh/year

75.00

(231)

Electricity for lighting (Appendix L)

237.50

(232)

Total delivered energy for all uses

(211)...(221) + (231) + (232)...(237b) = 3549.81

(238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	1454.42	x	3.48	x 0.01 =	50.61	(240)
Water heating	1782.89	x	3.48	x 0.01 =	62.04	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	237.50	x	13.19	x 0.01 =	31.33	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	273.88	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.21	(257)
SAP value	83.14	
SAP rating (section 13)	83	(258)
SAP band	B	

12a. CO₂ emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	1454.42	x	0.216	=	314.16	(261)
Water heating	1782.89	x	0.216	=	385.10	(264)
Space and water heating				(261) + (262) + (263) + (264) =	699.26	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	237.50	x	0.519	=	123.26	(268)
Total CO ₂ , kg/year				(265)...(271) =	861.45	(272)
Dwelling CO ₂ emission rate				(272) ÷ (4) =	17.18	(273)
EI value					87.87	
EI rating (section 14)					88	(274)
EI band					B	

13a. Primary energy - individual heating systems including micro-CHP

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	1454.42	x	1.22	=	1774.40	(261)
Water heating	1782.89	x	1.22	=	2175.12	(264)
Space and water heating				(261) + (262) + (263) + (264) =	3949.52	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	237.50	x	3.07	=	729.13	(268)
Primary energy kWh/year					4908.90	(272)
Dwelling primary energy rate kWh/m ² /year					97.88	(273)

TER Worksheet Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	04/12/2018
Address	1Bed Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)		Average storey height (m)		Volume (m ³)	
Lowest occupied	50.15	(1a)	x	2.50	(2a)	= 125.38 (3a)
Total floor area	50.15	(4)				
Dwelling volume				(3a) + (3b) + (3c) + (3d)...(3n) =	125.38	(5)

2. Ventilation rate

			m ³ per hour	
Number of chimneys	0	x 40 =	0	(6a)
Number of open flues	0	x 20 =	0	(6b)
Number of intermittent 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)

Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 20	÷ (5) =	0.16	(8)
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If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	5.00	(17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.41	(18)
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Number of sides on which the dwelling is sheltered	3	(19)
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Shelter factor	1 - [0.075 x (19)] = 0.78	(20)
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Infiltration rate incorporating shelter factor	(18) x (20) = 0.32	(21)
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Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)

Wind factor (22)/m ÷ 4

	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)/m

	0.40	0.40	0.39	0.35	0.34	0.30	0.30	0.29	0.32	0.34	0.36	0.37	(22b)
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	N/A	(23a)
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If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A	(23c)
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d) natural ventilation or whole house positive input ventilation from loft

	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)

	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K
Window			9.00	x 1.33	= 11.93		(27)
Party wall			55.09	x 0.00	= 0.00		(32)
External wall			11.31	x 0.18	= 2.04		(29a)
Total area of external elements ΣA, m ²			20.31				(31)
Fabric heat loss, W/K = Σ(A x U)					(26)...(30) + (32) = 13.97		(33)
Heat capacity Cm = Σ(A x κ)					(28)...(30) + (32) + (32a)...(32e) = N/A		(34)
Thermal mass parameter (TMP) in kJ/m ² K					250.00		(35)
Thermal bridges: Σ(L x Ψ) calculated using Appendix K					1.71		(36)
Total fabric heat loss					(33) + (36) = 15.68		(37)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)											
24.07	23.94	23.81	23.21	23.09	22.57	22.57	22.47	22.77	23.09	23.32	23.56

Heat transfer coefficient, W/K (37)m + (38)m											
39.75	39.62	39.49	38.89	38.77	38.25	38.25	38.15	38.45	38.77	39.00	39.24
Average = Σ(39)1...12/12 =											38.89

Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)											
0.79	0.79	0.79	0.78	0.77	0.76	0.76	0.76	0.77	0.77	0.78	0.78
Average = Σ(40)1...12/12 =											0.78

Number of days in month (Table 1a)											
31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00

4. Water heating energy requirement

Assumed occupancy, N												1.69	(42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36												74.44	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
	81.89	78.91	75.93	72.96	69.98	67.00	67.00	69.98	72.96	75.93	78.91	81.89	
	Σ(44)1...12 =											893.34	(44)

Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)											
121.44	106.21	109.60	95.55	91.69	79.12	73.31	84.13	85.13	99.21	108.30	117.61
Σ(45)1...12 =											1171.31

Distribution loss 0.15 x (45)m											
18.22	15.93	16.44	14.33	13.75	11.87	11.00	12.62	12.77	14.88	16.25	17.64

Storage volume (litres) including any solar or WWHRS storage within same vessel	1.00	(47)
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Water storage loss:											
a) If manufacturer's declared loss factor is known (kWh/day)											0.21
Temperature factor from Table 2b											0.54
Energy lost from water storage (kWh/day) (48) x (49)											0.12
Enter (50) or (54) in (55)											0.12

Water storage loss calculated for each month (55) x (41)m											
3.57	3.23	3.57	3.46	3.57	3.46	3.57	3.57	3.46	3.57	3.46	3.57

If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)											
3.57	3.23	3.57	3.46	3.57	3.46	3.57	3.57	3.46	3.57	3.46	3.57

Primary circuit loss for each month from Table 3											
23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m											
148.27	130.45	136.43	121.52	118.52	105.09	100.15	110.96	111.10	126.05	134.27	144.44

Solar DHW input calculated using Appendix G or Appendix H											
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Output from water heater for each month (kWh/month) (62)m + (63)m											
148.27	130.45	136.43	121.52	118.52	105.09	100.15	110.96	111.10	126.05	134.27	144.44
Σ(64)1...12 =											1487.25

Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]											
61.85	54.71	57.91	52.55	51.95	47.08	45.84	49.44	49.08	54.46	56.78	60.57

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabolic gains (Table 5)											
84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5											
13.45	11.94	9.71	7.35	5.50	4.64	5.01	6.52	8.75	11.11	12.97	13.82

Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5											
147.62	149.16	145.30	137.08	126.70	116.95	110.44	108.91	112.77	120.99	131.36	141.11

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5											
31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47

Pump and fan gains (Table 5a)											
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00

Losses e.g. evaporation (Table 5)											
-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78

Water heating gains (Table 5)											
83.13	81.41	77.84	72.98	69.83	65.39	61.62	66.45	68.17	73.19	78.87	81.41

Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m											
295.62	293.92	284.26	268.83	253.45	238.40	228.49	233.30	241.10	256.71	274.61	287.76

6. Solar gains

	Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W
NorthWest	0.77	x 9.00	x 11.28	x 0.9 x 0.63	x 0.70	= 31.03

Solar gains in watts Σ(74)m...(82)m											
31.03	63.17	113.81	186.91	251.25	267.86	250.58	199.76	138.68	77.20	39.05	25.34

Total gains - internal and solar (73)m + (83)m											
326.65	357.09	398.08	455.74	504.70	506.26	479.07	433.06	379.79	333.91	313.66	313.11

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1(°C)											
											21.00

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area n1,m (see Table 9a)											
1.00	0.99	0.97	0.89	0.69	0.48	0.35	0.40	0.68	0.94	0.99	1.00

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)											
20.32	20.43	20.63	20.87	20.98	21.00	21.00	21.00	20.99	20.82	20.54	20.30

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

20.26	20.26	20.26	20.27	20.28	20.29	20.29	20.29	20.28	20.28	20.27	20.27	(88)		
Utilisation factor for gains for rest of dwelling n2,m														
0.99	0.99	0.97	0.86	0.65	0.43	0.29	0.34	0.62	0.92	0.99	1.00	(89)		
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)														
19.35	19.51	19.80	20.13	20.26	20.28	20.29	20.29	20.27	20.08	19.67	19.33	(90)		
Living area fraction												Living area ÷ (4) =	0.66	(91)
Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2														
19.99	20.11	20.34	20.61	20.73	20.75	20.75	20.75	20.74	20.56	20.24	19.97	(92)		
Apply adjustment to the mean internal temperature from Table 4e where appropriate														
19.99	20.11	20.34	20.61	20.73	20.75	20.75	20.75	20.74	20.56	20.24	19.97	(93)		

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Utilisation factor for gains, ηm														
0.99	0.99	0.97	0.87	0.68	0.46	0.33	0.38	0.66	0.93	0.99	1.00	(94)		
Useful gains, ηmGm, W (94)m x (84)m														
324.77	353.02	384.78	398.45	341.34	234.76	158.83	165.99	249.99	310.14	309.57	311.71	(95)		
Monthly average external temperature from Table U1														
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)		
Heat loss rate for mean internal temperature, Lm, W [(39)m x {(93)m - (96)m}]														
623.63	602.82	546.66	455.47	350.14	235.32	158.87	166.11	255.32	386.35	512.40	618.79	(97)		
Space heating requirement, kWh/month 0.024 x {(97)m - (95)m} x (41)m														
222.35	167.87	120.44	41.06	6.55	0.00	0.00	0.00	0.00	56.70	146.04	228.47			
												Σ(98)1...5, 10...12 =	989.48	(98)
Space heating requirement kWh/m²/year												(98) ÷ (4)	19.73	(99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating														
Fraction of space heat from secondary/supplementary system (table 11)												0.00	(201)	
Fraction of space heat from main system(s)												1 - (201) =	1.00	(202)
Fraction of space heat from main system 2													0.00	(202)
Fraction of total space heat from main system 1												(202) x [1 - (203)] =	1.00	(204)
Fraction of total space heat from main system 2												(202) x (203) =	0.00	(205)
Efficiency of main system 1 (%)													93.50	(206)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Space heating fuel (main system 1), kWh/month														
237.81	179.54	128.81	43.91	7.01	0.00	0.00	0.00	0.00	60.64	156.20	244.35			
												Σ(211)1...5, 10...12 =	1058.26	(211)

Water heating														
Efficiency of water heater														
85.89	85.49	84.48	82.26	80.30	79.80	79.80	79.80	79.80	82.84	85.04	86.03	(217)		
Water heating fuel, kWh/month														
172.63	152.59	161.49	147.74	147.60	131.69	125.50	139.05	139.23	152.16	157.89	167.89			
												Σ(219a)1...12 =	1795.46	(219)

Annual totals													
Space heating fuel - main system 1												1058.26	
Water heating fuel												1795.46	
Electricity for pumps, fans and electric keep-hot (Table 4f)													

central heating pump or water pump within warm air heating unit	30.00	(230c)
boiler flue fan	45.00	(230e)
Total electricity for the above, kWh/year		75.00 (231)
Electricity for lighting (Appendix L)		237.50 (232)
Total delivered energy for all uses	(211)...(221) + (231) + (232)...(237b) =	3166.22 (238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	1058.26	x	3.48	x 0.01 =	36.83	(240)
Water heating	1795.46	x	3.48	x 0.01 =	62.48	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	237.50	x	13.19	x 0.01 =	31.33	(250)
Additional standing charges					120.00	(251)
Total energy cost			(240)...(242) + (245)...(254) =		260.53	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.15	(257)
SAP value	83.96	
SAP rating (section 13)	84	(258)
SAP band	B	

12a. CO₂ emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	1058.26	x	0.216	=	228.58	(261)
Water heating	1795.46	x	0.216	=	387.82	(264)
Space and water heating			(261) + (262) + (263) + (264) =		616.40	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	237.50	x	0.519	=	123.26	(268)
Total CO ₂ , kg/year			(265)...(271) =		778.59	(272)
Dwelling CO ₂ emission rate			(272) ÷ (4) =		15.53	(273)
EI value					89.04	
EI rating (section 14)					89	(274)
EI band					B	

13a. Primary energy - individual heating systems including micro-CHP

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	1058.26	x	1.22	=	1291.08	(261)
Water heating	1795.46	x	1.22	=	2190.46	(264)
Space and water heating			(261) + (262) + (263) + (264) =		3481.54	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	237.50	x	3.07	=	729.13	(268)
Primary energy kWh/year					4440.92	(272)
Dwelling primary energy rate kWh/m2/year					88.55	(273)

TER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	04/12/2018
Address	1Bed Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	50.15 (1a) x	2.50 (2a) =	125.38 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 50.15 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) = 125.38 (5)	

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent 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
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 20 ÷ (5) = 0.16 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	5.00 (17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)

Number of sides on which the dwelling is sheltered	3 (19)
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Shelter factor	1 - [0.075 x (19)] = 0.78 (20)
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Infiltration rate incorporating shelter factor	(18) x (20) = 0.32 (21)
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Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70 (22)

Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18 (22a)
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.40	0.40	0.39	0.35	0.34	0.30	0.30	0.29	0.32	0.34	0.36	0.37 (22b)
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	N/A (23a)
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If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A (23c)
--	--

d) natural ventilation or whole house positive input ventilation from loft	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57 (24d)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57 (25)
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K
Window	9.00	x	1.33	=	11.93 (27)		
Party wall	55.09	x	0.00	=	0.00 (32)		
External wall	11.31	x	0.18	=	2.04 (29a)		
Roof	50.15	x	0.13	=	6.52 (30)		
Total area of external elements ΣA, m ²	70.46 (31)						
Fabric heat loss, W/K = Σ(A x U)					(26)...(30) + (32) = 20.49 (33)		
Heat capacity Cm = Σ(A x κ)					(28)...(30) + (32) + (32a)...(32e) = N/A (34)		
Thermal mass parameter (TMP) in kJ/m ² K					250.00 (35)		
Thermal bridges: Σ(L x Ψ) calculated using Appendix K					8.34 (36)		
Total fabric heat loss					(33) + (36) = 28.82 (37)		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	24.07	23.94	23.81	23.21	23.09	22.57	22.57	22.47	22.77	23.09	23.32	23.56 (38)
Heat transfer coefficient, W/K (37)m + (38)m	52.90	52.77	52.64	52.03	51.92	51.39	51.39	51.29	51.59	51.92	52.15	52.39
Average = Σ(39)1...12/12 =	52.03 (39)											

Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	1.05	1.05	1.05	1.04	1.04	1.02	1.02	1.02	1.03	1.04	1.04	1.04
Average = Σ(40)1...12/12 =	1.04 (40)											

Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00 (40)
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4. Water heating energy requirement

Assumed occupancy, N	1.69 (42)
Annual average hot water usage in litres per day V _{d,average} = (25 x N) + 36	74.44 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month V _{d,m} = factor from Table 1c x (43)	81.89	78.91	75.93	72.96	69.98	67.00	67.00	69.98	72.96	75.93	78.91	81.89
Σ(44)1...12 =	893.34 (44)											

Energy content of hot water used = 4.18 x V _{d,m} x n _m x T _m /3600 kWh/month (see Tables 1b, 1c 1d)	121.44	106.21	109.60	95.55	91.69	79.12	73.31	84.13	85.13	99.21	108.30	117.61
Σ(45)1...12 =	1171.31 (45)											

Distribution loss 0.15 x (45)m	18.22	15.93	16.44	14.33	13.75	11.87	11.00	12.62	12.77	14.88	16.25	17.64 (46)
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Storage volume (litres) including any solar or WWHRs storage within same vessel	1.00 (47)
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Water storage loss:	
a) If manufacturer's declared loss factor is known (kWh/day)	0.21 (48)
Temperature factor from Table 2b	0.54 (49)
Energy lost from water storage (kWh/day) (48) x (49)	0.12 (50)
Enter (50) or (54) in (55)	0.12 (55)

Water storage loss calculated for each month (55) x (41)m	3.57	3.23	3.57	3.46	3.57	3.46	3.57	3.57	3.46	3.57	3.46	3.57 (56)
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If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - V _s] ÷ (47), else (56)	3.57	3.23	3.57	3.46	3.57	3.46	3.57	3.57	3.46	3.57	3.46	3.57 (57)
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Primary circuit loss for each month from Table 3

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													
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)	
Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m													
148.27	130.45	136.43	121.52	118.52	105.09	100.15	110.96	111.10	126.05	134.27	144.44	(62)	
Solar DHW input calculated using Appendix G or Appendix H													
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)	
Output from water heater for each month (kWh/month) (62)m + (63)m													
148.27	130.45	136.43	121.52	118.52	105.09	100.15	110.96	111.10	126.05	134.27	144.44		
											$\Sigma(64)1...12 =$	1487.25	(64)
Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]													
61.85	54.71	57.91	52.55	51.95	47.08	45.84	49.44	49.08	54.46	56.78	60.57	(65)	

5. Internal gains												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)												
84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
13.45	11.94	9.71	7.35	5.50	4.64	5.01	6.52	8.75	11.11	12.97	13.82	(67)
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
147.62	149.16	145.30	137.08	126.70	116.95	110.44	108.91	112.77	120.99	131.36	141.11	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	(69)
Pump and fan gains (Table 5a)												
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evaporation (Table 5)												
-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	(71)
Water heating gains (Table 5)												
83.13	81.41	77.84	72.98	69.83	65.39	61.62	66.45	68.17	73.19	78.87	81.41	(72)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m												
295.62	293.92	284.26	268.83	253.45	238.40	228.49	233.30	241.10	256.71	274.61	287.76	(73)

6. Solar gains												
	Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W						
NorthEast	0.77	x 9.00	x 11.28	x 0.9 x 0.63	x 0.70	= 31.03	(75)					
Solar gains in watts $\Sigma(74)m...(82)m$												
31.03	63.17	113.81	186.91	251.25	267.86	250.58	199.76	138.68	77.20	39.05	25.34	(83)
Total gains - internal and solar (73)m + (83)m												
326.65	357.09	398.08	455.74	504.70	506.26	479.07	433.06	379.79	333.91	313.66	313.11	(84)

7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1(°C)											21.00	(85)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area n1,m (see Table 9a)												
1.00	0.99	0.99	0.95	0.83	0.63	0.47	0.54	0.82	0.97	0.99	1.00	(86)
Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)												
19.94	20.06	20.29	20.62	20.87	20.98	21.00	20.99	20.91	20.59	20.21	19.92	(87)

Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)													
20.04	20.04	20.04	20.05	20.05	20.06	20.06	20.06	20.06	20.05	20.05	20.05	(88)	
Utilisation factor for gains for rest of dwelling n2,m													
1.00	0.99	0.98	0.93	0.78	0.54	0.37	0.43	0.74	0.96	0.99	1.00	(89)	
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)													
18.62	18.80	19.14	19.61	19.93	20.05	20.06	20.06	19.99	19.57	19.03	18.60	(90)	
Living area fraction											Living area ÷ (4) =	0.66	(91)
Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2													
19.48	19.62	19.90	20.27	20.55	20.66	20.67	20.67	20.60	20.24	19.80	19.46	(92)	
Apply adjustment to the mean internal temperature from Table 4e where appropriate													
19.48	19.62	19.90	20.27	20.55	20.66	20.67	20.67	20.60	20.24	19.80	19.46	(93)	

8. Space heating requirement													
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, ηm													
1.00	0.99	0.98	0.93	0.80	0.60	0.43	0.50	0.79	0.96	0.99	1.00	(94)	
Useful gains, ηmGm, W (94)m x (84)m													
325.13	354.17	390.01	424.88	405.39	302.78	208.15	216.58	299.53	320.81	310.84	311.93	(95)	
Monthly average external temperature from Table U1													
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)	
Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]													
803.21	776.93	705.12	591.74	459.50	311.33	209.38	219.12	335.11	500.42	662.49	799.52	(97)	
Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m													
355.69	284.09	234.45	120.14	40.26	0.00	0.00	0.00	0.00	133.63	253.19	362.77		
											$\Sigma(98)1...5, 10...12 =$	1784.22	(98)
Space heating requirement kWh/m ² /year											(98) ÷ (4)	35.58	(99)

9a. Energy requirements - individual heating systems including micro-CHP													
Space heating													
Fraction of space heat from secondary/supplementary system (table 11)											0.00	(201)	
Fraction of space heat from main system(s)											1 - (201) =	1.00	(202)
Fraction of space heat from main system 2												0.00	(202)
Fraction of total space heat from main system 1											(202) x [1 - (203)] =	1.00	(204)
Fraction of total space heat from main system 2											(202) x (203) =	0.00	(205)
Efficiency of main system 1 (%)												93.50	(206)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating fuel (main system 1), kWh/month													
380.42	303.84	250.74	128.49	43.06	0.00	0.00	0.00	0.00	142.92	270.79	387.99		
											$\Sigma(211)1...5, 10...12 =$	1908.26	(211)

Water heating													
Efficiency of water heater													
87.07	86.84	86.25	84.78	82.27	79.80	79.80	79.80	79.80	84.97	86.48	87.17	(217)	
Water heating fuel, kWh/month													
170.30	150.22	158.19	143.33	144.07	131.69	125.50	139.05	139.23	148.35	155.26	165.70		
											$\Sigma(219a)1...12 =$	1770.88	(219)

Annual totals												
Space heating fuel - main system 1											1908.26	
Water heating fuel											1770.88	

Electricity for pumps, fans and electric keep-hot (Table 4f)

central heating pump or water pump within warm air heating unit

30.00

(230c)

boiler flue fan

45.00

(230e)

Total electricity for the above, kWh/year

75.00

(231)

Electricity for lighting (Appendix L)

237.50

(232)

Total delivered energy for all uses

(211)...(221) + (231) + (232)...(237b) = 3991.64

(238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	1908.26	x	3.48	x 0.01 =	66.41	(240)
Water heating	1770.88	x	3.48	x 0.01 =	61.63	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	237.50	x	13.19	x 0.01 =	31.33	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	289.25	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.28	(257)
SAP value	82.19	
SAP rating (section 13)	82	(258)
SAP band	B	

12a. CO₂ emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	1908.26	x	0.216	=	412.18	(261)
Water heating	1770.88	x	0.216	=	382.51	(264)
Space and water heating				(261) + (262) + (263) + (264) =	794.69	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	237.50	x	0.519	=	123.26	(268)
Total CO ₂ , kg/year				(265)...(271) =	956.88	(272)
Dwelling CO ₂ emission rate				(272) ÷ (4) =	19.08	(273)
EI value					86.52	
EI rating (section 14)					87	(274)
EI band					B	

13a. Primary energy - individual heating systems including micro-CHP

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	1908.26	x	1.22	=	2328.08	(261)
Water heating	1770.88	x	1.22	=	2160.47	(264)
Space and water heating				(261) + (262) + (263) + (264) =	4488.55	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	237.50	x	3.07	=	729.13	(268)
Primary energy kWh/year					5447.93	(272)
Dwelling primary energy rate kWh/m ² /year					108.63	(273)

TER Worksheet Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	05/12/2018
Address	2BED Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)		Average storey height (m)		Volume (m ³)	
Lowest occupied	63.63	(1a)	x	2.50	(2a)	= 159.08 (3a)
Total floor area	63.63	(4)				
Dwelling volume				(3a) + (3b) + (3c) + (3d)...(3n) =	159.08	(5)

2. Ventilation rate

			m ³ per hour	
Number of chimneys	0	x 40 =	0	(6a)
Number of open flues	0	x 20 =	0	(6b)
Number of intermittent 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	
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 20	÷ (5) =	0.13 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	5.00	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.38	(18)
Number of sides on which the dwelling is sheltered	2	(19)
Shelter factor	1 - [0.075 x (19)] = 0.85	(20)
Infiltration rate incorporating shelter factor	(18) x (20) = 0.32	(21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)

Wind factor (22)/m ÷ 4

	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)/m

	0.41	0.40	0.39	0.35	0.34	0.30	0.30	0.30	0.32	0.34	0.36	0.38	(22b)
--	------	------	------	------	------	------	------	------	------	------	------	------	-------

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system

N/A (23a)

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h

N/A (23c)

d) natural ventilation or whole house positive input ventilation from loft

	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)

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

3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K						
Window			11.76	x 1.33	= 15.59			(27)					
Exposed floor			63.63	x 0.13	= 8.27			(28b)					
Party wall			45.00	x 0.00	= 0.00			(32)					
External wall			33.12	x 0.18	= 5.96			(29a)					
Roof			63.63	x 0.13	= 8.27			(30)					
Total area of external elements ΣA, m ²			172.14					(31)					
Fabric heat loss, W/K = Σ(A x U)					(26)...(30) + (32) =	38.10		(33)					
Heat capacity Cm = Σ(A x κ)					(28)...(30) + (32) + (32a)...(32e) =	N/A		(34)					
Thermal mass parameter (TMP) in kJ/m ² K						250.00		(35)					
Thermal bridges: Σ(L x Ψ) calculated using Appendix K						11.21		(36)					
Total fabric heat loss					(33) + (36) =	49.30		(37)					
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
30.60	30.43	30.26	29.49	29.34	28.66	28.66	28.54	28.92	29.34	29.64	29.94	(38)	
Heat transfer coefficient, W/K (37)m + (38)m													
79.90	79.73	79.57	78.79	78.64	77.96	77.96	77.84	78.23	78.64	78.94	79.24		
Average = Σ(39)1...12/12 =												78.79	(39)
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)													
1.26	1.25	1.25	1.24	1.24	1.23	1.23	1.22	1.23	1.24	1.24	1.25		
Average = Σ(40)1...12/12 =												1.24	(40)
Number of days in month (Table 1a)													
31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)	

4. Water heating energy requirement

Assumed occupancy, N												2.08	(42)	
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36												83.65	(43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)														
	92.02	88.67	85.33	81.98	78.63	75.29	75.29	78.63	81.98	85.33	88.67	92.02		
												Σ(44)1...12 =	1003.82	(44)
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)														
	136.46	119.35	123.16	107.37	103.02	88.90	82.38	94.53	95.66	111.49	121.70	132.15		
												Σ(45)1...12 =	1316.17	(45)
Distribution loss 0.15 x (45)m														
	20.47	17.90	18.47	16.11	15.45	13.34	12.36	14.18	14.35	16.72	18.25	19.82	(46)	
Storage volume (litres) including any solar or WWHRS storage within same vessel												1.00	(47)	
Water storage loss:														
a) If manufacturer's declared loss factor is known (kWh/day)												0.21	(48)	
Temperature factor from Table 2b												0.54	(49)	
Energy lost from water storage (kWh/day) (48) x (49)												0.12	(50)	
Enter (50) or (54) in (55)												0.12	(55)	
Water storage loss calculated for each month (55) x (41)m														
	3.57	3.23	3.57	3.46	3.57	3.46	3.57	3.57	3.46	3.57	3.46	3.57	(56)	
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)														
	3.57	3.23	3.57	3.46	3.57	3.46	3.57	3.57	3.46	3.57	3.46	3.57	(57)	

Primary circuit loss for each month from Table 3

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												
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
Total heat required for water heating calculated for each month 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m												
163.29	143.58	149.99	133.34	129.86	114.87	109.22	121.37	121.63	138.32	147.66	158.99	(62)
Solar DHW input calculated using Appendix G or Appendix H												
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
Output from water heater for each month (kWh/month) (62)m + (63)m												
163.29	143.58	149.99	133.34	129.86	114.87	109.22	121.37	121.63	138.32	147.66	158.99	
Σ(64)1...12 =												1632.12 (64)
Heat gains from water heating (kWh/month) 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]												
66.84	59.07	62.42	56.48	55.72	50.33	48.86	52.90	52.58	58.54	61.24	65.41	(65)

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)												
104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
16.50	14.66	11.92	9.03	6.75	5.70	6.15	8.00	10.74	13.63	15.91	16.96	(67)
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
182.00	183.89	179.13	169.00	156.21	144.19	136.16	134.27	139.03	149.16	161.95	173.97	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	(69)
Pump and fan gains (Table 5a)												
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evaporation (Table 5)												
-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	(71)
Water heating gains (Table 5)												
89.84	87.91	83.89	78.44	74.90	69.91	65.67	71.10	73.03	78.68	85.05	87.91	(72)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m												
345.58	343.69	332.18	313.69	295.08	277.03	265.22	270.60	280.03	298.70	320.15	336.08	(73)

6. Solar gains

	Access factor Table 6d		Area m ²		Solar flux W/m ²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
East	0.77	x	1.10	x	19.64	x 0.9 x	0.63	x	0.70	=	6.60	(76)
South	0.77	x	10.66	x	46.75	x 0.9 x	0.63	x	0.70	=	152.31	(78)
Solar gains in watts Σ(74)m...(82)m												
	158.91	262.36	339.02	390.15	412.25	399.07	388.94	373.56	356.67	284.38	188.77	137.04 (83)
Total gains - internal and solar (73)m + (83)m												
	504.49	606.05	671.20	703.84	707.33	676.09	654.15	644.16	636.70	583.08	508.92	473.12 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1(°C)												21.00 (85)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.99	0.98	0.97	0.92	0.84	0.68	0.51	0.54	0.75	0.93	0.99	1.00	(86)

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)	19.79	20.00	20.27	20.56	20.80	20.95	20.99	20.99	20.91	20.60	20.14	19.75	(87)
Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)	19.88	19.88	19.88	19.89	19.89	19.90	19.90	19.90	19.90	19.89	19.89	19.88	(88)
Utilisation factor for gains for rest of dwelling n2,m	0.99	0.98	0.95	0.90	0.79	0.59	0.39	0.42	0.66	0.90	0.98	0.99	(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)	18.30	18.60	18.98	19.39	19.70	19.87	19.90	19.90	19.83	19.46	18.80	18.24	(90)
Living area fraction	Living area ÷ (4) =											0.50	(91)
Mean internal temperature for the whole dwelling fLA x T1 + (1 - fLA) x T2	19.05	19.31	19.63	19.98	20.26	20.41	20.45	20.45	20.38	20.04	19.47	19.00	(92)
Apply adjustment to the mean internal temperature from Table 4e where appropriate	19.05	19.31	19.63	19.98	20.26	20.41	20.45	20.45	20.38	20.04	19.47	19.00	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm	0.99	0.98	0.95	0.90	0.80	0.63	0.45	0.48	0.71	0.91	0.98	0.99	(94)
Useful gains, ηmGm, W (94)m x (84)m	499.04	591.45	638.61	634.61	569.20	428.52	295.98	309.57	449.05	530.01	497.50	469.20	(95)
Monthly average external temperature from Table U1	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]	1178.67	1148.91	1044.63	873.15	672.86	453.00	299.94	314.89	490.99	742.02	976.79	1173.07	(97)
Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m	505.64	374.62	302.08	171.75	77.13	0.00	0.00	0.00	0.00	157.73	345.09	523.68	
	Σ(98)1...5, 10...12 =											2457.71	(98)
Space heating requirement kWh/m²/year	(98) ÷ (4) =											38.63	(99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating

Fraction of space heat from secondary/supplementary system (table 11)												0.00	(201)
Fraction of space heat from main system(s)	1 - (201) =											1.00	(202)
Fraction of space heat from main system 2												0.00	(202)
Fraction of total space heat from main system 1	(202) x [1- (203)] =											1.00	(204)
Fraction of total space heat from main system 2	(202) x (203) =											0.00	(205)
Efficiency of main system 1 (%)												93.50	(206)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating fuel (main system 1), kWh/month	540.80	400.66	323.08	183.69	82.49	0.00	0.00	0.00	0.00	168.70	369.08	560.08	
	Σ(211)1...5, 10...12 =											2628.57	(211)

Water heating

Efficiency of water heater	87.63	87.26	86.65	85.49	83.48	79.80	79.80	79.80	79.80	85.16	87.00	87.76	(217)
Water heating fuel, kWh/month	186.34	164.55	173.11	155.97	143.95	136.86	152.09	152.42	162.41	169.72	181.16		
	Σ(219a)1...12 =											1934.15	(219)

Annual totals

Space heating fuel - main system 1	2628.57	
Water heating fuel	1934.15	
Electricity for pumps, fans and electric keep-hot (Table 4f)		
central heating pump or water pump within warm air heating unit	30.00	(230c)
boiler flue fan	45.00	(230e)
Total electricity for the above, kWh/year	75.00	(231)
Electricity for lighting (Appendix L)	291.48	(232)
Total delivered energy for all uses	(211)...(221) + (231) + (232)...(237b) =	4929.20 (238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	2628.57	x	3.48	x 0.01 =	91.47	(240)
Water heating	1934.15	x	3.48	x 0.01 =	67.31	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	291.48	x	13.19	x 0.01 =	38.45	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	327.12	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.26	(257)
SAP value	82.36	
SAP rating (section 13)	82	(258)
SAP band	B	

12a. CO₂ emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	2628.57	x	0.216	=	567.77	(261)
Water heating	1934.15	x	0.216	=	417.78	(264)
Space and water heating			(261) + (262) + (263) + (264) =		985.55	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	291.48	x	0.519	=	151.28	(268)
Total CO ₂ , kg/year			(265)...(271) =		1175.75	(272)
Dwelling CO ₂ emission rate			(272) ÷ (4) =		18.48	(273)
EI value					85.50	
EI rating (section 14)					85	(274)
EI band					B	

13a. Primary energy - individual heating systems including micro-CHP

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	2628.57	x	1.22	=	3206.86	(261)
Water heating	1934.15	x	1.22	=	2359.66	(264)
Space and water heating			(261) + (262) + (263) + (264) =		5566.52	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	291.48	x	3.07	=	894.84	(268)
Primary energy kWh/year					6691.61	(272)
Dwelling primary energy rate kWh/m2/year					105.16	(273)

TER Worksheet Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	05/12/2018
Address	2BED Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	63.63 (1a) x	2.50 (2a) =	159.08 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 63.63 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) = 159.08 (5)	

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent 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
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 20 ÷ (5) = 0.13 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q₅₀, expressed in cubic metres per hour per square metre of envelope area (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) (18)

Number of sides on which the dwelling is sheltered (19)

Shelter factor 1 - [0.075 x (19)] = (20)

Infiltration rate incorporating shelter factor (18) x (20) = (21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70 (22)

Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18 (22a)
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.41	0.40	0.39	0.35	0.34	0.30	0.30	0.30	0.32	0.34	0.36	0.38 (22b)
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system (23a)

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h (23c)

d) natural ventilation or whole house positive input ventilation from loft (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25) (25)

3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	k-value, kJ/m ² .K	A x k, kJ/K
Window			11.76	x 1.33	= 15.59 (27)		
Party wall			45.00	x 0.00	= 0.00 (32)		
External wall			33.12	x 0.18	= 5.96 (29a)		
Total area of external elements ΣA, m ²			44.88 (31)				
Fabric heat loss, W/K = Σ(A × U)					(26)...(30) + (32) = 21.55 (33)		
Heat capacity Cm = Σ(A × k)					(28)...(30) + (32) + (32a)...(32e) = N/A (34)		
Thermal mass parameter (TMP) in kJ/m ² K					250.00 (35)		
Thermal bridges: Σ(L × Ψ) calculated using Appendix K					3.85 (36)		
Total fabric heat loss					(33) + (36) = 25.40 (37)		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	30.60	30.43	30.26	29.49	29.34	28.66	28.66	28.54	28.92	29.34	29.64	29.94 (38)

Heat transfer coefficient, W/K (37)m + (38)m	56.00	55.83	55.66	54.89	54.74	54.06	54.06	53.94	54.32	54.74	55.03	55.34 (39)
Average = Σ(39)1...12/12 =	54.88 (39)											

Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	0.88	0.88	0.87	0.86	0.86	0.85	0.85	0.85	0.85	0.86	0.86	0.87 (40)
Average = Σ(40)1...12/12 =	0.86 (40)											

Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00 (40)
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4. Water heating energy requirement

Assumed occupancy, N	2.08 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	83.65 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	92.02	88.67	85.33	81.98	78.63	75.29	75.29	78.63	81.98	85.33	88.67	92.02 (44)
Σ(44)1...12 =	1003.82 (44)											

Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	136.46	119.35	123.16	107.37	103.02	88.90	82.38	94.53	95.66	111.49	121.70	132.15 (45)
Σ(45)1...12 =	1316.17 (45)											

Distribution loss 0.15 x (45)m	20.47	17.90	18.47	16.11	15.45	13.34	12.36	14.18	14.35	16.72	18.25	19.82 (46)
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Storage volume (litres) including any solar or WWHRs storage within same vessel (47)

Water storage loss:	
a) If manufacturer's declared loss factor is known (kWh/day)	0.21 (48)
Temperature factor from Table 2b	0.54 (49)
Energy lost from water storage (kWh/day) (48) x (49)	0.12 (50)
Enter (50) or (54) in (55)	0.12 (55)

Water storage loss calculated for each month (55) x (41)m	3.57	3.23	3.57	3.46	3.57	3.46	3.57	3.57	3.46	3.57	3.46	3.57 (56)
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If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - Vs] ÷ (47), else (56)	3.57	3.23	3.57	3.46	3.57	3.46	3.57	3.57	3.46	3.57	3.46	3.57 (57)
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Primary circuit loss for each month from Table 3	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)
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Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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 (61)

Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

163.29	143.58	149.99	133.34	129.86	114.87	109.22	121.37	121.63	138.32	147.66	158.99
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 (62)

Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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 (63)

Output from water heater for each month (kWh/month) (62)m + (63)m

163.29	143.58	149.99	133.34	129.86	114.87	109.22	121.37	121.63	138.32	147.66	158.99
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

$$\Sigma(64)1...12 = 1632.12$$
 (64)

Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

66.84	59.07	62.42	56.48	55.72	50.33	48.86	52.90	52.58	58.54	61.24	65.41
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 (65)

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Metabolic gains (Table 5)

104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11
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 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

16.50	14.66	11.92	9.03	6.75	5.70	6.15	8.00	10.74	13.63	15.91	16.96
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 (67)

Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

182.00	183.89	179.13	169.00	156.21	144.19	136.16	134.27	139.03	149.16	161.95	173.97
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 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41
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 (69)

Pump and fan gains (Table 5a)

3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
------	------	------	------	------	------	------	------	------	------	------	------

 (70)

Losses e.g. evaporation (Table 5)

-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29
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 (71)

Water heating gains (Table 5)

89.84	87.91	83.89	78.44	74.90	69.91	65.67	71.10	73.03	78.68	85.05	87.91
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 (72)

Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

345.58	343.69	332.18	313.69	295.08	277.03	265.22	270.60	280.03	298.70	320.15	336.08
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 (73)

6. Solar gains

	Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W
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West $\frac{0.77}{1.10} \times \frac{19.64}{0.9} \times \frac{0.63}{0.70} = 6.60$ (80)

North $\frac{0.77}{10.66} \times \frac{10.63}{0.9} \times \frac{0.63}{0.70} = 34.64$ (74)

Solar gains in watts $\Sigma(74)m... (82)m$

41.24	79.12	133.76	211.72	281.43	299.50	280.34	224.84	159.99	94.13	50.97	34.31
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 (83)

Total gains - internal and solar (73)m + (83)m

386.82	422.81	465.94	525.41	576.51	576.52	545.55	495.45	440.02	392.84	371.12	370.39
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 (84)

7. Mean internal temperature (heating season)

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

21.00

 (85)

Utilisation factor for gains for living area n1,m (see Table 9a)

1.00	1.00	0.99	0.94	0.81	0.59	0.43	0.50	0.79	0.97	0.99	1.00
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 (86)

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

20.15	20.26	20.46	20.74	20.93	20.99	21.00	20.96	20.71	20.38	20.13
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 (87)

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

20.18	20.19	20.19	20.20	20.20	20.21	20.21	20.21	20.21	20.20	20.20	20.19
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 (88)

Utilisation factor for gains for rest of dwelling n2,m

1.00	0.99	0.98	0.92	0.76	0.52	0.36	0.41	0.72	0.96	0.99	1.00
------	------	------	------	------	------	------	------	------	------	------	------

 (89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

19.04	19.20	19.50	19.89	20.14	20.21	20.21	20.21	20.17	19.86	19.39	19.02
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 (90)

Living area fraction

$$\text{Living area} \div (4) = 0.50$$
 (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

19.60	19.73	19.98	20.32	20.54	20.60	20.61	20.61	20.57	20.29	19.89	19.58
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 (92)

Apply adjustment to the mean internal temperature from Table 4e where appropriate

19.60	19.73	19.98	20.32	20.54	20.60	20.61	20.61	20.57	20.29	19.89	19.58
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 (93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Utilisation factor for gains, η_m

1.00	0.99	0.98	0.93	0.78	0.56	0.40	0.46	0.75	0.96	0.99	1.00
------	------	------	------	------	------	------	------	------	------	------	------

 (94)

Useful gains, $\eta_m G_m$, W (94)m x (84)m

385.35	419.74	456.86	487.40	448.72	320.95	216.34	226.17	330.78	375.98	368.09	369.30
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 (95)

Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20
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 (96)

Heat loss rate for mean internal temperature, L_m , W [(39)m x [(93)m - (96)m]

856.66	828.17	750.47	626.72	483.70	324.48	216.68	226.96	351.33	530.21	704.07	851.09
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 (97)

Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

350.65	274.47	218.45	100.31	26.02	0.00	0.00	0.00	0.00	114.75	241.91	358.45
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$$\Sigma(98)1...5, 10...12 = 1685.00$$
 (98)

Space heating requirement kWh/m²/year

$$(98) \div (4) = 26.48$$
 (99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating

Fraction of space heat from secondary/supplementary system (table 11) $= 0.00$ (201)

Fraction of space heat from main system(s) $1 - (201) = 1.00$ (202)

Fraction of space heat from main system 2 $= 0.00$ (202)

Fraction of total space heat from main system 1 $(202) \times [1 - (203)] = 1.00$ (204)

Fraction of total space heat from main system 2 $(202) \times (203) = 0.00$ (205)

Efficiency of main system 1 (%) $= 93.50$ (206)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Space heating fuel (main system 1), kWh/month

375.03	293.55	233.63	107.28	27.83	0.00	0.00	0.00	0.00	122.72	258.72	383.37
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$$\Sigma(211)1...5, 10...12 = 1802.14$$
 (211)

Water heating

Efficiency of water heater

86.80	86.52	85.82	84.07	81.41	79.80	79.80	79.80	79.80	84.32	86.12	86.92
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 (217)

Water heating fuel, kWh/month

188.12	165.96	174.78	158.61	159.52	143.95	136.86	152.09	152.42	164.04	171.46	182.91
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$$\Sigma(219a)1...12 = 1950.72$$
 (219)

Annual totals

Space heating fuel - main system 1 $= 1802.14$

Water heating fuel $= 1950.72$

Electricity for pumps, fans and electric keep-hot (Table 4f)

central heating pump or water pump within warm air heating unit

30.00

(230c)

boiler flue fan

45.00

(230e)

Total electricity for the above, kWh/year

75.00

(231)

Electricity for lighting (Appendix L)

291.48

(232)

Total delivered energy for all uses

(211)...(221) + (231) + (232)...(237b) = 4119.34

(238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	1802.14	x	3.48	x 0.01 =	62.71	(240)
Water heating	1950.72	x	3.48	x 0.01 =	67.89	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	291.48	x	13.19	x 0.01 =	38.45	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	298.94	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.16	(257)
SAP value	83.88	
SAP rating (section 13)	84	(258)
SAP band	B	

12a. CO₂ emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	1802.14	x	0.216	=	389.26	(261)
Water heating	1950.72	x	0.216	=	421.36	(264)
Space and water heating				(261) + (262) + (263) + (264) =	810.62	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	291.48	x	0.519	=	151.28	(268)
Total CO ₂ , kg/year				(265)...(271) =	1000.82	(272)
Dwelling CO ₂ emission rate				(272) ÷ (4) =	15.73	(273)
EI value					87.65	
EI rating (section 14)					88	(274)
EI band					B	

13a. Primary energy - individual heating systems including micro-CHP

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	1802.14	x	1.22	=	2198.61	(261)
Water heating	1950.72	x	1.22	=	2379.88	(264)
Space and water heating				(261) + (262) + (263) + (264) =	4578.49	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	291.48	x	3.07	=	894.84	(268)
Primary energy kWh/year					5703.58	(272)
Dwelling primary energy rate kWh/m ² /year					89.64	(273)

TER Worksheet Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	05/12/2018
Address	2BED Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)		Average storey height (m)		Volume (m ³)	
Lowest occupied	63.63	(1a)	x	2.50	(2a)	= 159.08 (3a)
Total floor area	63.63	(4)				
Dwelling volume				(3a) + (3b) + (3c) + (3d)...(3n) =	159.08	(5)

2. Ventilation rate

			m ³ per hour	
Number of chimneys	0	x 40 =	0	(6a)
Number of open flues	0	x 20 =	0	(6b)
Number of intermittent fans	2	x 10 =	20	(7a)
Number of passive vents	0	x 10 =	0	(7b)
Number of fuelless gas fires	0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 20	÷ (5) =	0.13 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q₅₀, expressed in cubic metres per hour per square metre of envelope area

5.00 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)

0.38 (18)

Number of sides on which the dwelling is sheltered

2 (19)

Shelter factor

1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor

(18) x (20) = 0.32 (21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)

Wind factor (22)/m ÷ 4

1.28 1.25 1.23 1.10 1.08 0.95 0.95 0.93 1.00 1.08 1.13 1.18 (22a)

Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)/m

0.41 0.40 0.39 0.35 0.34 0.30 0.30 0.30 0.32 0.34 0.36 0.38 (22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system

N/A (23a)

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h

N/A (23c)

d) natural ventilation or whole house positive input ventilation from loft

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

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)

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

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	κ-value, kJ/m².K	A x κ, kJ/K					
Window			11.76	x 1.33	= 15.59							
Party wall			45.00	x 0.00	= 0.00							
External wall			33.12	x 0.18	= 5.96							
Roof			63.63	x 0.13	= 8.27							
Total area of external elements ΣA, m²			108.51									
Fabric heat loss, W/K = Σ(A × U)					(26)...(30) + (32) =	29.82						
Heat capacity Cm = Σ(A × κ)					(28)...(30) + (32) + (32a)...(32e) =	N/A						
Thermal mass parameter (TMP) in kJ/m²K						250.00						
Thermal bridges: Σ(L × Ψ) calculated using Appendix K						14.66						
Total fabric heat loss					(33) + (36) =	44.48						
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	30.60	30.43	30.26	29.49	29.34	28.66	28.66	28.54	28.92	29.34	29.64	29.94
Heat transfer coefficient, W/K (37)m + (38)m	75.08	74.91	74.74	73.97	73.82	73.14	73.14	73.02	73.40	73.82	74.12	74.42
	Average = Σ(39)1...12/12 = 73.97											
Heat loss parameter (HLP), W/m²K (39)m ÷ (4)	1.18	1.18	1.17	1.16	1.16	1.15	1.15	1.15	1.15	1.16	1.16	1.17
	Average = Σ(40)1...12/12 = 1.16											
Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00

4. Water heating energy requirement

Assumed occupancy, N	2.08
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	83.65
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	92.02 88.67 85.33 81.98 78.63 75.29 75.29 78.63 81.98 85.33 88.67 92.02
	Σ(44)1...12 = 1003.82
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	136.46 119.35 123.16 107.37 103.02 88.90 82.38 94.53 95.66 111.49 121.70 132.15
	Σ(45)1...12 = 1316.17
Distribution loss 0.15 x (45)m	20.47 17.90 18.47 16.11 15.45 13.34 12.36 14.18 14.35 16.72 18.25 19.82
Storage volume (litres) including any solar or WWHRS storage within same vessel	1.00
Water storage loss:	
a) If manufacturer's declared loss factor is known (kWh/day)	0.21
Temperature factor from Table 2b	0.54
Energy lost from water storage (kWh/day) (48) x (49)	0.12
Enter (50) or (54) in (55)	0.12
Water storage loss calculated for each month (55) x (41)m	3.57 3.23 3.57 3.46 3.57 3.46 3.57 3.57 3.46 3.57 3.46 3.57
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)	3.57 3.23 3.57 3.46 3.57 3.46 3.57 3.57 3.46 3.57 3.46 3.57
Primary circuit loss for each month from Table 3	

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26
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Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
------	------	------	------	------	------	------	------	------	------	------	------

Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

163.29	143.58	149.99	133.34	129.86	114.87	109.22	121.37	121.63	138.32	147.66	158.99
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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Output from water heater for each month (kWh/month) (62)m + (63)m

163.29	143.58	149.99	133.34	129.86	114.87	109.22	121.37	121.63	138.32	147.66	158.99
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

66.84	59.07	62.42	56.48	55.72	50.33	48.86	52.90	52.58	58.54	61.24	65.41
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5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabolic gains (Table 5)											
104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5											
16.50	14.66	11.92	9.03	6.75	5.70	6.15	8.00	10.74	13.63	15.91	16.96
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5											
182.00	183.89	179.13	169.00	156.21	144.19	136.16	134.27	139.03	149.16	161.95	173.97
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5											
33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41
Pump and fan gains (Table 5a)											
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Losses e.g. evaporation (Table 5)											
-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29
Water heating gains (Table 5)											
89.84	87.91	83.89	78.44	74.90	69.91	65.67	71.10	73.03	78.68	85.05	87.91
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m											
345.58	343.69	332.18	313.69	295.08	277.03	265.22	270.60	280.03	298.70	320.15	336.08

6. Solar gains

	Access factor Table 6d	Area m²	Solar flux W/m²	g specific data or Table 6b	FF specific data or Table 6c	Gains W
South	0.77	x 1.10	x 46.75	x 0.9 x 0.63	x 0.70	= 15.72
West	0.77	x 10.66	x 19.64	x 0.9 x 0.63	x 0.70	= 63.98
Solar gains in watts Σ(74)m...(82)m						
	79.70	150.91	238.92	337.69	407.05	414.32
Total gains - internal and solar (73)m + (83)m						
	425.28	494.59	571.10	651.39	702.14	691.35

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1(°C)											21.00
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area n1,m (see Table 9a)											
1.00	0.99	0.98	0.93	0.82	0.64	0.48	0.53	0.79	0.96	0.99	1.00
Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)											

19.78	19.95	20.23	20.58	20.84	20.97	20.99	20.99	20.90	20.54	20.10	19.75	(87)
Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)												
19.94	19.94	19.94	19.95	19.95	19.96	19.96	19.96	19.96	19.95	19.95	19.94	(88)
Utilisation factor for gains for rest of dwelling n2,m												
1.00	0.99	0.97	0.91	0.77	0.55	0.37	0.42	0.71	0.95	0.99	1.00	(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)												
18.32	18.57	18.97	19.47	19.80	19.94	19.96	19.96	19.88	19.43	18.79	18.28	(90)
Living area fraction Living area ÷ (4) =												
											0.50	(91)
Mean internal temperature for the whole dwelling fLA x T1 + (1 - fLA) x T2												
19.06	19.27	19.61	20.03	20.33	20.46	20.48	20.48	20.40	19.99	19.45	19.02	(92)
Apply adjustment to the mean internal temperature from Table 4e where appropriate												
19.06	19.27	19.61	20.03	20.33	20.46	20.48	20.48	20.40	19.99	19.45	19.02	(93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm												
0.99	0.99	0.97	0.91	0.79	0.60	0.43	0.48	0.75	0.95	0.99	1.00	(94)
Useful gains, ηmGm, W (94)m x (84)m												
422.92	488.76	553.85	595.17	554.62	412.80	281.49	293.70	415.67	449.71	413.88	400.56	(95)
Monthly average external temperature from Table U1												
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]												
1108.04	1076.09	979.67	823.10	636.77	428.36	283.82	297.76	462.20	693.34	915.17	1103.25	(97)
Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m												
509.73	394.69	316.81	164.11	61.12	0.00	0.00	0.00	0.00	181.26	360.93	522.80	
											Σ(98)1...5, 10...12 =	2511.45 (98)
Space heating requirement kWh/m²/year											(98) ÷ (4)	39.47 (99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating												
Fraction of space heat from secondary/supplementary system (table 11)												0.00 (201)
Fraction of space heat from main system(s)												1 - (201) = 1.00 (202)
Fraction of space heat from main system 2												0.00 (202)
Fraction of total space heat from main system 1												(202) x [1- (203)] = 1.00 (204)
Fraction of total space heat from main system 2												(202) x (203) = 0.00 (205)
Efficiency of main system 1 (%)												93.50 (206)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating fuel (main system 1), kWh/month												
545.17	422.12	338.84	175.52	65.37	0.00	0.00	0.00	0.00	193.86	386.02	559.15	
											Σ(211)1...5, 10...12 =	2686.04 (211)

Water heating												
Efficiency of water heater												
87.65	87.37	86.76	85.37	82.94	79.80	79.80	79.80	79.80	85.54	87.11	87.76	(217)
Water heating fuel, kWh/month												
186.30	164.33	172.88	156.19	156.57	143.95	136.86	152.09	152.42	161.71	169.52	181.17	
											Σ(219a)1...12 =	1933.99 (219)

Annual totals												
Space heating fuel - main system 1												2686.04

Water heating fuel				1933.99	
Electricity for pumps, fans and electric keep-hot (Table 4f)					
central heating pump or water pump within warm air heating unit			30.00		(230c)
boiler flue fan			45.00		(230e)
Total electricity for the above, kWh/year				75.00	(231)
Electricity for lighting (Appendix L)				291.48	(232)
Total delivered energy for all uses		(211)...(221) + (231) + (232)...(237b) =		4986.51	(238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	2686.04	x	3.48	x 0.01 =	93.47	(240)
Water heating	1933.99	x	3.48	x 0.01 =	67.30	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	291.48	x	13.19	x 0.01 =	38.45	(250)
Additional standing charges					120.00	(251)
Total energy cost			(240)...(242) + (245)...(254) =		329.12	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)		1.27	(257)
SAP value		82.25	
SAP rating (section 13)		82	(258)
SAP band		B	

12a. CO₂ emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	2686.04	x	0.216	=	580.19	(261)
Water heating	1933.99	x	0.216	=	417.74	(264)
Space and water heating			(261) + (262) + (263) + (264) =		997.93	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	291.48	x	0.519	=	151.28	(268)
Total CO ₂ , kg/year			(265)...(271) =		1188.13	(272)
Dwelling CO ₂ emission rate			(272) ÷ (4) =		18.67	(273)
EI value					85.34	
EI rating (section 14)					85	(274)
EI band					B	

13a. Primary energy - individual heating systems including micro-CHP

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	2686.04	x	1.22	=	3276.97	(261)
Water heating	1933.99	x	1.22	=	2359.47	(264)
Space and water heating			(261) + (262) + (263) + (264) =		5636.44	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	291.48	x	3.07	=	894.84	(268)
Primary energy kWh/year					6761.53	(272)
Dwelling primary energy rate kWh/m2/year					106.26	(273)

TER Worksheet Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	04/12/2018
Address	3Bed Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	80.34 (1a) x	2.50 (2a) =	200.85 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 80.34 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) = 200.85 (5)	

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent 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
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 30 ÷ (5) = 0.15 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	5.00 (17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)

Number of sides on which the dwelling is sheltered	2 (19)
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Shelter factor	1 - [0.075 x (19)] = 0.85 (20)
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Infiltration rate incorporating shelter factor	(18) x (20) = 0.34 (21)
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Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70 (22)

Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18 (22a)
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.43	0.42	0.42	0.37	0.36	0.32	0.32	0.31	0.34	0.36	0.38	0.40 (22b)
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	N/A (23a)
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If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A (23c)
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d) natural ventilation or whole house positive input ventilation from loft	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58 (24d)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58 (25)
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	k-value, kJ/m ² .K	A x k, kJ/K
Window			13.12	x 1.33	= 17.39 (27)		
Exposed floor			63.63	x 0.13	= 8.27 (28b)		
Party wall			51.59	x 0.00	= 0.00 (32)		
External wall			38.33	x 0.18	= 6.90 (29a)		
Total area of external elements ΣA, m ²			115.08 (31)				
Fabric heat loss, W/K = Σ(A x U)					(26)...(30) + (32) = 32.57 (33)		
Heat capacity Cm = Σ(A x k)					(28)...(30) + (32) + (32a)...(32e) = N/A (34)		
Thermal mass parameter (TMP) in kJ/m ² K					250.00 (35)		
Thermal bridges: Σ(L x Ψ) calculated using Appendix K					7.82 (36)		
Total fabric heat loss					(33) + (36) = 40.39 (37)		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	39.35	39.11	38.87	37.76	37.55	36.59	36.59	36.41	36.96	37.55	37.97	38.41 (38)
Heat transfer coefficient, W/K (37)m + (38)m	79.74	79.50	79.26	78.15	77.94	76.98	76.98	76.80	77.35	77.94	78.36	78.80
Average = Σ(39)1...12/12 =	78.15 (39)											

Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	0.99	0.99	0.99	0.97	0.97	0.96	0.96	0.96	0.96	0.97	0.98	0.98
Average = Σ(40)1...12/12 =	0.97 (40)											

Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00 (40)
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4. Water heating energy requirement

Assumed occupancy, N	2.47 (42)
Annual average hot water usage in litres per day V _{d,average} = (25 x N) + 36	92.85 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month V _{d,m} = factor from Table 1c x (43)	102.13	98.42	94.70	90.99	87.27	83.56	83.56	87.27	90.99	94.70	98.42	102.13
Σ(44)1...12 =	1114.14 (44)											

Energy content of hot water used = 4.18 x V _{d,m} x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	151.46	132.46	136.69	119.17	114.35	98.67	91.43	104.92	106.18	123.74	135.07	146.68
Σ(45)1...12 =	1460.82 (45)											

Distribution loss 0.15 x (45)m	22.72	19.87	20.50	17.88	17.15	14.80	13.72	15.74	15.93	18.56	20.26	22.00 (46)
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Storage volume (litres) including any solar or WWHRs storage within same vessel	1.00 (47)
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Water storage loss:	
a) If manufacturer's declared loss factor is known (kWh/day)	0.21 (48)
Temperature factor from Table 2b	0.54 (49)
Energy lost from water storage (kWh/day) (48) x (49)	0.12 (50)
Enter (50) or (54) in (55)	0.12 (55)

Water storage loss calculated for each month (55) x (41)m	3.57	3.23	3.57	3.46	3.57	3.46	3.57	3.57	3.46	3.57	3.46	3.57 (56)
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If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - V _s] ÷ (47), else (56)	3.57	3.23	3.57	3.46	3.57	3.46	3.57	3.57	3.46	3.57	3.46	3.57 (57)
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Primary circuit loss for each month from Table 3

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												
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m												
178.29	156.70	163.53	145.14	141.18	124.64	118.27	131.76	132.14	150.57	161.04	173.51	(62)
Solar DHW input calculated using Appendix G or Appendix H												
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
Output from water heater for each month (kWh/month) (62)m + (63)m												
178.29	156.70	163.53	145.14	141.18	124.64	118.27	131.76	132.14	150.57	161.04	173.51	
$\Sigma(64)1...12 =$											1776.77	(64)
Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]												
71.83	63.43	66.92	60.40	59.49	53.58	51.87	56.35	56.08	62.61	65.69	70.24	(65)

5. Internal gains												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabolic gains (Table 5)												
	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	20.39	18.11	14.73	11.15	8.34	7.04	7.61	9.89	13.27	16.85	19.66	(67)
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	220.15	222.43	216.68	204.42	188.95	174.41	164.70	162.41	168.17	180.43	195.90	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	(69)
Pump and fan gains (Table 5a)												
	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evaporation (Table 5)												
	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	(71)
Water heating gains (Table 5)												
	96.54	94.40	89.94	83.89	79.96	74.42	69.72	75.74	77.89	84.15	91.23	(72)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m												
	400.12	397.98	384.39	362.50	340.28	318.91	305.06	311.08	322.36	344.47	369.83	(73)

6. Solar gains												
	Access factor Table 6d		Area m ²	Solar flux W/m ²		g specific data or Table 6b		FF specific data or Table 6c		Gains W		
NorthWest	0.77	x	10.59	x	11.28	x 0.9 x	0.63	x	0.70	=	36.52	(81)
SouthWest	0.77	x	2.53	x	36.79	x 0.9 x	0.63	x	0.70	=	28.45	(79)
Solar gains in watts $\Sigma(74)m...(82)m$												
	64.97	122.79	200.22	302.09	387.66	406.53	382.92	315.77	234.98	144.40	80.02	54.17 (83)
Total gains - internal and solar (73)m + (83)m												
	465.09	520.77	584.61	664.59	727.94	725.44	687.98	626.85	557.34	488.86	449.85	443.01 (84)

7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1(°C)											21.00	(85)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area n1,m (see Table 9a)												
1.00	1.00	0.99	0.96	0.85	0.65	0.49	0.55	0.83	0.98	1.00	1.00	(86)
Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)												

19.96	20.08	20.31	20.63	20.87	20.98	21.00	20.99	20.92	20.60	20.23	19.94	(87)	
Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)													
20.09	20.09	20.09	20.11	20.11	20.12	20.12	20.12	20.11	20.11	20.10	20.10	(88)	
Utilisation factor for gains for rest of dwelling n2,m													
1.00	1.00	0.99	0.94	0.80	0.57	0.39	0.45	0.77	0.97	0.99	1.00	(89)	
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)													
18.69	18.88	19.21	19.66	19.98	20.10	20.12	20.12	20.05	19.63	19.09	18.67	(90)	
Living area fraction										Living area ÷ (4) =		0.40	(91)
Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2													
19.19	19.36	19.65	20.05	20.34	20.45	20.47	20.47	20.39	20.02	19.55	19.17	(92)	
Apply adjustment to the mean internal temperature from Table 4e where appropriate													
19.19	19.36	19.65	20.05	20.34	20.45	20.47	20.47	20.39	20.02	19.55	19.17	(93)	

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains, η_m											
1.00	0.99	0.98	0.94	0.82	0.61	0.43	0.49	0.79	0.97	0.99	1.00
Useful gains, $\eta_m G_m$, W (94)m x (84)m											
463.69	517.58	574.86	625.11	594.84	439.53	296.49	309.66	440.20	472.17	447.00	441.99
Monthly average external temperature from Table U1											
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20
Heat loss rate for mean internal temperature, L_m , W [(39)m x [(93)m - (96)m]											
1187.67	1149.39	1042.29	871.24	673.34	450.57	297.77	312.35	486.86	734.12	975.28	1180.01
Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m											
538.64	424.58	347.76	177.21	58.41	0.00	0.00	0.00	0.00	194.89	380.37	549.09
$\Sigma(98)1...5, 10...12 =$										2670.94	
Space heating requirement kWh/m ² /year										(98) ÷ (4)	33.25

9a. Energy requirements - individual heating systems including micro-CHP			
Space heating			
Fraction of space heat from secondary/supplementary system (table 11)		0.00	(201)
Fraction of space heat from main system(s)	1 - (201) =	1.00	(202)
Fraction of space heat from main system 2		0.00	(202)
Fraction of total space heat from main system 1	(202) x [1 - (203)] =	1.00	(204)
Fraction of total space heat from main system 2	(202) x (203) =	0.00	(205)
Efficiency of main system 1 (%)		93.50	(206)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating fuel (main system 1), kWh/month											
576.08	454.09	371.94	189.53	62.47	0.00	0.00	0.00	0.00	208.44	406.81	587.26
Σ(211)1...5, 10...12 =										2856.62	(211)

Water heating

Efficiency of water heater

87.58	87.34	86.78	85.35	82.66	79.80	79.80	79.80	79.80	85.50	87.03	87.68
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(217)

Water heating fuel, kWh/month

203.57	179.41	188.44	170.06	170.80	156.19	148.21	165.11	165.59	176.10	185.04	197.90
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$\Sigma(219a)1...12 =$

2106.42

(219)

Annual totals											
Space heating fuel - main system 1											2856.62

Water heating fuel		2106.42	
Electricity for pumps, fans and electric keep-hot (Table 4f)			
central heating pump or water pump within warm air heating unit	30.00		(230c)
boiler flue fan	45.00		(230e)
Total electricity for the above, kWh/year		75.00	(231)
Electricity for lighting (Appendix L)		360.17	(232)
Total delivered energy for all uses	(211)...(221) + (231) + (232)...(237b) =	5398.21	(238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	2856.62	x	3.48	x 0.01 =	99.41	(240)
Water heating	2106.42	x	3.48	x 0.01 =	73.30	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	360.17	x	13.19	x 0.01 =	47.51	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	350.11	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.17	(257)
SAP value	83.63	
SAP rating (section 13)	84	(258)
SAP band	B	

12a. CO₂ emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	2856.62	x	0.216	=	617.03	(261)
Water heating	2106.42	x	0.216	=	454.99	(264)
Space and water heating			(261) + (262) + (263) + (264) =		1072.02	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	360.17	x	0.519	=	186.93	(268)
Total CO ₂ , kg/year			(265)...(271) =		1297.87	(272)
Dwelling CO ₂ emission rate			(272) ÷ (4) =		16.15	(273)
EI value					86.12	
EI rating (section 14)					86	(274)
EI band					B	

13a. Primary energy - individual heating systems including micro-CHP

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	2856.62	x	1.22	=	3485.07	(261)
Water heating	2106.42	x	1.22	=	2569.83	(264)
Space and water heating			(261) + (262) + (263) + (264) =		6054.90	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	360.17	x	3.07	=	1105.73	(268)
Primary energy kWh/year					7390.88	(272)
Dwelling primary energy rate kWh/m ² /year					92.00	(273)

TER Worksheet Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	04/12/2018
Address	3Bed Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)		Average storey height (m)		Volume (m ³)
Lowest occupied	80.34 (1a)	x	2.50 (2a)	=	200.85 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 80.34 (4)				
Dwelling volume			(3a) + (3b) + (3c) + (3d)...(3n) =		200.85 (5)

2. Ventilation rate

				m ³ per hour	
Number of chimneys	0	x 40 =	0		(6a)
Number of open flues	0	x 20 =	0		(6b)
Number of intermittent 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	
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 30		÷ (5) =	0.15	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5.00		(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.40		(18)
Number of sides on which the dwelling is sheltered			2		(19)
Shelter factor		1 - [0.075 x (19)] =	0.85		(20)
Infiltration rate incorporating shelter factor		(18) x (20) =	0.34		(21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70

Wind factor (22)m ÷ 4

1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m

0.43	0.42	0.42	0.37	0.36	0.32	0.32	0.31	0.34	0.36	0.38	0.40
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system N/A (23a)

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h N/A (23c)

d) natural ventilation or whole house positive input ventilation from loft

0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)

0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K						
Window			13.12	x 1.33	= 17.39		(27)						
Party wall			51.59	x 0.00	= 0.00		(32)						
External wall			38.33	x 0.18	= 6.90		(29a)						
Total area of external elements ΣA, m ²			51.45				(31)						
Fabric heat loss, W/K = Σ(A x U)					(26)...(30) + (32) =	24.29	(33)						
Heat capacity Cm = Σ(A x κ)					(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)						
Thermal mass parameter (TMP) in kJ/m ² K						250.00	(35)						
Thermal bridges: Σ(L x Ψ) calculated using Appendix K						4.39	(36)						
Total fabric heat loss					(33) + (36) =	28.69	(37)						
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	39.35	39.11	38.87	37.76	37.55	36.59	36.59	36.41	36.96	37.55	37.97	38.41	(38)
Heat transfer coefficient, W/K (37)m + (38)m	68.04	67.80	67.56	66.45	66.24	65.27	65.27	65.10	65.65	66.24	66.66	67.10	
													Average = Σ(39)1...12/12 = 66.45 (39)
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	0.85	0.84	0.84	0.83	0.82	0.81	0.81	0.81	0.82	0.82	0.83	0.84	
													Average = Σ(40)1...12/12 = 0.83 (40)
Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)

4. Water heating energy requirement

Assumed occupancy, N	2.47	(42)											
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	92.85	(43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	102.13	98.42	94.70	90.99	87.27	83.56	83.56	87.27	90.99	94.70	98.42	102.13	
													Σ(44)1...12 = 1114.14 (44)
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	151.46	132.46	136.69	119.17	114.35	98.67	91.43	104.92	106.18	123.74	135.07	146.68	
													Σ(45)1...12 = 1460.82 (45)
Distribution loss 0.15 x (45)m	22.72	19.87	20.50	17.88	17.15	14.80	13.72	15.74	15.93	18.56	20.26	22.00	(46)
Storage volume (litres) including any solar or WWHRS storage within same vessel	1.00												(47)
Water storage loss:													
a) If manufacturer's declared loss factor is known (kWh/day)	0.21												(48)
Temperature factor from Table 2b	0.54												(49)
Energy lost from water storage (kWh/day) (48) x (49)	0.12												(50)
Enter (50) or (54) in (55)	0.12												(55)
Water storage loss calculated for each month (55) x (41)m	3.57	3.23	3.57	3.46	3.57	3.46	3.57	3.57	3.46	3.57	3.46	3.57	(56)
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)	3.57	3.23	3.57	3.46	3.57	3.46	3.57	3.57	3.46	3.57	3.46	3.57	(57)
Primary circuit loss for each month from Table 3	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

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m													
178.29	156.70	163.53	145.14	141.18	124.64	118.27	131.76	132.14	150.57	161.04	173.51		(62)
Solar DHW input calculated using Appendix G or Appendix H													
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
Output from water heater for each month (kWh/month) (62)m + (63)m													
178.29	156.70	163.53	145.14	141.18	124.64	118.27	131.76	132.14	150.57	161.04	173.51		
													Σ(64)1...12 = 1776.77 (64)
Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]													
71.83	63.43	66.92	60.40	59.49	53.58	51.87	56.35	56.08	62.61	65.69	70.24		(65)

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)												
123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
20.39	18.11	14.73	11.15	8.34	7.04	7.61	9.89	13.27	16.85	19.66	20.96	(67)
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
220.15	222.43	216.68	204.42	188.95	174.41	164.70	162.41	168.17	180.43	195.90	210.44	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	(69)
Pump and fan gains (Table 5a)												
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evaporation (Table 5)												
-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	(71)
Water heating gains (Table 5)												
96.54	94.40	89.94	83.89	79.96	74.42	69.72	75.74	77.89	84.15	91.23	94.40	(72)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m												
400.12	397.98	384.39	362.50	340.28	318.91	305.06	311.08	322.36	344.47	369.83	388.84	(73)

6. Solar gains

	Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W						
NorthWest	0.77	x 10.59	x 11.28	x 0.9 x 0.63	x 0.70	= 36.52 (81)						
SouthWest	0.77	x 2.53	x 36.79	x 0.9 x 0.63	x 0.70	= 28.45 (79)						
Solar gains in watts Σ(74)m...(82)m												
64.97	122.79	200.22	302.09	387.66	406.53	382.92	315.77	234.98	144.40	80.02	54.17	(83)
Total gains - internal and solar (73)m + (83)m												
465.09	520.77	584.61	664.59	727.94	725.44	687.98	626.85	557.34	488.86	449.85	443.01	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1(°C)												21.00	(85)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains for living area n1,m (see Table 9a)													
1.00	1.00	0.99	0.94	0.79	0.57	0.42	0.48	0.76	0.97	1.00	1.00	(86)	
Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)													
20.17	20.29	20.50	20.77	20.95	20.99	21.00	21.00	20.97	20.73	20.41	20.15	(87)	

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

20.21	20.22	20.22	20.23	20.23	20.24	20.24	20.24	20.24	20.23	20.23	20.22	(88)
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Utilisation factor for gains for rest of dwelling n2,m

1.00	0.99	0.98	0.92	0.74	0.51	0.35	0.40	0.70	0.95	0.99	1.00	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

19.09	19.27	19.58	19.97	20.18	20.24	20.24	20.21	19.92	19.45	19.07	(90)
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Living area fraction

Living area ÷ (4) = 0.21 (91)

Mean internal temperature for the whole dwelling fLA x T1 + (1 - fLA) x T2

19.32	19.48	19.77	20.14	20.34	20.40	20.40	20.40	20.37	20.09	19.65	19.30	(92)
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Apply adjustment to the mean internal temperature from Table 4e where appropriate

19.32	19.48	19.77	20.14	20.34	20.40	20.40	20.40	20.37	20.09	19.65	19.30	(93)
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8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Utilisation factor for gains, ηm

1.00	0.99	0.98	0.91	0.75	0.52	0.36	0.41	0.71	0.95	0.99	1.00	(94)
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Useful gains, ηmGm, W (94)m x (84)m

463.52	516.89	571.48	606.86	542.69	376.03	247.88	260.04	395.79	464.69	446.31	441.89	(95)
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Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
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Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]

1021.64	988.72	896.47	746.59	572.38	378.36	248.05	260.46	411.61	628.55	836.51	1013.07	(97)
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Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

415.24	317.07	241.79	100.61	22.09	0.00	0.00	0.00	0.00	121.91	280.95	424.96	
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Σ(98)1...5, 10...12 = 1924.61 (98)

Space heating requirement kWh/m²/year

(98) ÷ (4) = 23.96 (99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating

Fraction of space heat from secondary/supplementary system (table 11)

0.00 (201)

Fraction of space heat from main system(s)

1 - (201) = 1.00 (202)

Fraction of space heat from main system 2

0.00 (202)

Fraction of total space heat from main system 1

(202) x [1 - (203)] = 1.00 (204)

Fraction of total space heat from main system 2

(202) x (203) = 0.00 (205)

Efficiency of main system 1 (%)

93.50 (206)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Space heating fuel (main system 1), kWh/month

444.10	339.12	258.60	107.60	23.63	0.00	0.00	0.00	0.00	130.38	300.48	454.50	
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Σ(211)1...5, 10...12 = 2058.41 (211)

Water heating

Efficiency of water heater

87.00	86.66	85.86	83.86	81.10	79.80	79.80	79.80	79.80	84.26	86.28	87.11	(217)
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Water heating fuel, kWh/month

204.94	180.83	190.47	173.07	174.09	156.19	148.21	165.11	165.59	178.71	186.64	199.18	
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Σ(219a)1...12 = 2123.02 (219)

Annual totals

Space heating fuel - main system 1

2058.41

Water heating fuel

2123.02

Electricity for pumps, fans and electric keep-hot (Table 4f)

central heating pump or water pump within warm air heating unit

30.00 (230c)

boiler flue fan

45.00 (230e)

Total electricity for the above, kWh/year

75.00 (231)

Electricity for lighting (Appendix L)

360.17 (232)

Total delivered energy for all uses

(211)...(221) + (231) + (232)...(237b) = 4616.60 (238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	2058.41	x	3.48	x 0.01 =	71.63	(240)
Water heating	2123.02	x	3.48	x 0.01 =	73.88	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	360.17	x	13.19	x 0.01 =	47.51	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	322.91	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.08	(257)
SAP value	84.91	
SAP rating (section 13)	85	(258)
SAP band	B	

12a. CO₂ emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	2058.41	x	0.216	=	444.62	(261)
Water heating	2123.02	x	0.216	=	458.57	(264)
Space and water heating			(261) + (262) + (263) + (264) =		903.19	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	360.17	x	0.519	=	186.93	(268)
Total CO ₂ , kg/year				(265)...(271) =	1129.04	(272)
Dwelling CO ₂ emission rate				(272) ÷ (4) =	14.05	(273)
EI value					87.93	
EI rating (section 14)					88	(274)
EI band					B	

13a. Primary energy - individual heating systems including micro-CHP

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	2058.41	x	1.22	=	2511.26	(261)
Water heating	2123.02	x	1.22	=	2590.08	(264)
Space and water heating			(261) + (262) + (263) + (264) =		5101.34	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	360.17	x	3.07	=	1105.73	(268)
Primary energy kWh/year					6437.33	(272)
Dwelling primary energy rate kWh/m2/year					80.13	(273)

TER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	04/12/2018
Address	3Bed Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	80.34 (1a) x	2.50 (2a) =	200.85 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 80.34 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) = 200.85 (5)	

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent 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)

Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 30 ÷ (5) =	0.15 (8)
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If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	5.00 (17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)

Number of sides on which the dwelling is sheltered	2 (19)
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Shelter factor	1 - [0.075 x (19)] = 0.85 (20)
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Infiltration rate incorporating shelter factor	(18) x (20) = 0.34 (21)
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Infiltration rate modified for monthly wind speed:

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70 (22)

Wind factor (22)m ÷ 4

1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18 (22a)
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m

0.43	0.42	0.42	0.37	0.36	0.32	0.32	0.31	0.34	0.36	0.38	0.40 (22b)
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	N/A (23a)
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If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A (23c)
--	--

d) natural ventilation or whole house positive input ventilation from loft

0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58 (24d)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)

0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58 (25)
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K
Window			13.12	x 1.33	= 17.39 (27)		
Party wall			51.59	x 0.00	= 0.00 (32)		
External wall			38.33	x 0.18	= 6.90 (29a)		
Roof			63.63	x 0.13	= 8.27 (30)		
Total area of external elements ΣA, m ²			115.08 (31)				

Fabric heat loss, W/K = Σ(A x U) (26)...(30) + (32) = (33)

Heat capacity Cm = Σ(A x κ) (28)...(30) + (32) + (32a)...(32e) = (34)

Thermal mass parameter (TMP) in kJ/m²K (35)

Thermal bridges: Σ(L x Ψ) calculated using Appendix K (36)

Total fabric heat loss (33) + (36) = (37)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
39.35	39.11	38.87	37.76	37.55	36.59	36.59	36.41	36.96	37.55	37.97	38.41 (38)

Heat transfer coefficient, W/K (37)m + (38)m

87.61	87.37	87.13	86.02	85.81	84.85	84.85	84.67	85.22	85.81	86.23	86.67	
Average = $\sum(39)1...12/12 =$											86.02	(39)

Heat loss parameter (HLP), W/m²K (39)m ÷ (4)

1.09	1.09	1.08	1.07	1.07	1.06	1.06	1.05	1.06	1.07	1.07	1.08	
Average = $\sum(40)1...12/12 =$											1.07	(40)

Number of days in month (Table 1a)

31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00 (40)
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4. Water heating energy requirement

Assumed occupancy, N (42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)												
102.13	98.42	94.70	90.99	87.27	83.56	83.56	87.27	90.99	94.70	98.42	102.13	
										Σ(44)1...12 =	1114.14	(44)

Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)

151.46	132.46	136.69	119.17	114.35	98.67	91.43	104.92	106.18	123.74	135.07	146.68	
										Σ(45)1...12 =	1460.82	(45)

Distribution loss 0.15 x (45)m

22.72	19.87	20.50	17.88	17.15	14.80	13.72	15.74	15.93	18.56	20.26	22.00 (46)
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Storage volume (litres) including any solar or WWHRs storage within same vessel (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day) (48)

Temperature factor from Table 2b (49)

Energy lost from water storage (kWh/day) (48) x (49) (50)

Enter (50) or (54) in (55) (55)

Water storage loss calculated for each month (55) x (41)m

3.57	3.23	3.57	3.46	3.57	3.46	3.57	3.57	3.46	3.57	3.46	3.57 (56)
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If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - Vs] ÷ (47), else (56)

3.57	3.23	3.57	3.46	3.57	3.46	3.57	3.57	3.46	3.57	3.46	3.57 (57)
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Primary circuit loss for each month from Table 3

	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													
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m													
	178.29	156.70	163.53	145.14	141.18	124.64	118.27	131.76	132.14	150.57	161.04	173.51	(62)
Solar DHW input calculated using Appendix G or Appendix H													
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
Output from water heater for each month (kWh/month) (62)m + (63)m													
	178.29	156.70	163.53	145.14	141.18	124.64	118.27	131.76	132.14	150.57	161.04	173.51	
	$\Sigma(64)1...12 =$											1776.77	(64)
Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]													
	71.83	63.43	66.92	60.40	59.49	53.58	51.87	56.35	56.08	62.61	65.69	70.24	(65)

5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)													
	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.39	18.11	14.73	11.15	8.34	7.04	7.61	9.89	13.27	16.85	19.66	20.96	(67)
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.15	222.43	216.68	204.42	188.95	174.41	164.70	162.41	168.17	180.43	195.90	210.44	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	(69)
Pump and fan gains (Table 5a)													
	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evaporation (Table 5)													
	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	(71)
Water heating gains (Table 5)													
	96.54	94.40	89.94	83.89	79.96	74.42	69.72	75.74	77.89	84.15	91.23	94.40	(72)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
	400.12	397.98	384.39	362.50	340.28	318.91	305.06	311.08	322.36	344.47	369.83	388.84	(73)

6. Solar gains

	Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W	
SouthEast	0.77	10.59	36.79	0.9	0.63	0.70	119.08 (77)
NorthEast	0.77	2.53	11.28	0.9	0.63	0.70	8.72 (75)
Solar gains in watts $\Sigma(74)m...(82)m$							
	127.81	220.60	309.53	396.42	455.80	457.68	439.10 394.01 339.50 245.88 153.61 109.03 (83)
Total gains - internal and solar (73)m + (83)m							
	527.93	618.58	693.92	758.92	796.08	776.59	744.16 705.09 661.86 590.35 523.44 497.87 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1(°C)												21.00 (85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area n1,m (see Table 9a)												
	1.00	0.99	0.98	0.94	0.84	0.67	0.50	0.54	0.79	0.96	0.99	1.00 (86)
Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)												

	19.89	20.06	20.31	20.61	20.85	20.97	20.99	20.99	20.92	20.61	20.20	19.86	(87)		
Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)															
	20.01	20.01	20.01	20.02	20.03	20.04	20.04	20.04	20.03	20.03	20.02	20.02	(88)		
Utilisation factor for gains for rest of dwelling n2,m															
	1.00	0.99	0.97	0.92	0.79	0.58	0.39	0.43	0.71	0.94	0.99	1.00	(89)		
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)															
	18.54	18.79	19.14	19.58	19.88	20.02	20.03	20.04	19.97	19.59	18.99	18.50	(90)		
Living area fraction										Living area ÷ (4) =				0.40	(91)
Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2															
	19.08	19.30	19.61	19.99	20.27	20.40	20.42	20.42	20.35	20.00	19.47	19.05	(92)		
Apply adjustment to the mean internal temperature from Table 4e where appropriate															
	19.08	19.30	19.61	19.99	20.27	20.40	20.42	20.42	20.35	20.00	19.47	19.05	(93)		

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, ηm	0.99	0.99	0.97	0.92	0.81	0.61	0.43	0.48	0.74	0.94	0.99	1.00	(94)	
Useful gains, ηmGm, W (94)m x (84)m	525.09	610.95	673.30	698.89	642.35	475.52	321.87	336.63	489.45	555.55	517.30	495.86	(95)	
Monthly average external temperature from Table U1	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)	
Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]	1294.70	1257.68	1142.26	954.07	735.32	491.82	323.96	340.12	532.80	806.39	1066.70	1286.67	(97)	
Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m	572.59	434.60	348.90	183.72	69.17	0.00	0.00	0.00	0.00	186.62	395.57	588.36		
	Σ(98)1...5, 10...12 =											2779.54	(98)	
Space heating requirement kWh/m²/year												(98) ÷ (4)	34.60	(99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating														
Fraction of space heat from secondary/supplementary system (table 11)												0.00	(201)	
Fraction of space heat from main system(s)												1 - (201) =	1.00	(202)
Fraction of space heat from main system 2													0.00	(202)
Fraction of total space heat from main system 1												(202) x [1 - (203)] =	1.00	(204)
Fraction of total space heat from main system 2												(202) x (203) =	0.00	(205)
Efficiency of main system 1 (%)													93.50	(206)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating fuel (main system 1), kWh/month														
	612.39	464.82	373.16	196.50	73.98	0.00	0.00	0.00	0.00	199.59	423.07	629.27		
												$\Sigma(211)1...5, 10...12 =$	2972.77	(211)

Water heating

Efficiency of water heater

87.71	87.39	86.79	85.44	83.03	79.80	79.80	79.80	79.80	85.39	87.12	87.82
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(217)

Water heating fuel, kWh/month

203.28	179.30	188.42	169.86	170.04	156.19	148.21	165.11	165.59	176.34	184.85	197.58
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$\Sigma(219a)1...12 =$

2104.77

(219)

Annual totals

Space heating fuel - main system 1

2972.77

Water heating fuel			2104.77	
Electricity for pumps, fans and electric keep-hot (Table 4f)				
central heating pump or water pump within warm air heating unit		30.00		(230c)
boiler flue fan		45.00		(230e)
Total electricity for the above, kWh/year			75.00	(231)
Electricity for lighting (Appendix L)			360.17	(232)
Total delivered energy for all uses	(211)...(221) + (231) + (232)...(237b) =		5512.72	(238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	2972.77	x	3.48	x 0.01 =	103.45	(240)
Water heating	2104.77	x	3.48	x 0.01 =	73.25	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	360.17	x	13.19	x 0.01 =	47.51	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	354.10	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.19	(257)
SAP value	83.45	
SAP rating (section 13)	83	(258)
SAP band	B	

12a. CO₂ emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	2972.77	x	0.216	=	642.12	(261)
Water heating	2104.77	x	0.216	=	454.63	(264)
Space and water heating			(261) + (262) + (263) + (264) =		1096.75	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	360.17	x	0.519	=	186.93	(268)
Total CO ₂ , kg/year			(265)...(271) =		1322.60	(272)
Dwelling CO ₂ emission rate			(272) ÷ (4) =		16.46	(273)
EI value					85.86	
EI rating (section 14)					86	(274)
EI band					B	

13a. Primary energy - individual heating systems including micro-CHP

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	2972.77	x	1.22	=	3626.78	(261)
Water heating	2104.77	x	1.22	=	2567.82	(264)
Space and water heating			(261) + (262) + (263) + (264) =		6194.61	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	360.17	x	3.07	=	1105.73	(268)
Primary energy kWh/year					7530.59	(272)
Dwelling primary energy rate kWh/m ² /year					93.73	(273)

TER Worksheet Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	04/12/2018
Address	4Bed Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)		Average storey height (m)		Volume (m ³)	
Lowest occupied	95.12	(1a) x	2.50	(2a) =	237.80	(3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 95.12					(4)
Dwelling volume			(3a) + (3b) + (3c) + (3d)...(3n) =		237.80	(5)

2. Ventilation rate

			m ³ per hour	
Number of chimneys	0	x 40 =	0	(6a)
Number of open flues	0	x 20 =	0	(6b)
Number of intermittent 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
Infiltration due to chimneys, flues, fans, PSVs	$(6a) + (6b) + (7a) + (7b) + (7c) =$	30	$\div (5) =$
			0.13
			(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	5.00	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.38	(18)
Number of sides on which the dwelling is sheltered	2	(19)
Shelter factor	1 - [0.075 x (19)] = 0.85	(20)
Infiltration rate incorporating shelter factor	(18) x (20) = 0.32	(21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)

Wind factor (22)/m ÷ 4

	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)/m

	0.41	0.40	0.39	0.35	0.34	0.30	0.30	0.30	0.32	0.34	0.36	0.38	(22b)
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system

N/A (23a)

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h

N/A (23c)

d) natural ventilation or whole house positive input ventilation from loft

	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)

	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)
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3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	κ-value, kJ/m².K	A x κ, kJ/K						
Window			15.04	x 1.33	= 19.94		(27)						
Exposed floor			95.12	x 0.13	= 12.37		(28b)						
Party wall			57.93	x 0.00	= 0.00		(32)						
External wall			35.19	x 0.18	= 6.33		(29a)						
Total area of external elements ΣA, m²			145.35				(31)						
Fabric heat loss, W/K = Σ(A x U)					(26)...(30) + (32) =	38.64	(33)						
Heat capacity Cm = Σ(A x κ)					(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)						
Thermal mass parameter (TMP) in kJ/m²K						250.00	(35)						
Thermal bridges: Σ(L x Ψ) calculated using Appendix K						8.47	(36)						
Total fabric heat loss					(33) + (36) =	47.11	(37)						
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	45.76	45.50	45.26	44.09	43.87	42.86	42.86	42.67	43.25	43.87	44.31	44.77	(38)
Heat transfer coefficient, W/K (37)m + (38)m	92.87	92.61	92.36	91.20	90.98	89.97	89.97	89.78	90.36	90.98	91.42	91.88	
	Average = Σ(39)1...12/12 = 91.20												(39)
Heat loss parameter (HLP), W/m²K (39)m ÷ (4)	0.98	0.97	0.97	0.96	0.96	0.95	0.95	0.94	0.95	0.96	0.96	0.97	
	Average = Σ(40)1...12/12 = 0.96												(40)
Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)

4. Water heating energy requirement

Assumed occupancy, N	2.69	(42)											
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	98.08	(43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	107.88	103.96	100.04	96.11	92.19	88.27	88.27	92.19	96.11	100.04	103.96	107.88	
	Σ(44)1...12 = 1176.91												(44)
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	159.99	139.93	144.39	125.88	120.79	104.23	96.59	110.83	112.16	130.71	142.68	154.94	
	Σ(45)1...12 = 1543.12												(45)
Distribution loss 0.15 x (45)m	24.00	20.99	21.66	18.88	18.12	15.63	14.49	16.63	16.82	19.61	21.40	23.24	(46)
Storage volume (litres) including any solar or WWHRS storage within same vessel	2.00												(47)
Water storage loss:													
a) If manufacturer's declared loss factor is known (kWh/day)	0.24												(48)
Temperature factor from Table 2b	0.54												(49)
Energy lost from water storage (kWh/day) (48) x (49)	0.13												(50)
Enter (50) or (54) in (55)	0.13												(55)
Water storage loss calculated for each month (55) x (41)m	4.00	3.61	4.00	3.87	4.00	3.87	4.00	4.00	3.87	4.00	3.87	4.00	(56)
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)	4.00	3.61	4.00	3.87	4.00	3.87	4.00	4.00	3.87	4.00	3.87	4.00	(57)
Primary circuit loss for each month from Table 3													

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)
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Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
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Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

187.25	164.55	171.65	152.27	148.05	130.61	123.85	138.09	138.54	157.97	169.06	182.20	(62)
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Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
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Output from water heater for each month (kWh/month) (62)m + (63)m

187.25	164.55	171.65	152.27	148.05	130.61	123.85	138.09	138.54	157.97	169.06	182.20	
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$$\Sigma(64)1...12 = \text{}$$

Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

75.00	66.22	69.82	62.96	61.97	55.76	53.92	58.66	58.40	65.27	68.55	73.33	(65)
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5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.14	20.55	16.71	12.65	9.46	7.99	8.63	11.22	15.05	19.11	22.31	23.78	(67)
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	248.19	250.76	244.27	230.46	213.02	196.63	185.67	183.10	189.59	203.41	220.85	237.24	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	(69)
Pump and fan gains (Table 5a)	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evaporation (Table 5)	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	(71)
Water heating gains (Table 5)	100.81	98.55	93.84	87.45	83.29	77.45	72.48	78.84	81.11	87.73	95.20	98.56	(72)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m	438.48	436.20	421.17	396.90	372.11	348.40	333.12	339.50	352.09	376.59	404.70	425.92	(73)

6. Solar gains

	Access factor Table 6d	Area m²	Solar flux W/m²	g specific data or Table 6b	FF specific data or Table 6c	Gains W							
NorthEast	0.77	x 5.65	x 11.28	x 0.9 x 0.63	x 0.70	= 19.48	(75)						
SouthEast	0.77	x 9.39	x 36.79	x 0.9 x 0.63	x 0.70	= 105.59	(77)						
Solar gains in watts Σ(74)m...(82)m	125.07	219.51	317.53	422.25	499.25	507.21	484.19	424.98	353.52	247.24	150.98	106.27	(83)
Total gains - internal and solar (73)m + (83)m	563.55	655.72	738.71	819.15	871.37	855.61	817.31	764.48	705.61	623.83	555.68	532.19	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1(°C)	21.00												(85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area n1,m (see Table 9a)	1.00	1.00	0.99	0.95	0.84	0.65	0.48	0.53	0.80	0.97	1.00	1.00	(86)

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

	19.99	20.14	20.38	20.67	20.88	20.98	21.00	20.99	20.94	20.65	20.27	19.97	(87)
Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)													
	20.10	20.11	20.11	20.12	20.12	20.13	20.13	20.13	20.13	20.12	20.12	20.11	(88)
Utilisation factor for gains for rest of dwelling n2,m													
	1.00	0.99	0.98	0.93	0.79	0.57	0.39	0.44	0.73	0.95	0.99	1.00	(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)													
	18.75	18.97	19.31	19.73	20.01	20.12	20.13	20.13	20.08	19.71	19.16	18.72	(90)
Living area fraction										Living area ÷ (4) =		0.15	(91)
Mean internal temperature for the whole dwelling fLA x T1 + (1 - fLA) x T2													
	18.93	19.14	19.47	19.86	20.14	20.24	20.25	20.25	20.20	19.85	19.32	18.90	(92)
Apply adjustment to the mean internal temperature from Table 4e where appropriate													
	18.93	19.14	19.47	19.86	20.14	20.24	20.25	20.25	20.20	19.85	19.32	18.90	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm													
	1.00	0.99	0.98	0.92	0.79	0.58	0.40	0.45	0.73	0.95	0.99	1.00	(94)
Useful gains, ηmGm, W (94)m x (84)m													
	561.44	649.76	720.58	756.86	692.36	497.76	327.83	344.27	516.67	591.58	550.84	530.72	(95)
Monthly average external temperature from Table U1													
	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]													
	1358.78	1319.26	1197.61	999.83	767.47	507.53	328.75	346.03	551.32	841.55	1117.32	1350.73	(97)
Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m													
	593.22	449.90	354.91	174.94	55.88	0.00	0.00	0.00	0.00	185.98	407.87	610.09	
	Σ(98)1...5, 10...12 =										2832.80		(98)
Space heating requirement kWh/m²/year										(98) ÷ (4) =		29.78	(99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating

Fraction of space heat from secondary/supplementary system (table 11)	0.00	(201)
Fraction of space heat from main system(s)	1 - (201) = 1.00	(202)
Fraction of space heat from main system 2	0.00	(202)
Fraction of total space heat from main system 1	(202) x [1- (203)] = 1.00	(204)
Fraction of total space heat from main system 2	(202) x (203) = 0.00	(205)
Efficiency of main system 1 (%)	93.50	(206)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating fuel (main system 1), kWh/month													
	634.46	481.18	379.59	187.10	59.77	0.00	0.00	0.00	0.00	198.91	436.22	652.50	
	Σ(211)1...5, 10...12 =										3029.73		(211)

Water heating

Efficiency of water heater													
	87.68	87.36	86.71	85.18	82.47	79.80	79.80	79.80	79.80	85.25	87.08	87.79	(217)
Water heating fuel, kWh/month													
	213.56	188.35	197.96	178.75	179.51	163.68	155.20	173.05	173.61	185.30	194.15	207.53	
	Σ(219a)1...12 =										2210.65		(219)

Annual totals

Space heating fuel - main system 1	3029.73
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Water heating fuel	2210.65
Electricity for pumps, fans and electric keep-hot (Table 4f)	
central heating pump or water pump within warm air heating unit	30.00 (230c)
boiler flue fan	45.00 (230e)
Total electricity for the above, kWh/year	75.00 (231)
Electricity for lighting (Appendix L)	408.63 (232)
Total delivered energy for all uses	(211)...(221) + (231) + (232)...(237b) = 5724.00 (238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	3029.73	x	3.48	x 0.01 =	105.43	(240)
Water heating	2210.65	x	3.48	x 0.01 =	76.93	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	408.63	x	13.19	x 0.01 =	53.90	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	366.16	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.10	(257)
SAP value	84.69	
SAP rating (section 13)	85	(258)
SAP band	B	

12a. CO₂ emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	3029.73	x	0.216	=	654.42	(261)
Water heating	2210.65	x	0.216	=	477.50	(264)
Space and water heating			(261) + (262) + (263) + (264) =		1131.92	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	408.63	x	0.519	=	212.08	(268)
Total CO ₂ , kg/year			(265)...(271) =		1382.92	(272)
Dwelling CO ₂ emission rate			(272) ÷ (4) =		14.54	(273)
EI value					86.77	
EI rating (section 14)					87	(274)
EI band					B	

13a. Primary energy - individual heating systems including micro-CHP

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	3029.73	x	1.22	=	3696.27	(261)
Water heating	2210.65	x	1.22	=	2696.99	(264)
Space and water heating			(261) + (262) + (263) + (264) =		6393.26	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	408.63	x	3.07	=	1254.49	(268)
Primary energy kWh/year					7877.99	(272)
Dwelling primary energy rate kWh/m2/year					82.82	(273)

TER Worksheet Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	04/12/2018
Address	4Bed Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	95.12 (1a) x	2.50 (2a) =	237.80 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 95.12 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) = 237.80 (5)	

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent 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
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 30 ÷ (5) = 0.13 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q₅₀, expressed in cubic metres per hour per square metre of envelope area (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) (18)

Number of sides on which the dwelling is sheltered (19)

Shelter factor 1 - [0.075 x (19)] = (20)

Infiltration rate incorporating shelter factor (18) x (20) = (21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70

Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.41	0.40	0.39	0.35	0.34	0.30	0.30	0.30	0.32	0.34	0.36	0.38
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system (23a)

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h (23c)

d) natural ventilation or whole house positive input ventilation from loft

0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)

0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K
Window			15.04	x 1.33	= 19.94		(27)
Party wall			57.92	x 0.00	= 0.00		(32)
External wall			35.19	x 0.18	= 6.33		(29a)
Total area of external elements ΣA, m ²			50.23				(31)
Fabric heat loss, W/K = Σ(A × U)						(26)...(30) + (32) =	26.27 (33)
Heat capacity Cm = Σ(A × κ)						(28)...(30) + (32) + (32a)...(32e) =	N/A (34)
Thermal mass parameter (TMP) in kJ/m ² K							250.00 (35)
Thermal bridges: Σ(L × Ψ) calculated using Appendix K							4.68 (36)
Total fabric heat loss						(33) + (36) =	30.95 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	45.76	45.50	45.26	44.09	43.87	42.86	42.86	42.67	43.25	43.87	44.31	44.77

Heat transfer coefficient, W/K (37)m + (38)m	76.71	76.46	76.21	75.04	74.83	73.81	73.81	73.62	74.20	74.83	75.27	75.73
Average = Σ(39)1...12/12 =	75.04 (39)											

Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	0.81	0.80	0.80	0.79	0.79	0.78	0.78	0.77	0.78	0.79	0.79	0.80
Average = Σ(40)1...12/12 =	0.79 (40)											

Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00
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4. Water heating energy requirement

Assumed occupancy, N	2.69 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	98.08 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	107.88	103.96	100.04	96.11	92.19	88.27	88.27	92.19	96.11	100.04	103.96	107.88
Σ(44)1...12 =	1176.91 (44)											

Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	159.99	139.93	144.39	125.88	120.79	104.23	96.59	110.83	112.16	130.71	142.68	154.94
Σ(45)1...12 =	1543.12 (45)											

Distribution loss 0.15 x (45)m	24.00	20.99	21.66	18.88	18.12	15.63	14.49	16.63	16.82	19.61	21.40	23.24
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Storage volume (litres) including any solar or WWHRs storage within same vessel (47)

Water storage loss:	
a) If manufacturer's declared loss factor is known (kWh/day)	0.24 (48)
Temperature factor from Table 2b	0.54 (49)
Energy lost from water storage (kWh/day) (48) x (49)	0.13 (50)
Enter (50) or (54) in (55)	0.13 (55)

Water storage loss calculated for each month (55) x (41)m	4.00	3.61	4.00	3.87	4.00	3.87	4.00	4.00	3.87	4.00	3.87	4.00
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If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - Vs] ÷ (47), else (56)	4.00	3.61	4.00	3.87	4.00	3.87	4.00	4.00	3.87	4.00	3.87	4.00
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Primary circuit loss for each month from Table 3	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26
--	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------

Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
------	------	------	------	------	------	------	------	------	------	------	------	------

Total heat required for water heating calculated for each month $0.85 \times (45)\text{m} + (46)\text{m} + (57)\text{m} + (59)\text{m} + (61)\text{m}$

187.25	164.55	171.65	152.27	148.05	130.61	123.85	138.09	138.54	157.97	169.06	182.20	(62)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
------	------	------	------	------	------	------	------	------	------	------	------	------

Output from water heater for each month (kWh/month) (62)m + (63)m

187.25	164.55	171.65	152.27	148.05	130.61	123.85	138.09	138.54	157.97	169.06	182.20	
$\Sigma(64)1...12 =$											1864.09	(64)

Heat gains from water heating (kWh/month) $0.25 \times [0.85 \times (45)\text{m} + (61)\text{m}] + 0.8 \times [(46)\text{m} + (57)\text{m} + (59)\text{m}]$

75.00	66.22	69.82	62.96	61.97	55.76	53.92	58.66	58.40	65.27	68.55	73.33	(65)
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5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)												

134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	(66)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

23.14	20.55	16.71	12.65	9.46	7.99	8.63	11.22	15.05	19.11	22.31	23.78	(67)
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------	------

Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

248.19	250.76	244.27	230.46	213.02	196.63	185.67	183.10	189.59	203.41	220.85	237.24	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	(69)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pump and fan gains (Table 5a)

3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
------	------	------	------	------	------	------	------	------	------	------	------	------

Losses e.g. evaporation (Table 5)

-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	(71)
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Water heating gains (Table 5)

100.81	98.55	93.84	87.45	83.29	77.45	72.48	78.84	81.11	87.73	95.20	98.56	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

438.48	436.20	421.17	396.90	372.11	348.40	333.12	339.50	352.09	376.59	404.70	425.92	(73)
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6. Solar gains

	Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W	
NorthEast	0.77	x 5.65	x 11.28	x 0.9 x 0.63	x 0.70	= 19.48	(75)
SouthEast	0.77	x 9.39	x 36.79	x 0.9 x 0.63	x 0.70	= 105.59	(77)

Solar gains in watts $\Sigma(74)\text{m}... (82)\text{m}$

125.07	219.51	317.53	422.25	499.25	507.21	484.19	424.98	353.52	247.24	150.98	106.27	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Total gains - internal and solar (73)m + (83)m

563.55	655.72	738.71	819.15	871.37	855.61	817.31	764.48	705.61	623.83	555.68	532.19	(84)
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7. Mean internal temperature (heating season)

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

21.00	(85)
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Utilisation factor for gains for living area n1,m (see Table 9a)

1.00	0.99	0.98	0.91	0.76	0.55	0.40	0.44	0.70	0.95	0.99	1.00	(86)
------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

20.24	20.39	20.60	20.83	20.96	21.00	21.00	21.00	20.98	20.80	20.48	20.22	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.25	20.25	20.25	20.26	20.26	20.27	20.27	20.28	20.27	20.26	20.26	20.26	(88)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling n2,m

1.00	0.99	0.97	0.89	0.71	0.49	0.33	0.37	0.64	0.93	0.99	1.00	(89)
------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

19.23	19.44	19.74	20.07	20.23	20.27	20.27	20.28	20.26	20.04	19.58	19.20	(90)
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Living area fraction

Living area ÷ (4) = 0.15 (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

19.38	19.58	19.87	20.18	20.34	20.38	20.38	20.38	20.36	20.15	19.71	19.35	(92)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e where appropriate

19.38	19.58	19.87	20.18	20.34	20.38	20.38	20.38	20.36	20.15	19.71	19.35	(93)
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8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm												

1.00	0.99	0.97	0.89	0.71	0.50	0.34	0.38	0.65	0.92	0.99	1.00	(94)
------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, ηmGm, W (94)m x (84)m

561.27	648.40	713.65	726.45	622.69	424.75	278.87	292.86	455.65	576.56	549.71	530.66	(95)
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Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
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Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]

1156.43	1122.38	1018.57	846.62	646.25	426.43	278.98	293.09	464.74	714.74	949.22	1147.02	(97)
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Space heating requirement, kWh/month $0.024 \times [(97)\text{m} - (95)\text{m}] \times (41)\text{m}$

442.80	318.51	226.86	86.53	17.53	0.00	0.00	0.00	0.00	102.80	287.64	458.57	
$\Sigma(98)1...5, 10...12 =$											1941.24	(98)

Space heating requirement kWh/m²/year

(98) ÷ (4) 20.41 (99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating

Fraction of space heat from secondary/supplementary system (table 11)

0.00 (201)

Fraction of space heat from main system(s)

1 - (201) = 1.00 (202)

Fraction of space heat from main system 2

0.00 (202)

Fraction of total space heat from main system 1

(202) x [1 - (203)] = 1.00 (204)

Fraction of total space heat from main system 2

(202) x (203) = 0.00 (205)

Efficiency of main system 1 (%)

93.50 (206)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating fuel (main system 1), kWh/month												
473.58	340.66	242.63	92.54	18.74	0.00	0.00	0.00	0.00	109.95	307.64	490.45	
$\Sigma(211)1...5, 10...12 =$											2076.19	(211)

Water heating

Efficiency of water heater

87.03	86.55	85.56	83.37	80.81	79.80	79.80	79.80	79.80	83.70	86.22	87.18	(217)
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Water heating fuel, kWh/month

215.15	190.13	200.63	182.63	183.20	163.68	155.20	173.05	173.61	188.73	196.08	209.00	
$\Sigma(219a)1...12 =$											2231.08	(219)

Annual totals

Space heating fuel - main system 1

2076.19

Water heating fuel

2231.08

Electricity for pumps, fans and electric keep-hot (Table 4f)

central heating pump or water pump within warm air heating unit

30.00

(230c)

boiler flue fan

45.00

(230e)

Total electricity for the above, kWh/year

75.00

(231)

Electricity for lighting (Appendix L)

408.63

(232)

Total delivered energy for all uses

(211)...(221) + (231) + (232)...(237b) =

4790.90

(238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	2076.19	x	3.48	x 0.01 =	72.25	(240)
Water heating	2231.08	x	3.48	x 0.01 =	77.64	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	408.63	x	13.19	x 0.01 =	53.90	(250)
Additional standing charges					120.00	(251)
Total energy cost			(240)...(242) + (245)...(254) =		333.68	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.00	(257)
SAP value	86.05	
SAP rating (section 13)	86	(258)
SAP band	B	

12a. CO₂ emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	2076.19	x	0.216	=	448.46	(261)
Water heating	2231.08	x	0.216	=	481.91	(264)
Space and water heating			(261) + (262) + (263) + (264) =		930.37	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	408.63	x	0.519	=	212.08	(268)
Total CO ₂ , kg/year			(265)...(271) =		1181.37	(272)
Dwelling CO ₂ emission rate			(272) ÷ (4) =		12.42	(273)
EI value					88.70	
EI rating (section 14)					89	(274)
EI band					B	

13a. Primary energy - individual heating systems including micro-CHP

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	2076.19	x	1.22	=	2532.96	(261)
Water heating	2231.08	x	1.22	=	2721.92	(264)
Space and water heating			(261) + (262) + (263) + (264) =		5254.87	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	408.63	x	3.07	=	1254.49	(268)
Primary energy kWh/year					6739.61	(272)
Dwelling primary energy rate kWh/m ² /year					70.85	(273)

TER Worksheet Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	04/12/2018
Address	4Bed Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)		Average storey height (m)		Volume (m ³)	
Lowest occupied	95.12	(1a)	x	2.50	(2a)	= 237.80 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 95.12	(4)				
Dwelling volume				(3a) + (3b) + (3c) + (3d)...(3n) =	237.80	(5)

2. Ventilation rate

			m ³ per hour	
Number of chimneys	0	x 40 =	0	(6a)
Number of open flues	0	x 20 =	0	(6b)
Number of intermittent 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)

Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 30	÷ (5) =	0.13	(8)
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If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	5.00	(17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.38	(18)
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Number of sides on which the dwelling is sheltered	2	(19)
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Shelter factor	1 - [0.075 x (19)] =	0.85	(20)
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Infiltration rate incorporating shelter factor	(18) x (20) =	0.32	(21)
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Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)

Wind factor (22)/m ÷ 4

	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)/m

	0.41	0.40	0.39	0.35	0.34	0.30	0.30	0.30	0.32	0.34	0.36	0.38	(22b)
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	N/A	(23a)
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If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A	(23c)
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d) natural ventilation or whole house positive input ventilation from loft

	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)

	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K						
Window			15.04	x 1.33	= 19.94		(27)						
Party wall			57.93	x 0.00	= 0.00		(32)						
External wall			35.19	x 0.18	= 6.33		(29a)						
Roof			95.12	x 0.13	= 12.37		(30)						
Total area of external elements ΣA, m ²			145.35				(31)						
Fabric heat loss, W/K = Σ(A x U)					(26)...(30) + (32) =	38.64	(33)						
Heat capacity Cm = Σ(A x κ)					(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)						
Thermal mass parameter (TMP) in kJ/m ² K						250.00	(35)						
Thermal bridges: Σ(L x Ψ) calculated using Appendix K						17.09	(36)						
Total fabric heat loss					(33) + (36) =	55.73	(37)						
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	45.76	45.50	45.26	44.09	43.87	42.86	42.86	42.67	43.25	43.87	44.31	44.77	(38)
Heat transfer coefficient, W/K (37)m + (38)m	101.49	101.23	100.98	99.82	99.60	98.58	98.58	98.40	98.98	99.60	100.04	100.50	
	Average = Σ(39)1...12/12 = 99.82												(39)
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	1.07	1.06	1.06	1.05	1.05	1.04	1.04	1.03	1.04	1.05	1.05	1.06	
	Average = Σ(40)1...12/12 = 1.05												(40)
Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)

4. Water heating energy requirement

Assumed occupancy, N	2.69	(42)											
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	98.08	(43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	107.88	103.96	100.04	96.11	92.19	88.27	88.27	92.19	96.11	100.04	103.96	107.88	
	Σ(44)1...12 = 1176.91												(44)
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	159.99	139.93	144.39	125.88	120.79	104.23	96.59	110.83	112.16	130.71	142.68	154.94	
	Σ(45)1...12 = 1543.12												(45)
Distribution loss 0.15 x (45)m	24.00	20.99	21.66	18.88	18.12	15.63	14.49	16.63	16.82	19.61	21.40	23.24	(46)
Storage volume (litres) including any solar or WWHRS storage within same vessel	2.00												(47)
Water storage loss:													
a) If manufacturer's declared loss factor is known (kWh/day)	0.24												(48)
Temperature factor from Table 2b	0.54												(49)
Energy lost from water storage (kWh/day) (48) x (49)	0.13												(50)
Enter (50) or (54) in (55)	0.13												(55)
Water storage loss calculated for each month (55) x (41)m	4.00	3.61	4.00	3.87	4.00	3.87	4.00	4.00	3.87	4.00	3.87	4.00	(56)
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)	4.00	3.61	4.00	3.87	4.00	3.87	4.00	4.00	3.87	4.00	3.87	4.00	(57)
Primary circuit loss for each month from Table 3													

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)
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Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
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Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

187.25	164.55	171.65	152.27	148.05	130.61	123.85	138.09	138.54	157.97	169.06	182.20	(62)
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Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
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Output from water heater for each month (kWh/month) (62)m + (63)m

187.25	164.55	171.65	152.27	148.05	130.61	123.85	138.09	138.54	157.97	169.06	182.20	
Σ(64)1...12 = 1864.09												(64)

Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

75.00	66.22	69.82	62.96	61.97	55.76	53.92	58.66	58.40	65.27	68.55	73.33	(65)
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5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.14	20.55	16.71	12.65	9.46	7.99	8.63	11.22	15.05	19.11	22.31	23.78	(67)
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	248.19	250.76	244.27	230.46	213.02	196.63	185.67	183.10	189.59	203.41	220.85	237.24	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	(69)
Pump and fan gains (Table 5a)	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evaporation (Table 5)	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	(71)
Water heating gains (Table 5)	100.81	98.55	93.84	87.45	83.29	77.45	72.48	78.84	81.11	87.73	95.20	98.56	(72)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m	438.48	436.20	421.17	396.90	372.11	348.40	333.12	339.50	352.09	376.59	404.70	425.92	(73)

6. Solar gains

	Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W							
NorthEast	0.77	x 5.65	x 11.28	x 0.9 x 0.63	x 0.70	= 19.48	(75)						
SouthEast	0.77	x 9.39	x 36.79	x 0.9 x 0.63	x 0.70	= 105.59	(77)						
Solar gains in watts Σ(74)m...(82)m	125.07	219.51	317.53	422.25	499.25	507.21	484.19	424.98	353.52	247.24	150.98	106.27	(83)
Total gains - internal and solar (73)m + (83)m	563.55	655.72	738.71	819.15	871.37	855.61	817.31	764.48	705.61	623.83	555.68	532.19	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1(°C)	21.00												(85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area n1,m (see Table 9a)	1.00	1.00	0.99	0.96	0.87	0.69	0.52	0.58	0.83	0.97	1.00	1.00	(86)
Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)													

	19.86	20.02	20.26	20.57	20.83	20.96	20.99	20.99	20.90	20.57	20.16	19.84	(87)
Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)													
	20.03	20.03	20.03	20.04	20.04	20.05	20.05	20.05	20.05	20.04	20.04	20.04	(88)
Utilisation factor for gains for rest of dwelling n2,m													
	1.00	0.99	0.98	0.94	0.82	0.61	0.41	0.47	0.76	0.96	0.99	1.00	(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)													
	18.51	18.74	19.09	19.54	19.88	20.03	20.05	20.05	19.97	19.54	18.95	18.48	(90)
Living area fraction										Living area ÷ (4) =		0.15	(91)
Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2													
	18.71	18.92	19.26	19.69	20.02	20.16	20.19	20.19	20.11	19.69	19.12	18.67	(92)
Apply adjustment to the mean internal temperature from Table 4e where appropriate													
	18.71	18.92	19.26	19.69	20.02	20.16	20.19	20.19	20.11	19.69	19.12	18.67	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm													
	1.00	0.99	0.98	0.93	0.82	0.62	0.43	0.48	0.76	0.95	0.99	1.00	(94)
Useful gains, ηmGm, W (94)m x (84)m													
	561.41	650.01	722.27	765.24	716.33	530.22	351.64	368.84	539.52	595.49	551.04	530.68	(95)
Monthly average external temperature from Table U1													
	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]													
	1462.09	1419.68	1288.68	1077.08	828.25	548.59	353.70	372.61	594.57	905.45	1202.87	1454.73	(97)
Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m													
	670.10	517.22	421.41	224.52	83.27	0.00	0.00	0.00	0.00	230.61	469.32	687.49	
	Σ(98)1...5, 10...12 =										3303.95		(98)
Space heating requirement kWh/m²/year										(98) ÷ (4)		34.73	(99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating

Fraction of space heat from secondary/supplementary system (table 11)	0.00	(201)
Fraction of space heat from main system(s)	1 - (201) = 1.00	(202)
Fraction of space heat from main system 2	0.00	(202)
Fraction of total space heat from main system 1	(202) x [1- (203)] = 1.00	(204)
Fraction of total space heat from main system 2	(202) x (203) = 0.00	(205)
Efficiency of main system 1 (%)	93.50	(206)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating fuel (main system 1), kWh/month													
	716.68	553.17	450.70	240.13	89.06	0.00	0.00	0.00	0.00	246.64	501.95	735.29	
	Σ(211)1...5, 10...12 =										3533.63		(211)

Water heating

Efficiency of water heater													
	87.93	87.66	87.12	85.85	83.35	79.80	79.80	79.80	79.80	85.82	87.40	88.03	(217)
Water heating fuel, kWh/month													
	212.96	187.71	197.03	177.37	177.63	163.68	155.20	173.05	173.61	184.07	193.44	206.98	
	Σ(219a)1...12 =										2202.72		(219)

Annual totals

Space heating fuel - main system 1	3533.63
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Water heating fuel	2202.72	
Electricity for pumps, fans and electric keep-hot (Table 4f)		
central heating pump or water pump within warm air heating unit	30.00	(230c)
boiler flue fan	45.00	(230e)
Total electricity for the above, kWh/year	75.00	(231)
Electricity for lighting (Appendix L)	408.63	(232)
Total delivered energy for all uses	(211)...(221) + (231) + (232)...(237b) =	6219.98 (238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	3533.63	x	3.48	x 0.01 =	122.97	(240)
Water heating	2202.72	x	3.48	x 0.01 =	76.65	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	408.63	x	13.19	x 0.01 =	53.90	(250)
Additional standing charges					120.00	(251)
Total energy cost			(240)...(242) + (245)...(254) =		383.42	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.15	(257)
SAP value	83.97	
SAP rating (section 13)	84	(258)
SAP band	B	

12a. CO₂ emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	3533.63	x	0.216	=	763.26	(261)
Water heating	2202.72	x	0.216	=	475.79	(264)
Space and water heating			(261) + (262) + (263) + (264) =		1239.05	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	408.63	x	0.519	=	212.08	(268)
Total CO ₂ , kg/year			(265)...(271) =		1490.05	(272)
Dwelling CO ₂ emission rate			(272) ÷ (4) =		15.66	(273)
EI value					85.75	
EI rating (section 14)					86	(274)
EI band					B	

13a. Primary energy - individual heating systems including micro-CHP

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	3533.63	x	1.22	=	4311.03	(261)
Water heating	2202.72	x	1.22	=	2687.31	(264)
Space and water heating			(261) + (262) + (263) + (264) =		6998.34	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	408.63	x	3.07	=	1254.49	(268)
Primary energy kWh/year					8483.08	(272)
Dwelling primary energy rate kWh/m2/year					89.18	(273)

TER Worksheet Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	04/12/2018
Address	Studio Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	40.28 (1a) x	2.50 (2a) =	100.70 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 40.28 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) =	100.70 (5)

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent 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
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 20 ÷ (5) = 0.20 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	5.00 (17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)

Number of sides on which the dwelling is sheltered	3 (19)
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Shelter factor	1 - [0.075 x (19)] = 0.78 (20)
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Infiltration rate incorporating shelter factor	(18) x (20) = 0.35 (21)
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Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70 (22)

Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18 (22a)
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.44	0.43	0.43	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41 (22b)
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	N/A (23a)
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If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A (23c)
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d) natural ventilation or whole house positive input ventilation from loft	0.60	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58 (24d)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.60	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58 (25)
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K
Window		7.85	x	1.33	=	10.41	(27)
Exposed floor	40.28	x	0.13	=	5.24		(28b)
Party wall	51.97	x	0.00	=	0.00		(32)
External wall	6.71	x	0.18	=	1.21		(29a)
Total area of external elements ΣA, m ²	54.84						(31)
Fabric heat loss, W/K = Σ(A x U)					(26)...(30) + (32) =	16.85	(33)
Heat capacity Cm = Σ(A x κ)					(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)
Thermal mass parameter (TMP) in kJ/m ² K						250.00	(35)
Thermal bridges: Σ(L x Ψ) calculated using Appendix K						6.27	(36)
Total fabric heat loss					(33) + (36) =	23.13	(37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	19.88	19.75	19.63	19.05	18.94	18.43	18.43	18.33	18.62	18.94	19.16	19.39 (38)
Heat transfer coefficient, W/K (37)m + (38)m	43.01	42.88	42.75	42.17	42.06	41.55	41.55	41.46	41.75	42.06	42.28	42.51
Average = Σ(39)1...12/12 =	42.17 (39)											

Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	1.07	1.06	1.06	1.05	1.04	1.03	1.03	1.03	1.04	1.04	1.05	1.06
Average = Σ(40)1...12/12 =	1.05 (40)											

Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00 (40)
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4. Water heating energy requirement

Assumed occupancy, N	1.41 (42)
Annual average hot water usage in litres per day V _{d,average} = (25 x N) + 36	67.78 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month V _{d,m} = factor from Table 1c x (43)	74.56	71.84	69.13	66.42	63.71	61.00	61.00	63.71	66.42	69.13	71.84	74.56
Σ(44)1...12 =	813.33 (44)											

Energy content of hot water used = 4.18 x V _{d,m} x nm x T _m /3600 kWh/month (see Tables 1b, 1c 1d)	110.56	96.70	99.79	87.00	83.47	72.03	66.75	76.59	77.51	90.33	98.60	107.07
Σ(45)1...12 =	1066.41 (45)											

Distribution loss 0.15 x (45)m	16.58	14.50	14.97	13.05	12.52	10.80	10.01	11.49	11.63	13.55	14.79	16.06 (46)
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Storage volume (litres) including any solar or WWHRs storage within same vessel	1.00 (47)
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Water storage loss:	
a) If manufacturer's declared loss factor is known (kWh/day)	0.21 (48)
Temperature factor from Table 2b	0.54 (49)
Energy lost from water storage (kWh/day) (48) x (49)	0.12 (50)
Enter (50) or (54) in (55)	0.12 (55)

Water storage loss calculated for each month (55) x (41)m	3.57	3.23	3.57	3.46	3.57	3.46	3.57	3.57	3.46	3.57	3.46	3.57 (56)
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If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - V _s] ÷ (47), else (56)	3.57	3.23	3.57	3.46	3.57	3.46	3.57	3.57	3.46	3.57	3.46	3.57 (57)
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Primary circuit loss for each month from Table 3

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													
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)	
Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m													
137.40	120.94	126.62	112.96	110.31	98.00	93.58	103.43	103.48	117.16	124.57	133.91	(62)	
Solar DHW input calculated using Appendix G or Appendix H													
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)	
Output from water heater for each month (kWh/month) (62)m + (63)m													
137.40	120.94	126.62	112.96	110.31	98.00	93.58	103.43	103.48	117.16	124.57	133.91		
											$\Sigma(64)1...12 =$	1382.35	(64)
Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]													
58.23	51.54	54.65	49.70	49.22	44.73	43.66	46.93	46.55	51.50	53.56	57.07	(65)	

5. Internal gains												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)												
70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
11.01	9.78	7.95	6.02	4.50	3.80	4.10	5.33	7.16	9.09	10.61	11.31	(67)
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
122.24	123.51	120.31	113.51	104.92	96.84	91.45	90.18	93.38	100.18	108.77	116.84	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	(69)
Pump and fan gains (Table 5a)												
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evaporation (Table 5)												
-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	(71)
Water heating gains (Table 5)												
78.27	76.70	73.45	69.03	66.16	62.12	58.68	63.08	64.65	69.22	74.39	76.71	(72)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m												
258.72	257.19	248.92	235.76	222.78	209.97	201.44	205.81	212.39	225.70	240.98	252.07	(73)

6. Solar gains												
	Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W						
SouthEast	0.77	x	7.85	x	0.9 x	0.63	x	0.70	=	88.27	(77)	
Solar gains in watts $\Sigma(74)m...(82)m$												
88.27	150.36	205.73	254.90	285.51	283.45	273.28	250.44	222.76	166.18	105.73	75.54	(83)
Total gains - internal and solar (73)m + (83)m												
346.99	407.55	454.64	490.66	508.29	493.42	474.72	456.25	435.15	391.88	346.71	327.61	(84)

7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1(°C)											21.00	(85)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area n1,m (see Table 9a)												
0.99	0.97	0.94	0.86	0.72	0.53	0.38	0.42	0.64	0.89	0.98	0.99	(86)
Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)												
20.11	20.31	20.54	20.79	20.94	20.99	21.00	21.00	20.97	20.79	20.41	20.08	(87)

Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)													
20.03	20.03	20.03	20.04	20.05	20.06	20.06	20.06	20.05	20.05	20.04	20.04	(88)	
Utilisation factor for gains for rest of dwelling n2,m													
0.99	0.97	0.92	0.83	0.66	0.46	0.30	0.33	0.56	0.85	0.97	0.99	(89)	
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)													
18.87	19.15	19.48	19.82	19.99	20.05	20.06	20.06	20.04	19.82	19.31	18.82	(90)	
Living area fraction											Living area ÷ (4) =	0.62	(91)
Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2													
19.64	19.87	20.14	20.42	20.58	20.63	20.64	20.64	20.62	20.42	19.99	19.60	(92)	
Apply adjustment to the mean internal temperature from Table 4e where appropriate													
19.64	19.87	20.14	20.42	20.58	20.63	20.64	20.64	20.62	20.42	19.99	19.60	(93)	

8. Space heating requirement													
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, η_m													
0.98	0.97	0.93	0.84	0.69	0.50	0.35	0.38	0.61	0.87	0.97	0.99	(94)	
Useful gains, $\eta_m G_m$, W (94)m x (84)m													
341.56	393.66	421.48	412.22	351.91	247.68	167.56	175.27	263.89	339.34	335.15	323.64	(95)	
Monthly average external temperature from Table U1													
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)	
Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]													
659.73	641.73	583.28	485.89	373.42	250.72	167.93	175.84	272.11	413.09	544.99	654.76	(97)	
Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m													
236.72	166.71	120.38	53.04	16.00	0.00	0.00	0.00	0.00	54.87	151.08	246.36		
											$\Sigma(98)1...5, 10...12 =$	1045.16	(98)
Space heating requirement kWh/m ² /year											(98) ÷ (4)	25.95	(99)

9a. Energy requirements - individual heating systems including micro-CHP													
Space heating													
Fraction of space heat from secondary/supplementary system (table 11)											0.00	(201)	
Fraction of space heat from main system(s)											1 - (201) =	1.00	(202)
Fraction of space heat from main system 2												0.00	(202)
Fraction of total space heat from main system 1											(202) x [1 - (203)] =	1.00	(204)
Fraction of total space heat from main system 2											(202) x (203) =	0.00	(205)
Efficiency of main system 1 (%)												93.50	(206)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating fuel (main system 1), kWh/month													
253.18	178.30	128.74	56.73	17.11	0.00	0.00	0.00	0.00	58.69	161.59	263.49		
											$\Sigma(211)1...5, 10...12 =$	1117.82	(211)

Water heating													
Efficiency of water heater													
86.25	85.67	84.68	82.93	81.01	79.80	79.80	79.80	79.80	82.93	85.33	86.42	(217)	
Water heating fuel, kWh/month													
159.30	141.17	149.53	136.21	136.16	122.81	117.27	129.61	129.67	141.28	145.99	154.95		
											$\Sigma(219a)1...12 =$	1663.94	(219)

Annual totals												
Space heating fuel - main system 1											1117.82	
Water heating fuel											1663.94	

Electricity for pumps, fans and electric keep-hot (Table 4f)

central heating pump or water pump within warm air heating unit

30.00

(230c)

boiler flue fan

45.00

(230e)

Total electricity for the above, kWh/year

75.00

(231)

Electricity for lighting (Appendix L)

194.38

(232)

Total delivered energy for all uses

(211)...(221) + (231) + (232)...(237b) = 3051.14

(238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	1117.82	x	3.48	x 0.01 =	38.90	(240)
Water heating	1663.94	x	3.48	x 0.01 =	57.91	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	194.38	x	13.19	x 0.01 =	25.64	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	252.34	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.24	(257)
SAP value	82.66	
SAP rating (section 13)	83	(258)
SAP band	B	

12a. CO₂ emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	1117.82	x	0.216	=	241.45	(261)
Water heating	1663.94	x	0.216	=	359.41	(264)
Space and water heating				(261) + (262) + (263) + (264) =	600.86	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	194.38	x	0.519	=	100.88	(268)
Total CO ₂ , kg/year				(265)...(271) =	740.67	(272)
Dwelling CO ₂ emission rate				(272) ÷ (4) =	18.39	(273)
EI value					88.36	
EI rating (section 14)					88	(274)
EI band					B	

13a. Primary energy - individual heating systems including micro-CHP

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	1117.82	x	1.22	=	1363.74	(261)
Water heating	1663.94	x	1.22	=	2030.01	(264)
Space and water heating				(261) + (262) + (263) + (264) =	3393.75	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	194.38	x	3.07	=	596.73	(268)
Primary energy kWh/year					4220.73	(272)
Dwelling primary energy rate kWh/m ² /year					104.78	(273)

TER Worksheet Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	05/12/2018
Address	Studio Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)		Average storey height (m)		Volume (m ³)	
Lowest occupied	40.28	(1a)	x	2.50	(2a)	= 100.70 (3a)
Total floor area	40.28	(4)				
Dwelling volume				(3a) + (3b) + (3c) + (3d)...(3n) =	100.70	(5)

2. Ventilation rate

			m ³ per hour	
Number of chimneys	0	x 40 =	0	(6a)
Number of open flues	0	x 20 =	0	(6b)
Number of intermittent 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)

Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 20	÷ (5) =	0.20	(8)
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If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	5.00	(17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.45	(18)
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Number of sides on which the dwelling is sheltered	3	(19)
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Shelter factor	1 - [0.075 x (19)] = 0.78	(20)
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Infiltration rate incorporating shelter factor	(18) x (20) = 0.35	(21)
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Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)

Wind factor (22)/m ÷ 4

	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)/m

	0.44	0.43	0.43	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41	(22b)
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	N/A	(23a)
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If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A	(23c)
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d) natural ventilation or whole house positive input ventilation from loft

	0.60	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)

	0.60	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K	
Window			7.85	x	1.33	=	10.41	(27)
Party wall			51.97	x	0.00	=	0.00	(32)
External wall			6.71	x	0.18	=	1.21	(29a)
Total area of external elements ΣA, m ²			14.56					(31)
Fabric heat loss, W/K = Σ(A x U)						(26)...(30) + (32) =	11.61	(33)
Heat capacity Cm = Σ(A x κ)						(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)
Thermal mass parameter (TMP) in kJ/m ² K							250.00	(35)
Thermal bridges: Σ(L x Ψ) calculated using Appendix K							1.51	(36)
Total fabric heat loss						(33) + (36) =	13.12	(37)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)												
19.88	19.75	19.63	19.05	18.94	18.43	18.43	18.33	18.62	18.94	19.16	19.39	(38)

Heat transfer coefficient, W/K (37)m + (38)m												
33.01	32.88	32.75	32.17	32.06	31.55	31.55	31.46	31.75	32.06	32.28	32.51	
Average = $\sum(39)1...12/12 =$											32.17	(39)

Heat loss parameter (HLP), W/m²K (39)m ÷ (4)												
0.82	0.82	0.81	0.80	0.80	0.78	0.78	0.78	0.79	0.80	0.80	0.81	
Average = $\sum(40)1...12/12 =$											0.80	(40)

Number of days in month (Table 1a)												
31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)

4. Water heating energy requirement

Assumed occupancy, N											1.41	(42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36											67.78	(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)												
74.56	71.84	69.13	66.42	63.71	61.00	61.00	63.71	66.42	69.13	71.84	74.56	
Σ(44)1...12 =											813.33	(44)

Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)												
110.56	96.70	99.79	87.00	83.47	72.03	66.75	76.59	77.51	90.33	98.60	107.07	
Σ(45)1...12 =											1066.41	(45)

Distribution loss 0.15 x (45)m												
16.58	14.50	14.97	13.05	12.52	10.80	10.01	11.49	11.63	13.55	14.79	16.06	(46)

Storage volume (litres) including any solar or WWHRS storage within same vessel												1.00	(47)
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Water storage loss:			
a) If manufacturer's declared loss factor is known (kWh/day)		0.21	(48)
Temperature factor from Table 2b		0.54	(49)
Energy lost from water storage (kWh/day) (48) x (49)		0.12	(50)
Enter (50) or (54) in (55)		0.12	(55)

Water storage loss calculated for each month (55) x (41)m												
3.57	3.23	3.57	3.46	3.57	3.46	3.57	3.57	3.46	3.57	3.46	3.57	(56)

If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)												
3.57	3.23	3.57	3.46	3.57	3.46	3.57	3.57	3.46	3.57	3.46	3.57	(57)

Primary circuit loss for each month from Table 3												
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

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
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Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m												
137.40	120.94	126.62	112.96	110.31	98.00	93.58	103.43	103.48	117.16	124.57	133.91	(62)

Solar DHW input calculated using Appendix G or Appendix H												
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)

Output from water heater for each month (kWh/month) (62)m + (63)m												
137.40	120.94	126.62	112.96	110.31	98.00	93.58	103.43	103.48	117.16	124.57	133.91	
Σ(64)1...12 =											1382.35	(64)

Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]												
58.23	51.54	54.65	49.70	49.22	44.73	43.66	46.93	46.55	51.50	53.56	57.07	(65)

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)												
70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
11.01	9.78	7.95	6.02	4.50	3.80	4.10	5.33	7.16	9.09	10.61	11.31	(67)

Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
122.24	123.51	120.31	113.51	104.92	96.84	91.45	90.18	93.38	100.18	108.77	116.84	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	(69)

Pump and fan gains (Table 5a)												
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)

Losses e.g. evaporation (Table 5)												
-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	(71)

Water heating gains (Table 5)												
78.27	76.70	73.45	69.03	66.16	62.12	58.68	63.08	64.65	69.22	74.39	76.71	(72)

Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m												
258.72	257.19	248.92	235.76	222.78	209.97	201.44	205.81	212.39	225.70	240.98	252.07	(73)

6. Solar gains

	Access factor Table 6d		Area m ²		Solar flux W/m ²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
North	0.77	x	7.85	x	10.63	x 0.9 x	0.63	x	0.70	=	25.51	(74)

Solar gains in watts $\Sigma(74)m \dots (82)m$												
25.51	48.75	82.84	133.06	179.25	191.89	179.15	142.14	99.60	58.03	31.47	21.27	(83)

Total gains - internal and solar (73)m + (83)m												
284.23	305.94	331.76	368.82	402.03	401.86	380.60	347.94	311.99	283.73	272.45	273.34	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1(°C)												21.00	(85)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

Utilisation factor for gains for living area n1,m (see Table 9a)												
0.99	0.99	0.97	0.89	0.71	0.50	0.36	0.42	0.68	0.93	0.99	1.00	(86)

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)												
20.33	20.44	20.62	20.85	20.97	21.00	21.00	21.00	20.98	20.83	20.55	20.32	(87)

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

20.24	20.24	20.24	20.25	20.26	20.27	20.27	20.27	20.26	20.26	20.25	20.25	(88)
Utilisation factor for gains for rest of dwelling n2,m												
0.99	0.99	0.96	0.87	0.67	0.44	0.30	0.35	0.62	0.91	0.98	0.99	(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)												
19.35	19.50	19.77	20.09	20.23	20.27	20.27	20.27	20.25	20.07	19.68	19.34	(90)
Living area fraction												
Living area ÷ (4) =											0.62	(91)
Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2												
19.96	20.08	20.30	20.56	20.69	20.72	20.72	20.72	20.71	20.54	20.22	19.95	(92)
Apply adjustment to the mean internal temperature from Table 4e where appropriate												
19.96	20.08	20.30	20.56	20.69	20.72	20.72	20.72	20.71	20.54	20.22	19.95	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, η_m													
	0.99	0.98	0.96	0.88	0.69	0.48	0.34	0.39	0.66	0.92	0.98	0.99	(94)
Useful gains, $\eta_m G_m$, W (94)m x (84)m													
	281.80	301.31	319.47	324.22	279.15	192.48	130.01	135.86	205.07	260.09	267.40	271.46	(95)
Monthly average external temperature from Table U1													
	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate for mean internal temperature, L_m , W [(39)m x [(93)m - (96)m]													
	516.88	499.17	451.88	375.19	288.28	193.12	130.06	135.98	209.76	318.64	423.57	511.94	(97)
Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m													
	174.89	132.96	98.52	36.69	6.79	0.00	0.00	0.00	0.00	43.56	112.44	178.92	
	$\Sigma(98)1...5, 10...12 =$										784.77		(98)
Space heating requirement kWh/m ² /year											(98) ÷ (4)	19.48	(99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating															
Fraction of space heat from secondary/supplementary system (table 11)											0.00		(201)		
Fraction of space heat from main system(s)											1 - (201) =	1.00		(202)	
Fraction of space heat from main system 2											0.00		(202)		
Fraction of total space heat from main system 1											(202) x [1 - (203)] =	1.00		(204)	
Fraction of total space heat from main system 2											(202) x (203) =	0.00		(205)	
Efficiency of main system 1 (%)											93.50		(206)		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec				
Space heating fuel (main system 1), kWh/month															
187.05	142.20	105.36	39.25	7.26	0.00	0.00	0.00	0.00	46.58	120.26	191.35				
											Σ(211)1...5, 10...12 =		839.33		(211)

Water heating												
Efficiency of water heater												
85.46	85.07	84.15	82.18	80.35	79.80	79.80	79.80	79.80	82.44	84.54	85.59	(217)
Water heating fuel, kWh/month												
160.78	142.17	150.46	137.45	137.28	122.81	117.27	129.61	129.67	142.12	147.35	156.46	
Σ(219a)1...12 =											1673.42	(219)

Annual totals												
Space heating fuel - main system 1											839.33	
Water heating fuel											1673.42	
Electricity for pumps, fans and electric keep-hot (Table 4f)												

central heating pump or water pump within warm air heating unit	30.00	(230c)
boiler flue fan	45.00	(230e)
Total electricity for the above, kWh/year	75.00	(231)
Electricity for lighting (Appendix L)	194.38	(232)
Total delivered energy for all uses	(211)...(221) + (231) + (232)...(237b) =	2782.12 (238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	839.33	x	3.48	x 0.01 =	29.21	(240)
Water heating	1673.42	x	3.48	x 0.01 =	58.24	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	194.38	x	13.19	x 0.01 =	25.64	(250)
Additional standing charges					120.00	(251)
Total energy cost			(240)...(242) + (245)...(254) =		242.97	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.20	(257)
SAP value	83.31	
SAP rating (section 13)	83	(258)
SAP band	B	

12a. CO₂ emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	839.33	x	0.216	=	181.29	(261)
Water heating	1673.42	x	0.216	=	361.46	(264)
Space and water heating			(261) + (262) + (263) + (264) =		542.75	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	194.38	x	0.519	=	100.88	(268)
Total CO ₂ , kg/year			(265)...(271) =		682.56	(272)
Dwelling CO ₂ emission rate			(272) ÷ (4) =		16.95	(273)
EI value					89.27	
EI rating (section 14)					89	(274)
EI band					B	

13a. Primary energy - individual heating systems including micro-CHP

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	839.33	x	1.22	=	1023.98	(261)
Water heating	1673.42	x	1.22	=	2041.57	(264)
Space and water heating			(261) + (262) + (263) + (264) =		3065.55	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	194.38	x	3.07	=	596.73	(268)
Primary energy kWh/year					3892.54	(272)
Dwelling primary energy rate kWh/m2/year					96.64	(273)

TER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	04/12/2018
Address	Studio Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	40.28 (1a) x	2.50 (2a) =	100.70 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 40.28 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) = 100.70 (5)	

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent 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
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 20 ÷ (5) = 0.20 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	5.00 (17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)

Number of sides on which the dwelling is sheltered	3 (19)
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Shelter factor	1 - [0.075 x (19)] = 0.78 (20)
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Infiltration rate incorporating shelter factor	(18) x (20) = 0.35 (21)
--	--

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70 (22)

Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18 (22a)
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.44	0.43	0.43	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41 (22b)
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	N/A (23a)
---	--

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A (23c)
--	--

d) natural ventilation or whole house positive input ventilation from loft	0.60	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58 (24d)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.60	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58 (25)
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K
Window		7.85	x	1.33	=	10.41	(27)
Party wall	51.97	x	0.00	=	0.00		(32)
External wall	6.71	x	0.18	=	1.21		(29a)
Roof	40.28	x	0.13	=	5.24		(30)
Total area of external elements ΣA, m ²	54.84						(31)
Fabric heat loss, W/K = Σ(A x U)					(26)...(30) + (32) =	16.85	(33)
Heat capacity Cm = Σ(A x κ)					(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)
Thermal mass parameter (TMP) in kJ/m ² K						250.00	(35)
Thermal bridges: Σ(L x Ψ) calculated using Appendix K						6.59	(36)
Total fabric heat loss						(33) + (36) =	23.45 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	19.88	19.75	19.63	19.05	18.94	18.43	18.43	18.33	18.62	18.94	19.16	19.39 (38)
Heat transfer coefficient, W/K (37)m + (38)m	43.33	43.20	43.08	42.49	42.38	41.87	41.87	41.78	42.07	42.38	42.60	42.83
Average = Σ(39)1...12/12 =	42.49 (39)											

Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	1.08	1.07	1.07	1.05	1.05	1.04	1.04	1.04	1.04	1.05	1.06	1.06
Average = Σ(40)1...12/12 =	1.05 (40)											

Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00 (40)
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4. Water heating energy requirement

Assumed occupancy, N	1.41 (42)
Annual average hot water usage in litres per day V _{d,average} = (25 x N) + 36	67.78 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month V _{d,m} = factor from Table 1c x (43)	74.56	71.84	69.13	66.42	63.71	61.00	61.00	63.71	66.42	69.13	71.84	74.56
Σ(44)1...12 =	813.33 (44)											

Energy content of hot water used = 4.18 x V _{d,m} x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	110.56	96.70	99.79	87.00	83.47	72.03	66.75	76.59	77.51	90.33	98.60	107.07
Σ(45)1...12 =	1066.41 (45)											

Distribution loss 0.15 x (45)m	16.58	14.50	14.97	13.05	12.52	10.80	10.01	11.49	11.63	13.55	14.79	16.06 (46)
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Storage volume (litres) including any solar or WWHRs storage within same vessel	1.00 (47)
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Water storage loss:	
a) If manufacturer's declared loss factor is known (kWh/day)	0.21 (48)
Temperature factor from Table 2b	0.54 (49)
Energy lost from water storage (kWh/day) (48) x (49)	0.12 (50)
Enter (50) or (54) in (55)	0.12 (55)

Water storage loss calculated for each month (55) x (41)m	3.57	3.23	3.57	3.46	3.57	3.46	3.57	3.57	3.46	3.57	3.46	3.57 (56)
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If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - V _s] ÷ (47), else (56)	3.57	3.23	3.57	3.46	3.57	3.46	3.57	3.57	3.46	3.57	3.46	3.57 (57)
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Primary circuit loss for each month from Table 3

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													
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)	
Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m													
137.40	120.94	126.62	112.96	110.31	98.00	93.58	103.43	103.48	117.16	124.57	133.91	(62)	
Solar DHW input calculated using Appendix G or Appendix H													
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)	
Output from water heater for each month (kWh/month) (62)m + (63)m													
137.40	120.94	126.62	112.96	110.31	98.00	93.58	103.43	103.48	117.16	124.57	133.91		
											$\Sigma(64)1...12 =$	1382.35	(64)
Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]													
58.23	51.54	54.65	49.70	49.22	44.73	43.66	46.93	46.55	51.50	53.56	57.07	(65)	

5. Internal gains												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)												
70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
11.01	9.78	7.95	6.02	4.50	3.80	4.10	5.33	7.16	9.09	10.61	11.31	(67)
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
122.24	123.51	120.31	113.51	104.92	96.84	91.45	90.18	93.38	100.18	108.77	116.84	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	(69)
Pump and fan gains (Table 5a)												
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evaporation (Table 5)												
-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	(71)
Water heating gains (Table 5)												
78.27	76.70	73.45	69.03	66.16	62.12	58.68	63.08	64.65	69.22	74.39	76.71	(72)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m												
258.72	257.19	248.92	235.76	222.78	209.97	201.44	205.81	212.39	225.70	240.98	252.07	(73)

6. Solar gains												
	Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W						
NorthWest	0.77	x	7.85	x	11.28	x 0.9 x	0.63	x	0.70	=	27.07	(81)
Solar gains in watts $\Sigma(74)m...(82)m$												
27.07	55.10	99.27	163.03	219.14	233.63	218.56	174.24	120.96	67.33	34.06	22.11	(83)
Total gains - internal and solar (73)m + (83)m												
285.79	312.29	348.19	398.79	441.93	443.60	420.00	380.04	333.35	293.04	275.04	274.18	(84)

7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1(°C)											21.00	(85)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area n1,m (see Table 9a)												
1.00	0.99	0.98	0.93	0.79	0.59	0.44	0.50	0.78	0.96	0.99	1.00	(86)
Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)												
19.96	20.09	20.33	20.66	20.89	20.98	21.00	20.99	20.93	20.62	20.24	19.94	(87)

Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)													
20.02	20.02	20.03	20.04	20.04	20.05	20.05	20.05	20.05	20.04	20.04	20.03	(88)	
Utilisation factor for gains for rest of dwelling n2,m													
0.99	0.99	0.97	0.91	0.74	0.51	0.34	0.40	0.70	0.94	0.99	1.00	(89)	
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)													
18.65	18.83	19.18	19.65	19.94	20.04	20.05	20.05	19.99	19.61	19.07	18.62	(90)	
Living area fraction											Living area ÷ (4) =	0.62	(91)
Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2													
19.46	19.61	19.89	20.28	20.53	20.63	20.64	20.64	20.57	20.24	19.80	19.44	(92)	
Apply adjustment to the mean internal temperature from Table 4e where appropriate													
19.46	19.61	19.89	20.28	20.53	20.63	20.64	20.64	20.57	20.24	19.80	19.44	(93)	

8. Space heating requirement													
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, η_m													
0.99	0.99	0.97	0.91	0.77	0.56	0.40	0.46	0.75	0.95	0.99	0.99	(94)	
Useful gains, $\eta_m G_m$, W (94)m x (84)m													
283.82	308.61	338.43	363.80	338.67	247.16	168.37	175.53	249.49	277.39	271.43	272.64	(95)	
Monthly average external temperature from Table U1													
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)	
Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]													
656.97	635.51	576.94	483.38	374.40	252.31	169.08	176.99	272.34	408.46	540.88	652.91	(97)	
Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m													
277.62	219.68	177.45	86.09	26.58	0.00	0.00	0.00	0.00	97.52	194.01	282.92		
											$\Sigma(98)1...5, 10...12 =$	1361.86	(98)
Space heating requirement kWh/m ² /year											(98) ÷ (4)	33.81	(99)

9a. Energy requirements - individual heating systems including micro-CHP													
Space heating													
Fraction of space heat from secondary/supplementary system (table 11)											0.00	(201)	
Fraction of space heat from main system(s)											1 - (201) =	1.00	(202)
Fraction of space heat from main system 2												0.00	(202)
Fraction of total space heat from main system 1											(202) x [1 - (203)] =	1.00	(204)
Fraction of total space heat from main system 2											(202) x (203) =	0.00	(205)
Efficiency of main system 1 (%)												93.50	(206)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating fuel (main system 1), kWh/month													
296.92	234.95	189.79	92.08	28.43	0.00	0.00	0.00	0.00	104.30	207.49	302.59		
											$\Sigma(211)1...5, 10...12 =$	1456.54	(211)

Water heating													
Efficiency of water heater													
86.65	86.39	85.71	84.10	81.68	79.80	79.80	79.80	79.80	84.33	85.99	86.76	(217)	
Water heating fuel, kWh/month													
158.56	139.99	147.72	134.32	135.06	122.81	117.27	129.61	129.67	138.94	144.86	154.34		
											$\Sigma(219a)1...12 =$	1653.15	(219)

Annual totals												
Space heating fuel - main system 1											1456.54	
Water heating fuel											1653.15	

Electricity for pumps, fans and electric keep-hot (Table 4f)

central heating pump or water pump within warm air heating unit	30.00	(230c)
boiler flue fan	45.00	(230e)
Total electricity for the above, kWh/year	75.00	(231)
Electricity for lighting (Appendix L)	194.38	(232)
Total delivered energy for all uses	(211)...(221) + (231) + (232)...(237b) = 3379.06	(238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	1456.54	x	3.48	x 0.01 =	50.69	(240)
Water heating	1653.15	x	3.48	x 0.01 =	57.53	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	194.38	x	13.19	x 0.01 =	25.64	(250)
Additional standing charges					120.00	(251)
Total energy cost			(240)...(242) + (245)...(254) =		263.75	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.30	(257)
SAP value	81.88	
SAP rating (section 13)	82	(258)
SAP band	B	

12a. CO₂ emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	1456.54	x	0.216	=	314.61	(261)
Water heating	1653.15	x	0.216	=	357.08	(264)
Space and water heating			(261) + (262) + (263) + (264) =		671.69	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	194.38	x	0.519	=	100.88	(268)
Total CO ₂ , kg/year			(265)...(271) =		811.50	(272)
Dwelling CO ₂ emission rate			(272) ÷ (4) =		20.15	(273)
EI value					87.25	
EI rating (section 14)					87	(274)
EI band					B	

13a. Primary energy - individual heating systems including micro-CHP

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	1456.54	x	1.22	=	1776.98	(261)
Water heating	1653.15	x	1.22	=	2016.84	(264)
Space and water heating			(261) + (262) + (263) + (264) =		3793.82	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	194.38	x	3.07	=	596.73	(268)
Primary energy kWh/year					4620.80	(272)
Dwelling primary energy rate kWh/m ² /year					114.72	(273)

Appendix D

BRUKL Outputs – *Be Lean*

Project name

Shell and Core

Clarendon Cafe Be Lean

As designed

Date: Wed Dec 05 18:16:02 2018

Administrative information

Building Details

Address: Clarendon Cafe, London, N22

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.4.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v5.4.0

BRUKL compliance check version: v5.4.b.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name:

Telephone number:

Address: , ,

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	80
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	80
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	76.8
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.25	0.25	02 Lower Ground Floor - Kitchen_P_8
Floor	0.25	0.14	0.14	02 Lower Ground Floor - Kitchen_S_3
Roof	0.25	0.14	0.14	02 Lower Ground Floor - Cafe_R_5
Windows***, roof windows, and rooflights	2.2	1.4	1.4	02 Lower Ground Floor - Cafe_G_7
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)]				
* There might be more than one surface where the maximum U-value occurs. ** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. *** Display windows and similar glazing are excluded from the U-value check. N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Project HVAC

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.5	2.5	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types ≤12 kW output, refer to EN 14825 for limiting standards.					

1- Project DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0.004
Standard value	N/A	N/A

1- CHP 1

	CHPQA quality index	CHP electrical efficiency
This building	110	0.4
Standard value	Not provided	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
02 Lower Ground Floor - Kitchen	0.3	-	-	-	-	-	-	-	-	-	-	N/A
02 Lower Ground Floor - WCs	0.3	-	-	-	-	-	-	-	-	-	-	N/A
02 Lower Ground Floor - Cafe	-	-	-	1.5	-	-	-	-	-	-	0.85	0.5

Shell and core configuration

Zone	Assumed shell?
02 Lower Ground Floor - Kitchen	NO
02 Lower Ground Floor - WCs	NO
02 Lower Ground Floor - Cafe	NO

General lighting and display lighting		Luminous efficacy [lm/W]			
Zone name		Luminaire	Lamp	Display lamp	General lighting [W]
Standard value		60	60	22	
02 Lower Ground Floor - Kitchen		-	100	-	338
02 Lower Ground Floor - WCs		-	100	-	58
02 Lower Ground Floor - Cafe		-	100	50	557

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
02 Lower Ground Floor - Kitchen	N/A	N/A
02 Lower Ground Floor - WCs	N/A	N/A
02 Lower Ground Floor - Cafe	NO (-15.5%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	279.1	279.1
External area [m ²]	617	617
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	5	3
Average conductance [W/K]	262.97	255.52
Average U-value [W/m ² K]	0.43	0.41
Alpha value* [%]	13.21	12.51

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
100	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	5.08	6.53
Cooling	50.97	35.97
Auxiliary	11.99	8.5
Lighting	28.12	56.95
Hot water	124.51	117.6
Equipment*	129.28	129.28
TOTAL **	220.67	225.54

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	368.3	523.27
Primary energy* [kWh/m ²]	447.12	466.57
Total emissions [kg/m ²]	76.8	80

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	42.6	325.7	5.1	51	12	2.33	1.78	2.5	2.5
	Notional	57.1	466.2	6.5	36	8.5	2.43	3.6	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.24	02 Lower Ground Floor - Cafe_W_6
Floor	0.2	0.14	02 Lower Ground Floor - Kitchen_S_3
Roof	0.15	0.14	02 Lower Ground Floor - Cafe_R_5
Windows, roof windows, and rooflights	1.5	1.4	02 Lower Ground Floor - Cafe_G_7
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-Min} = Minimum individual element U-values [W/(m²K)]	
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

Project name

Shell and Core

Clarendon Offices Be Lean

As designed

Date: Wed Dec 05 17:46:24 2018

Administrative information

Building Details

Address: Clarendon Offices, London, N22

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.4.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v5.4.0

BRUKL compliance check version: v5.4.b.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name:

Telephone number:

Address: , ,

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	19.6
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	19.6
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	18.1
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.24	0.25	01 Lower Ground Floor - Offices 1_P_6
Floor	0.25	0.16	0.25	03 First Floor 1 - Offices 1_F_4
Roof	0.25	0.14	0.14	01 Lower Ground Floor - Offices_R_5
Windows***, roof windows, and rooflights	2.2	1.4	1.4	01 Lower Ground Floor - Offices 1_G_8
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)]				
* There might be more than one surface where the maximum U-value occurs. ** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. *** Display windows and similar glazing are excluded from the U-value check. N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Project HVAC

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.5	2.5	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types ≤12 kW output, refer to EN 14825 for limiting standards.					

1- Project DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0.006
Standard value	N/A	N/A

1- CHP 1

	CHPQA quality index	CHP electrical efficiency
This building	110	0.4
Standard value	Not provided	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
01 Lower Ground Floor - Offices 1	-	-	-	1.5	-	-	-	-	-		0.85	0.5
01 Lower Ground Floor - Offices	-	-	-	1.5	-	-	-	-	-		0.85	0.5
03 First Floor 1 - Offices 1	-	-	-	1.5	-	-	-	-	-		0.85	0.5
03 First Floor 1 - Offices 2	-	-	-	1.5	-	-	-	-	-		0.85	0.5
03 First Floor 1 - Offices 3	-	-	-	1.5	-	-	-	-	-		0.85	0.5
03 First Floor 1 - Offices	-	-	-	1.5	-	-	-	-	-		0.85	0.5

Shell and core configuration

Zone	Assumed shell?
01 Lower Ground Floor - Offices 1	NO
01 Lower Ground Floor - Offices	NO
03 First Floor 1 - Offices 1	NO
03 First Floor 1 - Offices 2	NO

Shell and core configuration

Zone	Assumed shell?
03 First Floor 1 - Offices 3	NO
03 First Floor 1 - Offices	NO

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name	Standard value	Luminaire	Lamp	Display lamp	
01 Lower Ground Floor - Offices 1	100	60	-	-	1918
01 Lower Ground Floor - Offices	100	60	-	-	2264
03 First Floor 1 - Offices 1	100	60	-	-	1167
03 First Floor 1 - Offices 2	100	60	-	-	1195
03 First Floor 1 - Offices 3	100	60	-	-	2648
03 First Floor 1 - Offices	100	60	-	-	1086

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
01 Lower Ground Floor - Offices 1	NO (-17.7%)	NO
01 Lower Ground Floor - Offices	NO (-13.7%)	NO
03 First Floor 1 - Offices 1	NO (-13.6%)	NO
03 First Floor 1 - Offices 2	NO (-41.1%)	NO
03 First Floor 1 - Offices 3	NO (-23.2%)	NO
03 First Floor 1 - Offices	NO (-31.5%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	1680.7	1680.7
External area [m ²]	2181.1	2181.1
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	5	3
Average conductance [W/K]	896.2	832.27
Average U-value [W/m ² K]	0.41	0.38
Alpha value* [%]	11.49	11.2

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	2.35	1.31
Cooling	12.3	9.08
Auxiliary	4.5	2.7
Lighting	13.81	24.3
Hot water	4.48	3.34
Equipment*	42.19	42.19
TOTAL **	37.44	40.72

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	98.28	129.12
Primary energy* [kWh/m ²]	106.64	115.97
Total emissions [kg/m ²]	18.1	19.6

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity									
Actual	19.7	78.6	2.4	12.3	4.5	2.33	1.78	2.5	2.5
Notional	11.5	117.6	1.3	9.1	2.7	2.43	3.6	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.24	01 Lower Ground Floor - Offices 1_W_7
Floor	0.2	0.14	01 Lower Ground Floor - Offices 1_S_3
Roof	0.15	0.14	01 Lower Ground Floor - Offices_R_5
Windows, roof windows, and rooflights	1.5	1.4	01 Lower Ground Floor - Offices 1_G_8
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-Min} = Minimum individual element U-values [W/(m²K)]	
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

Project name

Clarendon Resident Facilities Be Lean**As designed****Date:** Thu Dec 06 08:35:11 2018**Administrative information****Building Details****Address:** Clarendon Resident Facilities, London, N22**Certification tool****Calculation engine:** SBEM**Calculation engine version:** v5.4.b.0**Interface to calculation engine:** DesignBuilder SBEM**Interface to calculation engine version:** v5.4.0**BRUKL compliance check version:** v5.4.b.0**Owner Details****Name:****Telephone number:****Address:** , ,**Certifier details****Name:****Telephone number:****Address:** , ,**Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target**

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	20.5
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	20.5
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	19.8
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.25	0.25	01 Lower Ground Floor - Residents Facilities_P_7
Floor	0.25	0.14	0.14	01 Lower Ground Floor - Residents Facilities_S_3
Roof	0.25	0.14	0.14	01 Lower Ground Floor - Residents Facilities_R_5
Windows***, roof windows, and rooflights	2.2	1.4	1.4	01 Lower Ground Floor - Residents Facilities_G_15
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)]				
* There might be more than one surface where the maximum U-value occurs. ** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. *** Display windows and similar glazing are excluded from the U-value check. N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Project HVAC

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.5	2.5	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

1- Project DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0.012
Standard value	N/A	N/A

1- CHP 1

	CHPQA quality index	CHP electrical efficiency
This building	110	0.4
Standard value	Not provided	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
01 Lower Ground Floor - Residents Facilities	-	-	-	1.5	-	-	-	-	-		0.85	0.5

General lighting and display lighting

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
Standard value		60	60	22	
01 Lower Ground Floor - Residents Facilities		100	-	-	5541

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
01 Lower Ground Floor - Residents Facilities	NO (-72.8%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	935.5	935.5
External area [m ²]	1997.8	1997.8
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	5	3
Average conductance [W/K]	363.24	506.7
Average U-value [W/m ² K]	0.18	0.25
Alpha value* [%]	4.98	4.32

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	0.98	1.54
Cooling	10.8	7.13
Auxiliary	5.9	2.7
Lighting	18.24	27.8
Hot water	5.4	3.34
Equipment*	42.19	42.19
TOTAL **	41.32	42.5

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	77.27	105.85
Primary energy* [kWh/m ²]	116.87	121.31
Total emissions [kg/m ²]	19.8	20.5

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	8.3	69	1	10.8	5.9	2.33	1.78	2.5	2.5
	Notional	13.5	92.4	1.5	7.1	2.7	2.43	3.6	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.24	01 Lower Ground Floor - Residents Facilities_W_6
Floor	0.2	0.14	01 Lower Ground Floor - Residents Facilities_S_3
Roof	0.15	0.14	01 Lower Ground Floor - Residents Facilities_R_5
Windows, roof windows, and rooflights	1.5	1.4	01 Lower Ground Floor - Residents Facilities_G_15
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-Min} = Minimum individual element U-values [W/(m²K)]	
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

Project name

Shell and Core

Clarendon Restaurant Be Lean

As designed

Date: Wed Dec 05 17:57:40 2018

Administrative information

Building Details

Address: Clarendon Restaurant, London, N22

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.4.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v5.4.0

BRUKL compliance check version: v5.4.b.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name:

Telephone number:

Address: , ,

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	80.9
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	80.9
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	78
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.25	0.25	01 Lower Ground Floor - Restaurant_P_6
Floor	0.25	0.14	0.14	01 Lower Ground Floor - Restaurant_S_3
Roof	0.25	0.14	0.14	01 Lower Ground Floor - Restaurant_R_5
Windows***, roof windows, and rooflights	2.2	1.4	1.4	01 Lower Ground Floor - Restaurant_G_10
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)]				
* There might be more than one surface where the maximum U-value occurs. ** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. *** Display windows and similar glazing are excluded from the U-value check. N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Project HVAC

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.5	2.5	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

1- Project DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0.007
Standard value	N/A	N/A

1- CHP 1

	CHPQA quality index	CHP electrical efficiency
This building	110	0.4
Standard value	Not provided	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
01 Lower Ground Floor - Restaurant	-	-	-	1.5	-	-	-	-	-		0.85	0.5

Shell and core configuration

Zone	Assumed shell?
01 Lower Ground Floor - Restaurant	NO

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
01 Lower Ground Floor - Restaurant	-	100	50	306

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
01 Lower Ground Floor - Restaurant	NO (-25%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	129.5	129.5
External area [m ²]	297.3	297.3
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	5	5
Average conductance [W/K]	125.85	125.01
Average U-value [W/m ² K]	0.42	0.42
Alpha value* [%]	14.61	13.3

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
100	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	3.98	5.57
Cooling	45.77	33.05
Auxiliary	12.22	7.33
Lighting	24.13	54.34
Hot water	154.42	139.53
Equipment*	115.14	115.14
TOTAL **	240.51	239.82

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	325.81	477.13
Primary energy* [kWh/m ²]	452.69	470.44
Total emissions [kg/m ²]	78	80.9

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	33.3	292.5	4	45.8	12.2	2.33	1.78	2.5	2.5
	Notional	48.7	428.4	5.6	33.1	7.3	2.43	3.6	----	----

Key to terms

- Heat dem [MJ/m2] = Heating energy demand
- Cool dem [MJ/m2] = Cooling energy demand
- Heat con [kWh/m2] = Heating energy consumption
- Cool con [kWh/m2] = Cooling energy consumption
- Aux con [kWh/m2] = Auxiliary energy consumption
- Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
- Cool SSEER = Cooling system seasonal energy efficiency ratio
- Heat gen SSEFF = Heating generator seasonal efficiency
- Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
- ST = System type
- HS = Heat source
- HFT = Heating fuel type
- CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.24	01 Lower Ground Floor - Restaurant_W_9
Floor	0.2	0.14	01 Lower Ground Floor - Restaurant_S_3
Roof	0.15	0.14	01 Lower Ground Floor - Restaurant_R_5
Windows, roof windows, and rooflights	1.5	1.4	01 Lower Ground Floor - Restaurant_G_10
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-Min} = Minimum individual element U-values [W/(m²K)]	
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

Project name

Shell and Core

Clarendon Retail Be Lean

As designed

Date: Wed Dec 05 18:08:25 2018

Administrative information

Building Details

Address: Clarendon Retail, London, N22

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.4.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v5.4.0

BRUKL compliance check version: v5.4.b.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name:

Telephone number:

Address: , ,

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	41
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	41
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	39.3
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.25	0.25	02 Lower Ground Floor - Retail Unit 3_P_6
Floor	0.25	0.14	0.14	02 Lower Ground Floor - Retail Unit 3_S_3
Roof	0.25	0.14	0.14	02 Lower Ground Floor - Retail Unit 3_R_5
Windows***, roof windows, and rooflights	2.2	1.4	1.4	02 Lower Ground Floor - Retail Unit 3_G_9
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)]				
* There might be more than one surface where the maximum U-value occurs. ** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. *** Display windows and similar glazing are excluded from the U-value check. N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Project HVAC

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.5	2.5	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

1- Project DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0.182
Standard value	N/A	N/A

1- CHP 1

	CHPQA quality index	CHP electrical efficiency
This building	110	0.4
Standard value	Not provided	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
02 Lower Ground Floor - Retail Unit 3	-	-	-	1.5	-	-	-	-	-		0.85	0.5

Shell and core configuration

Zone	Assumed shell?
02 Lower Ground Floor - Retail Unit 3	NO

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
02 Lower Ground Floor - Retail Unit 3	-	100	50	849

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
02 Lower Ground Floor - Retail Unit 3	NO (-14.7%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	88.9	88.9
External area [m ²]	246.3	246.3
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	5	5
Average conductance [W/K]	106.13	97.71
Average U-value [W/m ² K]	0.43	0.4
Alpha value* [%]	15.92	12.54

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
100	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	10.19	4.97
Cooling	19.07	16.13
Auxiliary	7.04	3.78
Lighting	29.67	55.37
Hot water	23.65	1.96
Equipment*	20.26	20.26
TOTAL **	89.62	82.21

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	207.31	252.59
Primary energy* [kWh/m ²]	231.38	242.61
Total emissions [kg/m ²]	39.3	41

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	85.4	121.9	10.2	19.1	7	2.33	1.78	2.5	2.5
	Notional	43.5	209.1	5	16.1	3.8	2.43	3.6	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.24	02 Lower Ground Floor - Retail Unit 3_W_8
Floor	0.2	0.14	02 Lower Ground Floor - Retail Unit 3_S_3
Roof	0.15	0.14	02 Lower Ground Floor - Retail Unit 3_R_5
Windows, roof windows, and rooflights	1.5	1.4	02 Lower Ground Floor - Retail Unit 3_G_9
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-Min} = Minimum individual element U-values [W/(m²K)]	
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

Project name

Shell and Core

Clarendon Retail Units Be Lean

As designed

Date: Thu Dec 06 08:32:05 2018

Administrative information

Building Details

Address: Clarendon Retail Units, London, N22

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.4.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v5.4.0

BRUKL compliance check version: v5.4.b.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name:

Telephone number:

Address: , ,

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	41.3
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	41.3
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	36
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.25	0.25	01 Lower Ground Floor - Retail Unit 2_P_6
Floor	0.25	0.14	0.14	01 Lower Ground Floor - Retail Unit 2_S_3
Roof	0.25	0.14	0.14	01 Lower Ground Floor - Retail Unit 2_R_5
Windows***, roof windows, and rooflights	2.2	1.4	1.4	01 Lower Ground Floor - Retail Unit 2_G_10
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)] * There might be more than one surface where the maximum U-value occurs. ** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. *** Display windows and similar glazing are excluded from the U-value check. N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Project HVAC

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.5	2.5	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types ≤12 kW output, refer to EN 14825 for limiting standards.					

1- Project DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0.047
Standard value	N/A	N/A

1- CHP 1

	CHPQA quality index	CHP electrical efficiency
This building	110	0.4
Standard value	Not provided	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
01 Lower Ground Floor - Retail Unit 2	-	-	-	1.5	-	-	-	-	-		0.85	0.5
01 Lower Ground Floor - Retail Unit 1	-	-	-	1.5	-	-	-	-	-		0.85	0.5

Shell and core configuration

Zone	Assumed shell?
01 Lower Ground Floor - Retail Unit 2	NO
01 Lower Ground Floor - Retail Unit 1	NO

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
01 Lower Ground Floor - Retail Unit 2	-	100	50	1669

General lighting and display lighting		Luminous efficacy [lm/W]			
Zone name		Luminaire	Lamp	Display lamp	General lighting [W]
Standard value		60	60	22	
01 Lower Ground Floor - Retail Unit 1		-	100	50	1544

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
01 Lower Ground Floor - Retail Unit 2	NO (-17.5%)	NO
01 Lower Ground Floor - Retail Unit 1	NO (-4.9%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	344.2	344.2
External area [m ²]	704.1	704.1
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	5	3
Average conductance [W/K]	357.57	295.67
Average U-value [W/m ² K]	0.51	0.42
Alpha value* [%]	14.99	12.82

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area Building Type

100	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	7.49	2.81
Cooling	21.06	16.59
Auxiliary	7.04	3.78
Lighting	30.62	57.61
Hot water	7.56	1.96
Equipment*	20.26	20.26
TOTAL **	73.77	82.75

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	197.41	239.56
Primary energy* [kWh/m ²]	212.48	244.22
Total emissions [kg/m ²]	36	41.3

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	62.8	134.6	7.5	21.1	7	2.33	1.78	2.5	2.5
	Notional	24.6	215	2.8	16.6	3.8	2.43	3.6	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.24	01 Lower Ground Floor - Retail Unit 2_W_9
Floor	0.2	0.14	01 Lower Ground Floor - Retail Unit 2_S_3
Roof	0.15	0.14	01 Lower Ground Floor - Retail Unit 2_R_5
Windows, roof windows, and rooflights	1.5	1.4	01 Lower Ground Floor - Retail Unit 2_G_10
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-Min} = Minimum individual element U-values [W/(m²K)]	
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

Appendix E

DER Worksheets – *Be Lean*

DER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	05/12/2018
Address	1Bed Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	50.15 (1a) x	2.50 (2a) =	125.38 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 50.15 (4)		
Dwelling volume	(3a) + (3b) + (3c) + (3d)...(3n) = 125.38 (5)		

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	0 x 10 =	0 (7a)
Number of passive vents	0 x 10 =	0 (7b)
Number of flueless gas fires	0 x 40 =	0 (7c)

Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 0 ÷ (5) =	0.00 (8)
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If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	4.00 (17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)

Number of sides on which the dwelling is sheltered	3 (19)
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Shelter factor	1 - [0.075 x (19)] = 0.78 (20)
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Infiltration rate incorporating shelter factor	(18) x (20) = 0.16 (21)
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Infiltration rate modified for monthly wind speed:

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

 (22)

Wind factor (22)m ÷ 4

1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18
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 (22a)

Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m

0.20	0.19	0.19	0.17	0.17	0.15	0.15	0.14	0.16	0.17	0.18
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 (22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	0.50 (23a)
---	---

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A (23c)
--	--

c) whole house extract ventilation or positive input ventilation from outside

0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
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 (24c)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)

0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
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 (25)

3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² .K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K
Window			9.00	x 1.14	= 10.22		(27)
Exposed floor			50.15	x 0.08	= 4.01		(28b)
Party wall			55.09	x 0.00	= 0.00		(32)
External wall			11.31	x 0.24	= 2.71		(29a)
Total area of external elements ΣA, m ²			70.46				(31)
Fabric heat loss, W/K = Σ(A x U)						(26)...(30) + (32) =	16.95 (33)
Heat capacity Cm = Σ(A x κ)						(28)...(30) + (32) + (32a)...(32e) =	N/A (34)
Thermal mass parameter (TMP) in kJ/m ² .K							100.00 (35)
Thermal bridges: Σ(L x Ψ) calculated using Appendix K							10.29 (36)
Total fabric heat loss						(33) + (36) =	27.24 (37)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
20.69	20.69	20.69	20.69	20.69	20.69	20.69	20.69	20.69	20.69	20.69	20.69

 (38)

Heat transfer coefficient, W/K (37)m + (38)m

47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92
Average = Σ(39)1...12/12 =											47.92 (39)

Heat loss parameter (HLP), W/m².K (39)m ÷ (4)

0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Average = Σ(40)1...12/12 =											0.96 (40)

Number of days in month (Table 1a)

31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00
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 (40)

4. Water heating energy requirement

Assumed occupancy, N	1.69 (42)
Annual average hot water usage in litres per day V _{d,average} = (25 x N) + 36	74.44 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
81.89	78.91	75.93	72.96	69.98	67.00	67.00	69.98	72.96	75.93	78.91	81.89
Σ(44)1...12 =											893.34 (44)

Energy content of hot water used = 4.18 x V_{d,m} x n_m x T_m/3600 kWh/month (see Tables 1b, 1c 1d)

121.44	106.21	109.60	95.55	91.69	79.12	73.31	84.13	85.13	99.21	108.30	117.61
Σ(45)1...12 =											1171.31 (45)

Distribution loss 0.15 x (45)m

18.22	15.93	16.44	14.33	13.75	11.87	11.00	12.62	12.77	14.88	16.25	17.64
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 (46)

Storage volume (litres) including any solar or WWHRs storage within same vessel

1.00 (47)
--

Water storage loss:

b) Manufacturer's declared loss factor is not known

Hot water storage loss factor from Table 2 (kWh/litre/day)	0.02 (51)
--	--

Volume factor from Table 2a	4.93 (52)
-----------------------------	--

Temperature factor from Table 2b	1.00 (53)
----------------------------------	--

Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53)	0.10 (54)
--	--

Enter (50) or (54) in (55)

0.10 (55)
--

Water storage loss calculated for each month (55) x (41)m

3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24
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 (56)

If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - V_s] ÷ (47), else (56)

3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24	(57)
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Primary circuit loss for each month from Table 3

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)
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Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
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Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

147.94	130.15	136.10	121.20	118.19	104.76	99.81	110.63	110.78	125.72	133.95	144.11	(62)
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Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
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Output from water heater for each month (kWh/month) (62)m + (63)m

147.94	130.15	136.10	121.20	118.19	104.76	99.81	110.63	110.78	125.72	133.95	144.11	
$\Sigma[(64)1...12 =$											1483.33	(64)

Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

61.58	54.46	57.64	52.29	51.69	46.82	45.58	49.17	48.82	54.19	56.53	60.30	(65)
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5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

13.45	11.94	9.71	7.35	5.50	4.64	5.01	6.52	8.75	11.11	12.97	13.82	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

147.62	149.16	145.30	137.08	126.70	116.95	110.44	108.91	112.77	120.99	131.36	141.11	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	(69)
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Pump and fan gains (Table 5a)

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
------	------	------	------	------	------	------	------	------	------	------	------	------

Losses e.g. evaporation (Table 5)

-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	(71)
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Water heating gains (Table 5)

82.77	81.05	77.48	72.62	69.47	65.03	61.26	66.09	67.81	72.84	78.51	81.05	(72)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

292.26	290.57	280.90	265.47	250.09	235.04	225.13	229.94	237.75	253.35	271.25	284.40	(73)
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6. Solar gains

	Access factor Table 6d		Area m ²		Solar flux W/m ²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
SouthEast	0.77	x	9.00	x	36.79	x 0.9 x	0.45	x	0.80	=	82.61	(77)

Solar gains in watts $\Sigma(74)m...(82)m$

82.61	140.72	192.54	238.57	267.22	265.28	255.76	234.39	208.48	155.53	98.95	70.70	(83)
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Total gains - internal and solar (73)m + (83)m

374.87	431.29	473.45	504.04	517.31	500.33	480.89	464.33	446.23	408.88	370.20	355.10	(84)
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7. Mean internal temperature (heating season)

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

												21.00	(85)
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Utilisation factor for gains for living area n1,m (see Table 9a)

0.94	0.91	0.87	0.80	0.69	0.55	0.42	0.45	0.63	0.81	0.91	0.95	(86)
------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.29	19.55	19.91	20.32	20.66	20.87	20.96	20.95	20.80	20.37	19.75	19.21	(87)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	(88)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling n2,m

0.93	0.90	0.85	0.77	0.65	0.49	0.34	0.37	0.57	0.79	0.90	0.94	(89)
------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

17.83	18.21	18.72	19.28	19.74	20.00	20.09	20.08	19.93	19.36	18.49	17.72	(90)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Living area fraction

Living area ÷ (4) =

0.66

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

18.79	19.09	19.50	19.96	20.34	20.57	20.66	20.65	20.50	20.02	19.31	18.70	(92)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e where appropriate

18.79	19.09	19.50	19.96	20.34	20.57	20.66	20.65	20.50	20.02	19.31	18.70	(93)
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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm	0.92	0.88	0.84	0.76	0.66	0.52	0.39	0.42	0.59	0.78	0.89	0.93	(94)

Useful gains, ηmGm, W (94)m x (84)m

343.93	381.63	396.70	385.35	340.47	259.58	186.21	193.10	265.47	319.67	327.81	329.09	(95)
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Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
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Heat loss rate for mean internal temperature, Lm, W [(39)m x (93)m - (96)m]

694.29	680.11	623.21	530.07	414.08	286.31	194.56	203.67	306.82	451.57	585.34	694.75	(97)
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Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

260.66	200.58	168.52	104.20	54.76	0.00	0.00	0.00	0.00	98.13	185.42	272.05	
$\Sigma(98)1...5, 10...12 =$											1344.33	(98)

Space heating requirement kWh/m²/year

(98) ÷ (4)

26.81

9b. Energy requirements - community heating scheme

Fraction of space heat from secondary/supplementary system (table 11)	'0' if none	0.00	(301)
Fraction of space heat from community system	1 - (301) =	1.00	(302)
Fraction of community heat from boilers		1.00	(303a)
Fraction of total space heat from community boilers	(302) x (303a) =	1.00	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating		1.00	(305)
Factor for charging method (Table 4c(3)) for community water heating		1.00	(305a)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating

Annual space heating requirement	1344.33	(98)
Space heat from boilers	(98) x (304a) x (305) x (306) =	1411.54 (307)

Water heating

Annual water heating requirement	1483.33	(64)
Water heat from boilers	$(64) \times (303a) \times (305a) \times (306) =$	1557.49 (310)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	29.69 (313)

Electricity for pumps, fans and electric keep-hot (Table 4f)

mechanical ventilation fans - balanced, extract or positive input from outside	31.82	(330a)
Total electricity for the above, kWh/year	31.82	(331)
Electricity for lighting (Appendix L)	237.50	(332)
Total delivered energy for all uses	(307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) = 3238.35	(338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from boilers	1411.54	x	4.24	x 0.01 =	59.85	(340a)
Water heating from boilers	1557.49	x	4.24	x 0.01 =	66.04	(342a)
Pumps and fans	31.82	x	13.19	x 0.01 =	4.20	(349)
Electricity for lighting	237.50	x	13.19	x 0.01 =	31.33	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)...(342e) + (345)...(354) =		281.41	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.24	(357)
SAP value	82.67	
SAP rating (section 13)	83	(358)
SAP band	B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from other sources (space heating)						
Efficiency of boilers	95.00					(367a)
CO ₂ emissions from boilers	[(307a)+(310a)] x 100 ÷ (367a) = 3125.30	x	0.216	=	675.07	(367)
Electrical energy for community heat distribution	29.69	x	0.519	=	15.41	(372)
Total CO ₂ associated with community systems					690.47	(373)
Total CO ₂ associated with space and water heating					690.47	(376)
Pumps and fans	31.82	x	0.519	=	16.51	(378)
Electricity for lighting	237.50	x	0.519	=	123.26	(379)
Total CO ₂ , kg/year			(376)...(382) =		830.25	(383)
Dwelling CO ₂ emission rate			(383) ÷ (4) =		16.56	(384)
EI value					88.31	
EI rating (section 14)					88	(385)
EI band					B	

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary energy from other sources (space heating)						
Efficiency of boilers	95.00					(367a)
Primary energy from boilers	[(307a)+(310a)] x 100 ÷ (367a) = 3125.30	x	1.22	=	3812.87	(367)
Electrical energy for community heat distribution	29.69	x	3.07	=	91.15	(372)
Total primary energy associated with community systems					3904.02	(373)
Total primary energy associated with space and water heating					3904.02	(376)
Pumps and fans	31.82	x	3.07	=	97.67	(378)
Electricity for lighting	237.50	x	3.07	=	729.13	(379)

Primary energy kWh/year	4730.82	(383)
Dwelling primary energy rate kWh/m ² /year	94.33	(384)

DER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	04/12/2018
Address	1Bed Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	50.15 (1a) x	2.50 (2a) =	125.38 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 50.15 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) = 125.38 (5)	

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	0 x 10 =	0 (7a)
Number of passive vents	0 x 10 =	0 (7b)
Number of flueless gas fires	0 x 40 =	0 (7c)

Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 0 ÷ (5) =	0.00 (8)
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If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q₅₀, expressed in cubic metres per hour per square metre of envelope area (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) (18)

Number of sides on which the dwelling is sheltered (19)

Shelter factor 1 - [0.075 x (19)] = (20)

Infiltration rate incorporating shelter factor (18) x (20) = (21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70 (22)

Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18 (22a)
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.20	0.19	0.19	0.17	0.17	0.15	0.15	0.14	0.16	0.17	0.17 (22b)
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system (23a)

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h (23c)

c) whole house extract ventilation or positive input ventilation from outside (24c)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50 (25)
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² ·K	A x U W/K	κ-value, kJ/m ² ·K	A x κ, kJ/K
Window			9.00	x 1.14	= 10.22 (27)		
Party wall			55.09	x 0.00	= 0.00 (32)		
External wall			11.31	x 0.24	= 2.71 (29a)		
Total area of external elements ΣA, m ²			20.31 (31)				
Fabric heat loss, W/K = Σ(A × U)					(26)...(30) + (32) = 12.94 (33)		
Heat capacity Cm = Σ(A × κ)					(28)...(30) + (32) + (32a)...(32e) = N/A (34)		
Thermal mass parameter (TMP) in kJ/m ² K					100.00 (35)		
Thermal bridges: Σ(L × Ψ) calculated using Appendix K					6.20 (36)		
Total fabric heat loss					(33) + (36) = 19.14 (37)		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	20.69	20.69	20.69	20.69	20.69	20.69	20.69	20.69	20.69	20.69	20.69	20.69 (38)

Heat transfer coefficient, W/K (37)m + (38)m	39.83	39.83	39.83	39.83	39.83	39.83	39.83	39.83	39.83	39.83	39.83	39.83 (39)
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Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79 (40)
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Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00 (40)
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4. Water heating energy requirement

Assumed occupancy, N	1.69 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	74.44 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	81.89	78.91	75.93	72.96	69.98	67.00	67.00	69.98	72.96	75.93	78.91	81.89 (44)

Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	121.44	106.21	109.60	95.55	91.69	79.12	73.31	84.13	85.13	99.21	108.30	117.61 (45)
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Distribution loss 0.15 x (45)m	18.22	15.93	16.44	14.33	13.75	11.87	11.00	12.62	12.77	14.88	16.25	17.64 (46)
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Storage volume (litres) including any solar or WWHRs storage within same vessel	1.00 (47)
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Water storage loss:

b) Manufacturer's declared loss factor is not known	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.02 (51)
Volume factor from Table 2a	4.93 (52)
Temperature factor from Table 2b	1.00 (53)
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53)	0.10 (54)
Enter (50) or (54) in (55)	0.10 (55)

Water storage loss calculated for each month (55) x (41)m	3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24 (56)
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If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - Vs] ÷ (47), else (56)	3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24 (57)
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Primary circuit loss for each month from Table 3

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)
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Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
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Total heat required for water heating calculated for each month $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

147.94	130.15	136.10	121.20	118.19	104.76	99.81	110.63	110.78	125.72	133.95	144.11	(62)
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Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
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Output from water heater for each month (kWh/month) (62)m + (63)m

147.94	130.15	136.10	121.20	118.19	104.76	99.81	110.63	110.78	125.72	133.95	144.11	
$\Sigma(64)1...12 =$											1483.33	(64)

Heat gains from water heating (kWh/month) $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

61.58	54.46	57.64	52.29	51.69	46.82	45.58	49.17	48.82	54.19	56.53	60.30	(65)
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5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)												
84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

13.45	11.94	9.71	7.35	5.50	4.64	5.01	6.52	8.75	11.11	12.97	13.82	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

147.62	149.16	145.30	137.08	126.70	116.95	110.44	108.91	112.77	120.99	131.36	141.11	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	(69)
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Pump and fan gains (Table 5a)

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
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Losses e.g. evaporation (Table 5)

-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	(71)
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Water heating gains (Table 5)

82.77	81.05	77.48	72.62	69.47	65.03	61.26	66.09	67.81	72.84	78.51	81.05	(72)
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Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

292.26	290.57	280.90	265.47	250.09	235.04	225.13	229.94	237.75	253.35	271.25	284.40	(73)
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6. Solar gains

	Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W
NorthWest	0.77	x 9.00	x 11.28	x 0.9 x 0.45	x 0.80	= 25.33 (81)

Solar gains in watts $\Sigma(74)m...(82)m$

25.33	51.57	92.91	152.58	205.10	218.66	204.55	163.07	113.21	63.02	31.88	20.69	(83)
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Total gains - internal and solar (73)m + (83)m

317.59	342.13	373.81	418.05	455.19	453.70	429.68	393.01	350.96	316.37	303.13	305.09	(84)
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7. Mean internal temperature (heating season)

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

												21.00	(85)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

Utilisation factor for gains for living area n1,m (see Table 9a)

0.95	0.94	0.90	0.82	0.68	0.52	0.40	0.45	0.67	0.86	0.93	0.96	(86)
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Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.53	19.70	20.02	20.44	20.76	20.93	20.98	20.97	20.84	20.42	19.90	19.47	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.26	20.26	20.26	20.26	20.26	20.26	20.26	20.26	20.26	20.26	20.26	20.26	(88)
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Utilisation factor for gains for rest of dwelling n2,m

0.95	0.93	0.89	0.80	0.65	0.47	0.33	0.38	0.62	0.84	0.92	0.95	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

18.27	18.51	18.98	19.55	19.99	20.19	20.24	20.23	20.09	19.55	18.81	18.18	(90)
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Living area fraction

Living area ÷ (4) = 0.66 (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

19.09	19.29	19.66	20.13	20.49	20.67	20.72	20.71	20.58	20.12	19.53	19.03	(92)
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Apply adjustment to the mean internal temperature from Table 4e where appropriate

19.09	19.29	19.66	20.13	20.49	20.67	20.72	20.71	20.58	20.12	19.53	19.03	(93)
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8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm												
0.94	0.92	0.88	0.79	0.66	0.50	0.37	0.42	0.64	0.83	0.91	0.94	(94)

Useful gains, ηmGm, W (94)m x (84)m

297.53	314.45	328.61	332.12	300.55	227.01	160.09	165.52	224.72	263.65	277.07	287.77	(95)
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Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
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Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]

589.17	573.12	524.25	447.30	350.24	241.87	164.28	171.84	258.02	379.18	494.83	590.49	(97)
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Space heating requirement, kWh/month $0.024 \times [(97)m - (95)m] \times (41)m$

216.98	173.82	145.56	82.93	36.96	0.00	0.00	0.00	0.00	85.96	156.79	225.23	
$\Sigma(98)1...5, 10...12 =$											1124.22	(98)
$(98) \div (4) =$											22.42	(99)

Space heating requirement kWh/m²/year

9b. Energy requirements - community heating scheme

Fraction of space heat from secondary/supplementary system (table 11)	'0' if none	0.00	(301)
Fraction of space heat from community system	1 - (301) =	1.00	(302)
Fraction of community heat from boilers		1.00	(303a)
Fraction of total space heat from community boilers	(302) x (303a) =	1.00	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating		1.00	(305)
Factor for charging method (Table 4c(3)) for community water heating		1.00	(305a)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating

Annual space heating requirement	1124.22	(98)
Space heat from boilers	(98) x (304a) x (305) x (306) =	1180.43 (307a)

Water heating

Annual water heating requirement	1483.33	(64)
Water heat from boilers	(64) x (303a) x (305a) x (306) =	1557.49 (310a)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	27.38 (313)

Electricity for pumps, fans and electric keep-hot (Table 4f)

mechanical ventilation fans - balanced, extract or positive input from outside	31.82	(330a)
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Total electricity for the above, kWh/year					31.82	(331)
Electricity for lighting (Appendix L)					237.50	(332)
Total delivered energy for all uses	(307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) =				3007.24	(338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from boilers	1180.43	x	4.24	x 0.01 =	50.05	(340a)
Water heating from boilers	1557.49	x	4.24	x 0.01 =	66.04	(342a)
Pumps and fans	31.82	x	13.19	x 0.01 =	4.20	(349)
Electricity for lighting	237.50	x	13.19	x 0.01 =	31.33	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)...(342e) + (345)...(354) =		271.61	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)					0.42	(356)
Energy cost factor (ECF)					1.20	(357)
SAP value					83.28	
SAP rating (section 13)					83	(358)
SAP band					B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from other sources (space heating)						
Efficiency of boilers	95.00					(367a)
CO ₂ emissions from boilers	[(307a)+(310a)] x 100 ÷ (367a) =	2882.03	x	0.216	=	622.52 (367)
Electrical energy for community heat distribution	27.38	x	0.519	=	14.21	(372)
Total CO ₂ associated with community systems					636.73	(373)
Total CO ₂ associated with space and water heating					636.73	(376)
Pumps and fans	31.82	x	0.519	=	16.51	(378)
Electricity for lighting	237.50	x	0.519	=	123.26	(379)
Total CO ₂ , kg/year				(376)...(382) =	776.50	(383)
Dwelling CO ₂ emission rate				(383) ÷ (4) =	15.48	(384)
EI value					89.06	
EI rating (section 14)					89	(385)
EI band					B	

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary energy from other sources (space heating)						
Efficiency of boilers	95.00					(367a)
Primary energy from boilers	[(307a)+(310a)] x 100 ÷ (367a) =	2882.03	x	1.22	=	3516.08 (367)
Electrical energy for community heat distribution	27.38	x	3.07	=	84.05	(372)
Total primary energy associated with community systems					3600.13	(373)
Total primary energy associated with space and water heating					3600.13	(376)
Pumps and fans	31.82	x	3.07	=	97.67	(378)
Electricity for lighting	237.50	x	3.07	=	729.13	(379)
Primary energy kWh/year					4426.93	(383)

Dwelling primary energy rate kWh/m²/year

88.27 (384)

DER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	04/12/2018
Address	1Bed Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	50.15 (1a) x	2.50 (2a) =	125.38 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =		50.15 (4)
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) =	125.38 (5)

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	0 x 10 =	0 (7a)
Number of passive vents	0 x 10 =	0 (7b)
Number of flueless gas fires	0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 0 ÷ (5) = 0.00 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	4.00 (17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)

Number of sides on which the dwelling is sheltered	3 (19)
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Shelter factor	1 - [0.075 x (19)] = 0.78 (20)
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Infiltration rate incorporating shelter factor	(18) x (20) = 0.16 (21)
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Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70

Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.20	0.19	0.19	0.17	0.17	0.15	0.15	0.14	0.16	0.17	0.17	0.18
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	0.50 (23a)
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If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A (23c)
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c) whole house extract ventilation or positive input ventilation from outside	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	k-value, kJ/m ² .K	A x k, kJ/K
Window	9.00			1.14	10.22		
Party wall	55.09			0.00	0.00		
External wall	11.31			0.24	2.71		
Roof	50.15			0.14	7.02		
Total area of external elements ΣA, m ²	70.46						
Fabric heat loss, W/K = Σ(A x U)						(26)...(30) + (32) =	19.96 (33)
Heat capacity Cm = Σ(A x k)						(28)...(30) + (32) + (32a)...(32e) =	N/A (34)
Thermal mass parameter (TMP) in kJ/m ² K							100.00 (35)
Thermal bridges: Σ(L x Ψ) calculated using Appendix K							13.86 (36)
Total fabric heat loss						(33) + (36) =	33.82 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	20.69	20.69	20.69	20.69	20.69	20.69	20.69	20.69	20.69	20.69	20.69	20.69
Heat transfer coefficient, W/K (37)m + (38)m	54.50	54.50	54.50	54.50	54.50	54.50	54.50	54.50	54.50	54.50	54.50	54.50
Average = Σ(39)1...12/12 =												54.50 (39)

Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09
Average = Σ(40)1...12/12 =												1.09 (40)

Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00
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4. Water heating energy requirement

Assumed occupancy, N	1.69 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	74.44 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	81.89	78.91	75.93	72.96	69.98	67.00	67.00	69.98	72.96	75.93	78.91	81.89
Σ(44)1...12 =												893.34 (44)

Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	121.44	106.21	109.60	95.55	91.69	79.12	73.31	84.13	85.13	99.21	108.30	117.61
Σ(45)1...12 =												1171.31 (45)

Distribution loss 0.15 x (45)m	18.22	15.93	16.44	14.33	13.75	11.87	11.00	12.62	12.77	14.88	16.25	17.64
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Storage volume (litres) including any solar or WWHRs storage within same vessel	1.00 (47)
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Water storage loss:

b) Manufacturer's declared loss factor is not known	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.02 (51)
Volume factor from Table 2a	4.93 (52)
Temperature factor from Table 2b	1.00 (53)
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53)	0.10 (54)
Enter (50) or (54) in (55)	0.10 (55)

Water storage loss calculated for each month (55) x (41)m	3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24
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If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - Vs] ÷ (47), else (56)

	3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24	(57)
Primary circuit loss for each month from Table 3													
	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													
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m													
	147.94	130.15	136.10	121.20	118.19	104.76	99.81	110.63	110.78	125.72	133.95	144.11	(62)
Solar DHW input calculated using Appendix G or Appendix H													
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
Output from water heater for each month (kWh/month) (62)m + (63)m													
	147.94	130.15	136.10	121.20	118.19	104.76	99.81	110.63	110.78	125.72	133.95	144.11	
	$\Sigma[(64)1...12 =$											1483.33	(64)
Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]													
	61.58	54.46	57.64	52.29	51.69	46.82	45.58	49.17	48.82	54.19	56.53	60.30	(65)

5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)													
	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.45	11.94	9.71	7.35	5.50	4.64	5.01	6.52	8.75	11.11	12.97	13.82	(67)
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	147.62	149.16	145.30	137.08	126.70	116.95	110.44	108.91	112.77	120.99	131.36	141.11	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	(69)
Pump and fan gains (Table 5a)													
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
Losses e.g. evaporation (Table 5)													
	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	(71)
Water heating gains (Table 5)													
	82.77	81.05	77.48	72.62	69.47	65.03	61.26	66.09	67.81	72.84	78.51	81.05	(72)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
	292.26	290.57	280.90	265.47	250.09	235.04	225.13	229.94	237.75	253.35	271.25	284.40	(73)

6. Solar gains

	Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W							
NorthEast	0.77	x	9.00	x	11.28	x 0.9 x	0.45	x	0.80	=	25.33	(75)	
Solar gains in watts $\Sigma(74)m...(82)m$													
	25.33	51.57	92.91	152.58	205.10	218.66	204.55	163.07	113.21	63.02	31.88	20.69	(83)
Total gains - internal and solar (73)m + (83)m													
	317.59	342.13	373.81	418.05	455.19	453.70	429.68	393.01	350.96	316.37	303.13	305.09	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1(°C)												21.00	(85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area n1,m (see Table 9a)													
	0.96	0.95	0.93	0.87	0.77	0.63	0.50	0.55	0.75	0.90	0.95	0.97	(86)

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)													
	18.80	18.99	19.38	19.92	20.43	20.77	20.91	20.88	20.60	19.97	19.29	18.74	(87)
Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)													
	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	(88)
Utilisation factor for gains for rest of dwelling n2,m													
	0.96	0.94	0.91	0.85	0.73	0.56	0.41	0.46	0.70	0.88	0.94	0.96	(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)													
	17.06	17.34	17.91	18.67	19.36	19.80	19.95	19.92	19.60	18.75	17.78	16.98	(90)
Living area fraction													
Living area ÷ (4) =												0.66	(91)
Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2													
	18.20	18.42	18.87	19.49	20.06	20.43	20.58	20.55	20.25	19.55	18.77	18.13	(92)
Apply adjustment to the mean internal temperature from Table 4e where appropriate													
	18.20	18.42	18.87	19.49	20.06	20.43	20.58	20.55	20.25	19.55	18.77	18.13	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, ηm														
	0.94	0.93	0.90	0.83	0.73	0.59	0.46	0.51	0.71	0.86	0.92	0.95	(94)	
Useful gains, ηmGm, W (94)m x (84)m														
	299.28	317.69	335.74	348.95	332.48	268.25	198.52	201.44	250.29	273.21	280.26	289.04	(95)	
Monthly average external temperature from Table U1														
	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)	
Heat loss rate for mean internal temperature, Lm, W [(39)m x (93)m - (96)m]														
	757.57	736.92	674.40	577.23	455.68	317.93	216.89	226.20	335.31	487.80	635.86	759.29	(97)	
Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m														
	340.97	281.72	251.96	164.36	91.67	0.00	0.00	0.00	0.00	159.66	256.04	349.87		
	$\Sigma(98)1...5, 10...12 =$											1896.24	(98)	
Space heating requirement kWh/m ² /year												(98) ÷ (4) =	37.81	(99)

9b. Energy requirements - community heating scheme

Fraction of space heat from secondary/supplementary system (table 11)	'0' if none	0.00	(301)
Fraction of space heat from community system	1 - (301) =	1.00	(302)
Fraction of community heat from boilers		1.00	(303a)
Fraction of total space heat from community boilers	(302) x (303a) =	1.00	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating		1.00	(305)
Factor for charging method (Table 4c(3)) for community water heating		1.00	(305a)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating			
Annual space heating requirement	1896.24	(98)	
Space heat from boilers	(98) x (304a) x (305) x (306) =	1991.05	(307a)

Water heating			
Annual water heating requirement	1483.33	(64)	
Water heat from boilers	(64) x (303a) x (305a) x (306) =	1557.49	(310a)
Electricity used for heat distribution	0.01 x [(307a)...(307e) + (310a)...(310e)] =	35.49	(313)

Electricity for pumps, fans and electric keep-hot (Table 4f)

mechanical ventilation fans - balanced, extract or positive input from outside	31.82	(330a)
Total electricity for the above, kWh/year	31.82	(331)
Electricity for lighting (Appendix L)	237.50	(332)
Total delivered energy for all uses	(307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) = 3817.86	(338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from boilers	1991.05	x	4.24	x 0.01 =	84.42	(340a)
Water heating from boilers	1557.49	x	4.24	x 0.01 =	66.04	(342a)
Pumps and fans	31.82	x	13.19	x 0.01 =	4.20	(349)
Electricity for lighting	237.50	x	13.19	x 0.01 =	31.33	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)...(342e) + (345)...(354) =		305.98	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.35	(357)
SAP value	81.16	
SAP rating (section 13)	81	(358)
SAP band	B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from other sources (space heating)						
Efficiency of boilers	95.00					(367a)
CO ₂ emissions from boilers	[(307a)+(310a)] x 100 ÷ (367a) = 3735.31	x	0.216	=	806.83	(367)
Electrical energy for community heat distribution	35.49	x	0.519	=	18.42	(372)
Total CO ₂ associated with community systems					825.24	(373)
Total CO ₂ associated with space and water heating					825.24	(376)
Pumps and fans	31.82	x	0.519	=	16.51	(378)
Electricity for lighting	237.50	x	0.519	=	123.26	(379)
Total CO ₂ , kg/year			(376)...(382) =		965.02	(383)
Dwelling CO ₂ emission rate			(383) ÷ (4) =		19.24	(384)
EI value					86.41	
EI rating (section 14)					86	(385)
EI band					B	

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary energy from other sources (space heating)						
Efficiency of boilers	95.00					(367a)
Primary energy from boilers	[(307a)+(310a)] x 100 ÷ (367a) = 3735.31	x	1.22	=	4557.08	(367)
Electrical energy for community heat distribution	35.49	x	3.07	=	108.94	(372)
Total primary energy associated with community systems					4666.02	(373)
Total primary energy associated with space and water heating					4666.02	(376)
Pumps and fans	31.82	x	3.07	=	97.67	(378)
Electricity for lighting	237.50	x	3.07	=	729.13	(379)

Primary energy kWh/year	5492.82	(383)
Dwelling primary energy rate kWh/m ² /year	109.53	(384)

DER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	05/12/2018
Address	2BED Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	63.63 (1a) x	2.50 (2a) =	159.08 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 63.63 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) =	159.08 (5)

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	0 x 10 =	0 (7a)
Number of passive vents	0 x 10 =	0 (7b)
Number of flueless gas fires	0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 0 ÷ (5) = 0.00 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	4.00 (17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.20 (18)
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Number of sides on which the dwelling is sheltered	2 (19)
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Shelter factor	1 - [0.075 x (19)] = 0.85 (20)
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Infiltration rate incorporating shelter factor	(18) x (20) = 0.17 (21)
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Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70

Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.17	0.18	0.19	0.20
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	0.50 (23a)
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If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A (23c)
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c) whole house extract ventilation or positive input ventilation from outside	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K
Window	11.76		11.76	1.14	13.36		(27)
Exposed floor	63.63		63.63	0.08	5.09		(28b)
Party wall	45.00		45.00	0.00	0.00		(32)
External wall	33.12		33.12	0.24	7.95		(29a)
Roof	63.63		63.63	0.14	8.91		(30)
Total area of external elements ΣA, m ²	172.14		172.14				(31)
Fabric heat loss, W/K = Σ(A × U)					(26)...(30) + (32) =	35.31	(33)
Heat capacity Cm = Σ(A × κ)					(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)
Thermal mass parameter (TMP) in kJ/m ² K						100.00	(35)
Thermal bridges: Σ(L × Ψ) calculated using Appendix K						14.71	(36)
Total fabric heat loss					(33) + (36) =	50.01	(37)

Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25
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Heat transfer coefficient, W/K (37)m + (38)m	76.26	76.26	76.26	76.26	76.26	76.26	76.26	76.26	76.26	76.26	76.26	76.26
Average = Σ(39)1...12/12 =	76.26 (39)											

Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
Average = Σ(40)1...12/12 =	1.20 (40)											

Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00
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4. Water heating energy requirement

Assumed occupancy, N	2.08 (42)
Annual average hot water usage in litres per day V _{d,average} = (25 x N) + 36	83.65 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month V _{d,m} = factor from Table 1c x (43)	92.02	88.67	85.33	81.98	78.63	75.29	75.29	78.63	81.98	85.33	88.67	92.02
Σ(44)1...12 =	1003.82 (44)											

Energy content of hot water used = 4.18 x V _{d,m} x nm x T _m /3600 kWh/month (see Tables 1b, 1c 1d)	136.46	119.35	123.16	107.37	103.02	88.90	82.38	94.53	95.66	111.49	121.70	132.15
Σ(45)1...12 =	1316.17 (45)											

Distribution loss 0.15 x (45)m	20.47	17.90	18.47	16.11	15.45	13.34	12.36	14.18	14.35	16.72	18.25	19.82
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Storage volume (litres) including any solar or WWHRs storage within same vessel	1.00 (47)
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Water storage loss:

b) Manufacturer's declared loss factor is not known

Hot water storage loss factor from Table 2 (kWh/litre/day)	0.02 (51)
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Volume factor from Table 2a	4.93 (52)
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Temperature factor from Table 2b	1.00 (53)
----------------------------------	-----------

Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53)	0.10 (54)
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Enter (50) or (54) in (55)	0.10 (55)
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Water storage loss calculated for each month (55) x (41)m	3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24
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If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)

3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24	(57)
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Primary circuit loss for each month from Table 3

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)
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Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
------	------	------	------	------	------	------	------	------	------	------	------	------

Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

162.96	143.28	149.66	133.02	129.53	114.55	108.88	121.03	121.31	137.99	147.34	158.65	(62)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
------	------	------	------	------	------	------	------	------	------	------	------	------

Output from water heater for each month (kWh/month) (62)m + (63)m

162.96	143.28	149.66	133.02	129.53	114.55	108.88	121.03	121.31	137.99	147.34	158.65	
$\Sigma(64)1...12 =$											1628.19	(64)

Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

66.57	58.83	62.15	56.22	55.46	50.08	48.59	52.63	52.32	58.27	60.98	65.14	(65)
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5. Internal gains

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

Metabolic gains (Table 5)

104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	(66)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

16.50	14.66	11.92	9.03	6.75	5.70	6.15	8.00	10.74	13.63	15.91	16.96	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

182.00	183.89	179.13	169.00	156.21	144.19	136.16	134.27	139.03	149.16	161.95	173.97	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	(69)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pump and fan gains (Table 5a)

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
------	------	------	------	------	------	------	------	------	------	------	------	------

Losses e.g. evaporation (Table 5)

-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

89.48	87.55	83.53	78.08	74.54	69.55	65.31	70.74	72.67	78.32	84.69	87.56	(72)
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Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

342.22	340.33	328.82	310.34	291.73	273.67	261.86	267.24	276.67	295.35	316.79	332.72	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains

	Access factor Table 6d		Area m ²		Solar flux W/m ²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
East	0.77	x	1.10	x	19.64	x 0.9 x	0.45	x	0.80	=	5.39	(76)
South	0.77	x	10.66	x	46.75	x 0.9 x	0.45	x	0.80	=	124.34	(78)

Solar gains in watts $\Sigma(74)m...(82)m$

129.72	214.17	276.75	318.49	336.53	325.77	317.50	304.94	291.16	232.14	154.10	111.87	(83)
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Total gains - internal and solar (73)m + (83)m

471.94	554.50	605.57	628.82	628.26	599.44	579.36	572.19	567.83	527.49	470.89	444.59	(84)
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7. Mean internal temperature (heating season)

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

21.00	(85)
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Utilisation factor for gains for living area n1,m (see Table 9a)

0.95	0.92	0.89	0.84	0.76	0.64	0.51	0.53	0.69	0.84	0.93	0.95	(86)
------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

18.72	19.02	19.43	19.91	20.36	20.71	20.89	20.87	20.63	20.04	19.28	18.63	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	(88)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling n2,m

0.94	0.91	0.87	0.81	0.72	0.57	0.41	0.43	0.63	0.82	0.91	0.95	(89)
------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

16.90	17.33	17.92	18.59	19.21	19.66	19.85	19.83	19.56	18.79	17.71	16.78	(90)
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Living area fraction

Living area ÷ (4) =

0.50

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

17.82	18.19	18.68	19.25	19.79	20.19	20.37	20.35	20.10	19.42	18.50	17.71	(92)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e where appropriate

17.82	18.19	18.68	19.25	19.79	20.19	20.37	20.35	20.10	19.42	18.50	17.71	(93)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

Utilisation factor for gains, ηm

0.92	0.89	0.85	0.79	0.71	0.59	0.45	0.47	0.64	0.80	0.89	0.93	(94)
------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, ηmGm, W (94)m x (84)m

434.56	493.12	514.71	499.32	446.89	352.58	261.01	270.41	361.66	421.29	419.72	413.25	(95)
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Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
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Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]

1030.77	1013.13	929.07	789.60	616.86	426.34	287.60	301.57	457.55	672.48	869.16	1030.55	(97)
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Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

443.57	349.44	308.29	209.00	126.45	0.00	0.00	0.00	0.00	186.88	323.60	459.27	
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$\Sigma(98)1...5, 10...12 =$

2406.51

Space heating requirement kWh/m²/year

(98) ÷ (4)

37.82

9b. Energy requirements - community heating scheme

Fraction of space heat from secondary/supplementary system (table 11)

0' if none

0.00

Fraction of space heat from community system

1 - (301) =

1.00

Fraction of community heat from boilers

1.00

Fraction of total space heat from community boilers

(302) x (303a) =

1.00

Factor for control and charging method (Table 4c(3)) for community space heating

1.00

Factor for charging method (Table 4c(3)) for community water heating

1.00

Distribution loss factor (Table 12c) for community heating system

1.05

Space heating

Annual space heating requirement

2406.51

Space heat from boilers

(98) x (304a) x (305) x (306) =

2526.83

Water heating

Annual water heating requirement

1628.19

Water heat from boilers

(64) x (303a) x (305a) x (306) =

1709.60

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] =

42.36

Electricity for pumps, fans and electric keep-hot (Table 4f)

mechanical ventilation fans - balanced, extract or positive input from outside	40.37	(330a)
Total electricity for the above, kWh/year	40.37	(331)
Electricity for lighting (Appendix L)	291.48	(332)
Total delivered energy for all uses	(307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) =	4568.28 (338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from boilers	2526.83	x	4.24	x 0.01 =	107.14	(340a)
Water heating from boilers	1709.60	x	4.24	x 0.01 =	72.49	(342a)
Pumps and fans	40.37	x	13.19	x 0.01 =	5.32	(349)
Electricity for lighting	291.48	x	13.19	x 0.01 =	38.45	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)...(342e) + (345)...(354) =		343.40	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.33	(357)
SAP value	81.48	
SAP rating (section 13)	81	(358)
SAP band	B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from other sources (space heating)						
Efficiency of boilers	95.00					(367a)
CO ₂ emissions from boilers	[(307a)+(310a)] x 100 ÷ (367a) = 4459.40	x	0.216	=	963.23	(367)
Electrical energy for community heat distribution	42.36	x	0.519	=	21.99	(372)
Total CO ₂ associated with community systems					985.22	(373)
Total CO ₂ associated with space and water heating					985.22	(376)
Pumps and fans	40.37	x	0.519	=	20.95	(378)
Electricity for lighting	291.48	x	0.519	=	151.28	(379)
Total CO ₂ , kg/year				(376)...(382) =	1157.45	(383)
Dwelling CO ₂ emission rate				(383) ÷ (4) =	18.19	(384)
EI value					85.72	
EI rating (section 14)					86	(385)
EI band					B	

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary energy from other sources (space heating)						
Efficiency of boilers	95.00					(367a)
Primary energy from boilers	[(307a)+(310a)] x 100 ÷ (367a) = 4459.40	x	1.22	=	5440.47	(367)
Electrical energy for community heat distribution	42.36	x	3.07	=	130.06	(372)
Total primary energy associated with community systems					5570.53	(373)
Total primary energy associated with space and water heating					5570.53	(376)

Pumps and fans	40.37	x	3.07	=	123.93	(378)
Electricity for lighting	291.48	x	3.07	=	894.84	(379)
Primary energy kWh/year					6589.30	(383)
Dwelling primary energy rate kWh/m ² /year					103.56	(384)

DER Worksheet Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	05/12/2018
Address	2BED Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	63.63 (1a) x	2.50 (2a) =	159.08 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 63.63 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) = 159.08 (5)	

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	0 x 10 =	0 (7a)
Number of passive vents	0 x 10 =	0 (7b)
Number of flueless gas fires	0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 0 ÷ (5) = 0.00 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q₅₀, expressed in cubic metres per hour per square metre of envelope area (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) (18)

Number of sides on which the dwelling is sheltered (19)

Shelter factor 1 - [0.075 x (19)] = (20)

Infiltration rate incorporating shelter factor (18) x (20) = (21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70 (22)

Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18 (22a)
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.20 (22b)
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system (23a)

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h (23c)

c) whole house extract ventilation or positive input ventilation from outside (24c)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25) (25)

3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K
Window	11.76	0	11.76	1.14	13.36		156.53 (27)
Party wall	45.00	0	45.00	0.00	0.00		0.00 (32)
External wall	33.12	0	33.12	0.24	7.95		263.57 (29a)
Total area of external elements ΣA, m ²	44.88						283.10 (31)
Fabric heat loss, W/K = Σ(A × U)							283.10 (26)...(30) + (32) = 283.10 (33)
Heat capacity Cm = Σ(A × κ)							N/A (28)...(30) + (32) + (32a)...(32e) = N/A (34)
Thermal mass parameter (TMP) in kJ/m ² K							100.00 (35)
Thermal bridges: Σ(L × Ψ) calculated using Appendix K							9.24 (36)
Total fabric heat loss							30.54 (33) + (36) = 30.54 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25 (38)

Heat transfer coefficient, W/K (37)m + (38)m	56.79	56.79	56.79	56.79	56.79	56.79	56.79	56.79	56.79	56.79	56.79	56.79 (39)
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Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89 (40)
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Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00 (40)
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4. Water heating energy requirement

Assumed occupancy, N	2.08 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	83.65 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	92.02	88.67	85.33	81.98	78.63	75.29	75.29	78.63	81.98	85.33	88.67	92.02 (44)

Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	136.46	119.35	123.16	107.37	103.02	88.90	82.38	94.53	95.66	111.49	121.70	132.15 (45)
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Distribution loss 0.15 x (45)m	20.47	17.90	18.47	16.11	15.45	13.34	12.36	14.18	14.35	16.72	18.25	19.82 (46)
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Storage volume (litres) including any solar or WWHRs storage within same vessel	1.00 (47)
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Water storage loss:

b) Manufacturer's declared loss factor is not known	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.02 (51)
Volume factor from Table 2a	4.93 (52)
Temperature factor from Table 2b	1.00 (53)
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53)	0.10 (54)
Enter (50) or (54) in (55)	0.10 (55)

Water storage loss calculated for each month (55) x (41)m	3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24 (56)
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If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - Vs] ÷ (47), else (56)	3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24 (57)
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Primary circuit loss for each month from Table 3

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)
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Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
------	------	------	------	------	------	------	------	------	------	------	------	------

Total heat required for water heating calculated for each month $0.85 \times (45)\text{m} + (46)\text{m} + (57)\text{m} + (59)\text{m} + (61)\text{m}$

162.96	143.28	149.66	133.02	129.53	114.55	108.88	121.03	121.31	137.99	147.34	158.65	(62)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
------	------	------	------	------	------	------	------	------	------	------	------	------

Output from water heater for each month (kWh/month) (62)m + (63)m

162.96	143.28	149.66	133.02	129.53	114.55	108.88	121.03	121.31	137.99	147.34	158.65	
$\Sigma(64)1...12 =$											1628.19	(64)

Heat gains from water heating (kWh/month) $0.25 \times [0.85 \times (45)\text{m} + (61)\text{m}] + 0.8 \times [(46)\text{m} + (57)\text{m} + (59)\text{m}]$

66.57	58.83	62.15	56.22	55.46	50.08	48.59	52.63	52.32	58.27	60.98	65.14	(65)
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5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

16.50	14.66	11.92	9.03	6.75	5.70	6.15	8.00	10.74	13.63	15.91	16.96	(67)
-------	-------	-------	------	------	------	------	------	-------	-------	-------	-------	------

Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

182.00	183.89	179.13	169.00	156.21	144.19	136.16	134.27	139.03	149.16	161.95	173.97	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	(69)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pump and fan gains (Table 5a)

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
------	------	------	------	------	------	------	------	------	------	------	------	------

Losses e.g. evaporation (Table 5)

-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	(71)
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Water heating gains (Table 5)

89.48	87.55	83.53	78.08	74.54	69.55	65.31	70.74	72.67	78.32	84.69	87.56	(72)
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Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

342.22	340.33	328.82	310.34	291.73	273.67	261.86	267.24	276.67	295.35	316.79	332.72	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains

	Access factor Table 6d		Area m ²		Solar flux W/m ²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
West	0.77	x	1.10	x	19.64	x 0.9 x	0.45	x	0.80	=	5.39	(80)
North	0.77	x	10.66	x	10.63	x 0.9 x	0.45	x	0.80	=	28.28	(74)

Solar gains in watts $\Sigma(74)\text{m}...(82)\text{m}$

33.67	64.59	109.20	172.83	229.74	244.49	228.85	183.54	130.61	76.84	41.61	28.01	(83)
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Total gains - internal and solar (73)m + (83)m

375.89	404.91	438.01	483.17	521.46	518.16	490.70	450.79	407.28	372.19	358.40	360.73	(84)
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7. Mean internal temperature (heating season)

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	21.00	(85)
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Utilisation factor for gains for living area n1,m (see Table 9a)

0.96	0.95	0.93	0.87	0.76	0.61	0.48	0.53	0.74	0.89	0.95	0.97	(86)
------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.19	19.37	19.71	20.17	20.59	20.85	20.95	20.93	20.72	20.21	19.62	19.14	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	(88)
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Utilisation factor for gains for rest of dwelling n2,m

0.96	0.95	0.92	0.85	0.72	0.55	0.40	0.45	0.69	0.87	0.94	0.96	(89)
------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

17.73	17.99	18.48	19.13	19.70	20.03	20.14	20.12	19.88	19.19	18.35	17.65	(90)
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Living area fraction

Living area ÷ (4) =

0.50

Mean internal temperature for the whole dwelling fLA x T1 + (1 - fLA) x T2

18.47	18.69	19.10	19.66	20.15	20.45	20.55	20.53	20.31	19.70	18.99	18.40	(92)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e where appropriate

18.47	18.69	19.10	19.66	20.15	20.45	20.55	20.53	20.31	19.70	18.99	18.40	(93)
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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm	0.95	0.93	0.90	0.83	0.72	0.57	0.43	0.48	0.70	0.86	0.93	0.95	(94)

Useful gains, ηmGm, W (94)m x (84)m

355.69	377.29	394.59	403.40	376.76	295.75	212.73	218.23	284.11	320.74	332.43	343.26	(95)
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Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
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Heat loss rate for mean internal temperature, Lm, W [(39)m x (93)m - (96)m]

804.65	782.85	715.71	611.01	480.01	332.01	224.14	234.42	352.42	516.89	675.02	806.30	(97)
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Space heating requirement, kWh/month $0.024 \times [(97)\text{m} - (95)\text{m}] \times (41)\text{m}$

334.02	272.54	238.91	149.48	76.82	0.00	0.00	0.00	0.00	145.94	246.67	344.50	
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$\Sigma(98)1...5, 10...12 =$

1808.87

Space heating requirement kWh/m²/year

(98) ÷ (4)

28.43

9b. Energy requirements - community heating scheme

Fraction of space heat from secondary/supplementary system (table 11)	'0' if none	0.00	(301)
Fraction of space heat from community system	1 - (301) =	1.00	(302)
Fraction of community heat from boilers		1.00	(303a)
Fraction of total space heat from community boilers	(302) x (303a) =	1.00	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating		1.00	(305)
Factor for charging method (Table 4c(3)) for community water heating		1.00	(305a)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating

Annual space heating requirement	1808.87	(98)
Space heat from boilers	(98) x (304a) x (305) x (306) = 1899.31	(307)

Water heating

Annual water heating requirement	1628.19	(64)
Water heat from boilers	(64) x (303a) x (305a) x (306) =	1709.60 (310)
Electricity used for heat distribution	0.01 x [(307a)...(307e) + (310a)...(310e)] =	36.09 (313)

Electricity for pumps, fans and electric keep-hot (Table 4f)

mechanical ventilation fans - balanced, extract or positive input from outside	40.37	(330a)
Total electricity for the above, kWh/year	40.37	(331)
Electricity for lighting (Appendix L)	291.48	(332)
Total delivered energy for all uses	(307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) = 3940.76	(338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from boilers	1899.31	x	4.24	x 0.01 =	80.53	(340a)
Water heating from boilers	1709.60	x	4.24	x 0.01 =	72.49	(342a)
Pumps and fans	40.37	x	13.19	x 0.01 =	5.32	(349)
Electricity for lighting	291.48	x	13.19	x 0.01 =	38.45	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)...(342e) + (345)...(354) =		316.79	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.22	(357)
SAP value	82.91	
SAP rating (section 13)	83	(358)
SAP band	B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from other sources (space heating)						
Efficiency of boilers	95.00					(367a)
CO ₂ emissions from boilers	[(307a)+(310a)] x 100 ÷ (367a) = 3798.86	x	0.216	=	820.55	(367)
Electrical energy for community heat distribution	36.09	x	0.519	=	18.73	(372)
Total CO ₂ associated with community systems					839.28	(373)
Total CO ₂ associated with space and water heating					839.28	(376)
Pumps and fans	40.37	x	0.519	=	20.95	(378)
Electricity for lighting	291.48	x	0.519	=	151.28	(379)
Total CO ₂ , kg/year			(376)...(382) =		1011.51	(383)
Dwelling CO ₂ emission rate			(383) ÷ (4) =		15.90	(384)
EI value					87.52	
EI rating (section 14)					88	(385)
EI band					B	

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary energy from other sources (space heating)						
Efficiency of boilers	95.00					(367a)
Primary energy from boilers	[(307a)+(310a)] x 100 ÷ (367a) = 3798.86	x	1.22	=	4634.61	(367)
Electrical energy for community heat distribution	36.09	x	3.07	=	110.79	(372)
Total primary energy associated with community systems					4745.40	(373)
Total primary energy associated with space and water heating					4745.40	(376)
Pumps and fans	40.37	x	3.07	=	123.93	(378)
Electricity for lighting	291.48	x	3.07	=	894.84	(379)

Primary energy kWh/year	5764.17	(383)
Dwelling primary energy rate kWh/m ² /year	90.59	(384)

DER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	05/12/2018
Address	2BED Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	63.63 (1a) x	2.50 (2a) =	159.08 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 63.63 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) =	159.08 (5)

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	0 x 10 =	0 (7a)
Number of passive vents	0 x 10 =	0 (7b)
Number of flueless gas fires	0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 0 ÷ (5) = 0.00 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	4.00 (17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)

Number of sides on which the dwelling is sheltered	2 (19)
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Shelter factor	1 - [0.075 x (19)] = 0.85 (20)
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Infiltration rate incorporating shelter factor	(18) x (20) = 0.17 (21)
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Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70 (22)

Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18 (22a)
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.17	0.18	0.19	0.20 (22b)
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	0.50 (23a)
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If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A (23c)
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c) whole house extract ventilation or positive input ventilation from outside	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50 (24c)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50 (25)
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K
Window			11.76	x 1.14	= 13.36 (27)		
Party wall			45.00	x 0.00	= 0.00 (32)		
External wall			33.12	x 0.24	= 7.95 (29a)		
Roof			63.63	x 0.14	= 8.91 (30)		
Total area of external elements ΣA, m ²			108.51				(31)
Fabric heat loss, W/K = Σ(A x U)						(26)...(30) + (32) =	30.22 (33)
Heat capacity Cm = Σ(A x κ)						(28)...(30) + (32) + (32a)...(32e) =	N/A (34)
Thermal mass parameter (TMP) in kJ/m ² K							100.00 (35)
Thermal bridges: Σ(L x Ψ) calculated using Appendix K							20.23 (36)
Total fabric heat loss						(33) + (36) =	50.45 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25 (38)
Heat transfer coefficient, W/K (37)m + (38)m	76.70	76.70	76.70	76.70	76.70	76.70	76.70	76.70	76.70	76.70	76.70	76.70
Average = Σ(39)1...12/12 =												76.70 (39)

Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21
Average = Σ(40)1...12/12 =												1.21 (40)

Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00 (40)
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4. Water heating energy requirement

Assumed occupancy, N	2.08 (42)
Annual average hot water usage in litres per day V _{d,average} = (25 x N) + 36	83.65 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month V _{d,m} = factor from Table 1c x (43)	92.02	88.67	85.33	81.98	78.63	75.29	75.29	78.63	81.98	85.33	88.67	92.02
Σ(44)1...12 =												1003.82 (44)

Energy content of hot water used = 4.18 x V _{d,m} x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	136.46	119.35	123.16	107.37	103.02	88.90	82.38	94.53	95.66	111.49	121.70	132.15
Σ(45)1...12 =												1316.17 (45)

Distribution loss 0.15 x (45)m	20.47	17.90	18.47	16.11	15.45	13.34	12.36	14.18	14.35	16.72	18.25	19.82 (46)
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Storage volume (litres) including any solar or WWHRs storage within same vessel	1.00 (47)
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Water storage loss:

b) Manufacturer's declared loss factor is not known	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.02 (51)
Volume factor from Table 2a	4.93 (52)
Temperature factor from Table 2b	1.00 (53)
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53)	0.10 (54)
Enter (50) or (54) in (55)	0.10 (55)

Water storage loss calculated for each month (55) x (41)m	3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24 (56)
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If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - Vs] ÷ (47), else (56)

3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24	(57)
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Primary circuit loss for each month from Table 3

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)
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Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
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Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

162.96	143.28	149.66	133.02	129.53	114.55	108.88	121.03	121.31	137.99	147.34	158.65	(62)
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Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
------	------	------	------	------	------	------	------	------	------	------	------	------

Output from water heater for each month (kWh/month) (62)m + (63)m

162.96	143.28	149.66	133.02	129.53	114.55	108.88	121.03	121.31	137.99	147.34	158.65	
$\Sigma(64)1...12 =$											1628.19	(64)

Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

66.57	58.83	62.15	56.22	55.46	50.08	48.59	52.63	52.32	58.27	60.98	65.14	(65)
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5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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Metabolic gains (Table 5)

104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	(66)
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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

16.50	14.66	11.92	9.03	6.75	5.70	6.15	8.00	10.74	13.63	15.91	16.96	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

182.00	183.89	179.13	169.00	156.21	144.19	136.16	134.27	139.03	149.16	161.95	173.97	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	(69)
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Pump and fan gains (Table 5a)

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
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Losses e.g. evaporation (Table 5)

-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	(71)
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Water heating gains (Table 5)

89.48	87.55	83.53	78.08	74.54	69.55	65.31	70.74	72.67	78.32	84.69	87.56	(72)
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Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

342.22	340.33	328.82	310.34	291.73	273.67	261.86	267.24	276.67	295.35	316.79	332.72	(73)
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6. Solar gains

	Access factor Table 6d		Area m ²		Solar flux W/m ²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
South	0.77	x	1.10	x	46.75	x 0.9 x	0.45	x	0.80	=	12.83	(78)
West	0.77	x	10.66	x	19.64	x 0.9 x	0.45	x	0.80	=	52.23	(80)

Solar gains in watts $\Sigma(74)m...(82)m$

65.06	123.19	195.04	275.67	332.29	338.22	322.76	280.57	223.67	143.91	80.34	54.04	(83)
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Total gains - internal and solar (73)m + (83)m

407.28	463.52	523.86	586.00	624.01	611.89	584.62	547.82	500.34	439.25	397.13	386.76	(84)
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7. Mean internal temperature (heating season)

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
											21.00	(85)

Utilisation factor for gains for living area n1,m (see Table 9a)

0.96	0.95	0.92	0.86	0.76	0.63	0.51	0.55	0.74	0.89	0.95	0.97	(86)
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Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

18.55	18.81	19.26	19.83	20.35	20.72	20.89	20.86	20.56	19.88	19.10	18.48	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	(88)
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Utilisation factor for gains for rest of dwelling n2,m

0.96	0.94	0.90	0.83	0.72	0.56	0.40	0.45	0.67	0.86	0.94	0.96	(89)
------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

16.65	17.02	17.67	18.48	19.19	19.66	19.84	19.82	19.48	18.56	17.45	16.55	(90)
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Living area fraction Living area ÷ (4) =

0.50

Mean internal temperature for the whole dwelling fLA x T1 + (1 - fLA) x T2

17.61	17.92	18.47	19.16	19.77	20.19	20.37	20.34	20.02	19.23	18.28	17.52	(92)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e where appropriate

17.61	17.92	18.47	19.16	19.77	20.19	20.37	20.34	20.02	19.23	18.28	17.52	(93)
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8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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Utilisation factor for gains, ηm

0.94	0.92	0.88	0.81	0.71	0.58	0.45	0.49	0.68	0.84	0.92	0.95	(94)
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Useful gains, ηmGm, W (94)m x (84)m

382.52	425.56	461.02	476.55	445.80	356.11	262.33	268.09	341.13	370.96	364.75	365.64	(95)
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Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
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Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]

1020.90	998.79	918.17	786.72	619.14	428.93	289.02	302.24	454.27	661.54	857.68	1021.94	(97)
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Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

474.95	385.21	340.12	223.32	128.96	0.00	0.00	0.00	0.00	216.19	354.91	488.29	
$\Sigma(98)1...5, 10...12 =$											2611.95	(98)

Space heating requirement kWh/m²/year (98) ÷ (4) =

41.05

9b. Energy requirements - community heating scheme

Fraction of space heat from secondary/supplementary system (table 11)

'0' if none

0.00

Fraction of space heat from community system

1 - (301) =

1.00

Fraction of community heat from boilers

1.00

Fraction of total space heat from community boilers

(302) x (303a) =

1.00

Factor for control and charging method (Table 4c(3)) for community space heating

1.00

Factor for charging method (Table 4c(3)) for community water heating

1.00

Distribution loss factor (Table 12c) for community heating system

1.05

Space heating

Annual space heating requirement

2611.95

Space heat from boilers

(98) x (304a) x (305) x (306) =

2742.55

Water heating

Annual water heating requirement

1628.19

Water heat from boilers

(64) x (303a) x (305a) x (306) =

1709.60

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] =

44.52

Electricity for pumps, fans and electric keep-hot (Table 4f)			
mechanical ventilation fans - balanced, extract or positive input from outside	40.37		(330a)
Total electricity for the above, kWh/year		40.37	(331)
Electricity for lighting (Appendix L)		291.48	(332)
Total delivered energy for all uses	(307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) =	4784.00	(338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from boilers	2742.55	x	4.24	x 0.01 =	116.28	(340a)
Water heating from boilers	1709.60	x	4.24	x 0.01 =	72.49	(342a)
Pumps and fans	40.37	x	13.19	x 0.01 =	5.32	(349)
Electricity for lighting	291.48	x	13.19	x 0.01 =	38.45	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)...(342e) + (345)...(354) =		352.54	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.36	(357)
SAP value	80.99	
SAP rating (section 13)	81	(358)
SAP band	B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from other sources (space heating)						
Efficiency of boilers	95.00					(367a)
CO ₂ emissions from boilers	[(307a)+(310a)] x 100 ÷ (367a) = 4686.48	x	0.216	=	1012.28	(367)
Electrical energy for community heat distribution	44.52	x	0.519	=	23.11	(372)
Total CO ₂ associated with community systems					1035.39	(373)
Total CO ₂ associated with space and water heating					1035.39	(376)
Pumps and fans	40.37	x	0.519	=	20.95	(378)
Electricity for lighting	291.48	x	0.519	=	151.28	(379)
Total CO ₂ , kg/year				(376)...(382) =	1207.61	(383)
Dwelling CO ₂ emission rate				(383) ÷ (4) =	18.98	(384)
EI value					85.10	
EI rating (section 14)					85	(385)
EI band					B	

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary energy from other sources (space heating)						
Efficiency of boilers	95.00					(367a)
Primary energy from boilers	[(307a)+(310a)] x 100 ÷ (367a) = 4686.48	x	1.22	=	5717.50	(367)
Electrical energy for community heat distribution	44.52	x	3.07	=	136.68	(372)
Total primary energy associated with community systems					5854.18	(373)
Total primary energy associated with space and water heating					5854.18	(376)
Pumps and fans	40.37	x	3.07	=	123.93	(378)

Electricity for lighting	291.48	x	3.07	=	894.84	(379)
Primary energy kWh/year					6872.95	(383)
Dwelling primary energy rate kWh/m ² /year					108.01	(384)

DER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	04/12/2018
Address	3Bed Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	80.34 (1a) x	2.50 (2a) =	200.85 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 80.34 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) = 200.85 (5)	

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	0 x 10 =	0 (7a)
Number of passive vents	0 x 10 =	0 (7b)
Number of flueless gas fires	0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 0 ÷ (5) = 0.00 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	4.00 (17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)

Number of sides on which the dwelling is sheltered	2 (19)
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Shelter factor	1 - [0.075 x (19)] = 0.85 (20)
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Infiltration rate incorporating shelter factor	(18) x (20) = 0.17 (21)
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Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70 (22)

Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18 (22a)
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.20 (22b)
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	0.50 (23a)
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If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A (23c)
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c) whole house extract ventilation or positive input ventilation from outside	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50 (24c)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50 (25)
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² .K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K
Window			13.12	x 1.14	= 14.90 (27)		
Exposed floor			63.63	x 0.14	= 8.91 (28b)		
Party wall			51.59	x 0.00	= 0.00 (32)		
External wall			38.33	x 0.24	= 9.20 (29a)		
Total area of external elements ΣA, m ²			115.08 (31)				
Fabric heat loss, W/K = Σ(A x U)					(26)...(30) + (32) = 33.01 (33)		
Heat capacity Cm = Σ(A x κ)					(28)...(30) + (32) + (32a)...(32e) = N/A (34)		
Thermal mass parameter (TMP) in kJ/m ² K					100.00 (35)		
Thermal bridges: Σ(L x Ψ) calculated using Appendix K					16.24 (36)		
Total fabric heat loss					(33) + (36) = 49.25 (37)		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	33.14	33.14	33.14	33.14	33.14	33.14	33.14	33.14	33.14	33.14	33.14	33.14 (38)
Heat transfer coefficient, W/K (37)m + (38)m	82.39	82.39	82.39	82.39	82.39	82.39	82.39	82.39	82.39	82.39	82.39	82.39 (39)
Average = Σ(39)1...12/12 =												82.39 (39)

Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03 (40)
Average = Σ(40)1...12/12 =												1.03 (40)

Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00 (40)
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4. Water heating energy requirement

Assumed occupancy, N	2.47 (42)
Annual average hot water usage in litres per day V _{d,average} = (25 x N) + 36	92.85 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month V _{d,m} = factor from Table 1c x (43)	102.13	98.42	94.70	90.99	87.27	83.56	83.56	87.27	90.99	94.70	98.42	102.13 (44)
Σ(44)1...12 =												1114.14 (44)

Energy content of hot water used = 4.18 x V _{d,m} x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	151.46	132.46	136.69	119.17	114.35	98.67	91.43	104.92	106.18	123.74	135.07	146.68 (45)
Σ(45)1...12 =												1460.82 (45)

Distribution loss 0.15 x (45)m	22.72	19.87	20.50	17.88	17.15	14.80	13.72	15.74	15.93	18.56	20.26	22.00 (46)
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Storage volume (litres) including any solar or WWHRs storage within same vessel	1.00 (47)
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Water storage loss:

b) Manufacturer's declared loss factor is not known	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.02 (51)
Volume factor from Table 2a	4.93 (52)
Temperature factor from Table 2b	1.00 (53)
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53)	0.10 (54)
Enter (50) or (54) in (55)	0.10 (55)

Water storage loss calculated for each month (55) x (41)m	3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24 (56)
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If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - Vs] ÷ (47), else (56)

3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24	(57)
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Primary circuit loss for each month from Table 3

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)
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Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
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Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

177.96	156.40	163.19	144.82	140.85	124.32	117.94	131.42	131.82	150.24	160.72	173.18	(62)
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Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
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Output from water heater for each month (kWh/month) (62)m + (63)m

177.96	156.40	163.19	144.82	140.85	124.32	117.94	131.42	131.82	150.24	160.72	173.18	
$\Sigma(64)1...12 =$											1772.84	(64)

Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

71.56	63.19	66.65	60.14	59.22	53.33	51.60	56.09	55.82	62.34	65.43	69.97	(65)
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5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

20.39	18.11	14.73	11.15	8.34	7.04	7.61	9.89	13.27	16.85	19.66	20.96	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

220.15	222.43	216.68	204.42	188.95	174.41	164.70	162.41	168.17	180.43	195.90	210.44	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	(69)
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Pump and fan gains (Table 5a)

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
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Losses e.g. evaporation (Table 5)

-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	(71)
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Water heating gains (Table 5)

96.18	94.04	89.58	83.53	79.60	74.06	69.36	75.39	77.53	83.79	90.87	94.05	(72)
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Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

396.77	394.62	381.03	359.14	336.93	315.55	301.70	307.72	319.01	341.11	366.47	385.48	(73)
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6. Solar gains

	Access factor Table 6d		Area m ²		Solar flux W/m ²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
NorthWest	0.77	x	10.59	x	11.28	x 0.9 x	0.45	x	0.80	=	29.81	(81)
SouthWest	0.77	x	2.53	x	36.79	x 0.9 x	0.45	x	0.80	=	23.22	(79)

Solar gains in watts $\Sigma(74)m...(82)m$

53.03	100.24	163.45	246.60	316.45	331.86	312.59	257.77	191.82	117.87	65.32	44.22	(83)
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Total gains - internal and solar (73)m + (83)m

449.80	494.86	544.48	605.75	653.38	647.42	614.29	565.49	510.82	458.98	431.79	429.70	(84)
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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1(°C)											21.00	(85)
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Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area n1,m (see Table 9a)												

0.97	0.96	0.94	0.89	0.79	0.66	0.53	0.58	0.78	0.91	0.96	0.97	(86)
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Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

18.82	19.02	19.41	19.93	20.42	20.76	20.91	20.88	20.60	19.98	19.30	18.76	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	(88)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling n2,m

0.97	0.95	0.93	0.87	0.76	0.59	0.43	0.49	0.72	0.89	0.95	0.97	(89)
------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

17.12	17.42	17.98	18.72	19.40	19.84	20.00	19.97	19.65	18.80	17.83	17.03	(90)
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Living area fraction Living area ÷ (4) = 0.40

Mean internal temperature for the whole dwelling fLA x T1 + (1 - fLA) x T2

17.80	18.06	18.55	19.20	19.81	20.21	20.36	20.33	20.03	19.27	18.41	17.72	(92)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e where appropriate

17.80	18.06	18.55	19.20	19.81	20.21	20.36	20.33	20.03	19.27	18.41	17.72	(93)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm												
0.95	0.94	0.91	0.85	0.75	0.60	0.46	0.51	0.72	0.87	0.93	0.96	(94)

Useful gains, ηmGm, W (94)m x (84)m

427.97	463.48	493.74	512.67	487.01	391.02	285.63	291.14	368.01	400.78	403.54	410.97	(95)
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Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
------	------	------	------	-------	-------	-------	-------	-------	-------	------	------	------

Heat loss rate for mean internal temperature, Lm, W [(39)m x (93)m - (96)m]

1112.14	1084.06	992.73	848.90	668.06	462.03	309.97	324.14	488.35	714.62	932.24	1114.00	(97)
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Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

509.02	417.03	371.25	242.09	134.70	0.00	0.00	0.00	0.00	233.50	380.66	523.05	
$\Sigma(98)1...5, 10...12 =$											2811.31	(98)

Space heating requirement kWh/m²/year (98) ÷ (4) = 34.99

9b. Energy requirements - community heating scheme

Fraction of space heat from secondary/supplementary system (table 11)	'0' if none	0.00	(301)
Fraction of space heat from community system	1 - (301) =	1.00	(302)
Fraction of community heat from boilers		1.00	(303a)
Fraction of total space heat from community boilers	(302) x (303a) =	1.00	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating		1.00	(305)
Factor for charging method (Table 4c(3)) for community water heating		1.00	(305a)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating

Annual space heating requirement	2811.31	(98)
Space heat from boilers	$(98) \times (304a) \times (305) \times (306) =$	2951.88 (307)

Water heating

Annual water heating requirement	1772.84	(64)
Water heat from boilers	$(64) \times (303a) \times (305a) \times (306) =$	1861.48 (310)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	48.13 (313)

Electricity for pumps, fans and electric keep-hot (Table 4f)				
mechanical ventilation fans - balanced, extract or positive input from outside	50.97			(330a)
Total electricity for the above, kWh/year			50.97	(331)
Electricity for lighting (Appendix L)			360.17	(332)
Total delivered energy for all uses	(307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) =		5224.50	(338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from boilers	2951.88	x	4.24	x 0.01 =	125.16	(340a)
Water heating from boilers	1861.48	x	4.24	x 0.01 =	78.93	(342a)
Pumps and fans	50.97	x	13.19	x 0.01 =	6.72	(349)
Electricity for lighting	360.17	x	13.19	x 0.01 =	47.51	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)...(342e) + (345)...(354) =		378.32	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.27	(357)
SAP value	82.32	
SAP rating (section 13)	82	(358)
SAP band	B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from other sources (space heating)						
Efficiency of boilers	95.00					(367a)
CO ₂ emissions from boilers	[(307a)+(310a)] x 100 ÷ (367a) = 5066.69	x	0.216	=	1094.41	(367)
Electrical energy for community heat distribution	48.13	x	0.519	=	24.98	(372)
Total CO ₂ associated with community systems					1119.39	(373)
Total CO ₂ associated with space and water heating					1119.39	(376)
Pumps and fans	50.97	x	0.519	=	26.45	(378)
Electricity for lighting	360.17	x	0.519	=	186.93	(379)
Total CO ₂ , kg/year				(376)...(382) =	1332.77	(383)
Dwelling CO ₂ emission rate				(383) ÷ (4) =	16.59	(384)
EI value					85.75	
EI rating (section 14)					86	(385)
EI band					B	

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary energy from other sources (space heating)						
Efficiency of boilers	95.00					(367a)
Primary energy from boilers	[(307a)+(310a)] x 100 ÷ (367a) = 5066.69	x	1.22	=	6181.37	(367)
Electrical energy for community heat distribution	48.13	x	3.07	=	147.77	(372)
Total primary energy associated with community systems					6329.14	(373)
Total primary energy associated with space and water heating					6329.14	(376)
Pumps and fans	50.97	x	3.07	=	156.47	(378)

Electricity for lighting	360.17	x	3.07	=	1105.73	(379)
Primary energy kWh/year					7591.34	(383)
Dwelling primary energy rate kWh/m ² /year					94.49	(384)

DER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	04/12/2018
Address	3Bed Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	80.34 (1a) x	2.50 (2a) =	200.85 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 80.34 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) = 200.85 (5)	

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	0 x 10 =	0 (7a)
Number of passive vents	0 x 10 =	0 (7b)
Number of flueless gas fires	0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 0 ÷ (5) = 0.00 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)	
Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	4.00 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.20 (18)
Number of sides on which the dwelling is sheltered	2 (19)
Shelter factor	1 - [0.075 x (19)] = 0.85 (20)
Infiltration rate incorporating shelter factor	(18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70 (22)

Wind factor (22)m ÷ 4

1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18 (22a)
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.20 (22b)
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system (23a)

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h (23c)

c) whole house extract ventilation or positive input ventilation from outside

0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50 (24c)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)

0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50 (25)
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	k-value, kJ/m ² .K	A x k, kJ/K
Window			13.12 x 1.14 =	14.90 (27)			
Party wall			51.59 x 0.00 =	0.00 (32)			
External wall			38.33 x 0.24 =	9.20 (29a)			
Total area of external elements ΣA, m ²	51.45						24.10 (31)
Fabric heat loss, W/K = Σ(A x U)					(26)...(30) + (32) =		N/A (33)
Heat capacity Cm = Σ(A x k)					(28)...(30) + (32) + (32a)...(32e) =		100.00 (34)
Thermal mass parameter (TMP) in kJ/m ² K							10.28 (35)
Thermal bridges: Σ(L x Ψ) calculated using Appendix K							34.38 (36)
Total fabric heat loss						(33) + (36) =	34.38 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	33.14	33.14	33.14	33.14	33.14	33.14	33.14	33.14	33.14	33.14	33.14	33.14 (38)

Heat transfer coefficient, W/K (37)m + (38)m

67.52	67.52	67.52	67.52	67.52	67.52	67.52	67.52	67.52	67.52	67.52	67.52	67.52 (39)
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Heat loss parameter (HLP), W/m²K (39)m ÷ (4)

0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84 (40)
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Number of days in month (Table 1a)

31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	31.00 (40)
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4. Water heating energy requirement

Assumed occupancy, N	2.47 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	92.85 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	102.13	98.42	94.70	90.99	87.27	83.56	83.56	87.27	90.99	94.70	98.42	102.13
										Σ(44)1...12 =	1114.14 (44)	

Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)

151.46	132.46	136.69	119.17	114.35	98.67	91.43	104.92	106.18	123.74	135.07	146.68	146.68 (45)
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Distribution loss 0.15 x (45)m

22.72	19.87	20.50	17.88	17.15	14.80	13.72	15.74	15.93	18.56	20.26	22.00 (46)
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Storage volume (litres) including any solar or WWHRs storage within same vessel

1.00 (47)
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Water storage loss:

b) Manufacturer's declared loss factor is not known

Hot water storage loss factor from Table 2 (kWh/litre/day) (51)

Volume factor from Table 2a (52)

Temperature factor from Table 2b (53)

Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53) (54)

Enter (50) or (54) in (55) (55)

Water storage loss calculated for each month (55) x (41)m

3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24	3.24 (56)
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If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - Vs] ÷ (47), else (56)

3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24	3.24 (57)
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Primary circuit loss for each month from Table 3

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)
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Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
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Total heat required for water heating calculated for each month $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

177.96	156.40	163.19	144.82	140.85	124.32	117.94	131.42	131.82	150.24	160.72	173.18	(62)
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Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
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Output from water heater for each month (kWh/month) (62)m + (63)m

177.96	156.40	163.19	144.82	140.85	124.32	117.94	131.42	131.82	150.24	160.72	173.18	
$\Sigma(64)1...12 =$											1772.84	(64)

Heat gains from water heating (kWh/month) $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

71.56	63.19	66.65	60.14	59.22	53.33	51.60	56.09	55.82	62.34	65.43	69.97	(65)
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5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)												
123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

20.39	18.11	14.73	11.15	8.34	7.04	7.61	9.89	13.27	16.85	19.66	20.96	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

220.15	222.43	216.68	204.42	188.95	174.41	164.70	162.41	168.17	180.43	195.90	210.44	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	(69)
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Pump and fan gains (Table 5a)

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
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Losses e.g. evaporation (Table 5)

-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	(71)
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Water heating gains (Table 5)

96.18	94.04	89.58	83.53	79.60	74.06	69.36	75.39	77.53	83.79	90.87	94.05	(72)
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Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

396.77	394.62	381.03	359.14	336.93	315.55	301.70	307.72	319.01	341.11	366.47	385.48	(73)
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6. Solar gains

	Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W	
NorthWest	0.77	10.59	11.28	0.9	0.45	0.80	29.81 (81)
SouthWest	0.77	2.53	36.79	0.9	0.45	0.80	23.22 (79)
Solar gains in watts $\Sigma(74)m...(82)m$							
	53.03	100.24	163.45	246.60	316.45	331.86	312.59 257.77 191.82 117.87 65.32 44.22 (83)
Total gains - internal and solar (73)m + (83)m							
	449.80	494.86	544.48	605.75	653.38	647.42	614.29 565.49 510.82 458.98 431.79 429.70 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1(°C)											21.00 (85)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area n1,m (see Table 9a)											
0.97	0.95	0.93	0.86	0.75	0.59	0.46	0.51	0.73	0.89	0.95	0.97 (86)

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.28	19.47	19.82	20.26	20.65	20.88	20.96	20.94	20.76	20.27	19.69	19.21 (87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22 (88)
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Utilisation factor for gains for rest of dwelling n2,m

0.96	0.95	0.92	0.84	0.71	0.54	0.38	0.44	0.68	0.87	0.95	0.97 (89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

17.88	18.16	18.66	19.29	19.82	20.10	20.19	20.18	19.97	19.31	18.48	17.79 (90)
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Living area fraction

Living area ÷ (4) = 0.21 (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

18.17	18.43	18.90	19.49	19.99	20.26	20.35	20.34	20.14	19.51	18.73	18.09 (92)
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Apply adjustment to the mean internal temperature from Table 4e where appropriate

18.17	18.43	18.90	19.49	19.99	20.26	20.35	20.34	20.14	19.51	18.73	18.09 (93)
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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, η_m													
	0.95	0.93	0.89	0.82	0.70	0.54	0.40	0.45	0.67	0.85	0.93	0.95	(94)
Useful gains, $\eta_m G_m$, W (94)m x (84)m													
	426.41	460.43	487.10	497.42	457.51	349.93	244.31	252.66	342.36	391.71	400.66	409.84	(95)
Monthly average external temperature from Table U1													
	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate for mean internal temperature, L_m , W [(39)m x ((93)m - (96)m)]													
	936.46	913.60	837.25	715.32	559.75	382.49	253.24	265.74	407.56	601.81	785.23	937.66	(97)
Space heating requirement, kWh/month $0.024 \times ((97)m - (95)m) \times (41)m$													
	379.48	304.53	260.51	156.89	76.07	0.00	0.00	0.00	0.00	156.32	276.89	392.70	
											$\Sigma(98)1...5, 10...12 =$	2003.37	(98)
Space heating requirement kWh/m ² /year											(98) ÷ (4)	24.94	(99)

9b. Energy requirements - community heating scheme

Fraction of space heat from secondary/supplementary system (table 11)	'0' if none	0.00 (301)
Fraction of space heat from community system	1 - (301) =	1.00 (302)
Fraction of community heat from boilers		1.00 (303a)
Fraction of total space heat from community boilers	(302) x (303a) =	1.00 (304a)
Factor for control and charging method (Table 4c(3)) for community space heating		1.00 (305)
Factor for charging method (Table 4c(3)) for community water heating		1.00 (305a)
Distribution loss factor (Table 12c) for community heating system		1.05 (306)

Space heating

Annual space heating requirement	2003.37 (98)
Space heat from boilers	(98) x (304a) x (305) x (306) = 2103.54 (307a)

Water heating

Annual water heating requirement	1772.84 (64)
Water heat from boilers	(64) x (303a) x (305a) x (306) = 1861.48 (310a)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] = 39.65 (313)$

Electricity for pumps, fans and electric keep-hot (Table 4f)

mechanical ventilation fans - balanced, extract or positive input from outside	50.97	(330a)
Total electricity for the above, kWh/year	50.97	(331)
Electricity for lighting (Appendix L)	360.17	(332)
Total delivered energy for all uses	$(307) + (309) + (310) + (312) + (315) + (331) + (332) \dots (337b) =$	4376.17 (338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from boilers	2103.54	x	4.24	x 0.01 =	89.19	(340a)
Water heating from boilers	1861.48	x	4.24	x 0.01 =	78.93	(342a)
Pumps and fans	50.97	x	13.19	x 0.01 =	6.72	(349)
Electricity for lighting	360.17	x	13.19	x 0.01 =	47.51	(350)
Additional standing charges					120.00	(351)
Total energy cost			$(340a) \dots (342e) + (345) \dots (354) =$		342.35	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.15	(357)
SAP value	84.00	
SAP rating (section 13)	84	(358)
SAP band	B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from other sources (space heating)						
Efficiency of boilers	95.00					(367a)
CO ₂ emissions from boilers	$[(307a) + (310a)] \times 100 \div (367a) =$	4173.71	x	0.216	=	901.52 (367)
Electrical energy for community heat distribution	39.65	x	0.519	=	20.58	(372)
Total CO ₂ associated with community systems					922.10	(373)
Total CO ₂ associated with space and water heating					922.10	(376)
Pumps and fans	50.97	x	0.519	=	26.45	(378)
Electricity for lighting	360.17	x	0.519	=	186.93	(379)
Total CO ₂ , kg/year				$(376) \dots (382) =$	1135.48	(383)
Dwelling CO ₂ emission rate				$(383) \div (4) =$	14.13	(384)
EI value					87.86	
EI rating (section 14)					88	(385)
EI band					B	

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary energy from other sources (space heating)						
Efficiency of boilers	95.00					(367a)
Primary energy from boilers	$[(307a) + (310a)] \times 100 \div (367a) =$	4173.71	x	1.22	=	5091.93 (367)
Electrical energy for community heat distribution	39.65	x	3.07	=	121.73	(372)
Total primary energy associated with community systems					5213.65	(373)
Total primary energy associated with space and water heating					5213.65	(376)
Pumps and fans	50.97	x	3.07	=	156.47	(378)
Electricity for lighting	360.17	x	3.07	=	1105.73	(379)

Primary energy kWh/year	6475.86	(383)
Dwelling primary energy rate kWh/m ² /year	80.61	(384)

DER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	04/12/2018
Address	3Bed Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	80.34 (1a) x	2.50 (2a) =	200.85 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 80.34 (4)		
Dwelling volume	(3a) + (3b) + (3c) + (3d)...(3n) = 200.85 (5)		

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	0 x 10 =	0 (7a)
Number of passive vents	0 x 10 =	0 (7b)
Number of flueless gas fires	0 x 40 =	0 (7c)

Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 0 ÷ (5) =	0.00 (8)
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If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	4.00 (17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.20 (18)
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Number of sides on which the dwelling is sheltered	2 (19)
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Shelter factor	1 - [0.075 x (19)] = 0.85 (20)
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Infiltration rate incorporating shelter factor	(18) x (20) = 0.17 (21)
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Infiltration rate modified for monthly wind speed:

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

(22)

Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18
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(22a)

Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.20
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(22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	0.50 (23a)
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If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A (23c)
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c) whole house extract ventilation or positive input ventilation from outside	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
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(24c)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
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(25)

3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² .K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K
Window			13.12	x 1.14	= 14.90		(27)
Party wall			51.59	x 0.00	= 0.00		(32)
External wall			38.33	x 0.24	= 9.20		(29a)
Roof			63.63	x 0.14	= 8.91		(30)
Total area of external elements ΣA, m ²			115.08				(31)
Fabric heat loss, W/K = Σ(A x U)						(26)...(30) + (32) =	33.01 (33)
Heat capacity Cm = Σ(A x κ)						(28)...(30) + (32) + (32a)...(32e) =	N/A (34)
Thermal mass parameter (TMP) in kJ/m ² .K							100.00 (35)
Thermal bridges: Σ(L x Ψ) calculated using Appendix K							22.32 (36)
Total fabric heat loss						(33) + (36) =	55.33 (37)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)											
33.14	33.14	33.14	33.14	33.14	33.14	33.14	33.14	33.14	33.14	33.14	33.14
Heat transfer coefficient, W/K (37)m + (38)m											
88.47	88.47	88.47	88.47	88.47	88.47	88.47	88.47	88.47	88.47	88.47	88.47
Average = Σ(39)1...12/12 =											
88.47 (39)											

Heat loss parameter (HLP), W/m ² .K (39)m ÷ (4)											
1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
Average = Σ(40)1...12/12 =											
1.10 (40)											

Number of days in month (Table 1a)											
31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00
(40)											

4. Water heating energy requirement

Assumed occupancy, N	2.47 (42)
Annual average hot water usage in litres per day V _{d,average} = (25 x N) + 36	92.85 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month V _{d,m} = factor from Table 1c x (43)											
102.13	98.42	94.70	90.99	87.27	83.56	83.56	87.27	90.99	94.70	98.42	102.13
Σ(44)1...12 =											
1114.14 (44)											

Energy content of hot water used = 4.18 x V _{d,m} x nm x T _m /3600 kWh/month (see Tables 1b, 1c 1d)											
151.46	132.46	136.69	119.17	114.35	98.67	91.43	104.92	106.18	123.74	135.07	146.68
Σ(45)1...12 =											
1460.82 (45)											

Distribution loss 0.15 x (45)m											
22.72	19.87	20.50	17.88	17.15	14.80	13.72	15.74	15.93	18.56	20.26	22.00
(46)											

Storage volume (litres) including any solar or WWHRs storage within same vessel	1.00 (47)
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Water storage loss:

b) Manufacturer's declared loss factor is not known											
Hot water storage loss factor from Table 2 (kWh/litre/day)											
Volume factor from Table 2a											
Temperature factor from Table 2b											
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53)											
Enter (50) or (54) in (55)											
0.10 (55)											

Water storage loss calculated for each month (55) x (41)m											
3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24
(56)											

If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - Vs] ÷ (47), else (56)

3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24	(57)
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Primary circuit loss for each month from Table 3

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)
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Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
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Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

177.96	156.40	163.19	144.82	140.85	124.32	117.94	131.42	131.82	150.24	160.72	173.18	(62)
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Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
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Output from water heater for each month (kWh/month) (62)m + (63)m

177.96	156.40	163.19	144.82	140.85	124.32	117.94	131.42	131.82	150.24	160.72	173.18	
$\Sigma(64)1...12 =$											1772.84	(64)

Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

71.56	63.19	66.65	60.14	59.22	53.33	51.60	56.09	55.82	62.34	65.43	69.97	(65)
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5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

20.39	18.11	14.73	11.15	8.34	7.04	7.61	9.89	13.27	16.85	19.66	20.96	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

220.15	222.43	216.68	204.42	188.95	174.41	164.70	162.41	168.17	180.43	195.90	210.44	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	(69)
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Pump and fan gains (Table 5a)

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
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Losses e.g. evaporation (Table 5)

-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	(71)
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Water heating gains (Table 5)

96.18	94.04	89.58	83.53	79.60	74.06	69.36	75.39	77.53	83.79	90.87	94.05	(72)
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Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

396.77	394.62	381.03	359.14	336.93	315.55	301.70	307.72	319.01	341.11	366.47	385.48	(73)
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6. Solar gains

	Access factor Table 6d		Area m ²		Solar flux W/m ²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
SouthEast	0.77	x	10.59	x	36.79	x 0.9 x	0.45	x	0.80	=	97.21	(77)
NorthEast	0.77	x	2.53	x	11.28	x 0.9 x	0.45	x	0.80	=	7.12	(75)

Solar gains in watts $\Sigma(74)m...(82)m$

104.33	180.08	252.68	323.61	372.08	373.62	358.45	321.64	277.14	200.72	125.39	89.01	(83)
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Total gains - internal and solar (73)m + (83)m

501.10	574.70	633.71	682.75	709.01	689.17	660.15	629.36	596.14	541.83	491.86	474.49	(84)
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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1(°C)											21.00	(85)
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Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area n1,m (see Table 9a)												

0.96	0.95	0.92	0.87	0.78	0.65	0.52	0.56	0.74	0.88	0.95	0.97	(86)
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Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

18.75	19.01	19.41	19.92	20.39	20.74	20.90	20.87	20.61	20.00	19.27	18.68	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	(88)
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Utilisation factor for gains for rest of dwelling n2,m

0.96	0.94	0.90	0.84	0.74	0.59	0.42	0.46	0.68	0.86	0.94	0.96	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

16.99	17.36	17.94	18.66	19.31	19.75	19.93	19.91	19.61	18.79	17.75	16.88	(90)
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Living area fraction Living area ÷ (4) = 0.40

Mean internal temperature for the whole dwelling fLA x T1 + (1 - fLA) x T2												
17.69	18.02	18.53	19.16	19.74	20.15	20.32	20.29	20.01	19.27	18.36	17.60	(92)

Apply adjustment to the mean internal temperature from Table 4e where appropriate

17.69	18.02	18.53	19.16	19.74	20.15	20.32	20.29	20.01	19.27	18.36	17.60	(93)
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8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm												
0.94	0.92	0.88	0.82	0.73	0.60	0.46	0.49	0.68	0.84	0.92	0.95	(94)

Useful gains, ηmGm, W (94)m x (84)m

471.06	527.06	558.77	561.36	517.26	411.09	301.22	309.73	404.84	455.13	451.29	449.20	(95)
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Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
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Heat loss rate for mean internal temperature, Lm, W [(39)m x (93)m - (96)m]

1184.71	1160.51	1064.30	907.61	711.28	490.76	328.80	344.49	522.92	767.39	995.78	1185.39	(97)
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Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

530.95	425.68	376.12	249.30	144.35	0.00	0.00	0.00	0.00	232.32	392.03	547.73	
$\Sigma(98)1...5, 10...12 =$											2898.48	(98)

Space heating requirement kWh/m²/year (98) ÷ (4) = 36.08

9b. Energy requirements - community heating scheme

Fraction of space heat from secondary/supplementary system (table 11)	'0' if none	0.00	(301)
Fraction of space heat from community system	1 - (301) =	1.00	(302)
Fraction of community heat from boilers		1.00	(303a)
Fraction of total space heat from community boilers	(302) x (303a) =	1.00	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating		1.00	(305)
Factor for charging method (Table 4c(3)) for community water heating		1.00	(305a)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating

Annual space heating requirement	2898.48	(98)
Space heat from boilers	$(98) \times (304a) \times (305) \times (306) =$	3043.41 (307)

Water heating

Annual water heating requirement	1772.84	(64)
Water heat from boilers	$(64) \times (303a) \times (305a) \times (306) =$	1861.48 (310)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	49.05 (313)

Electricity for pumps, fans and electric keep-hot (Table 4f)				
mechanical ventilation fans - balanced, extract or positive input from outside	50.97			(330a)
Total electricity for the above, kWh/year			50.97	(331)
Electricity for lighting (Appendix L)			360.17	(332)
Total delivered energy for all uses	(307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) =		5316.03	(338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from boilers	3043.41	x	4.24	x 0.01 =	129.04	(340a)
Water heating from boilers	1861.48	x	4.24	x 0.01 =	78.93	(342a)
Pumps and fans	50.97	x	13.19	x 0.01 =	6.72	(349)
Electricity for lighting	360.17	x	13.19	x 0.01 =	47.51	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)...(342e) + (345)...(354) =		382.20	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.28	(357)
SAP value	82.13	
SAP rating (section 13)	82	(358)
SAP band	B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from other sources (space heating)						
Efficiency of boilers	95.00					(367a)
CO ₂ emissions from boilers	[(307a)+(310a)] x 100 ÷ (367a) =	5163.04	x	0.216	=	1115.22 (367)
Electrical energy for community heat distribution	49.05	x	0.519	=	25.46	(372)
Total CO ₂ associated with community systems					1140.67	(373)
Total CO ₂ associated with space and water heating					1140.67	(376)
Pumps and fans	50.97	x	0.519	=	26.45	(378)
Electricity for lighting	360.17	x	0.519	=	186.93	(379)
Total CO ₂ , kg/year				(376)..(382) =	1354.06	(383)
Dwelling CO ₂ emission rate				(383) ÷ (4) =	16.85	(384)
EI value					85.52	
EI rating (section 14)					86	(385)
EI band					B	

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary energy from other sources (space heating)						
Efficiency of boilers	95.00					(367a)
Primary energy from boilers	[(307a)+(310a)] x 100 ÷ (367a) =	5163.04	x	1.22	=	6298.91 (367)
Electrical energy for community heat distribution	49.05	x	3.07	=	150.58	(372)
Total primary energy associated with community systems					6449.49	(373)
Total primary energy associated with space and water heating					6449.49	(376)
Pumps and fans	50.97	x	3.07	=	156.47	(378)

Electricity for lighting	360.17	x	3.07	=	1105.73	(379)
Primary energy kWh/year					7711.69	(383)
Dwelling primary energy rate kWh/m ² /year					95.99	(384)

DER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	04/12/2018
Address	4Bed Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	95.12 (1a) x	2.50 (2a) =	237.80 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 95.12 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) =	237.80 (5)

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	0 x 10 =	0 (7a)
Number of passive vents	0 x 10 =	0 (7b)
Number of flueless gas fires	0 x 40 =	0 (7c)

Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 0 ÷ (5) =	0.00 (8)
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If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	4.00 (17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.20 (18)
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Number of sides on which the dwelling is sheltered	2 (19)
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Shelter factor	1 - [0.075 x (19)] = 0.85 (20)
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Infiltration rate incorporating shelter factor	(18) x (20) = 0.17 (21)
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Infiltration rate modified for monthly wind speed:	
	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Monthly average wind speed from Table U2	5.10 5.00 4.90 4.40 4.30 3.80 3.80 3.70 4.00 4.30 4.50 4.70 (22)

Wind factor (22)m ÷ 4	1.28 1.25 1.23 1.10 1.08 0.95 0.93 1.00 1.08 1.13 1.18 (22a)
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.22 0.21 0.21 0.19 0.18 0.16 0.16 0.17 0.18 0.19 0.20 (22b)
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Calculate effective air change rate for the applicable case:	
If mechanical ventilation: air change rate through system	0.50 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A (23c)
c) whole house extract ventilation or positive input ventilation from outside	0.50 0.50 0.50 0.50 0.50 0.50 0.50 0.50 0.50 0.50 0.50 (24c)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.50 0.50 0.50 0.50 0.50 0.50 0.50 0.50 0.50 0.50 0.50 (25)
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K
Window			15.04	x 1.14 =	17.08		(27)
Exposed floor			95.12	x 0.14 =	13.32		(28b)
Party wall			57.93	x 0.00 =	0.00		(32)
External wall			35.19	x 0.24 =	8.45		(29a)
Total area of external elements ΣA, m ²			145.35				(31)
Fabric heat loss, W/K = Σ(A x U)						(26)...(30) + (32) =	38.85 (33)
Heat capacity Cm = Σ(A x κ)						(28)...(30) + (32) + (32a)...(32e) =	N/A (34)
Thermal mass parameter (TMP) in kJ/m ² K							100.00 (35)
Thermal bridges: Σ(L x Ψ) calculated using Appendix K							17.51 (36)
Total fabric heat loss						(33) + (36) =	56.36 (37)

Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
	39.24 39.24 39.24 39.24 39.24 39.24 39.24 39.24 39.24 39.24 39.24 39.24 (38)
Heat transfer coefficient, W/K (37)m + (38)m	95.60 95.60 95.60 95.60 95.60 95.60 95.60 95.60 95.60 95.60 95.60 95.60
	Average = Σ(39)1...12/12 = 95.60 (39)

Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	1.01 1.01 1.01 1.01 1.01 1.01 1.01 1.01 1.01 1.01 1.01 1.01
	Average = Σ(40)1...12/12 = 1.01 (40)

Number of days in month (Table 1a)	31.00 28.00 31.00 30.00 31.00 30.00 31.00 31.00 30.00 31.00 30.00 31.00 (40)
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4. Water heating energy requirement

Assumed occupancy, N	2.69 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	98.08 (43)

	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	107.88 103.96 100.04 96.11 92.19 88.27 88.27 92.19 96.11 100.04 103.96 107.88
	Σ(44)1...12 = 1176.91 (44)

Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	159.99 139.93 144.39 125.88 120.79 104.23 96.59 110.83 112.16 130.71 142.68 154.94
	Σ(45)1...12 = 1543.12 (45)

Distribution loss 0.15 x (45)m	24.00 20.99 21.66 18.88 18.12 15.63 14.49 16.63 16.82 19.61 21.40 23.24 (46)
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Storage volume (litres) including any solar or WWHRs storage within same vessel	2.00 (47)
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Water storage loss:	
b) Manufacturer's declared loss factor is not known	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.02 (51)
Volume factor from Table 2a	3.91 (52)
Temperature factor from Table 2b	1.00 (53)
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53)	0.17 (54)
Enter (50) or (54) in (55)	0.17 (55)

Water storage loss calculated for each month (55) x (41)m	5.14 4.64 5.14 4.97 5.14 4.97 5.14 4.97 5.14 4.97 5.14 5.14 (56)
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If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - Vs] ÷ (47), else (56)

5.14	4.64	5.14	4.97	5.14	4.97	5.14	5.14	4.97	5.14	4.97	5.14	(57)
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Primary circuit loss for each month from Table 3

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)
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Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
------	------	------	------	------	------	------	------	------	------	------	------	------

Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

188.39	165.58	172.79	153.37	149.19	131.72	124.99	139.24	139.64	159.11	170.17	183.34	(62)
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Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
------	------	------	------	------	------	------	------	------	------	------	------	------

Output from water heater for each month (kWh/month) (62)m + (63)m

188.39	165.58	172.79	153.37	149.19	131.72	124.99	139.24	139.64	159.11	170.17	183.34	
$\Sigma(64)1...12 =$											1877.54	(64)

Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

75.92	67.05	70.73	63.85	62.88	56.65	54.84	59.57	59.28	66.18	69.43	74.24	(65)
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5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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Metabolic gains (Table 5)

134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	(66)
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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

23.14	20.55	16.71	12.65	9.46	7.99	8.63	11.22	15.05	19.11	22.31	23.78	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

248.19	250.76	244.27	230.46	213.02	196.63	185.67	183.10	189.59	203.41	220.85	237.24	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	(69)
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Pump and fan gains (Table 5a)

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
------	------	------	------	------	------	------	------	------	------	------	------	------

Losses e.g. evaporation (Table 5)

-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	(71)
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Water heating gains (Table 5)

102.04	99.77	95.07	88.67	84.52	78.68	73.71	80.07	82.34	88.96	96.43	99.78	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

436.71	434.43	419.40	395.13	370.34	346.63	331.35	337.73	350.32	374.82	402.93	424.15	(73)
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6. Solar gains

	Access factor Table 6d		Area m ²		Solar flux W/m ²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
NorthEast	0.77	x	5.65	x	11.28	x 0.9 x	0.45	x	0.80	=	15.90	(75)
SouthEast	0.77	x	9.39	x	36.79	x 0.9 x	0.45	x	0.80	=	86.19	(77)

Solar gains in watts $\Sigma(74)m...(82)m$

102.10	179.19	259.21	344.69	407.55	414.05	395.26	346.92	288.59	201.83	123.25	86.75	(83)
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Total gains - internal and solar (73)m + (83)m

538.81	613.63	678.61	739.82	777.89	760.68	726.61	684.65	638.91	576.65	526.18	510.90	(84)
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7. Mean internal temperature (heating season)

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
											21.00	(85)

Utilisation factor for gains for living area n1,m (see Table 9a)

0.97	0.95	0.93	0.88	0.79	0.65	0.52	0.56	0.75	0.90	0.96	0.97	(86)
------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

18.88	19.11	19.50	20.00	20.45	20.78	20.92	20.89	20.64	20.06	19.37	18.81	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	(88)
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Utilisation factor for gains for rest of dwelling n2,m

0.96	0.95	0.92	0.86	0.75	0.59	0.43	0.47	0.70	0.88	0.95	0.97	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

17.22	17.56	18.12	18.82	19.45	19.86	20.02	20.00	19.71	18.92	17.93	17.12	(90)
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Living area fraction Living area ÷ (4) = 0.15 (91)

Mean internal temperature for the whole dwelling fLA x T1 + (1 - fLA) x T2

17.46	17.79	18.32	18.99	19.60	20.00	20.15	20.13	19.85	19.09	18.14	17.36	(92)
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Apply adjustment to the mean internal temperature from Table 4e where appropriate

17.46	17.79	18.32	18.99	19.60	20.00	20.15	20.13	19.85	19.09	18.14	17.36	(93)
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8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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Utilisation factor for gains, ηm

0.95	0.93	0.89	0.83	0.73	0.58	0.44	0.48	0.68	0.85	0.93	0.95	(94)
------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, ηmGm, W (94)m x (84)m

510.03	568.03	604.60	612.97	566.71	444.89	317.41	327.34	435.63	490.15	486.99	486.74	(95)
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Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
------	------	------	------	-------	-------	-------	-------	-------	-------	------	------	------

Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]

1257.81	1232.00	1130.35	964.69	754.83	515.93	339.36	356.42	549.63	811.26	1055.29	1258.35	(97)
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Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

556.35	446.19	391.16	253.24	139.95	0.00	0.00	0.00	0.00	238.90	409.18	574.08	
$\Sigma(98)1...5, 10...12 =$											3009.05	(98)

Space heating requirement kWh/m²/year (98) ÷ (4) = 31.63 (99)

9b. Energy requirements - community heating scheme

Fraction of space heat from secondary/supplementary system (table 11)	'0' if none	0.00	(301)
Fraction of space heat from community system	1 - (301) =	1.00	(302)
Fraction of community heat from boilers		1.00	(303a)
Fraction of total space heat from community boilers	(302) x (303a) =	1.00	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating		1.00	(305)
Factor for charging method (Table 4c(3)) for community water heating		1.00	(305a)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating

Annual space heating requirement	3009.05	(98)
Space heat from boilers	$(98) \times (304a) \times (305) \times (306) =$	3159.50 (307)

Water heating

Annual water heating requirement	1877.54	(64)
Water heat from boilers	$(64) \times (303a) \times (305a) \times (306) =$	1971.41 (310)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	51.31 (313)

Electricity for pumps, fans and electric keep-hot (Table 4f)			
mechanical ventilation fans - balanced, extract or positive input from outside	60.34		(330a)
Total electricity for the above, kWh/year		60.34	(331)
Electricity for lighting (Appendix L)		408.63	(332)
Total delivered energy for all uses	(307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) =	5599.89	(338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from boilers	3159.50	x	4.24	x 0.01 =	133.96	(340a)
Water heating from boilers	1971.41	x	4.24	x 0.01 =	83.59	(342a)
Pumps and fans	60.34	x	13.19	x 0.01 =	7.96	(349)
Electricity for lighting	408.63	x	13.19	x 0.01 =	53.90	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)...(342e) + (345)...(354) =		399.41	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.20	(357)
SAP value	83.30	
SAP rating (section 13)	83	(358)
SAP band	B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from other sources (space heating)						
Efficiency of boilers	95.00					(367a)
CO ₂ emissions from boilers	[(307a)+(310a)] x 100 ÷ (367a) = 5400.97	x	0.216	=	1166.61	(367)
Electrical energy for community heat distribution	51.31	x	0.519	=	26.63	(372)
Total CO ₂ associated with community systems					1193.24	(373)
Total CO ₂ associated with space and water heating					1193.24	(376)
Pumps and fans	60.34	x	0.519	=	31.32	(378)
Electricity for lighting	408.63	x	0.519	=	212.08	(379)
Total CO ₂ , kg/year				(376)...(382) =	1436.63	(383)
Dwelling CO ₂ emission rate				(383) ÷ (4) =	15.10	(384)
EI value					86.26	
EI rating (section 14)					86	(385)
EI band					B	

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary energy from other sources (space heating)						
Efficiency of boilers	95.00					(367a)
Primary energy from boilers	[(307a)+(310a)] x 100 ÷ (367a) = 5400.97	x	1.22	=	6589.18	(367)
Electrical energy for community heat distribution	51.31	x	3.07	=	157.52	(372)
Total primary energy associated with community systems					6746.70	(373)
Total primary energy associated with space and water heating					6746.70	(376)
Pumps and fans	60.34	x	3.07	=	185.26	(378)

Electricity for lighting	408.63	x	3.07	=	1254.49	(379)
Primary energy kWh/year					8186.44	(383)
Dwelling primary energy rate kWh/m ² /year					86.06	(384)

DER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	04/12/2018
Address	4Bed Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	95.12 (1a) x	2.50 (2a) =	237.80 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 95.12 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) = 237.80 (5)	

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	0 x 10 =	0 (7a)
Number of passive vents	0 x 10 =	0 (7b)
Number of flueless gas fires	0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 0 ÷ (5) = 0.00 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q₅₀, expressed in cubic metres per hour per square metre of envelope area (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) (18)

Number of sides on which the dwelling is sheltered (19)

Shelter factor 1 - [0.075 x (19)] = (20)

Infiltration rate incorporating shelter factor (18) x (20) = (21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70 (22)

Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18 (22a)
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.20 (22b)
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system (23a)

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h (23c)

c) whole house extract ventilation or positive input ventilation from outside (24c)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25) (25)

3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² .K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K
Window			15.04	x 1.14	= 17.08		(27)
Party wall			57.92	x 0.00	= 0.00		(32)
External wall			35.19	x 0.24	= 8.45		(29a)
Total area of external elements ΣA, m ²			50.23				(31)
Fabric heat loss, W/K = Σ(A × U)						(26)...(30) + (32) =	25.53 (33)
Heat capacity Cm = Σ(A × κ)						(28)...(30) + (32) + (32a)...(32e) =	N/A (34)
Thermal mass parameter (TMP) in kJ/m ² .K							100.00 (35)
Thermal bridges: Σ(L × Ψ) calculated using Appendix K							10.77 (36)
Total fabric heat loss						(33) + (36) =	36.30 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	39.24	39.24	39.24	39.24	39.24	39.24	39.24	39.24	39.24	39.24	39.24	39.24 (38)

Heat transfer coefficient, W/K (37)m + (38)m	75.54	75.54	75.54	75.54	75.54	75.54	75.54	75.54	75.54	75.54	75.54	75.54 (39)
Average = Σ(39)1...12/12 =												

Heat loss parameter (HLP), W/m ² .K (39)m ÷ (4)	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79 (40)
Average = Σ(40)1...12/12 =												

Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00 (40)
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4. Water heating energy requirement

Assumed occupancy, N	2.69 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	98.08 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	107.88	103.96	100.04	96.11	92.19	88.27	88.27	92.19	96.11	100.04	103.96	107.88
Σ(44)1...12 =												

Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	159.99	139.93	144.39	125.88	120.79	104.23	96.59	110.83	112.16	130.71	142.68	154.94
Σ(45)1...12 =												

Distribution loss 0.15 x (45)m	24.00	20.99	21.66	18.88	18.12	15.63	14.49	16.63	16.82	19.61	21.40	23.24 (46)
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Storage volume (litres) including any solar or WWHRs storage within same vessel (47)

Water storage loss:

b) Manufacturer's declared loss factor is not known	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.02 (51)
Volume factor from Table 2a	3.91 (52)
Temperature factor from Table 2b	1.00 (53)
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53)	0.17 (54)
Enter (50) or (54) in (55)	0.17 (55)

Water storage loss calculated for each month (55) x (41)m	5.14	4.64	5.14	4.97	5.14	4.97	5.14	5.14	4.97	5.14	4.97	5.14 (56)
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If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - Vs] ÷ (47), else (56)	5.14	4.64	5.14	4.97	5.14	4.97	5.14	5.14	4.97	5.14	4.97	5.14 (57)
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Primary circuit loss for each month from Table 3

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)
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Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
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Total heat required for water heating calculated for each month $0.85 \times (45)\text{m} + (46)\text{m} + (57)\text{m} + (61)\text{m}$

188.39	165.58	172.79	153.37	149.19	131.72	124.99	139.24	139.64	159.11	170.17	183.34	(62)
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Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
------	------	------	------	------	------	------	------	------	------	------	------	------

Output from water heater for each month (kWh/month) (62)m + (63)m

188.39	165.58	172.79	153.37	149.19	131.72	124.99	139.24	139.64	159.11	170.17	183.34	
$\Sigma(64)1...12 =$											1877.54	(64)

Heat gains from water heating (kWh/month) $0.25 \times [0.85 \times (45)\text{m} + (61)\text{m}] + 0.8 \times [(46)\text{m} + (57)\text{m} + (59)\text{m}]$

75.92	67.05	70.73	63.85	62.88	56.65	54.84	59.57	59.28	66.18	69.43	74.24	(65)
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5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)												
134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

23.14	20.55	16.71	12.65	9.46	7.99	8.63	11.22	15.05	19.11	22.31	23.78	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

248.19	250.76	244.27	230.46	213.02	196.63	185.67	183.10	189.59	203.41	220.85	237.24	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	(69)
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Pump and fan gains (Table 5a)

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
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Losses e.g. evaporation (Table 5)

-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	(71)
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Water heating gains (Table 5)

102.04	99.77	95.07	88.67	84.52	78.68	73.71	80.07	82.34	88.96	96.43	99.78	(72)
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Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

436.71	434.43	419.40	395.13	370.34	346.63	331.35	337.73	350.32	374.82	402.93	424.15	(73)
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6. Solar gains

	Access factor Table 6d		Area m ²		Solar flux W/m ²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
NorthEast	0.77	x	5.65	x	11.28	x 0.9 x	0.45	x	0.80	=	15.90	(75)
SouthEast	0.77	x	9.39	x	36.79	x 0.9 x	0.45	x	0.80	=	86.19	(77)

Solar gains in watts $\Sigma(74)\text{m}...(82)\text{m}$

102.10	179.19	259.21	344.69	407.55	414.05	395.26	346.92	288.59	201.83	123.25	86.75	(83)
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Total gains - internal and solar (73)m + (83)m

538.81	613.63	678.61	739.82	777.89	760.68	726.61	684.65	638.91	576.65	526.18	510.90	(84)
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7. Mean internal temperature (heating season)

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	21.00	(85)
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Utilisation factor for gains for living area n1,m (see Table 9a)

0.97	0.95	0.91	0.84	0.73	0.58	0.44	0.48	0.69	0.87	0.95	0.97	(86)
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Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.41	19.64	19.98	20.38	20.71	20.90	20.97	20.96	20.82	20.39	19.82	19.34	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.26	20.26	20.26	20.26	20.26	20.26	20.26	20.26	20.26	20.26	20.26	20.26	(88)
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Utilisation factor for gains for rest of dwelling n2,m

0.96	0.94	0.90	0.82	0.69	0.52	0.37	0.41	0.64	0.85	0.94	0.97	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

18.10	18.43	18.91	19.48	19.92	20.16	20.24	20.23	20.07	19.51	18.69	18.00	(90)
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Living area fraction Living area ÷ (4) =

0.15

Mean internal temperature for the whole dwelling fLA x T1 + (1 - fLA) x T2

18.29	18.60	19.07	19.61	20.04	20.27	20.34	20.33	20.18	19.64	18.85	18.20	(92)
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Apply adjustment to the mean internal temperature from Table 4e where appropriate

18.29	18.60	19.07	19.61	20.04	20.27	20.34	20.33	20.18	19.64	18.85	18.20	(93)
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8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm												
0.95	0.92	0.88	0.80	0.68	0.52	0.38	0.42	0.63	0.83	0.92	0.95	(94)

Useful gains, ηmGm, W (94)m x (84)m

509.23	564.80	596.14	593.47	530.83	398.32	275.21	286.44	402.89	478.23	484.35	486.45	(95)
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Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
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Heat loss rate for mean internal temperature, Lm, W [(39)m x (96)m]

1056.90	1035.18	949.49	808.80	629.80	428.46	282.78	297.15	459.48	682.61	887.97	1057.34	(97)
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Space heating requirement, kWh/month $0.024 \times [(97)\text{m} - (95)\text{m}] \times (41)\text{m}$

407.47	316.09	262.90	155.04	73.63	0.00	0.00	0.00	0.00	152.06	290.61	424.74	
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$\Sigma(98)1...5, 10...12 =$

2082.54

Space heating requirement kWh/m²/year

(98) ÷ (4)

21.89

9b. Energy requirements - community heating scheme

Fraction of space heat from secondary/supplementary system (table 11)	'0' if none	0.00	(301)
Fraction of space heat from community system	1 - (301) =	1.00	(302)
Fraction of community heat from boilers		1.00	(303a)
Fraction of total space heat from community boilers	(302) x (303a) =	1.00	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating		1.00	(305)
Factor for charging method (Table 4c(3)) for community water heating		1.00	(305a)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating

Annual space heating requirement	2082.54	(98)
Space heat from boilers	$(98) \times (304a) \times (305) \times (306) =$	2186.66 (307)

Water heating

Annual water heating requirement	1877.54	(64)
Water heat from boilers	$(64) \times (303a) \times (305a) \times (306) =$	1971.41 (310)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	41.58 (313)

Electricity for pumps, fans and electric keep-hot (Table 4f)

mechanical ventilation fans - balanced, extract or positive input from outside	60.34	(330a)
Total electricity for the above, kWh/year	60.34	(331)
Electricity for lighting (Appendix L)	408.63	(332)
Total delivered energy for all uses	$(307) + (309) + (310) + (312) + (315) + (331) + (332) \dots (337b) =$	4627.05 (338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from boilers	2186.66	x	4.24	x 0.01 =	92.71	(340a)
Water heating from boilers	1971.41	x	4.24	x 0.01 =	83.59	(342a)
Pumps and fans	60.34	x	13.19	x 0.01 =	7.96	(349)
Electricity for lighting	408.63	x	13.19	x 0.01 =	53.90	(350)
Additional standing charges					120.00	(351)
Total energy cost			$(340a) \dots (342e) + (345) \dots (354) =$		358.16	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.07	(357)
SAP value	85.02	
SAP rating (section 13)	85	(358)
SAP band	B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from other sources (space heating)						
Efficiency of boilers	95.00					(367a)
CO ₂ emissions from boilers	$[(307a)+(310a)] \times 100 \div (367a) =$	4376.92	x	0.216	=	945.42 (367)
Electrical energy for community heat distribution	41.58	x	0.519	=	21.58	(372)
Total CO ₂ associated with community systems					967.00	(373)
Total CO ₂ associated with space and water heating					967.00	(376)
Pumps and fans	60.34	x	0.519	=	31.32	(378)
Electricity for lighting	408.63	x	0.519	=	212.08	(379)
Total CO ₂ , kg/year				$(376) \dots (382) =$	1210.39	(383)
Dwelling CO ₂ emission rate				$(383) \div (4) =$	12.72	(384)
EI value					88.42	
EI rating (section 14)					88	(385)
EI band					B	

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary energy from other sources (space heating)						
Efficiency of boilers	95.00					(367a)
Primary energy from boilers	$[(307a)+(310a)] \times 100 \div (367a) =$	4376.92	x	1.22	=	5339.84 (367)
Electrical energy for community heat distribution	41.58	x	3.07	=	127.65	(372)
Total primary energy associated with community systems					5467.50	(373)
Total primary energy associated with space and water heating					5467.50	(376)
Pumps and fans	60.34	x	3.07	=	185.26	(378)
Electricity for lighting	408.63	x	3.07	=	1254.49	(379)

Primary energy kWh/year	6907.24	(383)
Dwelling primary energy rate kWh/m ² /year	72.62	(384)

DER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	04/12/2018
Address	4Bed Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	95.12 (1a) x	2.50 (2a) =	237.80 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =		95.12 (4)
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) =	237.80 (5)

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	0 x 10 =	0 (7a)
Number of passive vents	0 x 10 =	0 (7b)
Number of flueless gas fires	0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 0 ÷ (5) = 0.00 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	4.00 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.20 (18)
Number of sides on which the dwelling is sheltered	2 (19)
Shelter factor	1 - [0.075 x (19)] = 0.85 (20)
Infiltration rate incorporating shelter factor	(18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70

Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.17	0.18	0.19	0.20
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system 0.50 (23a)

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h N/A (23c)

c) whole house extract ventilation or positive input ventilation from outside	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K
Window			15.04	x 1.14	= 17.08		(27)
Party wall			57.93	x 0.00	= 0.00		(32)
External wall			35.19	x 0.24	= 8.45		(29a)
Roof			95.12	x 0.14	= 13.32		(30)
Total area of external elements ΣA, m ²			145.35				(31)
Fabric heat loss, W/K = Σ(A x U)						(26)...(30) + (32) =	38.85 (33)
Heat capacity Cm = Σ(A x κ)						(28)...(30) + (32) + (32a)...(32e) =	N/A (34)
Thermal mass parameter (TMP) in kJ/m ² K							100.00 (35)
Thermal bridges: Σ(L x Ψ) calculated using Appendix K							23.93 (36)
Total fabric heat loss						(33) + (36) =	62.78 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	39.24	39.24	39.24	39.24	39.24	39.24	39.24	39.24	39.24	39.24	39.24	39.24
Heat transfer coefficient, W/K (37)m + (38)m	102.02	102.02	102.02	102.02	102.02	102.02	102.02	102.02	102.02	102.02	102.02	102.02
Average = Σ(39)1...12/12 =												102.02 (39)

Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Average = Σ(40)1...12/12 =												1.07 (40)

Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00
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4. Water heating energy requirement

Assumed occupancy, N	2.69 (42)
Annual average hot water usage in litres per day V _{d,average} = (25 x N) + 36	98.08 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month V _{d,m} = factor from Table 1c x (43)	107.88	103.96	100.04	96.11	92.19	88.27	88.27	92.19	96.11	100.04	103.96	107.88
Σ(44)1...12 =												1176.91 (44)

Energy content of hot water used = 4.18 x V _{d,m} x nm x T _m /3600 kWh/month (see Tables 1b, 1c 1d)	159.99	139.93	144.39	125.88	120.79	104.23	96.59	110.83	112.16	130.71	142.68	154.94
Σ(45)1...12 =												1543.12 (45)

Distribution loss 0.15 x (45)m	24.00	20.99	21.66	18.88	18.12	15.63	14.49	16.63	16.82	19.61	21.40	23.24
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Storage volume (litres) including any solar or WWHRs storage within same vessel	2.00 (47)
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Water storage loss:

b) Manufacturer's declared loss factor is not known	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.02 (51)
Volume factor from Table 2a	3.91 (52)
Temperature factor from Table 2b	1.00 (53)
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53)	0.17 (54)
Enter (50) or (54) in (55)	0.17 (55)

Water storage loss calculated for each month (55) x (41)m	5.14	4.64	5.14	4.97	5.14	4.97	5.14	5.14	4.97	5.14	4.97	5.14
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If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - Vs] ÷ (47), else (56)

5.14	4.64	5.14	4.97	5.14	4.97	5.14	5.14	4.97	5.14	4.97	5.14	(57)
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Primary circuit loss for each month from Table 3

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)
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Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
------	------	------	------	------	------	------	------	------	------	------	------	------

Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

188.39	165.58	172.79	153.37	149.19	131.72	124.99	139.24	139.64	159.11	170.17	183.34	(62)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
------	------	------	------	------	------	------	------	------	------	------	------	------

Output from water heater for each month (kWh/month) (62)m + (63)m

188.39	165.58	172.79	153.37	149.19	131.72	124.99	139.24	139.64	159.11	170.17	183.34	
$\Sigma(64)1...12 =$											1877.54	(64)

Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

75.92	67.05	70.73	63.85	62.88	56.65	54.84	59.57	59.28	66.18	69.43	74.24	(65)
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5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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Metabolic gains (Table 5)

134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	(66)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

23.14	20.55	16.71	12.65	9.46	7.99	8.63	11.22	15.05	19.11	22.31	23.78	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

248.19	250.76	244.27	230.46	213.02	196.63	185.67	183.10	189.59	203.41	220.85	237.24	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	(69)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pump and fan gains (Table 5a)

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
------	------	------	------	------	------	------	------	------	------	------	------	------

Losses e.g. evaporation (Table 5)

-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	(71)
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Water heating gains (Table 5)

102.04	99.77	95.07	88.67	84.52	78.68	73.71	80.07	82.34	88.96	96.43	99.78	(72)
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Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

436.71	434.43	419.40	395.13	370.34	346.63	331.35	337.73	350.32	374.82	402.93	424.15	(73)
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6. Solar gains

	Access factor Table 6d		Area m ²		Solar flux W/m ²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
NorthEast	0.77	x	5.65	x	11.28	x 0.9 x	0.45	x	0.80	=	15.90	(75)
SouthEast	0.77	x	9.39	x	36.79	x 0.9 x	0.45	x	0.80	=	86.19	(77)

Solar gains in watts $\Sigma(74)m...(82)m$

102.10	179.19	259.21	344.69	407.55	414.05	395.26	346.92	288.59	201.83	123.25	86.75	(83)
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Total gains - internal and solar (73)m + (83)m

538.81	613.63	678.61	739.82	777.89	760.68	726.61	684.65	638.91	576.65	526.18	510.90	(84)
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7. Mean internal temperature (heating season)

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	21.00	(85)
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Utilisation factor for gains for living area n1,m (see Table 9a)

0.97	0.96	0.93	0.88	0.80	0.67	0.54	0.58	0.77	0.90	0.96	0.97	(86)
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Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

18.72	18.96	19.37	19.88	20.37	20.73	20.89	20.87	20.59	19.96	19.23	18.65	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	(88)
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Utilisation factor for gains for rest of dwelling n2,m

0.97	0.95	0.92	0.86	0.76	0.61	0.44	0.49	0.71	0.88	0.95	0.97	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

16.96	17.31	17.89	18.62	19.30	19.77	19.95	19.92	19.60	18.75	17.71	16.86	(90)
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Living area fraction Living area ÷ (4) = 0.15 (91)

Mean internal temperature for the whole dwelling fLA x T1 + (1 - fLA) x T2

17.22	17.55	18.10	18.81	19.46	19.91	20.09	20.06	19.74	18.92	17.93	17.12	(92)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e where appropriate

17.22	17.55	18.10	18.81	19.46	19.91	20.09	20.06	19.74	18.92	17.93	17.12	(93)
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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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Utilisation factor for gains, ηm

0.95	0.93	0.89	0.83	0.74	0.60	0.45	0.49	0.69	0.85	0.93	0.95	(94)
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Useful gains, ηmGm, W (94)m x (84)m

509.97	568.39	605.97	616.57	573.98	455.38	327.84	337.15	442.43	492.26	487.27	486.59	(95)
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Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
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Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]

1317.63	1290.49	1183.88	1010.50	791.25	541.28	355.67	373.46	575.66	848.99	1104.89	1318.22	(97)
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Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

600.90	485.25	429.97	283.63	161.65	0.00	0.00	0.00	0.00	265.41	444.69	618.74	
$\Sigma(98)1...5, 10...12 =$											3290.23	(98)

Space heating requirement kWh/m²/year (98) ÷ (4) 34.59 (99)

9b. Energy requirements - community heating scheme

Fraction of space heat from secondary/supplementary system (table 11) '0' if none 0.00 (301)

Fraction of space heat from community system 1 - (301) = 1.00 (302)

Fraction of community heat from boilers 1.00 (303a)

Fraction of total space heat from community boilers (302) x (303a) = 1.00 (304a)

Factor for control and charging method (Table 4c(3)) for community space heating 1.00 (305)

Factor for charging method (Table 4c(3)) for community water heating 1.00 (305a)

Distribution loss factor (Table 12c) for community heating system 1.05 (306)

Space heating

Annual space heating requirement 3290.23 (98)

Space heat from boilers (98) x (304a) x (305) x (306) = 3454.74 (307a)

Water heating

Annual water heating requirement 1877.54 (64)

Water heat from boilers (64) x (303a) x (305a) x (306) = 1971.41 (310a)

Electricity used for heat distribution 0.01 x [(307a)...(307e) + (310a)...(310e)] = 54.26 (313)

Electricity for pumps, fans and electric keep-hot (Table 4f)				
mechanical ventilation fans - balanced, extract or positive input from outside	60.34			(330a)
Total electricity for the above, kWh/year			60.34	(331)
Electricity for lighting (Appendix L)			408.63	(332)
Total delivered energy for all uses	(307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) =		5895.12	(338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from boilers	3454.74	x	4.24	x 0.01 =	146.48	(340a)
Water heating from boilers	1971.41	x	4.24	x 0.01 =	83.59	(342a)
Pumps and fans	60.34	x	13.19	x 0.01 =	7.96	(349)
Electricity for lighting	408.63	x	13.19	x 0.01 =	53.90	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)...(342e) + (345)...(354) =		411.93	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.23	(357)
SAP value	82.78	
SAP rating (section 13)	83	(358)
SAP band	B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from other sources (space heating)						
Efficiency of boilers	95.00					(367a)
CO ₂ emissions from boilers	[(307a)+(310a)] x 100 ÷ (367a) = 5711.74	x	0.216	=	1233.74	(367)
Electrical energy for community heat distribution	54.26	x	0.519	=	28.16	(372)
Total CO ₂ associated with community systems					1261.90	(373)
Total CO ₂ associated with space and water heating					1261.90	(376)
Pumps and fans	60.34	x	0.519	=	31.32	(378)
Electricity for lighting	408.63	x	0.519	=	212.08	(379)
Total CO ₂ , kg/year				(376)...(382) =	1505.29	(383)
Dwelling CO ₂ emission rate				(383) ÷ (4) =	15.83	(384)
EI value					85.60	
EI rating (section 14)					86	(385)
EI band					B	

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary energy from other sources (space heating)						
Efficiency of boilers	95.00					(367a)
Primary energy from boilers	[(307a)+(310a)] x 100 ÷ (367a) = 5711.74	x	1.22	=	6968.32	(367)
Electrical energy for community heat distribution	54.26	x	3.07	=	166.58	(372)
Total primary energy associated with community systems					7134.90	(373)
Total primary energy associated with space and water heating					7134.90	(376)
Pumps and fans	60.34	x	3.07	=	185.26	(378)

Electricity for lighting	408.63	x	3.07	=	1254.49	(379)
Primary energy kWh/year					8574.65	(383)
Dwelling primary energy rate kWh/m ² /year					90.15	(384)

DER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	04/12/2018
Address	Studio Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	40.28 (1a) x	2.50 (2a) =	100.70 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 40.28 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) =	100.70 (5)

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	0 x 10 =	0 (7a)
Number of passive vents	0 x 10 =	0 (7b)
Number of flueless gas fires	0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 0 ÷ (5) = 0.00 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	4.00 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.20 (18)
Number of sides on which the dwelling is sheltered	3 (19)
Shelter factor	1 - [0.075 x (19)] = 0.78 (20)
Infiltration rate incorporating shelter factor	(18) x (20) = 0.16 (21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70 (22)

Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18 (22a)
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.20	0.19	0.19	0.17	0.17	0.15	0.15	0.14	0.16	0.17	0.17	0.18 (22b)
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	0.50	(23a)										
If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A	(23c)										
c) whole house extract ventilation or positive input ventilation from outside												
0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(24c)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50 (25)
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K
Window	7.85	x	1.14	=	8.92 (27)		
Exposed floor	40.28	x	0.08	=	3.22 (28b)		
Party wall	51.97	x	0.00	=	0.00 (32)		
External wall	6.71	x	0.24	=	1.61 (29a)		
Total area of external elements ΣA, m ²	54.84 (31)						
Fabric heat loss, W/K = Σ(A x U)					(26)...(30) + (32) = 13.75 (33)		
Heat capacity Cm = Σ(A x κ)					(28)...(30) + (32) + (32a)...(32e) = N/A (34)		
Thermal mass parameter (TMP) in kJ/m ² K					100.00 (35)		
Thermal bridges: Σ(L x Ψ) calculated using Appendix K					7.62 (36)		
Total fabric heat loss					(33) + (36) = 21.37 (37)		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	16.62	16.62	16.62	16.62	16.62	16.62	16.62	16.62	16.62	16.62	16.62	16.62 (38)
Heat transfer coefficient, W/K (37)m + (38)m	37.98	37.98	37.98	37.98	37.98	37.98	37.98	37.98	37.98	37.98	37.98	37.98 (39)
Average = Σ(39)1...12/12 =	37.98 (39)											

Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94 (40)
Average = Σ(40)1...12/12 =	0.94 (40)											

Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00 (40)
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4. Water heating energy requirement

Assumed occupancy, N	1.41												(42)														
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	67.78												(43)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec															
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	<table><tr><td>74.56</td><td>71.84</td><td>69.13</td><td>66.42</td><td>63.71</td><td>61.00</td><td>61.00</td><td>63.71</td><td>66.42</td><td>69.13</td><td>71.84</td><td>74.56</td></tr></table>													74.56	71.84	69.13	66.42	63.71	61.00	61.00	63.71	66.42	69.13	71.84	74.56	Σ(44)1...12 = 813.33	(44)
74.56	71.84	69.13	66.42	63.71	61.00	61.00	63.71	66.42	69.13	71.84	74.56																
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	<table><tr><td>110.56</td><td>96.70</td><td>99.79</td><td>87.00</td><td>83.47</td><td>72.03</td><td>66.75</td><td>76.59</td><td>77.51</td><td>90.33</td><td>98.60</td><td>107.07</td></tr></table>													110.56	96.70	99.79	87.00	83.47	72.03	66.75	76.59	77.51	90.33	98.60	107.07	Σ(45)1...12 = 1066.41	(45)
110.56	96.70	99.79	87.00	83.47	72.03	66.75	76.59	77.51	90.33	98.60	107.07																

Distribution loss 0.15 x (45)m	16.58	14.50	14.97	13.05	12.52	10.80	10.01	11.49	11.63	13.55	14.79	16.06 (46)
Storage volume (litres) including any solar or WWHRs storage within same vessel	1.00 (47)											

Water storage loss:												
b) Manufacturer's declared loss factor is not known												
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.02 (51)											
Volume factor from Table 2a	4.93 (52)											
Temperature factor from Table 2b	1.00 (53)											
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53)	0.10 (54)											
Enter (50) or (54) in (55)	0.10 (55)											

Water storage loss calculated for each month (55) x (41)m	3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24 (56)
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If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - Vs] ÷ (47), else (56)

	3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24	(57)
Primary circuit loss for each month from Table 3													
	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													
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m													
	137.06	120.64	126.29	112.64	109.97	97.68	93.25	103.09	103.15	116.83	124.25	133.58	(62)
Solar DHW input calculated using Appendix G or Appendix H													
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
Output from water heater for each month (kWh/month) (62)m + (63)m													
	137.06	120.64	126.29	112.64	109.97	97.68	93.25	103.09	103.15	116.83	124.25	133.58	
	$\Sigma(64)1...12 =$											1378.43	(64)
Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]													
	57.96	51.30	54.38	49.44	48.96	44.47	43.39	46.67	46.29	51.23	53.30	56.80	(65)

5. Internal gains													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)													
	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	11.01	9.78	7.95	6.02	4.50	3.80	4.10	5.33	7.16	9.09	10.61	11.31	(67)
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	122.24	123.51	120.31	113.51	104.92	96.84	91.45	90.18	93.38	100.18	108.77	116.84	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	(69)
Pump and fan gains (Table 5a)													
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
Losses e.g. evaporation (Table 5)													
	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	(71)
Water heating gains (Table 5)													
	77.91	76.34	73.09	68.67	65.80	61.76	58.33	62.73	64.29	68.86	74.03	76.35	(72)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
	255.36	253.83	245.56	232.40	219.42	206.61	198.09	202.45	209.03	222.34	237.62	248.71	(73)

6. Solar gains													
	Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W							
SouthEast	0.77	x	7.85	x	36.79	x 0.9 x	0.45	x	0.80	=	72.06	(77)	
Solar gains in watts $\Sigma(74)m...(82)m$													
	72.06	122.74	167.94	208.09	233.07	231.39	223.08	204.44	181.84	135.65	86.31	61.67	(83)
Total gains - internal and solar (73)m + (83)m													
	327.42	376.57	413.50	440.49	452.49	437.99	421.17	406.89	390.88	358.00	323.93	310.38	(84)

7. Mean internal temperature (heating season)													
Temperature during heating periods in the living area from Table 9, Th1(°C)												21.00	(85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area n1,m (see Table 9a)													
	0.93	0.89	0.84	0.76	0.65	0.51	0.38	0.41	0.59	0.78	0.89	0.94	(86)

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.42	19.68	20.03	20.41	20.72	20.90	20.97	20.96	20.84	20.45	19.86	19.34	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	(88)
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Utilisation factor for gains for rest of dwelling n2,m

0.92	0.88	0.82	0.74	0.61	0.45	0.31	0.34	0.53	0.75	0.88	0.93	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

18.03	18.40	18.89	19.41	19.82	20.04	20.11	20.10	19.98	19.48	18.66	17.91	(90)
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Living area fraction

Living area ÷ (4) = 0.62 (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

18.89	19.20	19.60	20.03	20.37	20.57	20.64	20.63	20.51	20.08	19.41	18.80	(92)
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Apply adjustment to the mean internal temperature from Table 4e where appropriate

18.89	19.20	19.60	20.03	20.37	20.57	20.64	20.63	20.51	20.08	19.41	18.80	(93)
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8. Space heating requirement														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, ηm														
	0.90	0.86	0.81	0.73	0.62	0.48	0.35	0.38	0.55	0.75	0.86	0.91	(94)	
Useful gains, ηmGm, W (94)m x (84)m														
	295.26	325.64	335.86	322.54	280.60	210.09	148.54	154.46	216.90	268.51	280.15	283.17	(95)	
Monthly average external temperature from Table U1														
	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)	
Heat loss rate for mean internal temperature, Lm, W [(39)m x (96)m]														
	554.17	543.10	497.64	422.84	329.48	226.89	153.54	160.84	243.59	360.23	467.39	554.44	(97)	
Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m														
	192.63	146.13	120.36	72.21	36.36	0.00	0.00	0.00	0.00	68.24	134.81	201.82		
	$\Sigma(98)1...5, 10...12 =$											972.57	(98)	
Space heating requirement kWh/m ² /year												(98) ÷ (4)	24.15	(99)

9b. Energy requirements - community heating scheme			
Fraction of space heat from secondary/supplementary system (table 11)	'0' if none	0.00	(301)
Fraction of space heat from community system	1 - (301) =	1.00	(302)
Fraction of community heat from boilers		1.00	(303a)
Fraction of total space heat from community boilers	(302) x (303a) =	1.00	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating		1.00	(305)
Factor for charging method (Table 4c(3)) for community water heating		1.00	(305a)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating

Annual space heating requirement 972.57 (98)

Space heat from boilers (98) x (304a) x (305) x (306) = 1021.20 (307a)

Water heating

Annual water heating requirement 1378.43 (64)

Water heat from boilers (64) x (303a) x (305a) x (306) = 1447.35 (310a)

Electricity used for heat distribution 0.01 x [(307a)...(307e) + (310a)...(310e)] = 24.69 (313)

Electricity for pumps, fans and electric keep-hot (Table 4f)

mechanical ventilation fans - balanced, extract or positive input from outside	25.55	(330a)
Total electricity for the above, kWh/year	25.55	(331)
Electricity for lighting (Appendix L)	194.38	(332)
Total delivered energy for all uses	(307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) = 2688.47	(338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from boilers	1021.20	x	4.24	x 0.01 =	43.30	(340a)
Water heating from boilers	1447.35	x	4.24	x 0.01 =	61.37	(342a)
Pumps and fans	25.55	x	13.19	x 0.01 =	3.37	(349)
Electricity for lighting	194.38	x	13.19	x 0.01 =	25.64	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)...(342e) + (345)...(354) =		253.68	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.25	(357)
SAP value	82.57	
SAP rating (section 13)	83	(358)
SAP band	B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from other sources (space heating)						
Efficiency of boilers	95.00					(367a)
CO ₂ emissions from boilers	[(307a)+(310a)] x 100 ÷ (367a) = 2598.47	x	0.216	=	561.27	(367)
Electrical energy for community heat distribution	24.69	x	0.519	=	12.81	(372)
Total CO ₂ associated with community systems					574.08	(373)
Total CO ₂ associated with space and water heating					574.08	(376)
Pumps and fans	25.55	x	0.519	=	13.26	(378)
Electricity for lighting	194.38	x	0.519	=	100.88	(379)
Total CO ₂ , kg/year				(376)...(382) =	688.22	(383)
Dwelling CO ₂ emission rate				(383) ÷ (4) =	17.09	(384)
EI value					89.19	
EI rating (section 14)					89	(385)
EI band					B	

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary energy from other sources (space heating)						
Efficiency of boilers	95.00					(367a)
Primary energy from boilers	[(307a)+(310a)] x 100 ÷ (367a) = 2598.47	x	1.22	=	3170.13	(367)
Electrical energy for community heat distribution	24.69	x	3.07	=	75.78	(372)
Total primary energy associated with community systems					3245.92	(373)
Total primary energy associated with space and water heating					3245.92	(376)
Pumps and fans	25.55	x	3.07	=	78.45	(378)
Electricity for lighting	194.38	x	3.07	=	596.73	(379)

Primary energy kWh/year	3921.10	(383)
Dwelling primary energy rate kWh/m ² /year	97.35	(384)

DER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	05/12/2018
Address	Studio Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	40.28 (1a) x	2.50 (2a) =	100.70 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 40.28 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) = 100.70 (5)	

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	0 x 10 =	0 (7a)
Number of passive vents	0 x 10 =	0 (7b)
Number of flueless gas fires	0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 0 ÷ (5) = 0.00 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q₅₀, expressed in cubic metres per hour per square metre of envelope area (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) (18)

Number of sides on which the dwelling is sheltered (19)

Shelter factor 1 - [0.075 x (19)] = (20)

Infiltration rate incorporating shelter factor (18) x (20) = (21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70 (22)

Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18 (22a)
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.20	0.19	0.19	0.17	0.17	0.15	0.15	0.14	0.16	0.17	0.17	0.18 (22b)
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system (23a)

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h (23c)

c) whole house extract ventilation or positive input ventilation from outside (24c)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25) (25)

3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K
Window		7.85	x	1.14	=	8.92	(27)
Party wall		51.97	x	0.00	=	0.00	(32)
External wall		6.71	x	0.24	=	1.61	(29a)
Total area of external elements ΣA, m ²		14.56					(31)
Fabric heat loss, W/K = Σ(A x U)						(26)...(30) + (32) =	10.53 (33)
Heat capacity Cm = Σ(A x κ)						(28)...(30) + (32) + (32a)...(32e) =	N/A (34)
Thermal mass parameter (TMP) in kJ/m ² K							100.00 (35)
Thermal bridges: Σ(L x Ψ) calculated using Appendix K							3.33 (36)
Total fabric heat loss						(33) + (36) =	13.86 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	16.62	16.62	16.62	16.62	16.62	16.62	16.62	16.62	16.62	16.62	16.62	16.62 (38)

Heat transfer coefficient, W/K (37)m + (38)m	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48
Average = Σ(39)1...12/12 =	30.48 (39)											

Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76
Average = Σ(40)1...12/12 =	0.76 (40)											

Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00 (40)
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4. Water heating energy requirement

Assumed occupancy, N	1.41 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	67.78 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	74.56	71.84	69.13	66.42	63.71	61.00	61.00	63.71	66.42	69.13	71.84	74.56
Σ(44)1...12 =	813.33 (44)											

Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	110.56	96.70	99.79	87.00	83.47	72.03	66.75	76.59	77.51	90.33	98.60	107.07
Σ(45)1...12 =	1066.41 (45)											

Distribution loss 0.15 x (45)m	16.58	14.50	14.97	13.05	12.52	10.80	10.01	11.49	11.63	13.55	14.79	16.06 (46)
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Storage volume (litres) including any solar or WWHRs storage within same vessel (47)

Water storage loss:

b) Manufacturer's declared loss factor is not known	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.02 (51)
Volume factor from Table 2a	4.93 (52)
Temperature factor from Table 2b	1.00 (53)
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53)	0.10 (54)
Enter (50) or (54) in (55)	0.10 (55)

Water storage loss calculated for each month (55) x (41)m	3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24 (56)
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If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - Vs] ÷ (47), else (56)	3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24 (57)
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Primary circuit loss for each month from Table 3

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)
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Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
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Total heat required for water heating calculated for each month $0.85 \times (45)\text{m} + (46)\text{m} + (57)\text{m} + (59)\text{m} + (61)\text{m}$

137.06	120.64	126.29	112.64	109.97	97.68	93.25	103.09	103.15	116.83	124.25	133.58	(62)
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Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
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Output from water heater for each month (kWh/month) (62)m + (63)m

137.06	120.64	126.29	112.64	109.97	97.68	93.25	103.09	103.15	116.83	124.25	133.58	
$\Sigma(64)1...12 =$											1378.43	(64)

Heat gains from water heating (kWh/month) $0.25 \times [0.85 \times (45)\text{m} + (61)\text{m}] + 0.8 \times [(46)\text{m} + (57)\text{m} + (59)\text{m}]$

57.96	51.30	54.38	49.44	48.96	44.47	43.39	46.67	46.29	51.23	53.30	56.80	(65)
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5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)												
70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

11.01	9.78	7.95	6.02	4.50	3.80	4.10	5.33	7.16	9.09	10.61	11.31	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

122.24	123.51	120.31	113.51	104.92	96.84	91.45	90.18	93.38	100.18	108.77	116.84	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	(69)
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Pump and fan gains (Table 5a)

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
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Losses e.g. evaporation (Table 5)

-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	(71)
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Water heating gains (Table 5)

77.91	76.34	73.09	68.67	65.80	61.76	58.33	62.73	64.29	68.86	74.03	76.35	(72)
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Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

255.36	253.83	245.56	232.40	219.42	206.61	198.09	202.45	209.03	222.34	237.62	248.71	(73)
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6. Solar gains

	Access factor Table 6d		Area m ²		Solar flux W/m ²		g specific data or Table 6b		FF specific data or Table 6c		Gains W
North	0.77	x	7.85	x	10.63	x 0.9 x	0.45	x	0.80	=	20.82 (74)

Solar gains in watts $\Sigma(74)\text{m}... (82)\text{m}$

20.82	39.80	67.62	108.62	146.32	156.64	146.25	116.03	81.31	47.37	25.69	17.36	(83)
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Total gains - internal and solar (73)m + (83)m

276.18	293.63	313.18	341.02	365.75	363.25	344.33	318.48	290.34	269.72	263.31	266.07	(84)
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7. Mean internal temperature (heating season)

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	21.00	(85)
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-------	------

Utilisation factor for gains for living area n1,m (see Table 9a)

0.94	0.92	0.89	0.80	0.67	0.51	0.38	0.43	0.64	0.83	0.92	0.95	(86)
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Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.72	19.87	20.16	20.52	20.80	20.94	20.98	20.98	20.87	20.53	20.06	19.66	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.29	20.29	20.29	20.29	20.29	20.29	20.29	20.29	20.29	20.29	20.29	20.29	(88)
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Utilisation factor for gains for rest of dwelling n2,m

0.93	0.92	0.87	0.78	0.63	0.46	0.32	0.36	0.59	0.81	0.91	0.94	(89)
------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

18.56	18.78	19.19	19.69	20.06	20.24	20.28	20.27	20.16	19.71	19.06	18.48	(90)
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Living area fraction

Living area ÷ (4) = 0.62 (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

19.28	19.46	19.79	20.20	20.52	20.67	20.72	20.71	20.60	20.22	19.68	19.22	(92)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e where appropriate

19.28	19.46	19.79	20.20	20.52	20.67	20.72	20.71	20.60	20.22	19.68	19.22	(93)
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8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm												
0.92	0.90	0.86	0.78	0.64	0.48	0.36	0.40	0.61	0.81	0.89	0.93	(94)

Useful gains, ηmGm, W (94)m x (84)m

254.59	265.17	270.23	265.64	235.76	175.76	122.96	127.60	177.51	217.45	235.51	247.21	(95)
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Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
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Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]

456.58	443.73	404.98	344.39	268.79	185.11	125.44	131.31	198.13	293.08	383.48	457.65	(97)
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Space heating requirement, kWh/month $0.024 \times [(97)\text{m} - (95)\text{m}] \times (41)\text{m}$

150.28	119.99	100.26	56.70	24.58	0.00	0.00	0.00	0.00	56.27	106.54	156.57	
$\Sigma(98)1...5, 10...12 =$											771.19	(98)
$(98) \div (4) =$											19.15	(99)

9b. Energy requirements - community heating scheme

Fraction of space heat from secondary/supplementary system (table 11)	'0' if none	0.00	(301)
Fraction of space heat from community system	1 - (301) =	1.00	(302)
Fraction of community heat from boilers		1.00	(303a)
Fraction of total space heat from community boilers	(302) x (303a) =	1.00	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating		1.00	(305)
Factor for charging method (Table 4c(3)) for community water heating		1.00	(305a)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating

Annual space heating requirement	771.19	(98)
Space heat from boilers	$(98) \times (304a) \times (305) \times (306) =$	809.75 (307a)

Water heating

Annual water heating requirement	1378.43	(64)
Water heat from boilers	$(64) \times (303a) \times (305a) \times (306) =$	1447.35 (310a)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	22.57 (313)

Electricity for pumps, fans and electric keep-hot (Table 4f)

mechanical ventilation fans - balanced, extract or positive input from outside	25.55	(330a)
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Total electricity for the above, kWh/year					25.55	(331)
Electricity for lighting (Appendix L)					194.38	(332)
Total delivered energy for all uses	(307) + (309) + (310) + (312) + (315) + (331) + (332)...	(337b) =			2477.03	(338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from boilers	809.75	x	4.24	x 0.01 =	34.33	(340a)
Water heating from boilers	1447.35	x	4.24	x 0.01 =	61.37	(342a)
Pumps and fans	25.55	x	13.19	x 0.01 =	3.37	(349)
Electricity for lighting	194.38	x	13.19	x 0.01 =	25.64	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)...(342e) + (345)...(354) =		244.71	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)					0.42	(356)
Energy cost factor (ECF)					1.21	(357)
SAP value					83.19	
SAP rating (section 13)					83	(358)
SAP band					B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from other sources (space heating)						
Efficiency of boilers	95.00					(367a)
CO2 emissions from boilers	[(307a)+(310a)] x 100 ÷ (367a) =	2375.89	x	0.216	=	513.19 (367)
Electrical energy for community heat distribution	22.57	x	0.519	=	11.71	(372)
Total CO2 associated with community systems					524.91	(373)
Total CO2 associated with space and water heating					524.91	(376)
Pumps and fans	25.55	x	0.519	=	13.26	(378)
Electricity for lighting	194.38	x	0.519	=	100.88	(379)
Total CO ₂ , kg/year				(376)..(382) =	639.05	(383)
Dwelling CO ₂ emission rate				(383) ÷ (4) =	15.87	(384)
EI value					89.96	
EI rating (section 14)					90	(385)
EI band					B	

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary energy from other sources (space heating)						
Efficiency of boilers	95.00					(367a)
Primary energy from boilers	$[(307a)+(310a)] \times 100 \div (367a) =$	2375.89	x	1.22	=	2898.59 (367)
Electrical energy for community heat distribution	22.57	x	3.07	=	69.29	(372)
Total primary energy associated with community systems					2967.88	(373)
Total primary energy associated with space and water heating					2967.88	(376)
Pumps and fans	25.55	x	3.07	=	78.45	(378)
Electricity for lighting	194.38	x	3.07	=	596.73	(379)
Primary energy kWh/year					3643.06	(383)

Dwelling primary energy rate kWh/m²/year

90.44 (384)

DER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	04/12/2018
Address	Studio Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	40.28 (1a) x	2.50 (2a) =	100.70 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 40.28 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) =	100.70 (5)

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	0 x 10 =	0 (7a)
Number of passive vents	0 x 10 =	0 (7b)
Number of flueless gas fires	0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 0 ÷ (5) = 0.00 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	4.00 (17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)

Number of sides on which the dwelling is sheltered	3 (19)
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Shelter factor	1 - [0.075 x (19)] = 0.78 (20)
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Infiltration rate incorporating shelter factor	(18) x (20) = 0.16 (21)
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Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70

Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.20	0.19	0.19	0.17	0.17	0.15	0.15	0.14	0.16	0.17	0.17	0.18
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	0.50 (23a)
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If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A (23c)
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c) whole house extract ventilation or positive input ventilation from outside	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² .K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K
Window		7.85	x	1.14	=	8.92	(27)
Party wall		51.97	x	0.00	=	0.00	(32)
External wall		6.71	x	0.24	=	1.61	(29a)
Roof		40.28	x	0.14	=	5.64	(30)
Total area of external elements ΣA, m ²		54.84					(31)

Fabric heat loss, W/K = Σ(A x U)	(26)...(30) + (32) =	16.17	(33)
Heat capacity Cm = Σ(A x κ)	(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)
Thermal mass parameter (TMP) in kJ/m ² .K		100.00	(35)
Thermal bridges: Σ(L x Ψ) calculated using Appendix K		9.67	(36)
Total fabric heat loss	(33) + (36) =	25.83	(37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	16.62	16.62	16.62	16.62	16.62	16.62	16.62	16.62	16.62	16.62	16.62	16.62
Heat transfer coefficient, W/K (37)m + (38)m	42.45	42.45	42.45	42.45	42.45	42.45	42.45	42.45	42.45	42.45	42.45	42.45
Average = Σ(39)1...12/12 =												42.45

Heat loss parameter (HLP), W/m ² .K (39)m ÷ (4)	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
Average = Σ(40)1...12/12 =												1.05

Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00
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4. Water heating energy requirement

Assumed occupancy, N	1.41	(42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	67.78	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	74.56	71.84	69.13	66.42	63.71	61.00	61.00	63.71	66.42	69.13	71.84	74.56
Σ(44)1...12 =												813.33

Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	110.56	96.70	99.79	87.00	83.47	72.03	66.75	76.59	77.51	90.33	98.60	107.07
Σ(45)1...12 =												1066.41

Distribution loss 0.15 x (45)m	16.58	14.50	14.97	13.05	12.52	10.80	10.01	11.49	11.63	13.55	14.79	16.06
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Storage volume (litres) including any solar or WWHRs storage within same vessel	1.00	(47)
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Water storage loss:

b) Manufacturer's declared loss factor is not known		
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.02	(51)
Volume factor from Table 2a	4.93	(52)
Temperature factor from Table 2b	1.00	(53)
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53)	0.10	(54)
Enter (50) or (54) in (55)	0.10	(55)

Water storage loss calculated for each month (55) x (41)m	3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24
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If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - Vs] ÷ (47), else (56)

	3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24	(57)
Primary circuit loss for each month from Table 3													
	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													
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m													
	137.06	120.64	126.29	112.64	109.97	97.68	93.25	103.09	103.15	116.83	124.25	133.58	(62)
Solar DHW input calculated using Appendix G or Appendix H													
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
Output from water heater for each month (kWh/month) (62)m + (63)m													
	137.06	120.64	126.29	112.64	109.97	97.68	93.25	103.09	103.15	116.83	124.25	133.58	
	Σ[(64)1...12 =											1378.43	(64)
Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]													
	57.96	51.30	54.38	49.44	48.96	44.47	43.39	46.67	46.29	51.23	53.30	56.80	(65)

5. Internal gains													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)													
	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	11.01	9.78	7.95	6.02	4.50	3.80	4.10	5.33	7.16	9.09	10.61	11.31	(67)
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	122.24	123.51	120.31	113.51	104.92	96.84	91.45	90.18	93.38	100.18	108.77	116.84	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	(69)
Pump and fan gains (Table 5a)													
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
Losses e.g. evaporation (Table 5)													
	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	(71)
Water heating gains (Table 5)													
	77.91	76.34	73.09	68.67	65.80	61.76	58.33	62.73	64.29	68.86	74.03	76.35	(72)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
	255.36	253.83	245.56	232.40	219.42	206.61	198.09	202.45	209.03	222.34	237.62	248.71	(73)

6. Solar gains													
	Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W							
NorthWest	0.77	x	7.85	x	11.28	x 0.9 x	0.45	x	0.80	=	22.10	(81)	
Solar gains in watts Σ(74)m...(82)m													
	22.10	44.98	81.04	133.09	178.89	190.72	178.41	142.23	98.74	54.97	27.80	18.05	(83)
Total gains - internal and solar (73)m + (83)m													
	277.46	298.81	326.59	365.49	398.32	397.33	376.50	344.68	307.78	277.31	265.42	266.76	(84)

7. Mean internal temperature (heating season)													
Temperature during heating periods in the living area from Table 9, Th1(°C)												21.00	(85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area n1,m (see Table 9a)													
	0.95	0.94	0.91	0.84	0.73	0.58	0.46	0.51	0.72	0.88	0.94	0.96	(86)

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)													
	18.96	19.15	19.54	20.06	20.52	20.82	20.93	20.91	20.67	20.09	19.43	18.90	(87)
Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)													
	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	(88)
Utilisation factor for gains for rest of dwelling n2,m													
	0.95	0.93	0.90	0.82	0.69	0.52	0.37	0.42	0.66	0.85	0.93	0.95	(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)													
	17.31	17.59	18.14	18.88	19.50	19.87	19.99	19.97	19.70	18.93	18.00	17.23	(90)
Living area fraction													
	Living area ÷ (4) =											0.62	(91)
Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2													
	18.34	18.56	19.01	19.61	20.14	20.46	20.58	20.55	20.30	19.65	18.89	18.26	(92)
Apply adjustment to the mean internal temperature from Table 4e where appropriate													
	18.34	18.56	19.01	19.61	20.14	20.46	20.58	20.55	20.30	19.65	18.89	18.26	(93)

8. Space heating requirement															
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Utilisation factor for gains, ηm															
	0.93	0.92	0.88	0.81	0.69	0.55	0.42	0.47	0.67	0.84	0.91	0.94	(94)		
Useful gains, ηmGm, W (94)m x (84)m															
	258.35	273.43	287.37	295.32	276.33	217.83	158.07	161.55	207.50	232.84	241.52	249.94	(95)		
Monthly average external temperature from Table U1															
	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)		
Heat loss rate for mean internal temperature, Lm, W [(39)m x (93)m - (96)m]															
	595.79	579.85	531.04	454.59	358.15	248.71	168.79	176.30	263.23	384.13	500.41	597.03	(97)		
Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m															
	251.05	205.92	181.29	114.68	60.88	0.00	0.00	0.00	0.00	112.57	186.40	258.24			
	Σ(98)1...5, 10...12 =											1371.02	(98)		
Space heating requirement kWh/m ² /year													(98) ÷ (4)	34.04	(99)

9b. Energy requirements - community heating scheme			
Fraction of space heat from secondary/supplementary system (table 11)	'0' if none	0.00	(301)
Fraction of space heat from community system	1 - (301) =	1.00	(302)
Fraction of community heat from boilers		1.00	(303a)
Fraction of total space heat from community boilers	(302) x (303a) =	1.00	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating		1.00	(305)
Factor for charging method (Table 4c(3)) for community water heating		1.00	(305a)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating			
Annual space heating requirement	1371.02		(98)
Space heat from boilers	(98) x (304a) x (305) x (306) =	1439.57	(307a)
Water heating			
Annual water heating requirement	1378.43		(64)
Water heat from boilers	(64) x (303a) x (305a) x (306) =	1447.35	(310a)
Electricity used for heat distribution	0.01 x [(307a)...(307e) + (310a)...(310e)] =	28.87	(313)

Electricity for pumps, fans and electric keep-hot (Table 4f)

mechanical ventilation fans - balanced, extract or positive input from outside	25.55	(330a)
Total electricity for the above, kWh/year	25.55	(331)
Electricity for lighting (Appendix L)	194.38	(332)
Total delivered energy for all uses	(307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) = 3106.85	(338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from boilers	1439.57	x	4.24	x 0.01 =	61.04	(340a)
Water heating from boilers	1447.35	x	4.24	x 0.01 =	61.37	(342a)
Pumps and fans	25.55	x	13.19	x 0.01 =	3.37	(349)
Electricity for lighting	194.38	x	13.19	x 0.01 =	25.64	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)...(342e) + (345)...(354) =		271.41	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.34	(357)
SAP value	81.35	
SAP rating (section 13)	81	(358)
SAP band	B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from other sources (space heating)						
Efficiency of boilers	95.00					(367a)
CO ₂ emissions from boilers	[(307a)+(310a)] x 100 ÷ (367a) = 3038.86	x	0.216	=	656.39	(367)
Electrical energy for community heat distribution	28.87	x	0.519	=	14.98	(372)
Total CO ₂ associated with community systems					671.38	(373)
Total CO ₂ associated with space and water heating					671.38	(376)
Pumps and fans	25.55	x	0.519	=	13.26	(378)
Electricity for lighting	194.38	x	0.519	=	100.88	(379)
Total CO ₂ , kg/year			(376)...(382) =		785.52	(383)
Dwelling CO ₂ emission rate			(383) ÷ (4) =		19.50	(384)
EI value					87.66	
EI rating (section 14)					88	(385)
EI band					B	

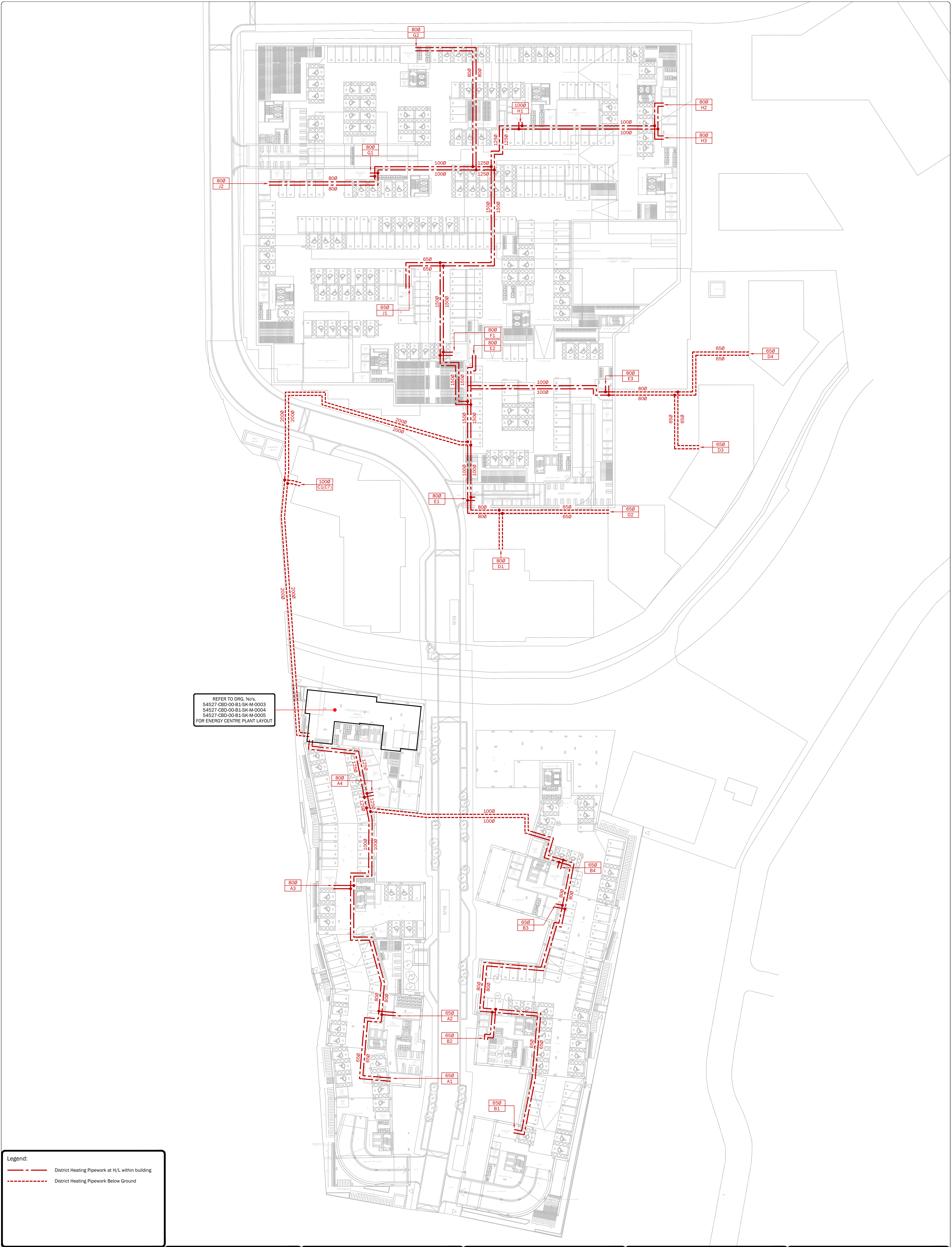
13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary energy from other sources (space heating)						
Efficiency of boilers	95.00					(367a)
Primary energy from boilers	[(307a)+(310a)] x 100 ÷ (367a) = 3038.86	x	1.22	=	3707.41	(367)
Electrical energy for community heat distribution	28.87	x	3.07	=	88.63	(372)
Total primary energy associated with community systems					3796.04	(373)
Total primary energy associated with space and water heating					3796.04	(376)
Pumps and fans	25.55	x	3.07	=	78.45	(378)
Electricity for lighting	194.38	x	3.07	=	596.73	(379)

Primary energy kWh/year	4471.22	(383)
Dwelling primary energy rate kWh/m ² /year	111.00	(384)

Appendix F

Indicative Heat Network Layout



Legend:

District Heating Pipework at H/L within building

District Heating Pipework Below Ground

Important:

This drawing is the copyright © of ChapmanBDSP and shall not be copied or reproduced without permission.

This drawing shall not be scaled.

Unless stated otherwise, all dimensions are in millimetres.

Where applicable, all dimensions shall be checked by the contractor onsite, prior to commencement of any works.

This drawing shall be read in conjunction with all other drawings and the services specification document(s).

All materials and workmanship shall conform with the relevant British & European Standards, Specifications and Codes of Practice.

Notes:

PO1	Sept '17	Preliminary Issue	RH	PE
Rev	Date	Description	Dwn	Chkd
Reference files				

Client				
St William Homes				
Project				
Clarendon Gas Works				
Production software				
Autocad				

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Status

Preliminary Issue

Drawing title					
Basement Plan District Heating Distribution					
Drawn	Engineer	Approved	Date		
hawkxr	PE	PH	Sept '17		
Scale @ A1	File/BIM ref				
1:500	54527-CBD-00-B1-SK-M-0001.dwg				
Drawing number	Revision				
54527-CBD-00-B1-SK-M-0001	P01				

Appendix G

Summary CO₂ Emissions Rates – *Be Clean*

Appendix G

CO₂ Emissions at Be Clean Stage

Unit Type Description	Individual			Total				Emissions Rate Improvement
	Unit Floor Area	Dwelling Emissions Rate	Target Emissions Rate	Number of Units	Total Floor Area	Dwelling Emissions Rate	Target Emissions Rate	
	m ²	kg CO ₂ /m ² /year	kg CO ₂ /m ² /year		m ²	kg CO ₂ /year	kg CO ₂ /year	-
Domestic								
1 BED - Exposed Floor	50	10.9	17.2	16	802	8,710	13,783	36.8%
1 BED - Mid Floor	50	10.2	15.5	56	2,808	28,759	43,601	34.0%
1 BED - Top Floor	50	12.4	19.1	12	602	7,461	11,483	35.0%
2 BED - Exposed Floor	64	11.6	18.5	30	1,909	22,213	35,272	37.0%
2 BED - Mid Floor	64	10.3	15.7	182	11,581	119,510	182,149	34.4%
2 BED - Top Floor	64	12.1	18.7	34	2,163	26,154	40,396	35.3%
3 BED - Exposed Floor	80	10.8	16.2	2	161	1,738	2,596	33.0%
3 BED - Mid Floor	80	9.4	14.1	13	1,044	9,827	14,678	33.0%
3 BED - Top Floor	80	11.0	16.5	2	161	1,763	2,645	33.4%
4 BED - Exposed Floor	95	9.8	14.5	2	190	1,865	2,766	32.6%
4 BED - Mid Floor	95	8.4	12.4	13	1,237	10,432	15,358	32.1%
4 BED - Top Floor	95	10.2	15.7	2	190	1,943	2,980	34.8%
MANHATTAN - Exposed Floor	40	11.2	18.4	9	363	4,053	6,666	39.2%
MANHATTAN - Mid Floor	40	10.5	16.9	58	2,336	24,482	39,588	38.2%
MANHATTAN - Top Floor	40	12.6	20.1	8	322	4,049	6,492	37.6%
			Subtotal	439	25,869	272,959	420,454	35.1%
Non-Domestic								
Café	279	59.0	80.0	1	279	16,467	22,328	26.3%
Office	1,681	17.6	19.6	1	1,681	29,580	32,942	10.2%
Resident Facilities	936	19.3	20.5	1	936	18,055	19,178	5.9%
Restaurant	130	56.9	80.9	1	130	7,369	10,477	29.7%
Retail	89	38.9	41.0	1	89	3,458	3,645	5.1%
Retail Units	344	35.6	41.3	1	344	12,254	14,215	13.8%
			Subtotal		3,458	87,183	102,784	15.2%
Total for All Units					29,327	360,142	523,238	31.2%

Appendix H

DER Worksheets – *Be Clean*

DER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	07/12/2018
Address	1Bed Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	50.15 (1a) x	2.50 (2a) =	125.38 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 50.15 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) =	125.38 (5)

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	0 x 10 =	0 (7a)
Number of passive vents	0 x 10 =	0 (7b)
Number of flueless gas fires	0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 0 ÷ (5) = 0.00 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	4.00 (17)
--	-----------

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)

Number of sides on which the dwelling is sheltered	3 (19)
--	--------

Shelter factor	1 - [0.075 x (19)] = 0.78 (20)
----------------	--------------------------------

Infiltration rate incorporating shelter factor	(18) x (20) = 0.16 (21)
--	-------------------------

Infiltration rate modified for monthly wind speed:

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

(22)

Wind factor (22)m ÷ 4

1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18
------	------	------	------	------	------	------	------	------	------	------

(22a)

Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m

0.20	0.19	0.19	0.17	0.17	0.15	0.15	0.14	0.16	0.17	0.18
------	------	------	------	------	------	------	------	------	------	------

(22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	0.50 (23a)
---	------------

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A (23c)
--	-----------

c) whole house extract ventilation or positive input ventilation from outside

0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
------	------	------	------	------	------	------	------	------	------	------	------

(24c)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)

0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
------	------	------	------	------	------	------	------	------	------	------	------

(25)

3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² .K	A x U W/K	k-value, kJ/m ² .K	A x k, kJ/K
Window			9.00	x 1.14	= 10.22 (27)		
Exposed floor	50.15	x 0.08	= 4.01 (28b)				
Party wall	55.09	x 0.00	= 0.00 (32)				
External wall	11.31	x 0.24	= 2.71 (29a)				
Total area of external elements ΣA, m ²	70.46						(31)

Fabric heat loss, W/K = Σ(A x U) (26)...(30) + (32) = 16.95 (33)

Heat capacity Cm = Σ(A x k) (28)...(30) + (32) + (32a)...(32e) = N/A (34)

Thermal mass parameter (TMP) in kJ/m².K 100.00 (35)

Thermal bridges: Σ(L x Ψ) calculated using Appendix K 10.29 (36)

Total fabric heat loss (33) + (36) = 27.24 (37)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
20.69	20.69	20.69	20.69	20.69	20.69	20.69	20.69	20.69	20.69	20.69	20.69

(38)

Heat transfer coefficient, W/K (37)m + (38)m

47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	
Average = $\sum(39)1...12/12 =$											47.92	(39)

Heat loss parameter (HLP), W/m².K (39)m ÷ (4)

0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	
Average = $\sum(40)1...12/12 =$											0.96	(40)

Number of days in month (Table 1a)

31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(40)

4. Water heating energy requirement

Assumed occupancy, N 1.69 (42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.44 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)												
81.89	78.91	75.93	72.96	69.98	67.00	67.00	69.98	72.96	75.93	78.91	81.89	
										Σ(44)1...12 =	893.34	(44)

Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)

121.44	106.21	109.60	95.55	91.69	79.12	73.31	84.13	85.13	99.21	108.30	117.61	
										$\sum(45)1...12 =$	1171.31	(45)

Distribution loss 0.15 x (45)m

18.22	15.93	16.44	14.33	13.75	11.87	11.00	12.62	12.77	14.88	16.25	17.64
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Storage volume (litres) including any solar or WWHRs storage within same vessel 1.00 (47)

Water storage loss:

b) Manufacturer's declared loss factor is not known

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

Volume factor from Table 2a 4.93 (52)

Temperature factor from Table 2b 1.00 (53)

Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53) 0.10 (54)

Enter (50) or (54) in (55) 0.10 (55)

Water storage loss calculated for each month (55) x (41)m

3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24
------	------	------	------	------	------	------	------	------	------	------	------

(56)

If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - Vs] ÷ (47), else (56)

	3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24	(57)
Primary circuit loss for each month from Table 3													
	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													
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m													
	147.94	130.15	136.10	121.20	118.19	104.76	99.81	110.63	110.78	125.72	133.95	144.11	(62)
Solar DHW input calculated using Appendix G or Appendix H													
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
Output from water heater for each month (kWh/month) (62)m + (63)m													
	147.94	130.15	136.10	121.20	118.19	104.76	99.81	110.63	110.78	125.72	133.95	144.11	
	$\Sigma(64)1...12 =$											1483.33	(64)
Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]													
	61.58	54.46	57.64	52.29	51.69	46.82	45.58	49.17	48.82	54.19	56.53	60.30	(65)

5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)													
	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.45	11.94	9.71	7.35	5.50	4.64	5.01	6.52	8.75	11.11	12.97	13.82	(67)
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	147.62	149.16	145.30	137.08	126.70	116.95	110.44	108.91	112.77	120.99	131.36	141.11	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	(69)
Pump and fan gains (Table 5a)													
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
Losses e.g. evaporation (Table 5)													
	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	(71)
Water heating gains (Table 5)													
	82.77	81.05	77.48	72.62	69.47	65.03	61.26	66.09	67.81	72.84	78.51	81.05	(72)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
	292.26	290.57	280.90	265.47	250.09	235.04	225.13	229.94	237.75	253.35	271.25	284.40	(73)

6. Solar gains

	Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W							
SouthEast	0.77	x	9.00	x	36.79	x 0.9 x	0.45	x	0.80	=	82.61	(77)	
Solar gains in watts $\Sigma(74)m...(82)m$													
	82.61	140.72	192.54	238.57	267.22	265.28	255.76	234.39	208.48	155.53	98.95	70.70	(83)
Total gains - internal and solar (73)m + (83)m													
	374.87	431.29	473.45	504.04	517.31	500.33	480.89	464.33	446.23	408.88	370.20	355.10	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1(°C)												21.00	(85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area n1,m (see Table 9a)													
	0.94	0.91	0.87	0.80	0.69	0.55	0.42	0.45	0.63	0.81	0.91	0.95	(86)

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)													
	19.29	19.55	19.91	20.32	20.66	20.87	20.96	20.95	20.80	20.37	19.75	19.21	(87)
Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)													
	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	(88)
Utilisation factor for gains for rest of dwelling n2,m													
	0.93	0.90	0.85	0.77	0.65	0.49	0.34	0.37	0.57	0.79	0.90	0.94	(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)													
	17.83	18.21	18.72	19.28	19.74	20.00	20.09	20.08	19.93	19.36	18.49	17.72	(90)
Living area fraction													
Living area ÷ (4) =												0.66	(91)
Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2													
	18.79	19.09	19.50	19.96	20.34	20.57	20.66	20.65	20.50	20.02	19.31	18.70	(92)
Apply adjustment to the mean internal temperature from Table 4e where appropriate													
	18.79	19.09	19.50	19.96	20.34	20.57	20.66	20.65	20.50	20.02	19.31	18.70	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, ηm														
	0.92	0.88	0.84	0.76	0.66	0.52	0.39	0.42	0.59	0.78	0.89	0.93	(94)	
Useful gains, ηmGm, W (94)m x (84)m														
	343.93	381.63	396.70	385.35	340.47	259.58	186.21	193.10	265.47	319.67	327.81	329.09	(95)	
Monthly average external temperature from Table U1														
	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)	
Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]														
	694.29	680.11	623.21	530.07	414.08	286.31	194.56	203.67	306.82	451.57	585.34	694.75	(97)	
Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m														
	260.66	200.58	168.52	104.20	54.76	0.00	0.00	0.00	0.00	98.13	185.42	272.05		
	$\Sigma(98)1...5, 10...12 =$											1344.33	(98)	
Space heating requirement kWh/m ² /year												(98) ÷ (4)	26.81	(99)

9b. Energy requirements - community heating scheme

Fraction of space heat from secondary/supplementary system (table 11)	'0' if none	0.00	(301)
Fraction of space heat from community system	1 - (301) =	1.00	(302)
Fraction of community heat from boilers		0.25	(303a)
Fraction of community heat from CHP		0.75	(303b)
Fraction of total space heat from community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community boilers	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating		1.00	(305)
Factor for charging method (Table 4c(3)) for community water heating		1.00	(305a)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating	
Annual space heating requirement	1344.33 (98)
Space heat from CHP	(98) x (304a) x (305) x (306) = 1058.66 (307a)
Space heat from boilers	(98) x (304b) x (305) x (306) = 352.89 (307b)

Water heating	
Annual water heating requirement	1483.33 (64)
Water heat from CHP	(64) x (303a) x (305a) x (306) = 1168.12 (310a)

Water heat from boilers	(64) x (303b) x (305a) x (306) =	389.37	(310b)
Electricity used for heat distribution	0.01 x [(307a)...(307e) + (310a)...(310e)] =	29.69	(313)

Electricity for pumps, fans and electric keep-hot (Table 4f)

mechanical ventilation fans - balanced, extract or positive input from outside	47.72	(330a)
Total electricity for the above, kWh/year	47.72	(331)
Electricity for lighting (Appendix L)	237.50	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) =	3254.26	(338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from CHP	1058.66	x	2.97	x 0.01 =	31.44	(340a)
Space heating from boilers	352.89	x	4.24	x 0.01 =	14.96	(340b)
Water heating from CHP	1168.12	x	2.97	x 0.01 =	34.69	(342a)
Water heating from boilers	389.37	x	4.24	x 0.01 =	16.51	(342b)
Pumps and fans	47.72	x	13.19	x 0.01 =	6.29	(349)
Electricity for lighting	237.50	x	13.19	x 0.01 =	31.33	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)...(342e) + (345)...(354) =		255.23	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.13	(357)
SAP value	84.28	
SAP rating (section 13)	84	(358)
SAP band	B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)	
<i>Emissions from community CHP (space and water heating)</i>						
Power efficiency of CHP unit	31.37					(361)
Heat efficiency of CHP unit	55.83					(362)
Space heating from CHP	(307a) x 100 ÷ (362) = 1896.1121	x	0.2160	=	409.5602	(363)
less credit emissions for electricity	-594.7517	x	0.5190	=	-308.6761	(364)
Water heated by CHP	2092.1647	x	0.2160	=	451.9076	(365)
less credit emissions for electricity	-656.2473	x	0.5190	=	-340.5924	(366)
Emissions from other sources (space heating)						
Efficiency of boilers	95.00					(367b)
CO ₂ emissions from boilers	[(307b)+(310b)] x 100 ÷ (367b) = 781.33	x	0.216	=	168.77	(368)
Electrical energy for community heat distribution	29.69	x	0.519	=	15.41	(372)
Total CO ₂ associated with community systems					396.37	(373)
Total CO ₂ associated with space and water heating					396.37	(376)
Pumps and fans	47.72	x	0.519	=	24.77	(378)
Electricity for lighting	237.50	x	0.519	=	123.26	(379)
Total CO ₂ , kg/year				(376)...(382) =	544.41	(383)
Dwelling CO ₂ emission rate				(383) ÷ (4) =	10.86	(384)
EI value					92.33	

EI rating (section 14)	92	(385)
EI band	A	

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
<i>Primary Energy from community CHP (space and water heating)</i>						
Power efficiency of CHP unit	31.37					(361)
Heat efficiency of CHP unit	55.83					(362)
Space heating from CHP	(307a) x 100 ÷ (362) = 1896.11	x	1.22	=	2313.26	(363)
less credit energy for electricity	-594.75	x	3.07	=	-1825.89	(364)
Water heated by CHP	2092.16	x	1.22	=	2552.44	(365)
less credit energy for electricity	-656.25	x	3.07	=	-2014.68	(366)
Primary energy from other sources (space heating)						
Efficiency of boilers	95.00					(367b)
Primary energy from boilers	[(307b)+(310b)] x 100 ÷ (367b) = 781.33	x	1.22	=	953.22	(368)
Electrical energy for community heat distribution	29.69	x	3.07	=	91.15	(372)
Total primary energy associated with community systems					2069.50	(373)
Total primary energy associated with space and water heating					2069.50	(376)
Pumps and fans	47.72	x	3.07	=	146.51	(378)
Electricity for lighting	237.50	x	3.07	=	729.13	(379)
Primary energy kWh/year					2945.13	(383)
Dwelling primary energy rate kWh/m ² /year					58.73	(384)

DER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	07/12/2018
Address	1Bed Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	50.15 (1a) x	2.50 (2a) =	125.38 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 50.15 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) = 125.38 (5)	

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	0 x 10 =	0 (7a)
Number of passive vents	0 x 10 =	0 (7b)
Number of flueless gas fires	0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 0 ÷ (5) = 0.00 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q₅₀, expressed in cubic metres per hour per square metre of envelope area (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) (18)

Number of sides on which the dwelling is sheltered (19)

Shelter factor 1 - [0.075 x (19)] = (20)

Infiltration rate incorporating shelter factor (18) x (20) = (21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70

Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.20	0.19	0.19	0.17	0.17	0.15	0.15	0.14	0.16	0.17	0.18
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system (23a)

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h (23c)

c) whole house extract ventilation or positive input ventilation from outside (24c)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K
Window		9.00	x	1.14	=	10.22	(27)
Party wall		55.09	x	0.00	=	0.00	(32)
External wall		11.31	x	0.24	=	2.71	(29a)
Total area of external elements ΣA, m ²		20.31					(31)
Fabric heat loss, W/K = Σ(A × U)						(26)...(30) + (32) =	12.94 (33)
Heat capacity Cm = Σ(A × κ)						(28)...(30) + (32) + (32a)...(32e) =	N/A (34)
Thermal mass parameter (TMP) in kJ/m ² K							100.00 (35)
Thermal bridges: Σ(L × Ψ) calculated using Appendix K							6.20 (36)
Total fabric heat loss						(33) + (36) =	19.14 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	20.69	20.69	20.69	20.69	20.69	20.69	20.69	20.69	20.69	20.69	20.69	20.69

Heat transfer coefficient, W/K (37)m + (38)m	39.83	39.83	39.83	39.83	39.83	39.83	39.83	39.83	39.83	39.83	39.83	39.83
Average = Σ(39)1...12/12 =	39.83 (39)											

Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79
Average = Σ(40)1...12/12 =	0.79 (40)											

Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00
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4. Water heating energy requirement

Assumed occupancy, N	1.69 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	74.44 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	81.89	78.91	75.93	72.96	69.98	67.00	67.00	69.98	72.96	75.93	78.91	81.89
Σ(44)1...12 =	893.34 (44)											

Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	121.44	106.21	109.60	95.55	91.69	79.12	73.31	84.13	85.13	99.21	108.30	117.61
Σ(45)1...12 =	1171.31 (45)											

Distribution loss 0.15 x (45)m	18.22	15.93	16.44	14.33	13.75	11.87	11.00	12.62	12.77	14.88	16.25	17.64
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Storage volume (litres) including any solar or WWHRs storage within same vessel (47)

Water storage loss:

b) Manufacturer's declared loss factor is not known	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.02 (51)
Volume factor from Table 2a	4.93 (52)
Temperature factor from Table 2b	1.00 (53)
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53)	0.10 (54)
Enter (50) or (54) in (55)	0.10 (55)

Water storage loss calculated for each month (55) x (41)m	3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24
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If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - Vs] ÷ (47), else (56)	3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24
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Primary circuit loss for each month from Table 3

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)
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Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
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Total heat required for water heating calculated for each month $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

147.94	130.15	136.10	121.20	118.19	104.76	99.81	110.63	110.78	125.72	133.95	144.11	(62)
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Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
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Output from water heater for each month (kWh/month) (62)m + (63)m

147.94	130.15	136.10	121.20	118.19	104.76	99.81	110.63	110.78	125.72	133.95	144.11	
$\Sigma(64)1...12 =$											1483.33	(64)

Heat gains from water heating (kWh/month) $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

61.58	54.46	57.64	52.29	51.69	46.82	45.58	49.17	48.82	54.19	56.53	60.30	(65)
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5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)												
84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

13.45	11.94	9.71	7.35	5.50	4.64	5.01	6.52	8.75	11.11	12.97	13.82	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

147.62	149.16	145.30	137.08	126.70	116.95	110.44	108.91	112.77	120.99	131.36	141.11	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	(69)
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Pump and fan gains (Table 5a)

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
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Losses e.g. evaporation (Table 5)

-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	(71)
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Water heating gains (Table 5)

82.77	81.05	77.48	72.62	69.47	65.03	61.26	66.09	67.81	72.84	78.51	81.05	(72)
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Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

292.26	290.57	280.90	265.47	250.09	235.04	225.13	229.94	237.75	253.35	271.25	284.40	(73)
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6. Solar gains

	Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W
NorthWest	0.77	9.00	11.28	0.9 x 0.45	0.80	25.33 (81)

Solar gains in watts $\Sigma(74)m...(82)m$

25.33	51.57	92.91	152.58	205.10	218.66	204.55	163.07	113.21	63.02	31.88	20.69	(83)
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Total gains - internal and solar (73)m + (83)m

317.59	342.13	373.81	418.05	455.19	453.70	429.68	393.01	350.96	316.37	303.13	305.09	(84)
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7. Mean internal temperature (heating season)

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	21.00	(85)
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Utilisation factor for gains for living area n1,m (see Table 9a)

0.95	0.94	0.90	0.82	0.68	0.52	0.40	0.45	0.67	0.86	0.93	0.96	(86)
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Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.53	19.70	20.02	20.44	20.76	20.93	20.98	20.97	20.84	20.42	19.90	19.47	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.26	20.26	20.26	20.26	20.26	20.26	20.26	20.26	20.26	20.26	20.26	20.26	(88)
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Utilisation factor for gains for rest of dwelling n2,m

0.95	0.93	0.89	0.80	0.65	0.47	0.33	0.38	0.62	0.84	0.92	0.95	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

18.27	18.51	18.98	19.55	19.99	20.19	20.24	20.23	20.09	19.55	18.81	18.18	(90)
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Living area fraction Living area ÷ (4) =

19.09	19.29	19.66	20.13	20.49	20.67	20.72	20.71	20.58	20.12	19.53	19.03	(92)
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Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

19.09	19.29	19.66	20.13	20.49	20.67	20.72	20.71	20.58	20.12	19.53	19.03	(92)
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Apply adjustment to the mean internal temperature from Table 4e where appropriate

19.09	19.29	19.66	20.13	20.49	20.67	20.72	20.71	20.58	20.12	19.53	19.03	(93)
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8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm												
0.94	0.92	0.88	0.79	0.66	0.50	0.37	0.42	0.64	0.83	0.91	0.94	(94)

Useful gains, ηmGm, W (94)m x (84)m

297.53	314.45	328.61	332.12	300.55	227.01	160.09	165.52	224.72	263.65	277.07	287.77	(95)
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Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
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Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]

589.17	573.12	524.25	447.30	350.24	241.87	164.28	171.84	258.02	379.18	494.83	590.49	(97)
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Space heating requirement, kWh/month $0.024 \times [(97)m - (95)m] \times (41)m$

216.98	173.82	145.56	82.93	36.96	0.00	0.00	0.00	0.00	85.96	156.79	225.23	
$\Sigma(98)1...5, 10...12 =$											1124.22	(98)

Space heating requirement kWh/m²/year (98) ÷ (4)

												22.42	(99)
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9b. Energy requirements - community heating scheme

Fraction of space heat from secondary/supplementary system (table 11)	'0' if none	0.00	(301)
Fraction of space heat from community system	1 - (301) =	1.00	(302)
Fraction of community heat from boilers		0.25	(303a)
Fraction of community heat from CHP		0.75	(303b)
Fraction of total space heat from community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community boilers	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating		1.00	(305)
Factor for charging method (Table 4c(3)) for community water heating		1.00	(305a)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating

Annual space heating requirement	1124.22	(98)
Space heat from CHP	(98) x (304a) x (305) x (306) = 885.33	(307)
Space heat from boilers	(98) x (304b) x (305) x (306) = 295.11	(307)

Water heating

Annual water heating requirement	1483.33	(64)
Water heat from CHP	(64) x (303a) x (305a) x (306) =	1168.12 (310)
Water heat from boilers	(64) x (303b) x (305a) x (306) =	389.37 (310)

Electricity used for heat distribution $0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$ (313)

Electricity for pumps, fans and electric keep-hot (Table 4f)

mechanical ventilation fans - balanced, extract or positive input from outside (330a)

Total electricity for the above, kWh/year (331)

Electricity for lighting (Appendix L) (332)

Total delivered energy for all uses $(307) + (309) + (310) + (312) + (315) + (331) + (332) \dots (337b) =$ (338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from CHP	885.33	x	2.97	x 0.01 =	26.29	(340a)
Space heating from boilers	295.11	x	4.24	x 0.01 =	12.51	(340b)
Water heating from CHP	1168.12	x	2.97	x 0.01 =	34.69	(342a)
Water heating from boilers	389.37	x	4.24	x 0.01 =	16.51	(342b)
Pumps and fans	47.72	x	13.19	x 0.01 =	6.29	(349)
Electricity for lighting	237.50	x	13.19	x 0.01 =	31.33	(350)
Additional standing charges					120.00	(351)
Total energy cost			$(340a) \dots (342e) + (345) \dots (354) =$		247.63	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.09	(357)
SAP value	84.75	
SAP rating (section 13)	85	(358)
SAP band	B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)	
<i>Emissions from community CHP (space and water heating)</i>						
Power efficiency of CHP unit	31.37					(361)
Heat efficiency of CHP unit	55.83					(362)
Space heating from CHP $(307a) \times 100 \div (362) =$	1585.6648	x	0.2160	=	342.5036	(363)
less credit emissions for electricity	-497.3740	x	0.5190	=	-258.1371	(364)
Water heated by CHP	2092.1647	x	0.2160	=	451.9076	(365)
less credit emissions for electricity	-656.2473	x	0.5190	=	-340.5924	(366)
<i>Emissions from other sources (space heating)</i>						
Efficiency of boilers	95.00					(367b)
CO ₂ emissions from boilers $[(307b) + (310b)] \times 100 \div (367b) =$	720.51	x	0.216	=	155.63	(368)
Electrical energy for community heat distribution	27.38	x	0.519	=	14.21	(372)
Total CO ₂ associated with community systems					365.52	(373)
Total CO ₂ associated with space and water heating					365.52	(376)
Pumps and fans	47.72	x	0.519	=	24.77	(378)
Electricity for lighting	237.50	x	0.519	=	123.26	(379)
Total CO ₂ , kg/year				$(376) \dots (382) =$	513.55	(383)
Dwelling CO ₂ emission rate				$(383) \div (4) =$	10.24	(384)
EI value					92.77	
EI rating (section 14)					93	(385)

EI band

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
<i>Primary Energy from community CHP (space and water heating)</i>						
Power efficiency of CHP unit	31.37					(361)
Heat efficiency of CHP unit	55.83					(362)
Space heating from CHP $(307a) \times 100 \div (362) =$	1585.66	x	1.22	=	1934.51	(363)
less credit energy for electricity	-497.37	x	3.07	=	-1526.94	(364)
Water heated by CHP	2092.16	x	1.22	=	2552.44	(365)
less credit energy for electricity	-656.25	x	3.07	=	-2014.68	(366)
<i>Primary energy from other sources (space heating)</i>						
Efficiency of boilers	95.00					(367b)
Primary energy from boilers $[(307b) + (310b)] \times 100 \div (367b) =$	720.51	x	1.22	=	879.02	(368)
Electrical energy for community heat distribution	27.38	x	3.07	=	84.05	(372)
Total primary energy associated with community systems					1908.41	(373)
Total primary energy associated with space and water heating					1908.41	(376)
Pumps and fans	47.72	x	3.07	=	146.51	(378)
Electricity for lighting	237.50	x	3.07	=	729.13	(379)
Primary energy kWh/year					2784.04	(383)
Dwelling primary energy rate kWh/m ² /year					55.51	(384)

DER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	07/12/2018
Address	1Bed Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	50.15 (1a) x	2.50 (2a) =	125.38 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 50.15 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) =	125.38 (5)

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	0 x 10 =	0 (7a)
Number of passive vents	0 x 10 =	0 (7b)
Number of flueless gas fires	0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 0 ÷ (5) = 0.00 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	4.00 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.20 (18)
Number of sides on which the dwelling is sheltered	3 (19)
Shelter factor	1 - [0.075 x (19)] = 0.78 (20)
Infiltration rate incorporating shelter factor	(18) x (20) = 0.16 (21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70

Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.20	0.19	0.19	0.17	0.17	0.15	0.15	0.14	0.16	0.17	0.17	0.18
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system 0.50 (23a)

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h N/A (23c)

c) whole house extract ventilation or positive input ventilation from outside	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	k-value, kJ/m ² .K	A x k, kJ/K
Window			9.00	x 1.14	= 10.22		
Party wall	55.09	x 0.00	= 0.00				
External wall	11.31	x 0.24	= 2.71				
Roof	50.15	x 0.14	= 7.02				
Total area of external elements ΣA, m ²	70.46						
Fabric heat loss, W/K = Σ(A x U)						(26)...(30) + (32) =	19.96 (33)
Heat capacity Cm = Σ(A x k)						(28)...(30) + (32) + (32a)...(32e) =	N/A (34)
Thermal mass parameter (TMP) in kJ/m ² K							100.00 (35)
Thermal bridges: Σ(L x Ψ) calculated using Appendix K							13.86 (36)
Total fabric heat loss						(33) + (36) =	33.82 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	20.69	20.69	20.69	20.69	20.69	20.69	20.69	20.69	20.69	20.69	20.69	20.69
Heat transfer coefficient, W/K (37)m + (38)m	54.50	54.50	54.50	54.50	54.50	54.50	54.50	54.50	54.50	54.50	54.50	54.50
Average = Σ(39)1...12/12 =												54.50 (39)

Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09
Average = Σ(40)1...12/12 =												1.09 (40)

Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00
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4. Water heating energy requirement

Assumed occupancy, N	1.69 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	74.44 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	81.89	78.91	75.93	72.96	69.98	67.00	67.00	69.98	72.96	75.93	78.91	81.89
Σ(44)1...12 =												893.34 (44)

Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	121.44	106.21	109.60	95.55	91.69	79.12	73.31	84.13	85.13	99.21	108.30	117.61
Σ(45)1...12 =												1171.31 (45)

Distribution loss 0.15 x (45)m	18.22	15.93	16.44	14.33	13.75	11.87	11.00	12.62	12.77	14.88	16.25	17.64
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Storage volume (litres) including any solar or WWHRs storage within same vessel	1.00 (47)
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Water storage loss:

b) Manufacturer's declared loss factor is not known	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.02 (51)
Volume factor from Table 2a	4.93 (52)
Temperature factor from Table 2b	1.00 (53)
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53)	0.10 (54)
Enter (50) or (54) in (55)	0.10 (55)

Water storage loss calculated for each month (55) x (41)m	3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24
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If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - Vs] ÷ (47), else (56)

	3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24	(57)
Primary circuit loss for each month from Table 3													
	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													
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m													
	147.94	130.15	136.10	121.20	118.19	104.76	99.81	110.63	110.78	125.72	133.95	144.11	(62)
Solar DHW input calculated using Appendix G or Appendix H													
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
Output from water heater for each month (kWh/month) (62)m + (63)m													
	147.94	130.15	136.10	121.20	118.19	104.76	99.81	110.63	110.78	125.72	133.95	144.11	
	$\Sigma(64)1...12 =$											1483.33	(64)
Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]													
	61.58	54.46	57.64	52.29	51.69	46.82	45.58	49.17	48.82	54.19	56.53	60.30	(65)

5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)													
	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	84.73	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.45	11.94	9.71	7.35	5.50	4.64	5.01	6.52	8.75	11.11	12.97	13.82	(67)
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	147.62	149.16	145.30	137.08	126.70	116.95	110.44	108.91	112.77	120.99	131.36	141.11	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	(69)
Pump and fan gains (Table 5a)													
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
Losses e.g. evaporation (Table 5)													
	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	-67.78	(71)
Water heating gains (Table 5)													
	82.77	81.05	77.48	72.62	69.47	65.03	61.26	66.09	67.81	72.84	78.51	81.05	(72)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
	292.26	290.57	280.90	265.47	250.09	235.04	225.13	229.94	237.75	253.35	271.25	284.40	(73)

6. Solar gains

	Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W							
NorthEast	0.77	x	9.00	x	11.28	x 0.9 x	0.45	x	0.80	=	25.33	(75)	
Solar gains in watts $\Sigma(74)m...(82)m$													
	25.33	51.57	92.91	152.58	205.10	218.66	204.55	163.07	113.21	63.02	31.88	20.69	(83)
Total gains - internal and solar (73)m + (83)m													
	317.59	342.13	373.81	418.05	455.19	453.70	429.68	393.01	350.96	316.37	303.13	305.09	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1(°C)												21.00	(85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area n1,m (see Table 9a)													
	0.96	0.95	0.93	0.87	0.77	0.63	0.50	0.55	0.75	0.90	0.95	0.97	(86)

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)													
	18.80	18.99	19.38	19.92	20.43	20.77	20.91	20.88	20.60	19.97	19.29	18.74	(87)
Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)													
	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	(88)
Utilisation factor for gains for rest of dwelling n2,m													
	0.96	0.94	0.91	0.85	0.73	0.56	0.41	0.46	0.70	0.88	0.94	0.96	(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)													
	17.06	17.34	17.91	18.67	19.36	19.80	19.95	19.92	19.60	18.75	17.78	16.98	(90)
Living area fraction													
	Living area ÷ (4) =											0.66	(91)
Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2													
	18.20	18.42	18.87	19.49	20.06	20.43	20.58	20.55	20.25	19.55	18.77	18.13	(92)
Apply adjustment to the mean internal temperature from Table 4e where appropriate													
	18.20	18.42	18.87	19.49	20.06	20.43	20.58	20.55	20.25	19.55	18.77	18.13	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, ηm														
	0.94	0.93	0.90	0.83	0.73	0.59	0.46	0.51	0.71	0.86	0.92	0.95	(94)	
Useful gains, ηmGm, W (94)m x (84)m														
	299.28	317.69	335.74	348.95	332.48	268.25	198.52	201.44	250.29	273.21	280.26	289.04	(95)	
Monthly average external temperature from Table U1														
	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)	
Heat loss rate for mean internal temperature, Lm, W [(39)m x (93)m - (96)m]														
	757.57	736.92	674.40	577.23	455.68	317.93	216.89	226.20	335.31	487.80	635.86	759.29	(97)	
Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m														
	340.97	281.72	251.96	164.36	91.67	0.00	0.00	0.00	0.00	159.66	256.04	349.87		
	$\Sigma(98)1...5, 10...12 =$											1896.24	(98)	
Space heating requirement kWh/m ² /year												(98) ÷ (4)	37.81	(99)

9b. Energy requirements - community heating scheme

Fraction of space heat from secondary/supplementary system (table 11)	'0' if none	0.00	(301)
Fraction of space heat from community system	1 - (301) =	1.00	(302)
Fraction of community heat from boilers		0.25	(303a)
Fraction of community heat from CHP		0.75	(303b)
Fraction of total space heat from community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community boilers	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating		1.00	(305)
Factor for charging method (Table 4c(3)) for community water heating		1.00	(305a)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating	
Annual space heating requirement	1896.24 (98)
Space heat from CHP	(98) x (304a) x (305) x (306) = 1493.29 (307a)
Space heat from boilers	(98) x (304b) x (305) x (306) = 497.76 (307b)

Water heating	
Annual water heating requirement	1483.33 (64)
Water heat from CHP	(64) x (303a) x (305a) x (306) = 1168.12 (310a)

Water heat from boilers	$(64) \times (303b) \times (305a) \times (306) =$	389.37	(310b)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	35.49	(313)

Electricity for pumps, fans and electric keep-hot (Table 4f)

mechanical ventilation fans - balanced, extract or positive input from outside	47.72	(330a)
Total electricity for the above, kWh/year	47.72	(331)
Electricity for lighting (Appendix L)	237.50	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) =	3833.77	(338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from CHP	1493.29	x	2.97	x 0.01 =	44.35	(340a)
Space heating from boilers	497.76	x	4.24	x 0.01 =	21.11	(340b)
Water heating from CHP	1168.12	x	2.97	x 0.01 =	34.69	(342a)
Water heating from boilers	389.37	x	4.24	x 0.01 =	16.51	(342b)
Pumps and fans	47.72	x	13.19	x 0.01 =	6.29	(349)
Electricity for lighting	237.50	x	13.19	x 0.01 =	31.33	(350)
Additional standing charges					120.00	(351)
Total energy cost			$(340a)...(342e) + (345)...(354) =$		274.28	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.21	(357)
SAP value	83.11	
SAP rating (section 13)	83	(358)
SAP band	B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)
<i>Emissions from community CHP (space and water heating)</i>					
Power efficiency of CHP unit	31.37				(361)
Heat efficiency of CHP unit	55.83				(362)
Space heating from CHP	(307a) × 100 ÷ (362) =	2674.5615	x	0.2160	= 577.7053 (363)
less credit emissions for electricity		-838.9272	x	0.5190	= -435.4032 (364)
Water heated by CHP		2092.1647	x	0.2160	= 451.9076 (365)
less credit emissions for electricity		-656.2473	x	0.5190	= -340.5924 (366)
Emissions from other sources (space heating)					
Efficiency of boilers	95.00				(367b)
CO2 emissions from boilers	[(307b)+(310b)] × 100 ÷ (367b) =	933.83	x	0.216	= 201.71 (368)
Electrical energy for community heat distribution		35.49	x	0.519	= 18.42 (372)
Total CO2 associated with community systems					473.74 (373)
Total CO2 associated with space and water heating					473.74 (376)
Pumps and fans	47.72	x	0.519	=	24.77 (378)
Electricity for lighting	237.50	x	0.519	=	123.26 (379)
Total CO ₂ , kg/year					(376)·(382) = 621.77 (383)
Dwelling CO ₂ emission rate					(383) ÷ (4) = 12.40 (384)
EI value					91.24

EI rating (section 14)	91	(385)
EI band	B	

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary Energy from community CHP (space and water heating)						
Power efficiency of CHP unit	31.37					(361)
Heat efficiency of CHP unit	55.83					(362)
Space heating from CHP	(307a) × 100 ÷ (362) =	2674.56	x	1.22	=	3262.97 (363)
less credit energy for electricity		-838.93	x	3.07	=	-2575.51 (364)
Water heated by CHP		2092.16	x	1.22	=	2552.44 (365)
less credit energy for electricity		-656.25	x	3.07	=	-2014.68 (366)
Primary energy from other sources (space heating)						
Efficiency of boilers	95.00					(367b)
Primary energy from boilers	[(307b)+(310b)] x 100 ÷ (367b) =	933.83	x	1.22	=	1139.27 (368)
Electrical energy for community heat distribution		35.49	x	3.07	=	108.94 (372)
Total primary energy associated with community systems						2473.43 (373)
Total primary energy associated with space and water heating						2473.43 (376)
Pumps and fans	47.72	x	3.07	=	146.51	(378)
Electricity for lighting	237.50	x	3.07	=	729.13	(379)
Primary energy kWh/year						3349.07 (383)
Dwelling primary energy rate kWh/m2/year						66.78 (384)

DER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	07/12/2018
Address	2BED Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	63.63 (1a) x	2.50 (2a) =	159.08 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 63.63 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) =	159.08 (5)

2. Ventilation rate

	m ³ per hour
Number of chimneys	0 x 40 = 0 (6a)
Number of open flues	0 x 20 = 0 (6b)
Number of intermittent fans	0 x 10 = 0 (7a)
Number of passive vents	0 x 10 = 0 (7b)
Number of flueless gas fires	0 x 40 = 0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 0 ÷ (5) = 0.00 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	4.00 (17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.20 (18)
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Number of sides on which the dwelling is sheltered	2 (19)
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Shelter factor	1 - [0.075 x (19)] = 0.85 (20)
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Infiltration rate incorporating shelter factor	(18) x (20) = 0.17 (21)
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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70

Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.17	0.18	0.19	0.20
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Calculate effective air change rate for the applicable case:	
If mechanical ventilation: air change rate through system	0.50 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A (23c)
c) whole house extract ventilation or positive input ventilation from outside	0.50 (24c)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K
Window	11.76		11.76	1.14	13.36		(27)
Exposed floor	63.63		63.63	0.08	5.09		(28b)
Party wall	45.00		45.00	0.00	0.00		(32)
External wall	33.12		33.12	0.24	7.95		(29a)
Roof	63.63		63.63	0.14	8.91		(30)
Total area of external elements ΣA, m ²	172.14		172.14				(31)
Fabric heat loss, W/K = Σ(A × U)						(26)...(30) + (32) =	35.31 (33)
Heat capacity Cm = Σ(A × κ)						(28)...(30) + (32) + (32a)...(32e) =	N/A (34)
Thermal mass parameter (TMP) in kJ/m ² K							100.00 (35)
Thermal bridges: Σ(L × Ψ) calculated using Appendix K							14.71 (36)
Total fabric heat loss						(33) + (36) =	50.01 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25
Heat transfer coefficient, W/K (37)m + (38)m	76.26	76.26	76.26	76.26	76.26	76.26	76.26	76.26	76.26	76.26	76.26	76.26
Average = Σ(39)1...12/12 =	76.26 (39)											

Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
Average = Σ(40)1...12/12 =	1.20 (40)											

Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00
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4. Water heating energy requirement

Assumed occupancy, N	2.08 (42)
Annual average hot water usage in litres per day V _{d,average} = (25 x N) + 36	83.65 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month V _{d,m} = factor from Table 1c x (43)	92.02	88.67	85.33	81.98	78.63	75.29	75.29	78.63	81.98	85.33	88.67	92.02
Σ(44)1...12 =	1003.82 (44)											

Energy content of hot water used = 4.18 x V _{d,m} x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	136.46	119.35	123.16	107.37	103.02	88.90	82.38	94.53	95.66	111.49	121.70	132.15
Σ(45)1...12 =	1316.17 (45)											

Distribution loss 0.15 x (45)m	20.47	17.90	18.47	16.11	15.45	13.34	12.36	14.18	14.35	16.72	18.25	19.82
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Storage volume (litres) including any solar or WWHRs storage within same vessel	1.00 (47)
Water storage loss:	

b) Manufacturer's declared loss factor is not known	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.02 (51)
Volume factor from Table 2a	4.93 (52)
Temperature factor from Table 2b	1.00 (53)
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53)	0.10 (54)
Enter (50) or (54) in (55)	0.10 (55)

Water storage loss calculated for each month (55) x (41)m	3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24
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If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)

3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24	(57)
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Primary circuit loss for each month from Table 3

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)
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Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
------	------	------	------	------	------	------	------	------	------	------	------	------

Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

162.96	143.28	149.66	133.02	129.53	114.55	108.88	121.03	121.31	137.99	147.34	158.65	(62)
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Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
------	------	------	------	------	------	------	------	------	------	------	------	------

Output from water heater for each month (kWh/month) (62)m + (63)m

162.96	143.28	149.66	133.02	129.53	114.55	108.88	121.03	121.31	137.99	147.34	158.65	
$\Sigma(64)1...12 =$											1628.19	(64)

Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

66.57	58.83	62.15	56.22	55.46	50.08	48.59	52.63	52.32	58.27	60.98	65.14	(65)
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5. Internal gains

Metabolic gains (Table 5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

16.50	14.66	11.92	9.03	6.75	5.70	6.15	8.00	10.74	13.63	15.91	16.96	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

182.00	183.89	179.13	169.00	156.21	144.19	136.16	134.27	139.03	149.16	161.95	173.97	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	(69)
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Pump and fan gains (Table 5a)

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
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Losses e.g. evaporation (Table 5)

-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	(71)
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Water heating gains (Table 5)

89.48	87.55	83.53	78.08	74.54	69.55	65.31	70.74	72.67	78.32	84.69	87.56	(72)
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Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

342.22	340.33	328.82	310.34	291.73	273.67	261.86	267.24	276.67	295.35	316.79	332.72	(73)
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6. Solar gains

	Access factor Table 6d		Area m ²		Solar flux W/m ²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
East	0.77	x	1.10	x	19.64	x 0.9 x	0.45	x	0.80	=	5.39	(76)
South	0.77	x	10.66	x	46.75	x 0.9 x	0.45	x	0.80	=	124.34	(78)

Solar gains in watts $\Sigma(74)m...(82)m$

129.72	214.17	276.75	318.49	336.53	325.77	317.50	304.94	291.16	232.14	154.10	111.87	(83)
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Total gains - internal and solar (73)m + (83)m

471.94	554.50	605.57	628.82	628.26	599.44	579.36	572.19	567.83	527.49	470.89	444.59	(84)
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7. Mean internal temperature (heating season)

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

21.00	(85)
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Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Utilisation factor for gains for living area n1,m (see Table 9a)

0.95	0.92	0.89	0.84	0.76	0.64	0.51	0.53	0.69	0.84	0.93	0.95	(86)
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Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

18.72	19.02	19.43	19.91	20.36	20.71	20.89	20.87	20.63	20.04	19.28	18.63	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	(88)
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Utilisation factor for gains for rest of dwelling n2,m

0.94	0.91	0.87	0.81	0.72	0.57	0.41	0.43	0.63	0.82	0.91	0.95	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

16.90	17.33	17.92	18.59	19.21	19.66	19.85	19.83	19.56	18.79	17.71	16.78	(90)
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Living area fraction Living area ÷ (4) = 0.50 (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

17.82	18.19	18.68	19.25	19.79	20.19	20.37	20.35	20.10	19.42	18.50	17.71	(92)
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Apply adjustment to the mean internal temperature from Table 4e where appropriate

17.82	18.19	18.68	19.25	19.79	20.19	20.37	20.35	20.10	19.42	18.50	17.71	(93)
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8. Space heating requirement

Utilisation factor for gains, ηm

0.92	0.89	0.85	0.79	0.71	0.59	0.45	0.47	0.64	0.80	0.89	0.93	(94)
------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, ηmGm, W (94)m x (84)m

434.56	493.12	514.71	499.32	446.89	352.58	261.01	270.41	361.66	421.29	419.72	413.25	(95)
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Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
------	------	------	------	-------	-------	-------	-------	-------	-------	------	------	------

Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]

1030.77	1013.13	929.07	789.60	616.86	426.34	287.60	301.57	457.55	672.48	869.16	1030.55	(97)
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Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

443.57	349.44	308.29	209.00	126.45	0.00	0.00	0.00	0.00	186.88	323.60	459.27	
$\Sigma(98)1...5, 10...12 =$											2406.51	(98)

Space heating requirement kWh/m²/year (98) ÷ (4) 37.82 (99)

9b. Energy requirements - community heating scheme

Fraction of space heat from secondary/supplementary system (table 11) '0' if none 0.00 (301)

Fraction of space heat from community system 1 - (301) = 1.00 (302)

Fraction of community heat from boilers 0.25 (303a)

Fraction of community heat from CHP 0.75 (303b)

Fraction of total space heat from community CHP (302) x (303a) = 0.75 (304a)

Fraction of total space heat from community boilers (302) x (303b) = 0.25 (304b)

Factor for control and charging method (Table 4c(3)) for community space heating 1.00 (305)

Factor for charging method (Table 4c(3)) for community water heating 1.00 (305a)

Distribution loss factor (Table 12c) for community heating system 1.05 (306)

Space heating

Annual space heating requirement 2406.51 (98)

Space heat from CHP (98) x (304a) x (305) x (306) = 1895.12 (307a)

Space heat from boilers (98) x (304b) x (305) x (306) = 631.71 (307b)

Water heating

Annual water heating requirement	1628.19	(64)
Water heat from CHP	(64) x (303a) x (305a) x (306) =	1282.20 (310a)
Water heat from boilers	(64) x (303b) x (305a) x (306) =	427.40 (310b)
Electricity used for heat distribution	0.01 x [(307a)...(307e) + (310a)...(310e)] =	42.36 (313)

Electricity for pumps, fans and electric keep-hot (Table 4f)

mechanical ventilation fans - balanced, extract or positive input from outside	45.41	(330a)
Total electricity for the above, kWh/year	45.41	(331)
Electricity for lighting (Appendix L)	291.48	(332)
Total delivered energy for all uses	(307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) =	4573.33 (338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from CHP	1895.12	x	2.97	x 0.01 =	56.29	(340a)
Space heating from boilers	631.71	x	4.24	x 0.01 =	26.78	(340b)
Water heating from CHP	1282.20	x	2.97	x 0.01 =	38.08	(342a)
Water heating from boilers	427.40	x	4.24	x 0.01 =	18.12	(342b)
Pumps and fans	45.41	x	13.19	x 0.01 =	5.99	(349)
Electricity for lighting	291.48	x	13.19	x 0.01 =	38.45	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)...(342e) + (345)...(354) =		303.71	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.17	(357)
SAP value	83.62	
SAP rating (section 13)	84	(358)
SAP band	B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)	
<i>Emissions from community CHP (space and water heating)</i>						
Power efficiency of CHP unit	31.37					(361)
Heat efficiency of CHP unit	55.83					(362)
Space heating from CHP	(307a) x 100 ÷ (362) = 3394.2666	x	0.2160	=	733.1616	(363)
less credit emissions for electricity	-1064.6764	x	0.5190	=	-552.5671	(364)
Water heated by CHP	2296.4909	x	0.2160	=	496.0420	(365)
less credit emissions for electricity	-720.3382	x	0.5190	=	-373.8555	(366)
Emissions from other sources (space heating)						
Efficiency of boilers	95.00					(367b)
CO ₂ emissions from boilers	[(307b)+(310b)] x 100 ÷ (367b) = 1114.85	x	0.216	=	240.81	(368)
Electrical energy for community heat distribution	42.36	x	0.519	=	21.99	(372)
Total CO ₂ associated with community systems					565.58	(373)
Total CO ₂ associated with space and water heating					565.58	(376)
Pumps and fans	45.41	x	0.519	=	23.57	(378)
Electricity for lighting	291.48	x	0.519	=	151.28	(379)
Total CO ₂ , kg/year			(376)...(382) =		740.42	(383)

Dwelling CO ₂ emission rate	(383) ÷ (4) =	11.64	(384)
EI value		90.87	
EI rating (section 14)		91	(385)
EI band		B	

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
<i>Primary Energy from community CHP (space and water heating)</i>						
Power efficiency of CHP unit	31.37					(361)
Heat efficiency of CHP unit	55.83					(362)
Space heating from CHP	(307a) x 100 ÷ (362) = 3394.27	x	1.22	=	4141.01	(363)
less credit energy for electricity	-1064.68	x	3.07	=	-3268.56	(364)
Water heated by CHP	2296.49	x	1.22	=	2801.72	(365)
less credit energy for electricity	-720.34	x	3.07	=	-2211.44	(366)
Primary energy from other sources (space heating)						
Efficiency of boilers	95.00					(367b)
Primary energy from boilers	[(307b)+(310b)] x 100 ÷ (367b) = 1114.85	x	1.22	=	1360.12	(368)
Electrical energy for community heat distribution	42.36	x	3.07	=	130.06	(372)
Total primary energy associated with community systems					2952.91	(373)
Total primary energy associated with space and water heating					2952.91	(376)
Pumps and fans	45.41	x	3.07	=	139.42	(378)
Electricity for lighting	291.48	x	3.07	=	894.84	(379)
Primary energy kWh/year					3987.16	(383)
Dwelling primary energy rate kWh/m ² /year					62.66	(384)

DER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	07/12/2018
Address	2BED Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	63.63 (1a) x	2.50 (2a) =	159.08 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 63.63 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) = 159.08 (5)	

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	0 x 10 =	0 (7a)
Number of passive vents	0 x 10 =	0 (7b)
Number of flueless gas fires	0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 0 ÷ (5) = 0.00 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	4.00 (17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.20 (18)
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Number of sides on which the dwelling is sheltered	2 (19)
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Shelter factor	1 - [0.075 x (19)] = 0.85 (20)
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Infiltration rate incorporating shelter factor	(18) x (20) = 0.17 (21)
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Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70

Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.20
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	0.50 (23a)
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If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A (23c)
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c) whole house extract ventilation or positive input ventilation from outside	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K
Window			11.76	x 1.14	= 13.36		(27)
Party wall			45.00	x 0.00	= 0.00		(32)
External wall			33.12	x 0.24	= 7.95		(29a)
Total area of external elements ΣA, m ²			44.88				(31)
Fabric heat loss, W/K = Σ(A × U)						(26)...(30) + (32) =	21.31 (33)
Heat capacity Cm = Σ(A × κ)						(28)...(30) + (32) + (32a)...(32e) =	N/A (34)
Thermal mass parameter (TMP) in kJ/m ² K							100.00 (35)
Thermal bridges: Σ(L × Ψ) calculated using Appendix K							9.24 (36)
Total fabric heat loss						(33) + (36) =	30.54 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25

Heat transfer coefficient, W/K (37)m + (38)m	56.79	56.79	56.79	56.79	56.79	56.79	56.79	56.79	56.79	56.79	56.79	56.79
Average = Σ(39)1...12/12 =	56.79 (39)											

Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Average = Σ(40)1...12/12 =	0.89 (40)											

Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00
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4. Water heating energy requirement

Assumed occupancy, N	2.08 (42)
Annual average hot water usage in litres per day V _{d,average} = (25 x N) + 36	83.65 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month V _{d,m} = factor from Table 1c x (43)	92.02	88.67	85.33	81.98	78.63	75.29	75.29	78.63	81.98	85.33	88.67	92.02
Σ(44)1...12 =	1003.82 (44)											

Energy content of hot water used = 4.18 x V _{d,m} x nm x T _m /3600 kWh/month (see Tables 1b, 1c 1d)	136.46	119.35	123.16	107.37	103.02	88.90	82.38	94.53	95.66	111.49	121.70	132.15
Σ(45)1...12 =	1316.17 (45)											

Distribution loss 0.15 x (45)m	20.47	17.90	18.47	16.11	15.45	13.34	12.36	14.18	14.35	16.72	18.25	19.82
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Storage volume (litres) including any solar or WWHRs storage within same vessel	1.00 (47)
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Water storage loss:

b) Manufacturer's declared loss factor is not known	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.02 (51)
Volume factor from Table 2a	4.93 (52)
Temperature factor from Table 2b	1.00 (53)
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53)	0.10 (54)
Enter (50) or (54) in (55)	0.10 (55)

Water storage loss calculated for each month (55) x (41)m	3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24
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If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - Vs] ÷ (47), else (56)	3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24
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Primary circuit loss for each month from Table 3

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)
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Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
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Total heat required for water heating calculated for each month $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

162.96	143.28	149.66	133.02	129.53	114.55	108.88	121.03	121.31	137.99	147.34	158.65	(62)
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Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
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Output from water heater for each month (kWh/month) $(62)m + (63)m$

162.96	143.28	149.66	133.02	129.53	114.55	108.88	121.03	121.31	137.99	147.34	158.65	
$\Sigma(64)1...12 =$											1628.19	(64)

Heat gains from water heating (kWh/month) $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

66.57	58.83	62.15	56.22	55.46	50.08	48.59	52.63	52.32	58.27	60.98	65.14	(65)
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5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

16.50	14.66	11.92	9.03	6.75	5.70	6.15	8.00	10.74	13.63	15.91	16.96	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

182.00	183.89	179.13	169.00	156.21	144.19	136.16	134.27	139.03	149.16	161.95	173.97	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	(69)
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Pump and fan gains (Table 5a)

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
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Losses e.g. evaporation (Table 5)

-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	(71)
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Water heating gains (Table 5)

89.48	87.55	83.53	78.08	74.54	69.55	65.31	70.74	72.67	78.32	84.69	87.56	(72)
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Total internal gains $(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$

342.22	340.33	328.82	310.34	291.73	273.67	261.86	267.24	276.67	295.35	316.79	332.72	(73)
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6. Solar gains

	Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W	
West	0.77	x	1.10	x	19.64	x	0.9 x 0.45 x 0.80 = 5.39 (80)
North	0.77	x	10.66	x	10.63	x	0.9 x 0.45 x 0.80 = 28.28 (74)
Solar gains in watts $\Sigma(74)m...(82)m$							
	33.67	64.59	109.20	172.83	229.74	244.49	228.85 183.54 130.61 76.84 41.61 28.01 (83)

Total gains - internal and solar $(73)m + (83)m$

375.89	404.91	438.01	483.17	521.46	518.16	490.70	450.79	407.28	372.19	358.40	360.73	(84)
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7. Mean internal temperature (heating season)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	21.00 (85)
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Utilisation factor for gains for living area n1,m (see Table 9a)

0.96	0.95	0.93	0.87	0.76	0.61	0.48	0.53	0.74	0.89	0.95	0.97	(86)
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Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.19	19.37	19.71	20.17	20.59	20.85	20.95	20.93	20.72	20.21	19.62	19.14	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	(88)
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Utilisation factor for gains for rest of dwelling n2,m

0.96	0.95	0.92	0.85	0.72	0.55	0.40	0.45	0.69	0.87	0.94	0.96	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

17.73	17.99	18.48	19.13	19.70	20.03	20.14	20.12	19.88	19.19	18.35	17.65	(90)
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Living area fraction Living area ÷ (4) = 0.50 (91)

Mean internal temperature for the whole dwelling $f_{LA} \times T1 + (1 - f_{LA}) \times T2$

18.47	18.69	19.10	19.66	20.15	20.45	20.55	20.53	20.31	19.70	18.99	18.40	(92)
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Apply adjustment to the mean internal temperature from Table 4e where appropriate

18.47	18.69	19.10	19.66	20.15	20.45	20.55	20.53	20.31	19.70	18.99	18.40	(93)
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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, η_m	0.95	0.93	0.90	0.83	0.72	0.57	0.43	0.48	0.70	0.86	0.93	0.95	(94)

Useful gains, $\eta_m G_m$, W $(94)m \times (84)m$

355.69	377.29	394.59	403.40	376.76	295.75	212.73	218.23	284.11	320.74	332.43	343.26	(95)
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Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
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Heat loss rate for mean internal temperature, L_m , W $[(39)m \times (93)m - (96)m]$

804.65	782.85	715.71	611.01	480.01	332.01	224.14	234.42	352.42	516.89	675.02	806.30	(97)
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Space heating requirement, kWh/month $0.024 \times [(97)m - (95)m] \times (41)m$

334.02	272.54	238.91	149.48	76.82	0.00	0.00	0.00	0.00	145.94	246.67	344.50	
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$\Sigma(98)1...5, 10...12 = 1808.87 (98)$

Space heating requirement kWh/m²/year (98) ÷ (4) = 28.43 (99)

9b. Energy requirements - community heating scheme

Fraction of space heat from secondary/supplementary system (table 11)	'0' if none	0.00	(301)
Fraction of space heat from community system	1 - (301) =	1.00	(302)
Fraction of community heat from boilers		0.25	(303a)
Fraction of community heat from CHP		0.75	(303b)
Fraction of total space heat from community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community boilers	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating		1.00	(305)
Factor for charging method (Table 4c(3)) for community water heating		1.00	(305a)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating

Annual space heating requirement	1808.87	(98)
Space heat from CHP	(98) x (304a) x (305) x (306) =	1424.49 (307a)
Space heat from boilers	(98) x (304b) x (305) x (306) =	474.83 (307b)

Water heating

Annual water heating requirement	1628.19	(64)
Water heat from CHP	(64) x (303a) x (305a) x (306) =	1282.20 (310a)

Water heat from boilers	(64) x (303b) x (305a) x (306) =	427.40	(310b)
Electricity used for heat distribution	0.01 x [(307a)...(307e) + (310a)...(310e)] =	36.09	(313)

Electricity for pumps, fans and electric keep-hot (Table 4f)

mechanical ventilation fans - balanced, extract or positive input from outside	45.41	(330a)
Total electricity for the above, kWh/year	45.41	(331)
Electricity for lighting (Appendix L)	291.48	(332)
Total delivered energy for all uses	(307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) =	3945.81 (338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from CHP	1424.49	x	2.97	x 0.01 =	42.31	(340a)
Space heating from boilers	474.83	x	4.24	x 0.01 =	20.13	(340b)
Water heating from CHP	1282.20	x	2.97	x 0.01 =	38.08	(342a)
Water heating from boilers	427.40	x	4.24	x 0.01 =	18.12	(342b)
Pumps and fans	45.41	x	13.19	x 0.01 =	5.99	(349)
Electricity for lighting	291.48	x	13.19	x 0.01 =	38.45	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)...(342e) + (345)...(354) =		283.08	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.09	(357)
SAP value	84.73	
SAP rating (section 13)	85	(358)
SAP band	B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)	
<i>Emissions from community CHP (space and water heating)</i>						
Power efficiency of CHP unit	31.37					(361)
Heat efficiency of CHP unit	55.83					(362)
Space heating from CHP	(307a) x 100 ÷ (362) = 2551.3287	x	0.2160	=	551.0870	(363)
less credit emissions for electricity	-800.2729	x	0.5190	=	-415.3416	(364)
Water heated by CHP	2296.4909	x	0.2160	=	496.0420	(365)
less credit emissions for electricity	-720.3382	x	0.5190	=	-373.8555	(366)
Emissions from other sources (space heating)						
Efficiency of boilers	95.00					(367b)
CO ₂ emissions from boilers	[(307b)+(310b)] x 100 ÷ (367b) = 949.71	x	0.216	=	205.14	(368)
Electrical energy for community heat distribution	36.09	x	0.519	=	18.73	(372)
Total CO ₂ associated with community systems					481.80	(373)
Total CO ₂ associated with space and water heating					481.80	(376)
Pumps and fans	45.41	x	0.519	=	23.57	(378)
Electricity for lighting	291.48	x	0.519	=	151.28	(379)
Total CO ₂ , kg/year			(376)...(382) =		656.65	(383)
Dwelling CO ₂ emission rate			(383) ÷ (4) =		10.32	(384)
EI value					91.90	

EI rating (section 14)	92	(385)
EI band	A	

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
<i>Primary Energy from community CHP (space and water heating)</i>						
Power efficiency of CHP unit	31.37					(361)
Heat efficiency of CHP unit	55.83					(362)
Space heating from CHP	(307a) x 100 ÷ (362) = 2551.33	x	1.22	=	3112.62	(363)
less credit energy for electricity	-800.27	x	3.07	=	-2456.84	(364)
Water heated by CHP	2296.49	x	1.22	=	2801.72	(365)
less credit energy for electricity	-720.34	x	3.07	=	-2211.44	(366)
Primary energy from other sources (space heating)						
Efficiency of boilers	95.00					(367b)
Primary energy from boilers	[(307b)+(310b)] x 100 ÷ (367b) = 949.71	x	1.22	=	1158.65	(368)
Electrical energy for community heat distribution	36.09	x	3.07	=	110.79	(372)
Total primary energy associated with community systems					2515.51	(373)
Total primary energy associated with space and water heating					2515.51	(376)
Pumps and fans	45.41	x	3.07	=	139.42	(378)
Electricity for lighting	291.48	x	3.07	=	894.84	(379)
Primary energy kWh/year					3549.77	(383)
Dwelling primary energy rate kWh/m ² /year					55.79	(384)

DER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	07/12/2018
Address	2BED Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	63.63 (1a) x	2.50 (2a) =	159.08 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 63.63 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) =	159.08 (5)

2. Ventilation rate

	m ³ per hour
Number of chimneys	0 x 40 = 0 (6a)
Number of open flues	0 x 20 = 0 (6b)
Number of intermittent fans	0 x 10 = 0 (7a)
Number of passive vents	0 x 10 = 0 (7b)
Number of flueless gas fires	0 x 40 = 0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 0 ÷ (5) = 0.00 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	4.00 (17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)

Number of sides on which the dwelling is sheltered	2 (19)
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Shelter factor	1 - [0.075 x (19)] = 0.85 (20)
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Infiltration rate incorporating shelter factor	(18) x (20) = 0.17 (21)
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Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70

Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.17	0.18	0.19	0.20
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	0.50 (23a)
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If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A (23c)
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c) whole house extract ventilation or positive input ventilation from outside	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K
Window			11.76	x	1.14	=	13.36 (27)
Party wall			45.00	x	0.00	=	0.00 (32)
External wall			33.12	x	0.24	=	7.95 (29a)
Roof			63.63	x	0.14	=	8.91 (30)
Total area of external elements ΣA, m ²			108.51				(31)
Fabric heat loss, W/K = Σ(A x U)						(26)...(30) + (32) =	30.22 (33)
Heat capacity Cm = Σ(A x κ)						(28)...(30) + (32) + (32a)...(32e) =	N/A (34)
Thermal mass parameter (TMP) in kJ/m ² K							100.00 (35)
Thermal bridges: Σ(L x Ψ) calculated using Appendix K							20.23 (36)
Total fabric heat loss						(33) + (36) =	50.45 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25
Heat transfer coefficient, W/K (37)m + (38)m	76.70	76.70	76.70	76.70	76.70	76.70	76.70	76.70	76.70	76.70	76.70	76.70
Average = Σ(39)1...12/12 =	76.70 (39)											

Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21
Average = Σ(40)1...12/12 =	1.21 (40)											

Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00
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4. Water heating energy requirement

Assumed occupancy, N	2.08 (42)
Annual average hot water usage in litres per day V _{d,average} = (25 x N) + 36	83.65 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month V _{d,m} = factor from Table 1c x (43)	92.02	88.67	85.33	81.98	78.63	75.29	75.29	78.63	81.98	85.33	88.67	92.02
Σ(44)1...12 =	1003.82 (44)											

Energy content of hot water used = 4.18 x V _{d,m} x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	136.46	119.35	123.16	107.37	103.02	88.90	82.38	94.53	95.66	111.49	121.70	132.15
Σ(45)1...12 =	1316.17 (45)											

Distribution loss 0.15 x (45)m	20.47	17.90	18.47	16.11	15.45	13.34	12.36	14.18	14.35	16.72	18.25	19.82
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Storage volume (litres) including any solar or WWHRs storage within same vessel	1.00 (47)
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Water storage loss:

b) Manufacturer's declared loss factor is not known	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.02 (51)
Volume factor from Table 2a	4.93 (52)
Temperature factor from Table 2b	1.00 (53)
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53)	0.10 (54)
Enter (50) or (54) in (55)	0.10 (55)

Water storage loss calculated for each month (55) x (41)m	3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24
---	------	------	------	------	------	------	------	------	------	------	------	------

If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - Vs] ÷ (47), else (56)

3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24	(57)
------	------	------	------	------	------	------	------	------	------	------	------	------

Primary circuit loss for each month from Table 3

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

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
------	------	------	------	------	------	------	------	------	------	------	------	------

Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

162.96	143.28	149.66	133.02	129.53	114.55	108.88	121.03	121.31	137.99	147.34	158.65	(62)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
------	------	------	------	------	------	------	------	------	------	------	------	------

Output from water heater for each month (kWh/month) (62)m + (63)m

162.96	143.28	149.66	133.02	129.53	114.55	108.88	121.03	121.31	137.99	147.34	158.65	
$\Sigma(64)1...12 =$											1628.19	(64)

Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

66.57	58.83	62.15	56.22	55.46	50.08	48.59	52.63	52.32	58.27	60.98	65.14	(65)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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Metabolic gains (Table 5)

104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	104.11	(66)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

16.50	14.66	11.92	9.03	6.75	5.70	6.15	8.00	10.74	13.63	15.91	16.96	(67)
-------	-------	-------	------	------	------	------	------	-------	-------	-------	-------	------

Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

182.00	183.89	179.13	169.00	156.21	144.19	136.16	134.27	139.03	149.16	161.95	173.97	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	(69)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pump and fan gains (Table 5a)

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
------	------	------	------	------	------	------	------	------	------	------	------	------

Losses e.g. evaporation (Table 5)

-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	-83.29	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

89.48	87.55	83.53	78.08	74.54	69.55	65.31	70.74	72.67	78.32	84.69	87.56	(72)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

342.22	340.33	328.82	310.34	291.73	273.67	261.86	267.24	276.67	295.35	316.79	332.72	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains

	Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W	
South	0.77	x	1.10	x	46.75	x 0.9 x	0.45 x 0.80 = 12.83 (78)
West	0.77	x	10.66	x	19.64	x 0.9 x	0.45 x 0.80 = 52.23 (80)

Solar gains in watts $\Sigma(74)m...(82)m$

65.06	123.19	195.04	275.67	332.29	338.22	322.76	280.57	223.67	143.91	80.34	54.04	(83)
-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	------

Total gains - internal and solar (73)m + (83)m

407.28	463.52	523.86	586.00	624.01	611.89	584.62	547.82	500.34	439.25	397.13	386.76	(84)
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7. Mean internal temperature (heating season)

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	21.00 (85)
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Utilisation factor for gains for living area n1,m (see Table 9a)

0.96	0.95	0.92	0.86	0.76	0.63	0.51	0.55	0.74	0.89	0.95	0.97	(86)
------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

18.55	18.81	19.26	19.83	20.35	20.72	20.89	20.86	20.56	19.88	19.10	18.48	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	(88)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling n2,m

0.96	0.94	0.90	0.83	0.72	0.56	0.40	0.45	0.67	0.86	0.94	0.96	(89)
------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

16.65	17.02	17.67	18.48	19.19	19.66	19.84	19.82	19.48	18.56	17.45	16.55	(90)
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Living area fraction Living area ÷ (4) = 0.50 (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

17.61	17.92	18.47	19.16	19.77	20.19	20.37	20.34	20.02	19.23	18.28	17.52	(92)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e where appropriate

17.61	17.92	18.47	19.16	19.77	20.19	20.37	20.34	20.02	19.23	18.28	17.52	(93)
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8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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Utilisation factor for gains, ηm

0.94	0.92	0.88	0.81	0.71	0.58	0.45	0.49	0.68	0.84	0.92	0.95	(94)
------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, ηmGm, W (94)m x (84)m

382.52	425.56	461.02	476.55	445.80	356.11	262.33	268.09	341.13	370.96	364.75	365.64	(95)
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Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
------	------	------	------	-------	-------	-------	-------	-------	-------	------	------	------

Heat loss rate for mean internal temperature, Lm, W [(39)m x (93)m - (96)m]

1020.90	998.79	918.17	786.72	619.14	428.93	289.02	302.24	454.27	661.54	857.68	1021.94	(97)
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Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

474.95	385.21	340.12	223.32	128.96	0.00	0.00	0.00	0.00	216.19	354.91	488.29	
$\Sigma(98)1...5, 10...12 =$											2611.95	(98)

Space heating requirement kWh/m²/year (98) ÷ (4) 41.05 (99)

9b. Energy requirements - community heating scheme

Fraction of space heat from secondary/supplementary system (table 11)	'0' if none	0.00	(301)
Fraction of space heat from community system	1 - (301) =	1.00	(302)
Fraction of community heat from boilers		0.25	(303a)
Fraction of community heat from CHP		0.75	(303b)
Fraction of total space heat from community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community boilers	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating		1.00	(305)
Factor for charging method (Table 4c(3)) for community water heating		1.00	(305a)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating

Annual space heating requirement	2611.95	(98)
Space heat from CHP	(98) x (304a) x (305) x (306) =	2056.91 (307a)
Space heat from boilers	(98) x (304b) x (305) x (306) =	685.64 (307b)

Water heating

Annual water heating requirement	1628.19	(64)
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Water heat from CHP	(64) x (303a) x (305a) x (306) =	1282.20	(310a)
Water heat from boilers	(64) x (303b) x (305a) x (306) =	427.40	(310b)
Electricity used for heat distribution	0.01 x [(307a)...(307e) + (310a)...(310e)] =	44.52	(313)

Electricity for pumps, fans and electric keep-hot (Table 4f)

mechanical ventilation fans - balanced, extract or positive input from outside	45.41	(330a)
Total electricity for the above, kWh/year	45.41	(331)
Electricity for lighting (Appendix L)	291.48	(332)
Total delivered energy for all uses	(307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) = 4789.04	(338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from CHP	2056.91	x	2.97	x 0.01 =	61.09	(340a)
Space heating from boilers	685.64	x	4.24	x 0.01 =	29.07	(340b)
Water heating from CHP	1282.20	x	2.97	x 0.01 =	38.08	(342a)
Water heating from boilers	427.40	x	4.24	x 0.01 =	18.12	(342b)
Pumps and fans	45.41	x	13.19	x 0.01 =	5.99	(349)
Electricity for lighting	291.48	x	13.19	x 0.01 =	38.45	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)...(342e) + (345)...(354) =		310.80	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.20	(357)
SAP value	83.24	
SAP rating (section 13)	83	(358)
SAP band	B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)	
<i>Emissions from community CHP (space and water heating)</i>						
Power efficiency of CHP unit	31.37					(361)
Heat efficiency of CHP unit	55.83					(362)
Space heating from CHP	(307a) x 100 ÷ (362) = 3684.0367	x	0.2160	=	795.7519	(363)
less credit emissions for electricity	-1155.5683	x	0.5190	=	-599.7400	(364)
Water heated by CHP	2296.4909	x	0.2160	=	496.0420	(365)
less credit emissions for electricity	-720.3382	x	0.5190	=	-373.8555	(366)
Emissions from other sources (space heating)						
Efficiency of boilers	95.00					(367b)
CO ₂ emissions from boilers	[(307b)+(310b)] x 100 ÷ (367b) = 1171.62	x	0.216	=	253.07	(368)
Electrical energy for community heat distribution	44.52	x	0.519	=	23.11	(372)
Total CO ₂ associated with community systems					594.37	(373)
Total CO ₂ associated with space and water heating					594.37	(376)
Pumps and fans	45.41	x	0.519	=	23.57	(378)
Electricity for lighting	291.48	x	0.519	=	151.28	(379)
Total CO ₂ , kg/year				(376)...(382) =	769.22	(383)
Dwelling CO ₂ emission rate				(383) ÷ (4) =	12.09	(384)

EI value	90.51	
EI rating (section 14)	91	(385)
EI band	B	

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
<i>Primary Energy from community CHP (space and water heating)</i>						
Power efficiency of CHP unit	31.37					(361)
Heat efficiency of CHP unit	55.83					(362)
Space heating from CHP	(307a) x 100 ÷ (362) = 3684.04	x	1.22	=	4494.52	(363)
less credit energy for electricity	-1155.57	x	3.07	=	-3547.59	(364)
Water heated by CHP	2296.49	x	1.22	=	2801.72	(365)
less credit energy for electricity	-720.34	x	3.07	=	-2211.44	(366)
Primary energy from other sources (space heating)						
Efficiency of boilers	95.00					(367b)
Primary energy from boilers	[(307b)+(310b)] x 100 ÷ (367b) = 1171.62	x	1.22	=	1429.37	(368)
Electrical energy for community heat distribution	44.52	x	3.07	=	136.68	(372)
Total primary energy associated with community systems					3103.27	(373)
Total primary energy associated with space and water heating					3103.27	(376)
Pumps and fans	45.41	x	3.07	=	139.42	(378)
Electricity for lighting	291.48	x	3.07	=	894.84	(379)
Primary energy kWh/year					4137.52	(383)
Dwelling primary energy rate kWh/m ² /year					65.02	(384)

DER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	07/12/2018
Address	3Bed Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	80.34 (1a) x	2.50 (2a) =	200.85 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 80.34 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) =	200.85 (5)

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	0 x 10 =	0 (7a)
Number of passive vents	0 x 10 =	0 (7b)
Number of flueless gas fires	0 x 40 =	0 (7c)

Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 0 ÷ (5) =	0.00 (8)
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If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	4.00 (17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.20 (18)
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Number of sides on which the dwelling is sheltered	2 (19)
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Shelter factor	1 - [0.075 x (19)] = 0.85 (20)
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Infiltration rate incorporating shelter factor	(18) x (20) = 0.17 (21)
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Infiltration rate modified for monthly wind speed:

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

 (22)

Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18
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 (22a)

Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.17	0.18	0.19	0.20
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 (22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	0.50 (23a)
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If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A (23c)
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c) whole house extract ventilation or positive input ventilation from outside	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
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 (24c)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
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 (25)

3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² .K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K
Window			13.12	x 1.14	= 14.90		(27)
Exposed floor			63.63	x 0.14	= 8.91		(28b)
Party wall			51.59	x 0.00	= 0.00		(32)
External wall			38.33	x 0.24	= 9.20		(29a)
Total area of external elements ΣA, m ²			115.08				(31)
Fabric heat loss, W/K = Σ(A x U)						(26)...(30) + (32) =	33.01 (33)
Heat capacity Cm = Σ(A x κ)						(28)...(30) + (32) + (32a)...(32e) =	N/A (34)
Thermal mass parameter (TMP) in kJ/m ² .K							100.00 (35)
Thermal bridges: Σ(L x Ψ) calculated using Appendix K							16.24 (36)
Total fabric heat loss						(33) + (36) =	49.25 (37)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)											
33.14	33.14	33.14	33.14	33.14	33.14	33.14	33.14	33.14	33.14	33.14	33.14
Heat transfer coefficient, W/K (37)m + (38)m											
82.39	82.39	82.39	82.39	82.39	82.39	82.39	82.39	82.39	82.39	82.39	82.39
Average = Σ(39)1...12/12 =											82.39 (39)

Heat loss parameter (HLP), W/m ² .K (39)m ÷ (4)											
1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03
Average = Σ(40)1...12/12 =											1.03 (40)

Number of days in month (Table 1a)											
31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00

 (40)

4. Water heating energy requirement

Assumed occupancy, N	2.47 (42)
Annual average hot water usage in litres per day V _{d,average} = (25 x N) + 36	92.85 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month V _{d,m} = factor from Table 1c x (43)											
102.13	98.42	94.70	90.99	87.27	83.56	83.56	87.27	90.99	94.70	98.42	102.13
Σ(44)1...12 =											1114.14 (44)

Energy content of hot water used = 4.18 x V _{d,m} x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)											
151.46	132.46	136.69	119.17	114.35	98.67	91.43	104.92	106.18	123.74	135.07	146.68
Σ(45)1...12 =											1460.82 (45)

Distribution loss 0.15 x (45)m											
22.72	19.87	20.50	17.88	17.15	14.80	13.72	15.74	15.93	18.56	20.26	22.00

 (46)

Storage volume (litres) including any solar or WWHRs storage within same vessel	1.00 (47)
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Water storage loss:

b) Manufacturer's declared loss factor is not known											
Hot water storage loss factor from Table 2 (kWh/litre/day)											0.02 (51)
Volume factor from Table 2a											4.93 (52)
Temperature factor from Table 2b											1.00 (53)
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53)											0.10 (54)
Enter (50) or (54) in (55)											0.10 (55)

Water storage loss calculated for each month (55) x (41)m											
3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24

 (56)

If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - Vs] ÷ (47), else (56)

3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24	(57)
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Primary circuit loss for each month from Table 3

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)
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Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
------	------	------	------	------	------	------	------	------	------	------	------	------

Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

177.96	156.40	163.19	144.82	140.85	124.32	117.94	131.42	131.82	150.24	160.72	173.18	(62)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
------	------	------	------	------	------	------	------	------	------	------	------	------

Output from water heater for each month (kWh/month) (62)m + (63)m

177.96	156.40	163.19	144.82	140.85	124.32	117.94	131.42	131.82	150.24	160.72	173.18	
$\Sigma(64)1...12 =$											1772.84	(64)

Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

71.56	63.19	66.65	60.14	59.22	53.33	51.60	56.09	55.82	62.34	65.43	69.97	(65)
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5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)												
123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

20.39	18.11	14.73	11.15	8.34	7.04	7.61	9.89	13.27	16.85	19.66	20.96	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

220.15	222.43	216.68	204.42	188.95	174.41	164.70	162.41	168.17	180.43	195.90	210.44	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	(69)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pump and fan gains (Table 5a)

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
------	------	------	------	------	------	------	------	------	------	------	------	------

Losses e.g. evaporation (Table 5)

-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

96.18	94.04	89.58	83.53	79.60	74.06	69.36	75.39	77.53	83.79	90.87	94.05	(72)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

396.77	394.62	381.03	359.14	336.93	315.55	301.70	307.72	319.01	341.11	366.47	385.48	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains

	Access factor Table 6d		Area m ²		Solar flux W/m ²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
NorthWest	0.77	x	10.59	x	11.28	x 0.9 x	0.45	x	0.80	=	29.81	(81)
SouthWest	0.77	x	2.53	x	36.79	x 0.9 x	0.45	x	0.80	=	23.22	(79)
Solar gains in watts $\Sigma(74)m...(82)m$												
53.03	100.24	163.45	246.60	316.45	331.86	312.59	257.77	191.82	117.87	65.32	44.22	(83)

Total gains - internal and solar (73)m + (83)m

449.80	494.86	544.48	605.75	653.38	647.42	614.29	565.49	510.82	458.98	431.79	429.70	(84)
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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1(°C)											21.00	(85)
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Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area n1,m (see Table 9a)												

0.97	0.96	0.94	0.89	0.79	0.66	0.53	0.58	0.78	0.91	0.96	0.97	(86)
------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

18.82	19.02	19.41	19.93	20.42	20.76	20.91	20.88	20.60	19.98	19.30	18.76	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	(88)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling n2,m

0.97	0.95	0.93	0.87	0.76	0.59	0.43	0.49	0.72	0.89	0.95	0.97	(89)
------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

17.12	17.42	17.98	18.72	19.40	19.84	20.00	19.97	19.65	18.80	17.83	17.03	(90)
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Living area fraction Living area ÷ (4) = 0.40

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

17.80	18.06	18.55	19.20	19.81	20.21	20.36	20.33	20.03	19.27	18.41	17.72	(92)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e where appropriate

17.80	18.06	18.55	19.20	19.81	20.21	20.36	20.33	20.03	19.27	18.41	17.72	(93)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm												
0.95	0.94	0.91	0.85	0.75	0.60	0.46	0.51	0.72	0.87	0.93	0.96	(94)

Useful gains, ηmGm, W (94)m x (84)m

427.97	463.48	493.74	512.67	487.01	391.02	285.63	291.14	368.01	400.78	403.54	410.97	(95)
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Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
------	------	------	------	-------	-------	-------	-------	-------	-------	------	------	------

Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]

1112.14	1084.06	992.73	848.90	668.06	462.03	309.97	324.14	488.35	714.62	932.24	1114.00	(97)
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Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

509.02	417.03	371.25	242.09	134.70	0.00	0.00	0.00	0.00	233.50	380.66	523.05	
$\Sigma(98)1...5, 10...12 =$											2811.31	(98)

Space heating requirement kWh/m²/year (98) ÷ (4) 34.99

9b. Energy requirements - community heating scheme

Fraction of space heat from secondary/supplementary system (table 11)	'0' if none	0.00	(301)
Fraction of space heat from community system	1 - (301) =	1.00	(302)
Fraction of community heat from boilers		0.25	(303a)
Fraction of community heat from CHP		0.75	(303b)
Fraction of total space heat from community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community boilers	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating		1.00	(305)
Factor for charging method (Table 4c(3)) for community water heating		1.00	(305a)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating

Annual space heating requirement	2811.31	(98)
Space heat from CHP	(98) x (304a) x (305) x (306) =	2213.91 (307)
Space heat from boilers	(98) x (304b) x (305) x (306) =	737.97 (307)

Water heating

Annual water heating requirement	1772.84	(64)
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Water heat from CHP	$(64) \times (303a) \times (305a) \times (306) =$	1396.11	(310a)
Water heat from boilers	$(64) \times (303b) \times (305a) \times (306) =$	465.37	(310b)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	48.13	(313)

Electricity for pumps, fans and electric keep-hot (Table 4f)

mechanical ventilation fans - balanced, extract or positive input from outside	76.45	(330a)
Total electricity for the above, kWh/year	76.45	(331)
Electricity for lighting (Appendix L)	360.17	(332)
Total delivered energy for all uses	(307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) = 5249.98	(338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from CHP	2213.91	x	2.97	x 0.01 =	65.75	(340a)
Space heating from boilers	737.97	x	4.24	x 0.01 =	31.29	(340b)
Water heating from CHP	1396.11	x	2.97	x 0.01 =	41.46	(342a)
Water heating from boilers	465.37	x	4.24	x 0.01 =	19.73	(342b)
Pumps and fans	76.45	x	13.19	x 0.01 =	10.08	(349)
Electricity for lighting	360.17	x	13.19	x 0.01 =	47.51	(350)
Additional standing charges					120.00	(351)
Total energy cost			$(340a)...(342e) + (345)...(354) =$		335.83	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.13	(357)
SAP value	84.30	
SAP rating (section 13)	84	(358)
SAP band	B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)	
<i>Emissions from community CHP (space and water heating)</i>						
Power efficiency of CHP unit	31.37					(361)
Heat efficiency of CHP unit	55.83					(362)
Space heating from CHP	(307a) × 100 ÷ (362) =	3965.2241	x	0.2160	=	856.4884 (363)
less credit emissions for electricity		-1243.7681	x	0.5190	=	-645.5157 (364)
Water heated by CHP		2500.5098	x	0.2160	=	540.1101 (365)
less credit emissions for electricity		-784.3326	x	0.5190	=	-407.0686 (366)
Emissions from other sources (space heating)						
Efficiency of boilers	95.00					(367b)
CO2 emissions from boilers	[(307b)+(310b)] × 100 ÷ (367b) =	1266.67	x	0.216	=	273.60 (368)
Electrical energy for community heat distribution		48.13	x	0.519	=	24.98 (372)
Total CO2 associated with community systems						642.60 (373)
Total CO2 associated with space and water heating						642.60 (376)
Pumps and fans	76.45	x	0.519	=	39.68	(378)
Electricity for lighting	360.17	x	0.519	=	186.93	(379)
Total CO ₂ , kg/year					(376)-(382) =	869.21 (383)
Dwelling CO ₂ emission rate					(383) ÷ (4) =	10.82 (384)

EI value	90.71	
EI rating (section 14)	91	(385)
EI band	B	

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)
Primary Energy from community CHP (space and water heating)					
Power efficiency of CHP unit	31.37				(361)
Heat efficiency of CHP unit	55.83				(362)
Space heating from CHP	(307a) × 100 ÷ (362) = 3965.22	x	1.22	=	4837.57 (363)
less credit energy for electricity	-1243.77	x	3.07	=	-3818.37 (364)
Water heated by CHP	2500.51	x	1.22	=	3050.62 (365)
less credit energy for electricity	-784.33	x	3.07	=	-2407.90 (366)
Primary energy from other sources (space heating)					
Efficiency of boilers	95.00				(367b)
Primary energy from boilers	[(307b)+(310b)] × 100 ÷ (367b) = 1266.67	x	1.22	=	1545.34 (368)
Electrical energy for community heat distribution	48.13	x	3.07	=	147.77 (372)
Total primary energy associated with community systems					3355.04 (373)
Total primary energy associated with space and water heating					3355.04 (376)
Pumps and fans	76.45	x	3.07	=	234.71 (378)
Electricity for lighting	360.17	x	3.07	=	1105.73 (379)
Primary energy kWh/year					4695.48 (383)
Dwelling primary energy rate kWh/m2/year					58.45 (384)

DER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	07/12/2018
Address	3Bed Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	80.34 (1a) x	2.50 (2a) =	200.85 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 80.34 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) = 200.85 (5)	

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	0 x 10 =	0 (7a)
Number of passive vents	0 x 10 =	0 (7b)
Number of flueless gas fires	0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 0 ÷ (5) = 0.00 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q₅₀, expressed in cubic metres per hour per square metre of envelope area (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) (18)

Number of sides on which the dwelling is sheltered (19)

Shelter factor 1 - [0.075 x (19)] = (20)

Infiltration rate incorporating shelter factor (18) x (20) = (21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70 (22)

Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18 (22a)
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.20 (22b)
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system (23a)

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h (23c)

c) whole house extract ventilation or positive input ventilation from outside (24c)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50 (25)
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K
Window			13.12 x 1.14 = 14.90 (27)				
Party wall			51.59 x 0.00 = 0.00 (32)				
External wall			38.33 x 0.24 = 9.20 (29a)				
Total area of external elements ΣA, m ²			51.45 (31)				
Fabric heat loss, W/K = Σ(A x U)					(26)...(30) + (32) = 24.10 (33)		
Heat capacity Cm = Σ(A x κ)					(28)...(30) + (32) + (32a)...(32e) = N/A (34)		
Thermal mass parameter (TMP) in kJ/m ² K					100.00 (35)		
Thermal bridges: Σ(L x Ψ) calculated using Appendix K					10.28 (36)		
Total fabric heat loss					(33) + (36) = 34.38 (37)		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	33.14	33.14	33.14	33.14	33.14	33.14	33.14	33.14	33.14	33.14	33.14	33.14 (38)

Heat transfer coefficient, W/K (37)m + (38)m	67.52	67.52	67.52	67.52	67.52	67.52	67.52	67.52	67.52	67.52	67.52	67.52 (39)
Average = Σ(39)1...12/12 =	67.52											

Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84 (40)
Average = Σ(40)1...12/12 =	0.84											

Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00 (40)
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4. Water heating energy requirement

Assumed occupancy, N	2.47 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	92.85 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	102.13	98.42	94.70	90.99	87.27	83.56	83.56	87.27	90.99	94.70	98.42	102.13 (44)
Σ(44)1...12 =	1114.14											

Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	151.46	132.46	136.69	119.17	114.35	98.67	91.43	104.92	106.18	123.74	135.07	146.68 (45)
Σ(45)1...12 =	1460.82											

Distribution loss 0.15 x (45)m	22.72	19.87	20.50	17.88	17.15	14.80	13.72	15.74	15.93	18.56	20.26	22.00 (46)
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Storage volume (litres) including any solar or WWHRs storage within same vessel	1.00 (47)
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Water storage loss:

b) Manufacturer's declared loss factor is not known	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.02 (51)
Volume factor from Table 2a	4.93 (52)
Temperature factor from Table 2b	1.00 (53)
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53)	0.10 (54)
Enter (50) or (54) in (55)	0.10 (55)

Water storage loss calculated for each month (55) x (41)m	3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24 (56)
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If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - Vs] ÷ (47), else (56)	3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24 (57)
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Primary circuit loss for each month from Table 3

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)
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Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
------	------	------	------	------	------	------	------	------	------	------	------	------

Total heat required for water heating calculated for each month $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

177.96	156.40	163.19	144.82	140.85	124.32	117.94	131.42	131.82	150.24	160.72	173.18	(62)
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Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
------	------	------	------	------	------	------	------	------	------	------	------	------

Output from water heater for each month (kWh/month) (62)m + (63)m

177.96	156.40	163.19	144.82	140.85	124.32	117.94	131.42	131.82	150.24	160.72	173.18	
$\Sigma(64)1...12 =$											1772.84	(64)

Heat gains from water heating (kWh/month) $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

71.56	63.19	66.65	60.14	59.22	53.33	51.60	56.09	55.82	62.34	65.43	69.97	(65)
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5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

20.39	18.11	14.73	11.15	8.34	7.04	7.61	9.89	13.27	16.85	19.66	20.96	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

220.15	222.43	216.68	204.42	188.95	174.41	164.70	162.41	168.17	180.43	195.90	210.44	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	(69)
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Pump and fan gains (Table 5a)

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
------	------	------	------	------	------	------	------	------	------	------	------	------

Losses e.g. evaporation (Table 5)

-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

96.18	94.04	89.58	83.53	79.60	74.06	69.36	75.39	77.53	83.79	90.87	94.05	(72)
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Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

396.77	394.62	381.03	359.14	336.93	315.55	301.70	307.72	319.01	341.11	366.47	385.48	(73)
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6. Solar gains

	Access factor Table 6d		Area m ²		Solar flux W/m ²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
NorthWest	0.77	x	10.59	x	11.28	x 0.9 x	0.45	x	0.80	=	29.81	(81)
SouthWest	0.77	x	2.53	x	36.79	x 0.9 x	0.45	x	0.80	=	23.22	(79)
Solar gains in watts $\Sigma(74)m...(82)m$												
	53.03	100.24	163.45	246.60	316.45	331.86	312.59	257.77	191.82	117.87	65.32	44.22 (83)

Total gains - internal and solar (73)m + (83)m

449.80	494.86	544.48	605.75	653.38	647.42	614.29	565.49	510.82	458.98	431.79	429.70	(84)
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7. Mean internal temperature (heating season)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	21.00 (85)
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Utilisation factor for gains for living area n1,m (see Table 9a)

0.97	0.95	0.93	0.86	0.75	0.59	0.46	0.51	0.73	0.89	0.95	0.97	(86)
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Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.28	19.47	19.82	20.26	20.65	20.88	20.96	20.94	20.76	20.27	19.69	19.21	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	(88)
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Utilisation factor for gains for rest of dwelling n2,m

0.96	0.95	0.92	0.84	0.71	0.54	0.38	0.44	0.68	0.87	0.95	0.97	(89)
------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

17.88	18.16	18.66	19.29	19.82	20.10	20.19	20.18	19.97	19.31	18.48	17.79	(90)
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Living area fraction Living area ÷ (4) = 0.21 (91)

Mean internal temperature for the whole dwelling fLA x T1 + (1 - fLA) x T2

18.17	18.43	18.90	19.49	19.99	20.26	20.35	20.34	20.14	19.51	18.73	18.09	(92)
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Apply adjustment to the mean internal temperature from Table 4e where appropriate

18.17	18.43	18.90	19.49	19.99	20.26	20.35	20.34	20.14	19.51	18.73	18.09	(93)
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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm	0.95	0.93	0.89	0.82	0.70	0.54	0.40	0.45	0.67	0.85	0.93	0.95	(94)

Useful gains, ηmGm, W (94)m x (84)m

426.41	460.43	487.10	497.42	457.51	349.93	244.31	252.66	342.36	391.71	400.66	409.84	(95)
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Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
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Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]

936.46	913.60	837.25	715.32	559.75	382.49	253.24	265.74	407.56	601.81	785.23	937.66	(97)
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Space heating requirement, kWh/month $0.024 \times [(97)m - (95)m] \times (41)m$

379.48	304.53	260.51	156.89	76.07	0.00	0.00	0.00	0.00	156.32	276.89	392.70	
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$\Sigma(98)1...5, 10...12 =$ 2003.37 (98)

Space heating requirement kWh/m²/year (98) ÷ (4) = 24.94 (99)

9b. Energy requirements - community heating scheme

Fraction of space heat from secondary/supplementary system (table 11)	'0' if none	0.00	(301)
Fraction of space heat from community system	1 - (301) =	1.00	(302)
Fraction of community heat from boilers		0.25	(303a)
Fraction of community heat from CHP		0.75	(303b)
Fraction of total space heat from community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community boilers	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating		1.00	(305)
Factor for charging method (Table 4c(3)) for community water heating		1.00	(305a)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating

Annual space heating requirement	2003.37	(98)
Space heat from CHP	(98) x (304a) x (305) x (306) =	1577.66 (307a)
Space heat from boilers	(98) x (304b) x (305) x (306) =	525.89 (307b)

Water heating

Annual water heating requirement	1772.84	(64)
Water heat from CHP	(64) x (303a) x (305a) x (306) =	1396.11 (310a)

Water heat from boilers	$(64) \times (303b) \times (305a) \times (306) =$	465.37	(310b)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	39.65	(313)

Electricity for pumps, fans and electric keep-hot (Table 4f)

mechanical ventilation fans - balanced, extract or positive input from outside	76.45	(330a)
Total electricity for the above, kWh/year	76.45	(331)
Electricity for lighting (Appendix L)	360.17	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) =	4401.65	(338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from CHP	1577.66	x	2.97	x 0.01 =	46.86	(340a)
Space heating from boilers	525.89	x	4.24	x 0.01 =	22.30	(340b)
Water heating from CHP	1396.11	x	2.97	x 0.01 =	41.46	(342a)
Water heating from boilers	465.37	x	4.24	x 0.01 =	19.73	(342b)
Pumps and fans	76.45	x	13.19	x 0.01 =	10.08	(349)
Electricity for lighting	360.17	x	13.19	x 0.01 =	47.51	(350)
Additional standing charges					120.00	(351)
Total energy cost			$(340a)...(342e) + (345)...(354) =$		307.94	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.03	(357)
SAP value	85.61	
SAP rating (section 13)	86	(358)
SAP band	B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)
<i>Emissions from community CHP (space and water heating)</i>					
Power efficiency of CHP unit	31.37				(361)
Heat efficiency of CHP unit	55.83				(362)
Space heating from CHP	(307a) × 100 ÷ (362) =	2825.6668	x	0.2160	= 610.3440 (363)
less credit emissions for electricity		-886.3243	x	0.5190	= -460.0023 (364)
Water heated by CHP		2500.5098	x	0.2160	= 540.1101 (365)
less credit emissions for electricity		-784.3326	x	0.5190	= -407.0686 (366)
Emissions from other sources (space heating)					
Efficiency of boilers	95.00				(367b)
CO2 emissions from boilers	[(307b)+(310b)] x 100 ÷ (367b) =	1043.43	x	0.216	= 225.38 (368)
Electrical energy for community heat distribution		39.65	x	0.519	= 20.58 (372)
Total CO2 associated with community systems					529.34 (373)
Total CO2 associated with space and water heating					529.34 (376)
Pumps and fans	76.45	x	0.519	=	39.68 (378)
Electricity for lighting	360.17	x	0.519	=	186.93 (379)
Total CO ₂ , kg/year				(376)·(382) =	755.95 (383)
Dwelling CO ₂ emission rate				(383) ÷ (4) =	9.41 (384)
EI value					91.92

EI rating (section 14)	92	(385)
EI band	A	

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)
Primary Energy from community CHP (space and water heating)					
Power efficiency of CHP unit	31.37				(361)
Heat efficiency of CHP unit	55.83				(362)
Space heating from CHP	(307a) × 100 ÷ (362) =	2825.67	x	1.22	= 3447.31 (363)
less credit energy for electricity		-886.32	x	3.07	= -2721.02 (364)
Water heated by CHP		2500.51	x	1.22	= 3050.62 (365)
less credit energy for electricity		-784.33	x	3.07	= -2407.90 (366)
Primary energy from other sources (space heating)					
Efficiency of boilers	95.00				(367b)
Primary energy from boilers	[(307b)+(310b)] × 100 ÷ (367b) =	1043.43	x	1.22	= 1272.98 (368)
Electrical energy for community heat distribution		39.65	x	3.07	= 121.73 (372)
Total primary energy associated with community systems					2763.73 (373)
Total primary energy associated with space and water heating					2763.73 (376)
Pumps and fans	76.45	x	3.07	=	234.71 (378)
Electricity for lighting	360.17	x	3.07	=	1105.73 (379)
Primary energy kWh/year					4104.17 (383)
Dwelling primary energy rate kWh/m2/year					51.08 (384)

DER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	07/12/2018
Address	3Bed Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	80.34 (1a) x	2.50 (2a) =	200.85 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 80.34 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) = 200.85 (5)	

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	0 x 10 =	0 (7a)
Number of passive vents	0 x 10 =	0 (7b)
Number of flueless gas fires	0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 0 ÷ (5) = 0.00 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	4.00 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.20 (18)
Number of sides on which the dwelling is sheltered	2 (19)
Shelter factor	1 - [0.075 x (19)] = 0.85 (20)
Infiltration rate incorporating shelter factor	(18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70 (22)

Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18 (22a)
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.20 (22b)
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system (23a)

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h (23c)

c) whole house extract ventilation or positive input ventilation from outside	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50 (24c)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50 (25)
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² .K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K
Window			13.12	x 1.14	= 14.90 (27)		
Party wall			51.59	x 0.00	= 0.00 (32)		
External wall			38.33	x 0.24	= 9.20 (29a)		
Roof			63.63	x 0.14	= 8.91 (30)		
Total area of external elements ΣA, m ²			115.08 (31)				
Fabric heat loss, W/K = Σ(A x U)					(26)...(30) + (32) = 33.01 (33)		
Heat capacity Cm = Σ(A x κ)					(28)...(30) + (32) + (32a)...(32e) = N/A (34)		
Thermal mass parameter (TMP) in kJ/m ² .K					100.00 (35)		
Thermal bridges: Σ(L x Ψ) calculated using Appendix K					22.32 (36)		
Total fabric heat loss					(33) + (36) = 55.33 (37)		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	33.14	33.14	33.14	33.14	33.14	33.14	33.14	33.14	33.14	33.14	33.14	33.14 (38)
Heat transfer coefficient, W/K (37)m + (38)m	88.47	88.47	88.47	88.47	88.47	88.47	88.47	88.47	88.47	88.47	88.47	88.47 (39)
Average = Σ(39)1...12/12 =	88.47 (39)											

Heat loss parameter (HLP), W/m ² .K (39)m ÷ (4)	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10 (40)
Average = Σ(40)1...12/12 =	1.10 (40)											

Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00 (40)
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4. Water heating energy requirement

Assumed occupancy, N	2.47 (42)
Annual average hot water usage in litres per day V _{d,average} = (25 x N) + 36	92.85 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month V _{d,m} = factor from Table 1c x (43)	102.13	98.42	94.70	90.99	87.27	83.56	83.56	87.27	90.99	94.70	98.42	102.13 (44)
Σ(44)1...12 =	1114.14 (44)											

Energy content of hot water used = 4.18 x V _{d,m} x nm x T _m /3600 kWh/month (see Tables 1b, 1c 1d)	151.46	132.46	136.69	119.17	114.35	98.67	91.43	104.92	106.18	123.74	135.07	146.68 (45)
Σ(45)1...12 =	1460.82 (45)											

Distribution loss 0.15 x (45)m	22.72	19.87	20.50	17.88	17.15	14.80	13.72	15.74	15.93	18.56	20.26	22.00 (46)
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Storage volume (litres) including any solar or WWHRs storage within same vessel	1.00 (47)
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Water storage loss:

b) Manufacturer's declared loss factor is not known	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.02 (51)
Volume factor from Table 2a	4.93 (52)
Temperature factor from Table 2b	1.00 (53)
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53)	0.10 (54)
Enter (50) or (54) in (55)	0.10 (55)

Water storage loss calculated for each month (55) x (41)m	3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24 (56)
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If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - Vs] ÷ (47), else (56)

3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24	(57)
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Primary circuit loss for each month from Table 3

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)
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Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
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Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

177.96	156.40	163.19	144.82	140.85	124.32	117.94	131.42	131.82	150.24	160.72	173.18	(62)
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Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
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Output from water heater for each month (kWh/month) (62)m + (63)m

177.96	156.40	163.19	144.82	140.85	124.32	117.94	131.42	131.82	150.24	160.72	173.18	
$\Sigma(64)1...12 =$											1772.84	(64)

Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

71.56	63.19	66.65	60.14	59.22	53.33	51.60	56.09	55.82	62.34	65.43	69.97	(65)
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5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)												
123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	123.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

20.39	18.11	14.73	11.15	8.34	7.04	7.61	9.89	13.27	16.85	19.66	20.96	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

220.15	222.43	216.68	204.42	188.95	174.41	164.70	162.41	168.17	180.43	195.90	210.44	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	35.35	(69)
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Pump and fan gains (Table 5a)

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
------	------	------	------	------	------	------	------	------	------	------	------	------

Losses e.g. evaporation (Table 5)

-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	-98.77	(71)
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Water heating gains (Table 5)

96.18	94.04	89.58	83.53	79.60	74.06	69.36	75.39	77.53	83.79	90.87	94.05	(72)
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Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

396.77	394.62	381.03	359.14	336.93	315.55	301.70	307.72	319.01	341.11	366.47	385.48	(73)
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6. Solar gains

	Access factor Table 6d		Area m ²		Solar flux W/m ²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
SouthEast	0.77	x	10.59	x	36.79	x 0.9 x	0.45	x	0.80	=	97.21	(77)
NorthEast	0.77	x	2.53	x	11.28	x 0.9 x	0.45	x	0.80	=	7.12	(75)

Solar gains in watts $\Sigma(74)m...(82)m$

104.33	180.08	252.68	323.61	372.08	373.62	358.45	321.64	277.14	200.72	125.39	89.01	(83)
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Total gains - internal and solar (73)m + (83)m

501.10	574.70	633.71	682.75	709.01	689.17	660.15	629.36	596.14	541.83	491.86	474.49	(84)
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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1(°C)											21.00	(85)
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Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area n1,m (see Table 9a)												

0.96	0.95	0.92	0.87	0.78	0.65	0.52	0.56	0.74	0.88	0.95	0.97	(86)
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Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

18.75	19.01	19.41	19.92	20.39	20.74	20.90	20.87	20.61	20.00	19.27	18.68	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	(88)
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Utilisation factor for gains for rest of dwelling n2,m

0.96	0.94	0.90	0.84	0.74	0.59	0.42	0.46	0.68	0.86	0.94	0.96	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

16.99	17.36	17.94	18.66	19.31	19.75	19.93	19.91	19.61	18.79	17.75	16.88	(90)
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Living area fraction Living area ÷ (4) = 0.40

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

17.69	18.02	18.53	19.16	19.74	20.15	20.32	20.29	20.01	19.27	18.36	17.60	(92)
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Apply adjustment to the mean internal temperature from Table 4e where appropriate

17.69	18.02	18.53	19.16	19.74	20.15	20.32	20.29	20.01	19.27	18.36	17.60	(93)
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8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm												
0.94	0.92	0.88	0.82	0.73	0.60	0.46	0.49	0.68	0.84	0.92	0.95	(94)

Useful gains, ηmGm, W (94)m x (84)m

471.06	527.06	558.77	561.36	517.26	411.09	301.22	309.73	404.84	455.13	451.29	449.20	(95)
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Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
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Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]

1184.71	1160.51	1064.30	907.61	711.28	490.76	328.80	344.49	522.92	767.39	995.78	1185.39	(97)
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Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

530.95	425.68	376.12	249.30	144.35	0.00	0.00	0.00	0.00	232.32	392.03	547.73	
$\Sigma(98)1...5, 10...12 =$											2898.48	(98)

Space heating requirement kWh/m²/year (98) ÷ (4) 36.08

9b. Energy requirements - community heating scheme

Fraction of space heat from secondary/supplementary system (table 11)	'0' if none	0.00	(301)
Fraction of space heat from community system	1 - (301) =	1.00	(302)
Fraction of community heat from boilers		0.25	(303a)
Fraction of community heat from CHP		0.75	(303b)
Fraction of total space heat from community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community boilers	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating		1.00	(305)
Factor for charging method (Table 4c(3)) for community water heating		1.00	(305a)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating

Annual space heating requirement	2898.48	(98)
Space heat from CHP	(98) x (304a) x (305) x (306) =	2282.55 (307)
Space heat from boilers	(98) x (304b) x (305) x (306) =	760.85 (307)

Water heating

Annual water heating requirement	1772.84	(64)
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Water heat from CHP	$(64) \times (303a) \times (305a) \times (306) =$	1396.11	(310a)
Water heat from boilers	$(64) \times (303b) \times (305a) \times (306) =$	465.37	(310b)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	49.05	(313)

Electricity for pumps, fans and electric keep-hot (Table 4f)

mechanical ventilation fans - balanced, extract or positive input from outside	76.45	(330a)
Total electricity for the above, kWh/year	76.45	(331)
Electricity for lighting (Appendix L)	360.17	(332)
Total delivered energy for all uses	(307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) = 5341.51	(338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from CHP	2282.55	x	2.97	x 0.01 =	67.79	(340a)
Space heating from boilers	760.85	x	4.24	x 0.01 =	32.26	(340b)
Water heating from CHP	1396.11	x	2.97	x 0.01 =	41.46	(342a)
Water heating from boilers	465.37	x	4.24	x 0.01 =	19.73	(342b)
Pumps and fans	76.45	x	13.19	x 0.01 =	10.08	(349)
Electricity for lighting	360.17	x	13.19	x 0.01 =	47.51	(350)
Additional standing charges					120.00	(351)
Total energy cost			$(340a)...(342e) + (345)...(354) =$		338.84	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.14	(357)
SAP value	84.16	
SAP rating (section 13)	84	(358)
SAP band	B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)	
<i>Emissions from community CHP (space and water heating)</i>						
Power efficiency of CHP unit	31.37					(361)
Heat efficiency of CHP unit	55.83					(362)
Space heating from CHP	$(307a) \times 100 \div (362) =$	4088.1737	x	0.2160	=	883.0455 (363)
less credit emissions for electricity		-1282.3336	x	0.5190	=	-665.5311 (364)
Water heated by CHP		2500.5098	x	0.2160	=	540.1101 (365)
less credit emissions for electricity		-784.3326	x	0.5190	=	-407.0686 (366)
Emissions from other sources (space heating)						
Efficiency of boilers	95.00					(367b)
CO ₂ emissions from boilers	$[(307b)+(310b)] \times 100 \div (367b) =$	1290.76	x	0.216	=	278.80 (368)
Electrical energy for community heat distribution		49.05	x	0.519	=	25.46 (372)
Total CO ₂ associated with community systems					654.82	(373)
Total CO ₂ associated with space and water heating					654.82	(376)
Pumps and fans	76.45	x	0.519	=	39.68	(378)
Electricity for lighting	360.17	x	0.519	=	186.93	(379)
Total CO ₂ , kg/year				$(376)...(382) =$	881.42	(383)
Dwelling CO ₂ emission rate				$(383) \div (4) =$	10.97	(384)

EI value	90.58	
EI rating (section 14)	91	(385)
EI band	B	

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
<i>Primary Energy from community CHP (space and water heating)</i>						
Power efficiency of CHP unit	31.37					(361)
Heat efficiency of CHP unit	55.83					(362)
Space heating from CHP	$(307a) \times 100 \div (362) =$	4088.17	x	1.22	=	4987.57 (363)
less credit energy for electricity		-1282.33	x	3.07	=	-3936.76 (364)
Water heated by CHP		2500.51	x	1.22	=	3050.62 (365)
less credit energy for electricity		-784.33	x	3.07	=	-2407.90 (366)
Primary energy from other sources (space heating)						
Efficiency of boilers	95.00					(367b)
Primary energy from boilers	$[(307b)+(310b)] \times 100 \div (367b) =$	1290.76	x	1.22	=	1574.73 (368)
Electrical energy for community heat distribution		49.05	x	3.07	=	150.58 (372)
Total primary energy associated with community systems					3418.84	(373)
Total primary energy associated with space and water heating					3418.84	(376)
Pumps and fans	76.45	x	3.07	=	234.71	(378)
Electricity for lighting	360.17	x	3.07	=	1105.73	(379)
Primary energy kWh/year					4759.27	(383)
Dwelling primary energy rate kWh/m ² /year					59.24	(384)

DER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	07/12/2018
Address	4Bed Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	95.12 (1a) x	2.50 (2a) =	237.80 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 95.12 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) =	237.80 (5)

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	0 x 10 =	0 (7a)
Number of passive vents	0 x 10 =	0 (7b)
Number of flueless gas fires	0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 0 ÷ (5) = 0.00 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	4.00 (17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)

Number of sides on which the dwelling is sheltered	2 (19)
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Shelter factor	1 - [0.075 x (19)] = 0.85 (20)
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Infiltration rate incorporating shelter factor	(18) x (20) = 0.17 (21)
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Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70

Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.17	0.18	0.19	0.20
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	0.50 (23a)
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If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A (23c)
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c) whole house extract ventilation or positive input ventilation from outside	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² .K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K
Window			15.04	x 1.14 =	17.08		(27)
Exposed floor			95.12	x 0.14 =	13.32		(28b)
Party wall			57.93	x 0.00 =	0.00		(32)
External wall			35.19	x 0.24 =	8.45		(29a)
Total area of external elements ΣA, m ²			145.35				(31)

Fabric heat loss, W/K = Σ(A x U)	(26)...(30) + (32) =	38.85	(33)
Heat capacity Cm = Σ(A x κ)	(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)
Thermal mass parameter (TMP) in kJ/m ² .K		100.00	(35)
Thermal bridges: Σ(L x Ψ) calculated using Appendix K		17.51	(36)
Total fabric heat loss	(33) + (36) =	56.36	(37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	39.24	39.24	39.24	39.24	39.24	39.24	39.24	39.24	39.24	39.24	39.24	39.24
Heat transfer coefficient, W/K (37)m + (38)m	95.60	95.60	95.60	95.60	95.60	95.60	95.60	95.60	95.60	95.60	95.60	95.60
Average = Σ(39)1...12/12 =	95.60											

Heat loss parameter (HLP), W/m ² .K (39)m ÷ (4)	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Average = Σ(40)1...12/12 =	1.01											

Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00
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4. Water heating energy requirement

Assumed occupancy, N	2.69	(42)
Annual average hot water usage in litres per day V _{d,average} = (25 x N) + 36	98.08	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month V _{d,m} = factor from Table 1c x (43)	107.88	103.96	100.04	96.11	92.19	88.27	88.27	92.19	96.11	100.04	103.96	107.88
Σ(44)1...12 =	1176.91											

Energy content of hot water used = 4.18 x V _{d,m} x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	159.99	139.93	144.39	125.88	120.79	104.23	96.59	110.83	112.16	130.71	142.68	154.94
Σ(45)1...12 =	1543.12											

Distribution loss 0.15 x (45)m	24.00	20.99	21.66	18.88	18.12	15.63	14.49	16.63	16.82	19.61	21.40	23.24
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Storage volume (litres) including any solar or WWHRs storage within same vessel	2.00	(47)
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Water storage loss:

b) Manufacturer's declared loss factor is not known		
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.02	(51)
Volume factor from Table 2a	3.91	(52)
Temperature factor from Table 2b	1.00	(53)
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53)	0.17	(54)
Enter (50) or (54) in (55)	0.17	(55)

Water storage loss calculated for each month (55) x (41)m	5.14	4.64	5.14	4.97	5.14	4.97	5.14	5.14	4.97	5.14	4.97	5.14
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If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - Vs] ÷ (47), else (56)

5.14	4.64	5.14	4.97	5.14	4.97	5.14	5.14	4.97	5.14	4.97	5.14	(57)
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Primary circuit loss for each month from Table 3

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)
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Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
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Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

188.39	165.58	172.79	153.37	149.19	131.72	124.99	139.24	139.64	159.11	170.17	183.34	(62)
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Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
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Output from water heater for each month (kWh/month) (62)m + (63)m

188.39	165.58	172.79	153.37	149.19	131.72	124.99	139.24	139.64	159.11	170.17	183.34	
$\Sigma(64)1...12 =$											1877.54	(64)

Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

75.92	67.05	70.73	63.85	62.88	56.65	54.84	59.57	59.28	66.18	69.43	74.24	(65)
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5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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Metabolic gains (Table 5)

134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	(66)
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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

23.14	20.55	16.71	12.65	9.46	7.99	8.63	11.22	15.05	19.11	22.31	23.78	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

248.19	250.76	244.27	230.46	213.02	196.63	185.67	183.10	189.59	203.41	220.85	237.24	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	(69)
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Pump and fan gains (Table 5a)

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
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Losses e.g. evaporation (Table 5)

-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	(71)
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Water heating gains (Table 5)

102.04	99.77	95.07	88.67	84.52	78.68	73.71	80.07	82.34	88.96	96.43	99.78	(72)
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Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

436.71	434.43	419.40	395.13	370.34	346.63	331.35	337.73	350.32	374.82	402.93	424.15	(73)
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6. Solar gains

	Access factor Table 6d		Area m ²		Solar flux W/m ²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
NorthEast	0.77	x	5.65	x	11.28	x 0.9 x	0.45	x	0.80	=	15.90	(75)
SouthEast	0.77	x	9.39	x	36.79	x 0.9 x	0.45	x	0.80	=	86.19	(77)

Solar gains in watts $\Sigma(74)m...(82)m$

102.10	179.19	259.21	344.69	407.55	414.05	395.26	346.92	288.59	201.83	123.25	86.75	(83)
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Total gains - internal and solar (73)m + (83)m

538.81	613.63	678.61	739.82	777.89	760.68	726.61	684.65	638.91	576.65	526.18	510.90	(84)
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7. Mean internal temperature (heating season)

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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Utilisation factor for gains for living area n1,m (see Table 9a)

0.97	0.95	0.93	0.88	0.79	0.65	0.52	0.56	0.75	0.90	0.96	0.97	(86)
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Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

18.88	19.11	19.50	20.00	20.45	20.78	20.92	20.89	20.64	20.06	19.37	18.81	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	(88)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling n2,m

0.96	0.95	0.92	0.86	0.75	0.59	0.43	0.47	0.70	0.88	0.95	0.97	(89)
------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

17.22	17.56	18.12	18.82	19.45	19.86	20.02	20.00	19.71	18.92	17.93	17.12	(90)
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Living area fraction Living area ÷ (4) = 0.15

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

17.46	17.79	18.32	18.99	19.60	20.00	20.15	20.13	19.85	19.09	18.14	17.36	(92)
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Apply adjustment to the mean internal temperature from Table 4e where appropriate

17.46	17.79	18.32	18.99	19.60	20.00	20.15	20.13	19.85	19.09	18.14	17.36	(93)
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8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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Utilisation factor for gains, ηm

0.95	0.93	0.89	0.83	0.73	0.58	0.44	0.48	0.68	0.85	0.93	0.95	(94)
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Useful gains, ηmGm, W (94)m x (84)m

510.03	568.03	604.60	612.97	566.71	444.89	317.41	327.34	435.63	490.15	486.99	486.74	(95)
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Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
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Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]

1257.81	1232.00	1130.35	964.69	754.83	515.93	339.36	356.42	549.63	811.26	1055.29	1258.35	(97)
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Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

556.35	446.19	391.16	253.24	139.95	0.00	0.00	0.00	0.00	238.90	409.18	574.08	
$\Sigma(98)1...5, 10...12 =$											3009.05	(98)

Space heating requirement kWh/m²/year (98) ÷ (4) 31.63

9b. Energy requirements - community heating scheme

Fraction of space heat from secondary/supplementary system (table 11)	'0' if none	0.00	(301)
Fraction of space heat from community system	1 - (301) =	1.00	(302)
Fraction of community heat from boilers		0.25	(303a)
Fraction of community heat from CHP		0.75	(303b)
Fraction of total space heat from community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community boilers	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating		1.00	(305)
Factor for charging method (Table 4c(3)) for community water heating		1.00	(305a)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating

Annual space heating requirement	3009.05	(98)
Space heat from CHP	$(98) \times (304a) \times (305) \times (306) =$	2369.63 (307)
Space heat from boilers	$(98) \times (304b) \times (305) \times (306) =$	789.88 (307)

Water heating

Annual water heating requirement	1877.54	(64)
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Water heat from CHP	$(64) \times (303a) \times (305a) \times (306) =$	1478.56	(310a)
Water heat from boilers	$(64) \times (303b) \times (305a) \times (306) =$	492.85	(310b)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	51.31	(313)

Electricity for pumps, fans and electric keep-hot (Table 4f)

mechanical ventilation fans - balanced, extract or positive input from outside	67.89	(330a)
Total electricity for the above, kWh/year	67.89	(331)
Electricity for lighting (Appendix L)	408.63	(332)
Total delivered energy for all uses	(307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) = 5607.43	(338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from CHP	2369.63	x	2.97	x 0.01 =	70.38	(340a)
Space heating from boilers	789.88	x	4.24	x 0.01 =	33.49	(340b)
Water heating from CHP	1478.56	x	2.97	x 0.01 =	43.91	(342a)
Water heating from boilers	492.85	x	4.24	x 0.01 =	20.90	(342b)
Pumps and fans	67.89	x	13.19	x 0.01 =	8.95	(349)
Electricity for lighting	408.63	x	13.19	x 0.01 =	53.90	(350)
Additional standing charges					120.00	(351)
Total energy cost			$(340a)...(342e) + (345)...(354) =$		351.53	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.05	(357)
SAP value	85.30	
SAP rating (section 13)	85	(358)
SAP band	B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)
<i>Emissions from community CHP (space and water heating)</i>					
Power efficiency of CHP unit	31.37				(361)
Heat efficiency of CHP unit	55.83				(362)
Space heating from CHP	(307a) × 100 ÷ (362) =	4244.1289	x	0.2160	= 916.7319 (363)
less credit emissions for electricity		-1331.2520	x	0.5190	= -690.9198 (364)
Water heated by CHP		2648.1784	x	0.2160	= 572.0065 (365)
less credit emissions for electricity		-830.6517	x	0.5190	= -431.1082 (366)
<i>Emissions from other sources (space heating)</i>					
Efficiency of boilers	95.00				(367b)
CO2 emissions from boilers	[(307b)+(310b)] x 100 ÷ (367b) =	1350.24	x	0.216	= 291.65 (368)
Electrical energy for community heat distribution		51.31	x	0.519	= 26.63 (372)
Total CO2 associated with community systems					684.99 (373)
Total CO2 associated with space and water heating					684.99 (376)
Pumps and fans	67.89	x	0.519	=	35.23 (378)
Electricity for lighting	408.63	x	0.519	=	212.08 (379)
Total CO ₂ , kg/year				(376).-(382) =	932.30 (383)
Dwelling CO ₂ emission rate				(383) ÷ (4) =	9.80 (384)

EI value	91.08	
EI rating (section 14)	91	(385)
EI band	B	

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)
Primary Energy from community CHP (space and water heating)					
Power efficiency of CHP unit	31.37				(361)
Heat efficiency of CHP unit	55.83				(362)
Space heating from CHP	(307a) × 100 ÷ (362) = 4244.13	x	1.22	=	5177.84 (363)
less credit energy for electricity	-1331.25	x	3.07	=	-4086.94 (364)
Water heated by CHP	2648.18	x	1.22	=	3230.78 (365)
less credit energy for electricity	-830.65	x	3.07	=	-2550.10 (366)
Primary energy from other sources (space heating)					
Efficiency of boilers	95.00				(367b)
Primary energy from boilers	[(307b)+(310b)] × 100 ÷ (367b) = 1350.24	x	1.22	=	1647.29 (368)
Electrical energy for community heat distribution	51.31	x	3.07	=	157.52 (372)
Total primary energy associated with community systems					3576.38 (373)
Total primary energy associated with space and water heating					3576.38 (376)
Pumps and fans	67.89	x	3.07	=	208.41 (378)
Electricity for lighting	408.63	x	3.07	=	1254.49 (379)
Primary energy kWh/year					5039.29 (383)
Dwelling primary energy rate kWh/m2/year					52.98 (384)

DER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	07/12/2018
Address	4Bed Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	95.12 (1a) x	2.50 (2a) =	237.80 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 95.12 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) = 237.80 (5)	

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	0 x 10 =	0 (7a)
Number of passive vents	0 x 10 =	0 (7b)
Number of flueless gas fires	0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 0 ÷ (5) = 0.00 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q₅₀, expressed in cubic metres per hour per square metre of envelope area (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) (18)

Number of sides on which the dwelling is sheltered (19)

Shelter factor 1 - [0.075 x (19)] = (20)

Infiltration rate incorporating shelter factor (18) x (20) = (21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70 (22)

Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18 (22a)
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.20 (22b)
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system (23a)

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h (23c)

c) whole house extract ventilation or positive input ventilation from outside (24c)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25) (25)

3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² .K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K
Window			15.04	x 1.14	= 17.08		(27)
Party wall			57.92	x 0.00	= 0.00		(32)
External wall			35.19	x 0.24	= 8.45		(29a)
Total area of external elements ΣA, m ²			50.23				(31)
Fabric heat loss, W/K = Σ(A × U)						(26)...(30) + (32) =	25.53 (33)
Heat capacity Cm = Σ(A × κ)						(28)...(30) + (32) + (32a)...(32e) =	N/A (34)
Thermal mass parameter (TMP) in kJ/m ² .K							100.00 (35)
Thermal bridges: Σ(L × Ψ) calculated using Appendix K							10.77 (36)
Total fabric heat loss						(33) + (36) =	36.30 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	39.24	39.24	39.24	39.24	39.24	39.24	39.24	39.24	39.24	39.24	39.24	39.24 (38)

Heat transfer coefficient, W/K (37)m + (38)m	75.54	75.54	75.54	75.54	75.54	75.54	75.54	75.54	75.54	75.54	75.54	75.54
Average = Σ(39)1...12/12 =	75.54 (39)											

Heat loss parameter (HLP), W/m ² .K (39)m ÷ (4)	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79
Average = Σ(40)1...12/12 =	0.79 (40)											

Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00 (40)
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4. Water heating energy requirement

Assumed occupancy, N	2.69 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	98.08 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	107.88	103.96	100.04	96.11	92.19	88.27	88.27	92.19	96.11	100.04	103.96	107.88
Σ(44)1...12 =	1176.91 (44)											

Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	159.99	139.93	144.39	125.88	120.79	104.23	96.59	110.83	112.16	130.71	142.68	154.94
Σ(45)1...12 =	1543.12 (45)											

Distribution loss 0.15 x (45)m	24.00	20.99	21.66	18.88	18.12	15.63	14.49	16.63	16.82	19.61	21.40	23.24 (46)
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Storage volume (litres) including any solar or WWHRs storage within same vessel (47)

Water storage loss:

b) Manufacturer's declared loss factor is not known	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.02 (51)
Volume factor from Table 2a	3.91 (52)
Temperature factor from Table 2b	1.00 (53)
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53)	0.17 (54)
Enter (50) or (54) in (55)	0.17 (55)

Water storage loss calculated for each month (55) x (41)m	5.14	4.64	5.14	4.97	5.14	4.97	5.14	5.14	4.97	5.14	4.97	5.14 (56)
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If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - Vs] ÷ (47), else (56)	5.14	4.64	5.14	4.97	5.14	4.97	5.14	5.14	4.97	5.14	4.97	5.14 (57)
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Primary circuit loss for each month from Table 3

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)
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Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
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Total heat required for water heating calculated for each month $0.85 \times (45)\text{m} + (46)\text{m} + (57)\text{m} + (59)\text{m} + (61)\text{m}$

188.39	165.58	172.79	153.37	149.19	131.72	124.99	139.24	139.64	159.11	170.17	183.34	(62)
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Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
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Output from water heater for each month (kWh/month) (62)m + (63)m

188.39	165.58	172.79	153.37	149.19	131.72	124.99	139.24	139.64	159.11	170.17	183.34	
$\Sigma(64)1...12 =$											1877.54	(64)

Heat gains from water heating (kWh/month) $0.25 \times [0.85 \times (45)\text{m} + (61)\text{m}] + 0.8 \times [(46)\text{m} + (57)\text{m} + (59)\text{m}]$

75.92	67.05	70.73	63.85	62.88	56.65	54.84	59.57	59.28	66.18	69.43	74.24	(65)
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5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)												
134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

23.14	20.55	16.71	12.65	9.46	7.99	8.63	11.22	15.05	19.11	22.31	23.78	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

248.19	250.76	244.27	230.46	213.02	196.63	185.67	183.10	189.59	203.41	220.85	237.24	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	(69)
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Pump and fan gains (Table 5a)

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
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Losses e.g. evaporation (Table 5)

-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	(71)
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Water heating gains (Table 5)

102.04	99.77	95.07	88.67	84.52	78.68	73.71	80.07	82.34	88.96	96.43	99.78	(72)
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Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

436.71	434.43	419.40	395.13	370.34	346.63	331.35	337.73	350.32	374.82	402.93	424.15	(73)
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6. Solar gains

	Access factor Table 6d		Area m ²		Solar flux W/m ²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
NorthEast	0.77	x	5.65	x	11.28	x 0.9 x	0.45	x	0.80	=	15.90	(75)
SouthEast	0.77	x	9.39	x	36.79	x 0.9 x	0.45	x	0.80	=	86.19	(77)

Solar gains in watts $\Sigma(74)\text{m}...(82)\text{m}$

102.10	179.19	259.21	344.69	407.55	414.05	395.26	346.92	288.59	201.83	123.25	86.75	(83)
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Total gains - internal and solar (73)m + (83)m

538.81	613.63	678.61	739.82	777.89	760.68	726.61	684.65	638.91	576.65	526.18	510.90	(84)
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7. Mean internal temperature (heating season)

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	21.00	(85)
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Utilisation factor for gains for living area n1,m (see Table 9a)

0.97	0.95	0.91	0.84	0.73	0.58	0.44	0.48	0.69	0.87	0.95	0.97	(86)
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Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.41	19.64	19.98	20.38	20.71	20.90	20.97	20.96	20.82	20.39	19.82	19.34	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.26	20.26	20.26	20.26	20.26	20.26	20.26	20.26	20.26	20.26	20.26	20.26	(88)
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Utilisation factor for gains for rest of dwelling n2,m

0.96	0.94	0.90	0.82	0.69	0.52	0.37	0.41	0.64	0.85	0.94	0.97	(89)
------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

18.10	18.43	18.91	19.48	19.92	20.16	20.24	20.23	20.07	19.51	18.69	18.00	(90)
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Living area fraction Living area ÷ (4) = 0.15 (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

18.29	18.60	19.07	19.61	20.04	20.27	20.34	20.33	20.18	19.64	18.85	18.20	(92)
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Apply adjustment to the mean internal temperature from Table 4e where appropriate

18.29	18.60	19.07	19.61	20.04	20.27	20.34	20.33	20.18	19.64	18.85	18.20	(93)
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8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm												
0.95	0.92	0.88	0.80	0.68	0.52	0.38	0.42	0.63	0.83	0.92	0.95	(94)

Useful gains, ηmGm, W (94)m x (84)m

509.23	564.80	596.14	593.47	530.83	398.32	275.21	286.44	402.89	478.23	484.35	486.45	(95)
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Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
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Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]

1056.90	1035.18	949.49	808.80	629.80	428.46	282.78	297.15	459.48	682.61	887.97	1057.34	(97)
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Space heating requirement, kWh/month $0.024 \times [(97)\text{m} - (95)\text{m}] \times (41)\text{m}$

407.47	316.09	262.90	155.04	73.63	0.00	0.00	0.00	0.00	152.06	290.61	424.74	
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$\Sigma(98)1...5, 10...12 =$ 2082.54 (98)

Space heating requirement kWh/m²/year (98) ÷ (4) = 21.89 (99)

9b. Energy requirements - community heating scheme

Fraction of space heat from secondary/supplementary system (table 11)	'0' if none	0.00	(301)
Fraction of space heat from community system	1 - (301) =	1.00	(302)
Fraction of community heat from boilers		0.25	(303a)
Fraction of community heat from CHP		0.75	(303b)
Fraction of total space heat from community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community boilers	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating		1.00	(305)
Factor for charging method (Table 4c(3)) for community water heating		1.00	(305a)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating

Annual space heating requirement	2082.54	(98)
Space heat from CHP	(98) x (304a) x (305) x (306) = 1640.00	(307)
Space heat from boilers	(98) x (304b) x (305) x (306) = 546.67	(307)

Water heating

Annual water heating requirement	1877.54	(64)
Water heat from CHP	(64) x (303a) x (305a) x (306) =	1478.56 (310)

Water heat from boilers	(64) x (303b) x (305a) x (306) =	492.85	(310b)
Electricity used for heat distribution	0.01 x [(307a)...(307e) + (310a)...(310e)] =	41.58	(313)

Electricity for pumps, fans and electric keep-hot (Table 4f)

mechanical ventilation fans - balanced, extract or positive input from outside	67.89	(330a)
Total electricity for the above, kWh/year	67.89	(331)
Electricity for lighting (Appendix L)	408.63	(332)
Total delivered energy for all uses	(307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) = 4634.59	(338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from CHP	1640.00	x	2.97	x 0.01 =	48.71	(340a)
Space heating from boilers	546.67	x	4.24	x 0.01 =	23.18	(340b)
Water heating from CHP	1478.56	x	2.97	x 0.01 =	43.91	(342a)
Water heating from boilers	492.85	x	4.24	x 0.01 =	20.90	(342b)
Pumps and fans	67.89	x	13.19	x 0.01 =	8.95	(349)
Electricity for lighting	408.63	x	13.19	x 0.01 =	53.90	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)...(342e) + (345)...(354) =		319.55	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	0.96	(357)
SAP value	86.64	
SAP rating (section 13)	87	(358)
SAP band	B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)	
<i>Emissions from community CHP (space and water heating)</i>						
Power efficiency of CHP unit	31.37					(361)
Heat efficiency of CHP unit	55.83					(362)
Space heating from CHP	(307a) x 100 ÷ (362) = 2937.3202	x	0.2160	=	634.4612	(363)
less credit emissions for electricity	-921.3465	x	0.5190	=	-478.1788	(364)
Water heated by CHP	2648.1784	x	0.2160	=	572.0065	(365)
less credit emissions for electricity	-830.6517	x	0.5190	=	-431.1082	(366)
Emissions from other sources (space heating)						
Efficiency of boilers	95.00					(367b)
CO ₂ emissions from boilers	[(307b)+(310b)] x 100 ÷ (367b) = 1094.23	x	0.216	=	236.35	(368)
Electrical energy for community heat distribution	41.58	x	0.519	=	21.58	(372)
Total CO ₂ associated with community systems					555.11	(373)
Total CO ₂ associated with space and water heating					555.11	(376)
Pumps and fans	67.89	x	0.519	=	35.23	(378)
Electricity for lighting	408.63	x	0.519	=	212.08	(379)
Total CO ₂ , kg/year				(376)...(382) =	802.43	(383)
Dwelling CO ₂ emission rate				(383) ÷ (4) =	8.44	(384)
EI value					92.33	

EI rating (section 14)	92	(385)
EI band	A	

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
<i>Primary Energy from community CHP (space and water heating)</i>						
Power efficiency of CHP unit	31.37					(361)
Heat efficiency of CHP unit	55.83					(362)
Space heating from CHP	(307a) x 100 ÷ (362) = 2937.32	x	1.22	=	3583.53	(363)
less credit energy for electricity	-921.35	x	3.07	=	-2828.53	(364)
Water heated by CHP	2648.18	x	1.22	=	3230.78	(365)
less credit energy for electricity	-830.65	x	3.07	=	-2550.10	(366)
Primary energy from other sources (space heating)						
Efficiency of boilers	95.00					(367b)
Primary energy from boilers	[(307b)+(310b)] x 100 ÷ (367b) = 1094.23	x	1.22	=	1334.96	(368)
Electrical energy for community heat distribution	41.58	x	3.07	=	127.65	(372)
Total primary energy associated with community systems					2898.29	(373)
Total primary energy associated with space and water heating					2898.29	(376)
Pumps and fans	67.89	x	3.07	=	208.41	(378)
Electricity for lighting	408.63	x	3.07	=	1254.49	(379)
Primary energy kWh/year					4361.19	(383)
Dwelling primary energy rate kWh/m ² /year					45.85	(384)

DER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	07/12/2018
Address	4Bed Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	95.12 (1a) x	2.50 (2a) =	237.80 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =		95.12 (4)
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) =	237.80 (5)

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	0 x 10 =	0 (7a)
Number of passive vents	0 x 10 =	0 (7b)
Number of flueless gas fires	0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 0 ÷ (5) = 0.00 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	4.00 (17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)

Number of sides on which the dwelling is sheltered	2 (19)
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Shelter factor	1 - [0.075 x (19)] = 0.85 (20)
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Infiltration rate incorporating shelter factor	(18) x (20) = 0.17 (21)
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Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70

Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.17	0.18	0.19	0.20
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	0.50 (23a)
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If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A (23c)
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c) whole house extract ventilation or positive input ventilation from outside	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K
Window			15.04	x 1.14	= 17.08		(27)
Party wall			57.93	x 0.00	= 0.00		(32)
External wall			35.19	x 0.24	= 8.45		(29a)
Roof			95.12	x 0.14	= 13.32		(30)
Total area of external elements ΣA, m ²			145.35				(31)
Fabric heat loss, W/K = Σ(A x U)						(26)...(30) + (32) =	38.85 (33)
Heat capacity Cm = Σ(A x κ)						(28)...(30) + (32) + (32a)...(32e) =	N/A (34)
Thermal mass parameter (TMP) in kJ/m ² K							100.00 (35)
Thermal bridges: Σ(L x Ψ) calculated using Appendix K							23.93 (36)
Total fabric heat loss						(33) + (36) =	62.78 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	39.24	39.24	39.24	39.24	39.24	39.24	39.24	39.24	39.24	39.24	39.24	39.24
Heat transfer coefficient, W/K (37)m + (38)m	102.02	102.02	102.02	102.02	102.02	102.02	102.02	102.02	102.02	102.02	102.02	102.02
Average = Σ(39)1...12/12 =												102.02 (39)

Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Average = Σ(40)1...12/12 =												1.07 (40)

Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00
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4. Water heating energy requirement

Assumed occupancy, N	2.69 (42)
Annual average hot water usage in litres per day V _{d,average} = (25 x N) + 36	98.08 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month V _{d,m} = factor from Table 1c x (43)	107.88	103.96	100.04	96.11	92.19	88.27	88.27	92.19	96.11	100.04	103.96	107.88
Σ(44)1...12 =												1176.91 (44)

Energy content of hot water used = 4.18 x V _{d,m} x nm x T _m /3600 kWh/month (see Tables 1b, 1c 1d)	159.99	139.93	144.39	125.88	120.79	104.23	96.59	110.83	112.16	130.71	142.68	154.94
Σ(45)1...12 =												1543.12 (45)

Distribution loss 0.15 x (45)m	24.00	20.99	21.66	18.88	18.12	15.63	14.49	16.63	16.82	19.61	21.40	23.24
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Storage volume (litres) including any solar or WWHRs storage within same vessel	2.00 (47)
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Water storage loss:

b) Manufacturer's declared loss factor is not known	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.02 (51)
Volume factor from Table 2a	3.91 (52)
Temperature factor from Table 2b	1.00 (53)
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53)	0.17 (54)
Enter (50) or (54) in (55)	0.17 (55)

Water storage loss calculated for each month (55) x (41)m	5.14	4.64	5.14	4.97	5.14	4.97	5.14	5.14	4.97	5.14	4.97	5.14
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If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - Vs] ÷ (47), else (56)

5.14	4.64	5.14	4.97	5.14	4.97	5.14	5.14	4.97	5.14	4.97	5.14	(57)
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Primary circuit loss for each month from Table 3

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)
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Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
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Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

188.39	165.58	172.79	153.37	149.19	131.72	124.99	139.24	139.64	159.11	170.17	183.34	(62)
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Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
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Output from water heater for each month (kWh/month) (62)m + (63)m

188.39	165.58	172.79	153.37	149.19	131.72	124.99	139.24	139.64	159.11	170.17	183.34	
$\Sigma(64)1...12 =$											1877.54	(64)

Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

75.92	67.05	70.73	63.85	62.88	56.65	54.84	59.57	59.28	66.18	69.43	74.24	(65)
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5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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Metabolic gains (Table 5)

134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	134.48	(66)
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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

23.14	20.55	16.71	12.65	9.46	7.99	8.63	11.22	15.05	19.11	22.31	23.78	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

248.19	250.76	244.27	230.46	213.02	196.63	185.67	183.10	189.59	203.41	220.85	237.24	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	36.45	(69)
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Pump and fan gains (Table 5a)

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
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Losses e.g. evaporation (Table 5)

-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	-107.58	(71)
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Water heating gains (Table 5)

102.04	99.77	95.07	88.67	84.52	78.68	73.71	80.07	82.34	88.96	96.43	99.78	(72)
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Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

436.71	434.43	419.40	395.13	370.34	346.63	331.35	337.73	350.32	374.82	402.93	424.15	(73)
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6. Solar gains

	Access factor Table 6d		Area m ²		Solar flux W/m ²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
NorthEast	0.77	x	5.65	x	11.28	x 0.9 x	0.45	x	0.80	=	15.90	(75)
SouthEast	0.77	x	9.39	x	36.79	x 0.9 x	0.45	x	0.80	=	86.19	(77)

Solar gains in watts $\Sigma(74)m...(82)m$

102.10	179.19	259.21	344.69	407.55	414.05	395.26	346.92	288.59	201.83	123.25	86.75	(83)
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Total gains - internal and solar (73)m + (83)m

538.81	613.63	678.61	739.82	777.89	760.68	726.61	684.65	638.91	576.65	526.18	510.90	(84)
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7. Mean internal temperature (heating season)

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

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

Utilisation factor for gains for living area n1,m (see Table 9a)

0.97	0.96	0.93	0.88	0.80	0.67	0.54	0.58	0.77	0.90	0.96	0.97	(86)
------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

18.72	18.96	19.37	19.88	20.37	20.73	20.89	20.87	20.59	19.96	19.23	18.65	(87)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	(88)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling n2,m

0.97	0.95	0.92	0.86	0.76	0.61	0.44	0.49	0.71	0.88	0.95	0.97	(89)
------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

16.96	17.31	17.89	18.62	19.30	19.77	19.95	19.92	19.60	18.75	17.71	16.86	(90)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Living area fraction Living area ÷ (4) = 0.15 (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

17.22	17.55	18.10	18.81	19.46	19.91	20.09	20.06	19.74	18.92	17.93	17.12	(92)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e where appropriate

17.22	17.55	18.10	18.81	19.46	19.91	20.09	20.06	19.74	18.92	17.93	17.12	(93)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

Utilisation factor for gains, ηm

0.95	0.93	0.89	0.83	0.74	0.60	0.45	0.49	0.69	0.85	0.93	0.95	(94)
------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, ηmGm, W (94)m x (84)m

509.97	568.39	605.97	616.57	573.98	455.38	327.84	337.15	442.43	492.26	487.27	486.59	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
------	------	------	------	-------	-------	-------	-------	-------	-------	------	------	------

Heat loss rate for mean internal temperature, Lm, W [(39)m x (93)m - (96)m]

1317.63	1290.49	1183.88	1010.50	791.25	541.28	355.67	373.46	575.66	848.99	1104.89	1318.22	(97)
---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	---------	---------	------

Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

600.90	485.25	429.97	283.63	161.65	0.00	0.00	0.00	0.00	265.41	444.69	618.74	
$\Sigma(98)1...5, 10...12 =$											3290.23	(98)

Space heating requirement kWh/m²/year (98) ÷ (4) = 34.59 (99)

9b. Energy requirements - community heating scheme

Fraction of space heat from secondary/supplementary system (table 11)	'0' if none	0.00	(301)
Fraction of space heat from community system	1 - (301) =	1.00	(302)
Fraction of community heat from boilers		0.25	(303a)
Fraction of community heat from CHP		0.75	(303b)
Fraction of total space heat from community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community boilers	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating		1.00	(305)
Factor for charging method (Table 4c(3)) for community water heating		1.00	(305a)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating

Annual space heating requirement	3290.23	(98)
Space heat from CHP	(98) x (304a) x (305) x (306) = 2591.05	(307)
Space heat from boilers	(98) x (304b) x (305) x (306) = 863.68	(307)

Water heating

Annual water heating requirement	1877.54	(64)
----------------------------------	---------	------

Water heat from CHP	$(64) \times (303a) \times (305a) \times (306) =$	1478.56	(310a)
Water heat from boilers	$(64) \times (303b) \times (305a) \times (306) =$	492.85	(310b)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	54.26	(313)

Electricity for pumps, fans and electric keep-hot (Table 4f)

mechanical ventilation fans - balanced, extract or positive input from outside	67.89	(330a)
Total electricity for the above, kWh/year	67.89	(331)
Electricity for lighting (Appendix L)	408.63	(332)
Total delivered energy for all uses	(307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) = 5902.66	(338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from CHP	2591.05	x	2.97	x 0.01 =	76.95	(340a)
Space heating from boilers	863.68	x	4.24	x 0.01 =	36.62	(340b)
Water heating from CHP	1478.56	x	2.97	x 0.01 =	43.91	(342a)
Water heating from boilers	492.85	x	4.24	x 0.01 =	20.90	(342b)
Pumps and fans	67.89	x	13.19	x 0.01 =	8.95	(349)
Electricity for lighting	408.63	x	13.19	x 0.01 =	53.90	(350)
Additional standing charges					120.00	(351)
Total energy cost			$(340a)...(342e) + (345)...(354) =$		361.24	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.08	(357)
SAP value	84.90	
SAP rating (section 13)	85	(358)
SAP band	B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)	
<i>Emissions from community CHP (space and water heating)</i>						
Power efficiency of CHP unit	31.37					(361)
Heat efficiency of CHP unit	55.83					(362)
Space heating from CHP	$(307a) \times 100 \div (362) =$	4640.7109	x	0.2160	=	1002.3936 (363)
less credit emissions for electricity		-1455.6475	x	0.5190	=	-755.4810 (364)
Water heated by CHP		2648.1784	x	0.2160	=	572.0065 (365)
less credit emissions for electricity		-830.6517	x	0.5190	=	-431.1082 (366)
Emissions from other sources (space heating)						
Efficiency of boilers	95.00					(367b)
CO ₂ emissions from boilers	$[(307b)+(310b)] \times 100 \div (367b) =$	1427.93	x	0.216	=	308.43 (368)
Electrical energy for community heat distribution		54.26	x	0.519	=	28.16 (372)
Total CO ₂ associated with community systems					724.41	(373)
Total CO ₂ associated with space and water heating					724.41	(376)
Pumps and fans	67.89	x	0.519	=	35.23	(378)
Electricity for lighting	408.63	x	0.519	=	212.08	(379)
Total CO ₂ , kg/year				$(376)...(382) =$	971.72	(383)
Dwelling CO ₂ emission rate				$(383) \div (4) =$	10.22	(384)

EI value	90.71	
EI rating (section 14)	91	(385)
EI band	B	

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
<i>Primary Energy from community CHP (space and water heating)</i>						
Power efficiency of CHP unit	31.37					(361)
Heat efficiency of CHP unit	55.83					(362)
Space heating from CHP	$(307a) \times 100 \div (362) =$	4640.71	x	1.22	=	5661.67 (363)
less credit energy for electricity		-1455.65	x	3.07	=	-4468.84 (364)
Water heated by CHP		2648.18	x	1.22	=	3230.78 (365)
less credit energy for electricity		-830.65	x	3.07	=	-2550.10 (366)
Primary energy from other sources (space heating)						
Efficiency of boilers	95.00					(367b)
Primary energy from boilers	$[(307b)+(310b)] \times 100 \div (367b) =$	1427.93	x	1.22	=	1742.08 (368)
Electrical energy for community heat distribution		54.26	x	3.07	=	166.58 (372)
Total primary energy associated with community systems					3782.17	(373)
Total primary energy associated with space and water heating					3782.17	(376)
Pumps and fans	67.89	x	3.07	=	208.41	(378)
Electricity for lighting	408.63	x	3.07	=	1254.49	(379)
Primary energy kWh/year					5245.07	(383)
Dwelling primary energy rate kWh/m ² /year					55.14	(384)

DER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	07/12/2018
Address	Studio Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	40.28 (1a) x	2.50 (2a) =	100.70 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 40.28 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) = 100.70 (5)	

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	0 x 10 =	0 (7a)
Number of passive vents	0 x 10 =	0 (7b)
Number of flueless gas fires	0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 0 ÷ (5) = 0.00 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	4.00 (17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)

Number of sides on which the dwelling is sheltered	3 (19)
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Shelter factor	1 - [0.075 x (19)] = 0.78 (20)
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Infiltration rate incorporating shelter factor	(18) x (20) = 0.16 (21)
--	--

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70 (22)

Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18 (22a)
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.20	0.19	0.19	0.17	0.17	0.15	0.15	0.14	0.16	0.17	0.17	0.18 (22b)
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	0.50 (23a)
---	---

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A (23c)
--	--

c) whole house extract ventilation or positive input ventilation from outside	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50 (24c)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50 (25)
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² .K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K
Window	7.85	x	1.14	=	8.92		78.92 (27)
Exposed floor	40.28	x	0.08	=	3.22		128.92 (28b)
Party wall	51.97	x	0.00	=	0.00		0.00 (32)
External wall	6.71	x	0.24	=	1.61		10.78 (29a)
Total area of external elements ΣA, m ²	54.84						190.60 (31)
Fabric heat loss, W/K = Σ(A x U)						(26)...(30) + (32) =	13.75 (33)
Heat capacity Cm = Σ(A x κ)						(28)...(30) + (32) + (32a)...(32e) =	N/A (34)
Thermal mass parameter (TMP) in kJ/m ² .K							100.00 (35)
Thermal bridges: Σ(L x Ψ) calculated using Appendix K							7.62 (36)
Total fabric heat loss						(33) + (36) =	21.37 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	16.62	16.62	16.62	16.62	16.62	16.62	16.62	16.62	16.62	16.62	16.62	16.62 (38)
Heat transfer coefficient, W/K (37)m + (38)m	37.98	37.98	37.98	37.98	37.98	37.98	37.98	37.98	37.98	37.98	37.98	37.98 (39)
Average = Σ(39)1...12/12 =												37.98 (39)

Heat loss parameter (HLP), W/m ² .K (39)m ÷ (4)	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94 (40)
Average = Σ(40)1...12/12 =												0.94 (40)

Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00 (40)
------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	---

4. Water heating energy requirement

Assumed occupancy, N	1.41 (42)
Annual average hot water usage in litres per day V _{d,average} = (25 x N) + 36	67.78 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month V _{d,m} = factor from Table 1c x (43)	74.56	71.84	69.13	66.42	63.71	61.00	61.00	63.71	66.42	69.13	71.84	74.56 (44)
Σ(44)1...12 =												813.33 (44)

Energy content of hot water used = 4.18 x V _{d,m} x nm x T _m /3600 kWh/month (see Tables 1b, 1c 1d)	110.56	96.70	99.79	87.00	83.47	72.03	66.75	76.59	77.51	90.33	98.60	107.07 (45)
Σ(45)1...12 =												1066.41 (45)

Distribution loss 0.15 x (45)m	16.58	14.50	14.97	13.05	12.52	10.80	10.01	11.49	11.63	13.55	14.79	16.06 (46)
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Storage volume (litres) including any solar or WWHRs storage within same vessel	1.00 (47)
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Water storage loss:

b) Manufacturer's declared loss factor is not known	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.02 (51)
Volume factor from Table 2a	4.93 (52)
Temperature factor from Table 2b	1.00 (53)
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53)	0.10 (54)
Enter (50) or (54) in (55)	0.10 (55)

Water storage loss calculated for each month (55) x (41)m	3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24 (56)
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If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - Vs] ÷ (47), else (56)

3.24

2.92

3.24

3.13

3.24

3.13

3.24

3.24

3.13

3.24

3.13

3.24

(57)

Primary circuit loss for each month from Table 3

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

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

(61)

Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

137.06

120.64

126.29

112.64

109.97

97.68

93.25

103.09

103.15

116.83

124.25

133.58

(62)

Solar DHW input calculated using Appendix G or Appendix H

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

(63)

Output from water heater for each month (kWh/month) (62)m + (63)m

137.06

120.64

126.29

112.64

109.97

97.68

93.25

103.09

103.15

116.83

124.25

133.58

Σ(64)1...12 =

1378.43

(64)

Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

57.96

51.30

54.38

49.44

48.96

44.47

43.39

46.67

46.29

51.23

53.30

56.80

(65)

5. Internal gains

Jan

Feb

Mar

Apr

May

Jun

Jul

Aug

Sep

Oct

Nov

Dec

Metabolic gains (Table 5)

70.69

70.69

70.69

70.69

70.69

70.69

70.69

70.69

70.69

70.69

70.69

70.69

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

11.01

9.78

7.95

6.02

4.50

3.80

4.10

5.33

7.16

9.09

10.61

11.31

(67)

Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

122.24

123.51

120.31

113.51

104.92

96.84

91.45

90.18

93.38

100.18

108.77

116.84

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

30.07

30.07

30.07

30.07

30.07

30.07

30.07

30.07

30.07

30.07

30.07

30.07

(69)

Pump and fan gains (Table 5a)

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

(70)

Losses e.g. evaporation (Table 5)

-56.55

-56.55

-56.55

-56.55

-56.55

-56.55

-56.55

-56.55

-56.55

-56.55

-56.55

-56.55

(71)

Water heating gains (Table 5)

77.91

76.34

73.09

68.67

65.80

61.76

58.33

62.73

64.29

68.86

74.03

76.35

(72)

Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

255.36

253.83

245.56

232.40

219.42

206.61

198.09

202.45

209.03

222.34

237.62

248.71

(73)

6. Solar gains

Access factor
Table 6d

Area
m²

Solar flux
W/m²

g
specific data
or Table 6b

FF
specific data
or Table 6c

Gains
W

SouthEast

0.77

x

7.85

x

36.79

x 0.9 x

0.45

x

0.80

=

72.06

(77)

Solar gains in watts Σ(74)m...(82)m

72.06

122.74

167.94

208.09

233.07

231.39

223.08

204.44

181.84

135.65

86.31

61.67

(83)

Total gains - internal and solar (73)m + (83)m

327.42

376.57

413.50

440.49

452.49

437.99

421.17

406.89

390.88

358.00

323.93

310.38

(84)

7. Mean internal temperature (heating season)

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

Jan

Feb

Mar

Apr

May

Jun

Jul

Aug

Sep

Oct

Nov

Dec

Utilisation factor for gains for living area n1,m (see Table 9a)

0.93

0.89

0.84

0.76

0.65

0.51

0.38

0.41

0.59

0.78

0.89

0.94

(86)

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.42

19.68

20.03

20.41

20.72

20.90

20.97

20.96

20.84

20.45

19.86

19.34

(87)

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

20.13

20.13

20.13

20.13

20.13

20.13

20.13

20.13

20.13

20.13

20.13

20.13

(88)

Utilisation factor for gains for rest of dwelling n2,m

0.92

0.88

0.82

0.74

0.61

0.45

0.31

0.34

0.53

0.75

0.88

0.93

(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

18.03

18.40

18.89

19.41

19.82

20.04

20.11

20.10

19.98

19.48

18.66

17.91

(90)

Living area fraction

Living area ÷ (4) =

0.62

(91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

18.89

19.20

19.60

20.03

20.37

20.57

20.64

20.63

20.51

20.08

19.41

18.80

(92)

Apply adjustment to the mean internal temperature from Table 4e where appropriate

18.89

19.20

19.60

20.03

20.37

20.57

20.64

20.63

20.51

20.08

19.41

18.80

(93)

8. Space heating requirement

Jan

Feb

Mar

Apr

May

Jun

Jul

Aug

Sep

Oct

Nov

Dec

Utilisation factor for gains, ηm

0.90

0.86

0.81

0.73

0.62

0.48

0.35

0.38

0.55

0.75

0.86

0.91

(94)

Useful gains, ηmGm, W (94)m x (84)m

295.26

325.64

335.86

322.54

280.60

210.09

148.54

154.46

216.90

268.51

280.15

283.17

(95)

Monthly average external temperature from Table U1

4.30

4.90

6.50

8.90

11.70

14.60

16.60

16.40

14.10

10.60

7.10

4.20

(96)

Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]

554.17

543.10

497.64

422.84

329.48

226.89

153.54

160.84

243.59

360.23

467.39

554.44

(97)

Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

192.63

146.13

120.36

72.21

36.36

0.00

0.00

0.00

0.00

68.24

134.81

201.82

Σ(98)1...5, 10...12 =

972.57

(98)

Space heating requirement kWh/m²/year

(98) ÷ (4)

24.15

(99)

9b. Energy requirements - community heating scheme

Fraction of space heat from secondary/supplementary system (table 11)

'0' if none

0.00

(301)

Fraction of space heat from community system

1 - (301) =

1.00

(302)

Fraction of community heat from boilers

0.25

(303a)

Fraction of community heat from CHP

0.75

(303b)

Fraction of total space heat from community CHP

(302) x (303a) =

0.75

(304a)

Fraction of total space heat from community boilers

(302) x (303b) =

0.25

(304b)

Factor for control and charging method (Table 4c(3)) for community space heating

1.00

(305)

Factor for charging method (Table 4c(3)) for community water heating

1.00

(305a)

Distribution loss factor (Table 12c) for community heating system

1.05

(306)

Space heating

Annual space heating requirement

972.57

(98)

Space heat from CHP

(98) x (304a) x (305) x (306) =

765.90

(307a)

Space heat from boilers

(98) x (304b) x (305) x (306) =

255.30

(307b)

Water heating

Annual water heating requirement

1378.43

(64)

Water heat from CHP

(64) x (303a) x (305a) x (306) =

1085.51

(310a)

Water heat from boilers	$(64) \times (303b) \times (305a) \times (306) =$	361.84	(310b)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	24.69	(313)

Electricity for pumps, fans and electric keep-hot (Table 4f)

mechanical ventilation fans - balanced, extract or positive input from outside	38.33	(330a)
Total electricity for the above, kWh/year	38.33	(331)
Electricity for lighting (Appendix L)	194.38	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) =	2701.25	(338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from CHP	765.90	x	2.97	x 0.01 =	22.75	(340a)
Space heating from boilers	255.30	x	4.24	x 0.01 =	10.82	(340b)
Water heating from CHP	1085.51	x	2.97	x 0.01 =	32.24	(342a)
Water heating from boilers	361.84	x	4.24	x 0.01 =	15.34	(342b)
Pumps and fans	38.33	x	13.19	x 0.01 =	5.06	(349)
Electricity for lighting	194.38	x	13.19	x 0.01 =	25.64	(350)
Additional standing charges					120.00	(351)
Total energy cost			$(340a)...(342e) + (345)...(354) =$		231.85	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.14	(357)
SAP value	84.07	
SAP rating (section 13)	84	(358)
SAP band	B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)	
<i>Emissions from community CHP (space and water heating)</i>						
Power efficiency of CHP unit	31.37					(361)
Heat efficiency of CHP unit	55.83					(362)
Space heating from CHP	(307a) × 100 ÷ (362) =	1371.7609	x	0.2160	=	296.3004 (363)
less credit emissions for electricity		-430.2790	x	0.5190	=	-223.3148 (364)
Water heated by CHP		1944.2087	x	0.2160	=	419.9491 (365)
less credit emissions for electricity		-609.8381	x	0.5190	=	-316.5060 (366)
Emissions from other sources (space heating)						
Efficiency of boilers	95.00					(367b)
CO2 emissions from boilers	[(307b)+(310b)] x 100 ÷ (367b) =	649.62	x	0.216	=	140.32 (368)
Electrical energy for community heat distribution		24.69	x	0.519	=	12.81 (372)
Total CO2 associated with community systems					329.56	(373)
Total CO2 associated with space and water heating					329.56	(376)
Pumps and fans	38.33	x	0.519	=	19.89	(378)
Electricity for lighting	194.38	x	0.519	=	100.88	(379)
Total CO ₂ , kg/year					(376)..(382) =	450.33 (383)
Dwelling CO ₂ emission rate					(383) ÷ (4) =	11.18 (384)
EI value					92.92	

EI rating (section 14)	93	(385)
EI band	A	

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)
Primary Energy from community CHP (space and water heating)					
Power efficiency of CHP unit	31.37				(361)
Heat efficiency of CHP unit	55.83				(362)
Space heating from CHP	(307a) × 100 ÷ (362) = 1371.76	x	1.22	=	1673.55 (363)
less credit energy for electricity	-430.28	x	3.07	=	-1320.96 (364)
Water heated by CHP	1944.21	x	1.22	=	2371.93 (365)
less credit energy for electricity	-609.84	x	3.07	=	-1872.20 (366)
Primary energy from other sources (space heating)					
Efficiency of boilers	95.00				(367b)
Primary energy from boilers	[(307b)+(310b)] × 100 ÷ (367b) = 649.62	x	1.22	=	792.53 (368)
Electrical energy for community heat distribution	24.69	x	3.07	=	75.78 (372)
Total primary energy associated with community systems					1720.64 (373)
Total primary energy associated with space and water heating					1720.64 (376)
Pumps and fans	38.33	x	3.07	=	117.67 (378)
Electricity for lighting	194.38	x	3.07	=	596.73 (379)
Primary energy kWh/year					2435.05 (383)
Dwelling primary energy rate kWh/m2/year					60.45 (384)

DER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	07/12/2018
Address	Studio Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	40.28 (1a) x	2.50 (2a) =	100.70 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 40.28 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) = 100.70 (5)	

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	0 x 10 =	0 (7a)
Number of passive vents	0 x 10 =	0 (7b)
Number of flueless gas fires	0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 0 ÷ (5) = 0.00 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q₅₀, expressed in cubic metres per hour per square metre of envelope area (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) (18)

Number of sides on which the dwelling is sheltered (19)

Shelter factor 1 - [0.075 x (19)] = (20)

Infiltration rate incorporating shelter factor (18) x (20) = (21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70 (22)

Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18 (22a)
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.20	0.19	0.19	0.17	0.17	0.15	0.15	0.14	0.16	0.17	0.17	0.18 (22b)
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system (23a)

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h (23c)

c) whole house extract ventilation or positive input ventilation from outside (24c)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50 (25)
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K
Window		7.85	x	1.14	=	8.92	(27)
Party wall		51.97	x	0.00	=	0.00	(32)
External wall		6.71	x	0.24	=	1.61	(29a)
Total area of external elements ΣA, m ²		14.56					(31)
Fabric heat loss, W/K = Σ(A x U)						(26)...(30) + (32) =	10.53 (33)
Heat capacity Cm = Σ(A x κ)						(28)...(30) + (32) + (32a)...(32e) =	N/A (34)
Thermal mass parameter (TMP) in kJ/m ² K							100.00 (35)
Thermal bridges: Σ(L x Ψ) calculated using Appendix K							3.33 (36)
Total fabric heat loss						(33) + (36) =	13.86 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	16.62	16.62	16.62	16.62	16.62	16.62	16.62	16.62	16.62	16.62	16.62	16.62 (38)

Heat transfer coefficient, W/K (37)m + (38)m	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48
Average = Σ(39)1...12/12 =	30.48 (39)											

Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76
Average = Σ(40)1...12/12 =	0.76 (40)											

Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00 (40)
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4. Water heating energy requirement

Assumed occupancy, N	1.41 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	67.78 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	74.56	71.84	69.13	66.42	63.71	61.00	61.00	63.71	66.42	69.13	71.84	74.56
Σ(44)1...12 =	813.33 (44)											

Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	110.56	96.70	99.79	87.00	83.47	72.03	66.75	76.59	77.51	90.33	98.60	107.07
Σ(45)1...12 =	1066.41 (45)											

Distribution loss 0.15 x (45)m	16.58	14.50	14.97	13.05	12.52	10.80	10.01	11.49	11.63	13.55	14.79	16.06 (46)
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Storage volume (litres) including any solar or WWHRs storage within same vessel	1.00 (47)
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Water storage loss:

b) Manufacturer's declared loss factor is not known	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.02 (51)
Volume factor from Table 2a	4.93 (52)
Temperature factor from Table 2b	1.00 (53)
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53)	0.10 (54)
Enter (50) or (54) in (55)	0.10 (55)

Water storage loss calculated for each month (55) x (41)m	3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24 (56)
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If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - Vs] ÷ (47), else (56)	3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24 (57)
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Primary circuit loss for each month from Table 3

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)
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Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
------	------	------	------	------	------	------	------	------	------	------	------	------

Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

137.06	120.64	126.29	112.64	109.97	97.68	93.25	103.09	103.15	116.83	124.25	133.58	(62)
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Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
------	------	------	------	------	------	------	------	------	------	------	------	------

Output from water heater for each month (kWh/month) (62)m + (63)m

137.06	120.64	126.29	112.64	109.97	97.68	93.25	103.09	103.15	116.83	124.25	133.58	
$\Sigma(64)1...12 =$											1378.43	(64)

Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

57.96	51.30	54.38	49.44	48.96	44.47	43.39	46.67	46.29	51.23	53.30	56.80	(65)
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5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)												
70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

11.01	9.78	7.95	6.02	4.50	3.80	4.10	5.33	7.16	9.09	10.61	11.31	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

122.24	123.51	120.31	113.51	104.92	96.84	91.45	90.18	93.38	100.18	108.77	116.84	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	(69)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pump and fan gains (Table 5a)

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
------	------	------	------	------	------	------	------	------	------	------	------	------

Losses e.g. evaporation (Table 5)

-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

77.91	76.34	73.09	68.67	65.80	61.76	58.33	62.73	64.29	68.86	74.03	76.35	(72)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

255.36	253.83	245.56	232.40	219.42	206.61	198.09	202.45	209.03	222.34	237.62	248.71	(73)
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6. Solar gains

	Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W
North	0.77	x 7.85	x 10.63	x 0.9 x 0.45	x 0.80	= 20.82 (74)

Solar gains in watts $\Sigma(74)m...(82)m$

20.82	39.80	67.62	108.62	146.32	156.64	146.25	116.03	81.31	47.37	25.69	17.36	(83)
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Total gains - internal and solar (73)m + (83)m

276.18	293.63	313.18	341.02	365.75	363.25	344.33	318.48	290.34	269.72	263.31	266.07	(84)
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7. Mean internal temperature (heating season)

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	21.00	(85)
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Utilisation factor for gains for living area n1,m (see Table 9a)

0.94	0.92	0.89	0.80	0.67	0.51	0.38	0.43	0.64	0.83	0.92	0.95	(86)
------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.72	19.87	20.16	20.52	20.80	20.94	20.98	20.98	20.87	20.53	20.06	19.66	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.29	20.29	20.29	20.29	20.29	20.29	20.29	20.29	20.29	20.29	20.29	20.29	(88)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling n2,m

0.93	0.92	0.87	0.78	0.63	0.46	0.32	0.36	0.59	0.81	0.91	0.94	(89)
------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

18.56	18.78	19.19	19.69	20.06	20.24	20.28	20.27	20.16	19.71	19.06	18.48	(90)
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Living area fraction

Living area ÷ (4) =

0.62

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

19.28	19.46	19.79	20.20	20.52	20.67	20.72	20.71	20.60	20.22	19.68	19.22	(92)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e where appropriate

19.28	19.46	19.79	20.20	20.52	20.67	20.72	20.71	20.60	20.22	19.68	19.22	(93)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, η_m												
0.92	0.90	0.86	0.78	0.64	0.48	0.36	0.40	0.61	0.81	0.89	0.93	(94)

Useful gains, $\eta_m G_m$, W (94)m x (84)m

254.59	265.17	270.23	265.64	235.76	175.76	122.96	127.60	177.51	217.45	235.51	247.21	(95)
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Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
------	------	------	------	-------	-------	-------	-------	-------	-------	------	------	------

Heat loss rate for mean internal temperature, Lm, W [(39)m x (93)m - (96)m]

456.58	443.73	404.98	344.39	268.79	185.11	125.44	131.31	198.13	293.08	383.48	457.65	(97)
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Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

150.28	119.99	100.26	56.70	24.58	0.00	0.00	0.00	0.00	56.27	106.54	156.57	
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$\Sigma(98)1...5, 10...12 =$

771.19

Space heating requirement kWh/m²/year

(98) ÷ (4)

19.15

9b. Energy requirements - community heating scheme

Fraction of space heat from secondary/supplementary system (table 11)	'0' if none	0.00	(301)
Fraction of space heat from community system	1 - (301) =	1.00	(302)
Fraction of community heat from boilers		0.25	(303a)
Fraction of community heat from CHP		0.75	(303b)
Fraction of total space heat from community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community boilers	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating		1.00	(305)
Factor for charging method (Table 4c(3)) for community water heating		1.00	(305a)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating

Annual space heating requirement	771.19	(98)
Space heat from CHP	(98) x (304a) x (305) x (306) =	607.31 (307)
Space heat from boilers	(98) x (304b) x (305) x (306) =	202.44 (307)

Water heating

Annual water heating requirement	1378.43	(64)
Water heat from CHP	(64) x (303a) x (305a) x (306) =	1085.51 (310)
Water heat from boilers	(64) x (303b) x (305a) x (306) =	361.84 (310)

Electricity used for heat distribution $0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$ (313)

Electricity for pumps, fans and electric keep-hot (Table 4f)

mechanical ventilation fans - balanced, extract or positive input from outside (330a)

Total electricity for the above, kWh/year (331)

Electricity for lighting (Appendix L) (332)

Total delivered energy for all uses $(307) + (309) + (310) + (312) + (315) + (331) + (332) \dots (337b) =$ (338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from CHP	607.31	x	2.97	x 0.01 =	18.04	(340a)
Space heating from boilers	202.44	x	4.24	x 0.01 =	8.58	(340b)
Water heating from CHP	1085.51	x	2.97	x 0.01 =	32.24	(342a)
Water heating from boilers	361.84	x	4.24	x 0.01 =	15.34	(342b)
Pumps and fans	38.33	x	13.19	x 0.01 =	5.06	(349)
Electricity for lighting	194.38	x	13.19	x 0.01 =	25.64	(350)
Additional standing charges					120.00	(351)
Total energy cost			$(340a) \dots (342e) + (345) \dots (354) =$		224.90	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.11	(357)
SAP value	84.55	
SAP rating (section 13)	85	(358)
SAP band	B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)	
<i>Emissions from community CHP (space and water heating)</i>						
Power efficiency of CHP unit	31.37					(361)
Heat efficiency of CHP unit	55.83					(362)
Space heating from CHP $(307a) \times 100 \div (362) =$	1087.7246	x	0.2160	=	234.9485	(363)
less credit emissions for electricity	-341.1856	x	0.5190	=	-177.0753	(364)
Water heated by CHP	1944.2087	x	0.2160	=	419.9491	(365)
less credit emissions for electricity	-609.8381	x	0.5190	=	-316.5060	(366)
<i>Emissions from other sources (space heating)</i>						
Efficiency of boilers	95.00					(367b)
CO ₂ emissions from boilers $[(307b) + (310b)] \times 100 \div (367b) =$	593.97	x	0.216	=	128.30	(368)
Electrical energy for community heat distribution	22.57	x	0.519	=	11.71	(372)
Total CO ₂ associated with community systems					301.33	(373)
Total CO ₂ associated with space and water heating					301.33	(376)
Pumps and fans	38.33	x	0.519	=	19.89	(378)
Electricity for lighting	194.38	x	0.519	=	100.88	(379)
Total CO ₂ , kg/year				$(376) \dots (382) =$	422.10	(383)
Dwelling CO ₂ emission rate				$(383) \div (4) =$	10.48	(384)
EI value					93.37	
EI rating (section 14)					93	(385)

EI band

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
<i>Primary Energy from community CHP (space and water heating)</i>						
Power efficiency of CHP unit	31.37					(361)
Heat efficiency of CHP unit	55.83					(362)
Space heating from CHP $(307a) \times 100 \div (362) =$	1087.72	x	1.22	=	1327.02	(363)
less credit energy for electricity	-341.19	x	3.07	=	-1047.44	(364)
Water heated by CHP	1944.21	x	1.22	=	2371.93	(365)
less credit energy for electricity	-609.84	x	3.07	=	-1872.20	(366)
<i>Primary energy from other sources (space heating)</i>						
Efficiency of boilers	95.00					(367b)
Primary energy from boilers $[(307b) + (310b)] \times 100 \div (367b) =$	593.97	x	1.22	=	724.65	(368)
Electrical energy for community heat distribution	22.57	x	3.07	=	69.29	(372)
Total primary energy associated with community systems					1573.26	(373)
Total primary energy associated with space and water heating					1573.26	(376)
Pumps and fans	38.33	x	3.07	=	117.67	(378)
Electricity for lighting	194.38	x	3.07	=	596.73	(379)
Primary energy kWh/year					2287.66	(383)
Dwelling primary energy rate kWh/m ² /year					56.79	(384)

DER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Simon Gowing	Assessor number	9641
Client		Last modified	07/12/2018
Address	Studio Eastern Quarter Claredon Gas Works, Hornsey, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	40.28 (1a) x	2.50 (2a) =	100.70 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 40.28 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) = 100.70 (5)	

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	0 x 10 =	0 (7a)
Number of passive vents	0 x 10 =	0 (7b)
Number of flueless gas fires	0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 0 ÷ (5) = 0.00 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	4.00 (17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)

Number of sides on which the dwelling is sheltered	3 (19)
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Shelter factor	1 - [0.075 x (19)] = 0.78 (20)
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Infiltration rate incorporating shelter factor	(18) x (20) = 0.16 (21)
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Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70 (22)

Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.93	1.00	1.08	1.13	1.18 (22a)
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.20	0.19	0.19	0.17	0.17	0.15	0.15	0.14	0.16	0.17	0.17	0.18 (22b)
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	0.50 (23a)
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If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A (23c)
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c) whole house extract ventilation or positive input ventilation from outside	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50 (24c)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50 (25)
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² .K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K
Window		7.85	x	1.14	=	8.92	(27)
Party wall		51.97	x	0.00	=	0.00	(32)
External wall		6.71	x	0.24	=	1.61	(29a)
Roof		40.28	x	0.14	=	5.64	(30)
Total area of external elements ΣA, m ²		54.84					(31)

Fabric heat loss, W/K = Σ(A x U)	(26)...(30) + (32) =	16.17 (33)
Heat capacity Cm = Σ(A x κ)	(28)...(30) + (32) + (32a)...(32e) =	N/A (34)
Thermal mass parameter (TMP) in kJ/m ² .K		100.00 (35)
Thermal bridges: Σ(L x Ψ) calculated using Appendix K		9.67 (36)
Total fabric heat loss	(33) + (36) =	25.83 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	16.62	16.62	16.62	16.62	16.62	16.62	16.62	16.62	16.62	16.62	16.62	16.62 (38)
Heat transfer coefficient, W/K (37)m + (38)m	42.45	42.45	42.45	42.45	42.45	42.45	42.45	42.45	42.45	42.45	42.45	42.45
Average = Σ(39)1...12/12 =	42.45 (39)											

Heat loss parameter (HLP), W/m ² .K (39)m ÷ (4)	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
Average = Σ(40)1...12/12 =	1.05 (40)											

Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00 (40)
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4. Water heating energy requirement

Assumed occupancy, N	1.41 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	67.78 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	74.56	71.84	69.13	66.42	63.71	61.00	61.00	63.71	66.42	69.13	71.84	74.56
Σ(44)1...12 =	813.33 (44)											

Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	110.56	96.70	99.79	87.00	83.47	72.03	66.75	76.59	77.51	90.33	98.60	107.07
Σ(45)1...12 =	1066.41 (45)											

Distribution loss 0.15 x (45)m	16.58	14.50	14.97	13.05	12.52	10.80	10.01	11.49	11.63	13.55	14.79	16.06 (46)
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Storage volume (litres) including any solar or WWHRs storage within same vessel	1.00 (47)
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Water storage loss:

b) Manufacturer's declared loss factor is not known	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.02 (51)
Volume factor from Table 2a	4.93 (52)
Temperature factor from Table 2b	1.00 (53)
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53)	0.10 (54)
Enter (50) or (54) in (55)	0.10 (55)

Water storage loss calculated for each month (55) x (41)m	3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24 (56)
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If the vessel contains dedicated solar storage or dedicated WWHRs (56)m x [(47) - Vs] ÷ (47), else (56)

3.24	2.92	3.24	3.13	3.24	3.13	3.24	3.24	3.13	3.24	3.13	3.24	(57)
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Primary circuit loss for each month from Table 3

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)
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Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
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Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

137.06	120.64	126.29	112.64	109.97	97.68	93.25	103.09	103.15	116.83	124.25	133.58	(62)
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Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
------	------	------	------	------	------	------	------	------	------	------	------	------

Output from water heater for each month (kWh/month) (62)m + (63)m

137.06	120.64	126.29	112.64	109.97	97.68	93.25	103.09	103.15	116.83	124.25	133.58	
$\Sigma\{64\}1...12 =$											1378.43	(64)

Heat gains from water heating (kWh/month) 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

57.96	51.30	54.38	49.44	48.96	44.47	43.39	46.67	46.29	51.23	53.30	56.80	(65)
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5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	70.69	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

11.01	9.78	7.95	6.02	4.50	3.80	4.10	5.33	7.16	9.09	10.61	11.31	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

122.24	123.51	120.31	113.51	104.92	96.84	91.45	90.18	93.38	100.18	108.77	116.84	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07	(69)
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Pump and fan gains (Table 5a)

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
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Losses e.g. evaporation (Table 5)

-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	-56.55	(71)
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Water heating gains (Table 5)

77.91	76.34	73.09	68.67	65.80	61.76	58.33	62.73	64.29	68.86	74.03	76.35	(72)
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Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

255.36	253.83	245.56	232.40	219.42	206.61	198.09	202.45	209.03	222.34	237.62	248.71	(73)
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6. Solar gains

	Access factor Table 6d		Area m ²		Solar flux W/m ²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
NorthWest	0.77	x	7.85	x	11.28	x 0.9 x	0.45	x	0.80	=	22.10	(81)

Solar gains in watts $\Sigma\{74\}m...(82)m$

22.10	44.98	81.04	133.09	178.89	190.72	178.41	142.23	98.74	54.97	27.80	18.05	(83)
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Total gains - internal and solar (73)m + (83)m

277.46	298.81	326.59	365.49	398.32	397.33	376.50	344.68	307.78	277.31	265.42	266.76	(84)
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7. Mean internal temperature (heating season)

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	21.00	(85)
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Utilisation factor for gains for living area n1,m (see Table 9a)

0.95	0.94	0.91	0.84	0.73	0.58	0.46	0.51	0.72	0.88	0.94	0.96	(86)
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Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

18.96	19.15	19.54	20.06	20.52	20.82	20.93	20.91	20.67	20.09	19.43	18.90	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	(88)
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Utilisation factor for gains for rest of dwelling n2,m

0.95	0.93	0.90	0.82	0.69	0.52	0.37	0.42	0.66	0.85	0.93	0.95	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

17.31	17.59	18.14	18.88	19.50	19.87	19.99	19.97	19.70	18.93	18.00	17.23	(90)
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Living area fraction Living area ÷ (4) = 0.62 (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

18.34	18.56	19.01	19.61	20.14	20.46	20.58	20.55	20.30	19.65	18.89	18.26	(92)
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Apply adjustment to the mean internal temperature from Table 4e where appropriate

18.34	18.56	19.01	19.61	20.14	20.46	20.58	20.55	20.30	19.65	18.89	18.26	(93)
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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm	0.93	0.92	0.88	0.81	0.69	0.55	0.42	0.47	0.67	0.84	0.91	0.94	(94)

Useful gains, ηmGm, W (94)m x (84)m

258.35	273.43	287.37	295.32	276.33	217.83	158.07	161.55	207.50	232.84	241.52	249.94	(95)
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Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
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Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]

595.79	579.85	531.04	454.59	358.15	248.71	168.79	176.30	263.23	384.13	500.41	597.03	(97)
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Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

251.05	205.92	181.29	114.68	60.88	0.00	0.00	0.00	0.00	112.57	186.40	258.24	
$\Sigma\{98\}1...5, 10...12 =$											1371.02	(98)

Space heating requirement kWh/m²/year (98) ÷ (4) = 34.04 (99)

9b. Energy requirements - community heating scheme

Fraction of space heat from secondary/supplementary system (table 11)	'0' if none	0.00	(301)
Fraction of space heat from community system	1 - (301) =	1.00	(302)
Fraction of community heat from boilers		0.25	(303a)
Fraction of community heat from CHP		0.75	(303b)
Fraction of total space heat from community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community boilers	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating		1.00	(305)
Factor for charging method (Table 4c(3)) for community water heating		1.00	(305a)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating

Annual space heating requirement	1371.02	(98)
Space heat from CHP	(98) x (304a) x (305) x (306) = 1079.68	(307)
Space heat from boilers	(98) x (304b) x (305) x (306) = 359.89	(307)

Water heating

Annual water heating requirement	1378.43	(64)
Water heat from CHP	$(64) \times (303a) \times (305a) \times (306) =$	1085.51 (310)

Water heat from boilers	$(64) \times (303b) \times (305a) \times (306) =$	361.84	(310b)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	28.87	(313)

Electricity for pumps, fans and electric keep-hot (Table 4f)

mechanical ventilation fans - balanced, extract or positive input from outside	38.33	(330a)
Total electricity for the above, kWh/year	38.33	(331)
Electricity for lighting (Appendix L)	194.38	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) =	3119.63	(338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from CHP	1079.68	x	2.97	x 0.01 =	32.07	(340a)
Space heating from boilers	359.89	x	4.24	x 0.01 =	15.26	(340b)
Water heating from CHP	1085.51	x	2.97	x 0.01 =	32.24	(342a)
Water heating from boilers	361.84	x	4.24	x 0.01 =	15.34	(342b)
Pumps and fans	38.33	x	13.19	x 0.01 =	5.06	(349)
Electricity for lighting	194.38	x	13.19	x 0.01 =	25.64	(350)
Additional standing charges					120.00	(351)
Total energy cost			$(340a)...(342e) + (345)...(354) =$		245.60	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.21	(357)
SAP value	83.13	
SAP rating (section 13)	83	(358)
SAP band	B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)	
<i>Emissions from community CHP (space and water heating)</i>						
Power efficiency of CHP unit	31.37					(361)
Heat efficiency of CHP unit	55.83					(362)
Space heating from CHP	(307a) × 100 ÷ (362) =	1933.7582	x	0.2160	=	417.6918 (363)
less credit emissions for electricity		-606.5601	x	0.5190	=	-314.8047 (364)
Water heated by CHP		1944.2087	x	0.2160	=	419.9491 (365)
less credit emissions for electricity		-609.8381	x	0.5190	=	-316.5060 (366)
Emissions from other sources (space heating)						
Efficiency of boilers	95.00					(367b)
CO2 emissions from boilers	[(307b)+(310b)] × 100 ÷ (367b) =	759.72	x	0.216	=	164.10 (368)
Electrical energy for community heat distribution		28.87	x	0.519	=	14.98 (372)
Total CO2 associated with community systems						385.41 (373)
Total CO2 associated with space and water heating						385.41 (376)
Pumps and fans	38.33	x	0.519	=	19.89	(378)
Electricity for lighting	194.38	x	0.519	=	100.88	(379)
Total CO ₂ , kg/year					(376)..(382) =	506.19 (383)
Dwelling CO ₂ emission rate					(383) ÷ (4) =	12.57 (384)
EI value						92.05

EI rating (section 14)	92	(385)
EI band	A	

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)
Primary Energy from community CHP (space and water heating)					
Power efficiency of CHP unit	31.37				(361)
Heat efficiency of CHP unit	55.83				(362)
Space heating from CHP	(307a) × 100 ÷ (362) = 1933.76	x	1.22	=	2359.19 (363)
less credit energy for electricity	-606.56	x	3.07	=	-1862.14 (364)
Water heated by CHP	1944.21	x	1.22	=	2371.93 (365)
less credit energy for electricity	-609.84	x	3.07	=	-1872.20 (366)
Primary energy from other sources (space heating)					
Efficiency of boilers	95.00				(367b)
Primary energy from boilers	[(307b)+(310b)] x 100 ÷ (367b) = 759.72	x	1.22	=	926.85 (368)
Electrical energy for community heat distribution	28.87	x	3.07	=	88.63 (372)
Total primary energy associated with community systems					2012.26 (373)
Total primary energy associated with space and water heating					2012.26 (376)
Pumps and fans	38.33	x	3.07	=	117.67 (378)
Electricity for lighting	194.38	x	3.07	=	596.73 (379)
Primary energy kWh/year					2726.67 (383)
Dwelling primary energy rate kWh/m2/year					67.69 (384)

Appendix I

BRUKL Outputs – *Be Clean*

Project name

Shell and Core

Clarendon Cafe Be Clean

As designed

Date: Wed Dec 05 18:03:56 2018

Administrative information

Building Details

Address: Clarendon Cafe, London, N22

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.4.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v5.4.0

BRUKL compliance check version: v5.4.b.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name:

Telephone number:

Address: , ,

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	80
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	80
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	59
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.25	0.25	02 Lower Ground Floor - Kitchen_P_8
Floor	0.25	0.14	0.14	02 Lower Ground Floor - Kitchen_S_3
Roof	0.25	0.14	0.14	02 Lower Ground Floor - Cafe_R_5
Windows***, roof windows, and rooflights	2.2	1.4	1.4	02 Lower Ground Floor - Cafe_G_7
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)]				
* There might be more than one surface where the maximum U-value occurs. ** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. *** Display windows and similar glazing are excluded from the U-value check. N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Project HVAC

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.5	2.5	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types ≤12 kW output, refer to EN 14825 for limiting standards.					

1- Project DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0.004
Standard value	N/A	N/A

1- CHP 1

	CHPQA quality index	CHP electrical efficiency
This building	110	0.4
Standard value	105	0.2

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
02 Lower Ground Floor - Kitchen	0.3	-	-	-	-	-	-	-	-	-	-	N/A
02 Lower Ground Floor - WCs	0.3	-	-	-	-	-	-	-	-	-	-	N/A
02 Lower Ground Floor - Cafe	-	-	-	1.5	-	-	-	-	-	-	0.85	0.5

Shell and core configuration

Zone	Assumed shell?
02 Lower Ground Floor - Kitchen	NO
02 Lower Ground Floor - WCs	NO
02 Lower Ground Floor - Cafe	NO

General lighting and display lighting		Luminous efficacy [lm/W]			
Zone name		Luminaire	Lamp	Display lamp	General lighting [W]
	Standard value	60	60	22	
02 Lower Ground Floor - Kitchen		-	100	-	338
02 Lower Ground Floor - WCs		-	100	-	58
02 Lower Ground Floor - Cafe		-	100	50	557

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
02 Lower Ground Floor - Kitchen	N/A	N/A
02 Lower Ground Floor - WCs	N/A	N/A
02 Lower Ground Floor - Cafe	NO (-15.5%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	279.1	279.1
External area [m ²]	617	617
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	5	3
Average conductance [W/K]	262.97	255.52
Average U-value [W/m ² K]	0.43	0.41
Alpha value* [%]	13.21	12.51

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
100	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	5.08	6.53
Cooling	50.97	35.97
Auxiliary	11.99	8.5
Lighting	28.12	56.95
Hot water	192.31	117.6
Equipment*	129.28	129.28
TOTAL **	225.98	225.54

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	62.5	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	368.3	523.27
Primary energy* [kWh/m ²]	337.98	466.57
Total emissions [kg/m ²]	59	80

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	42.6	325.7	5.1	51	12	2.33	1.78	2.5	2.5
	Notional	57.1	466.2	6.5	36	8.5	2.43	3.6	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.24	02 Lower Ground Floor - Cafe_W_6
Floor	0.2	0.14	02 Lower Ground Floor - Kitchen_S_3
Roof	0.15	0.14	02 Lower Ground Floor - Cafe_R_5
Windows, roof windows, and rooflights	1.5	1.4	02 Lower Ground Floor - Cafe_G_7
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-Min} = Minimum individual element U-values [W/(m²K)]	
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

Project name

Shell and Core

Clarendon Offices Be Clean

As designed

Date: Wed Dec 05 17:43:54 2018

Administrative information

Building Details

Address: Clarendon Offices, London, N22

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.4.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v5.4.0

BRUKL compliance check version: v5.4.b.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name:

Telephone number:

Address: , ,

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	19.6
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	19.6
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	17.6
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.24	0.25	01 Lower Ground Floor - Offices 1_P_6
Floor	0.25	0.16	0.25	03 First Floor 1 - Offices 1_F_4
Roof	0.25	0.14	0.14	01 Lower Ground Floor - Offices_R_5
Windows***, roof windows, and rooflights	2.2	1.4	1.4	01 Lower Ground Floor - Offices 1_G_8
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)]				
* There might be more than one surface where the maximum U-value occurs. ** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. *** Display windows and similar glazing are excluded from the U-value check. N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Project HVAC

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.5	2.5	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

1- Project DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0.006
Standard value	N/A	N/A

1- CHP 1

	CHPQA quality index	CHP electrical efficiency
This building	110	0.4
Standard value	105	0.2

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
01 Lower Ground Floor - Offices 1	-	-	-	1.5	-	-	-	-	-		0.85	0.5
01 Lower Ground Floor - Offices	-	-	-	1.5	-	-	-	-	-		0.85	0.5
03 First Floor 1 - Offices 1	-	-	-	1.5	-	-	-	-	-		0.85	0.5
03 First Floor 1 - Offices 2	-	-	-	1.5	-	-	-	-	-		0.85	0.5
03 First Floor 1 - Offices 3	-	-	-	1.5	-	-	-	-	-		0.85	0.5
03 First Floor 1 - Offices	-	-	-	1.5	-	-	-	-	-		0.85	0.5

Shell and core configuration

Zone	Assumed shell?
01 Lower Ground Floor - Offices 1	NO
01 Lower Ground Floor - Offices	NO
03 First Floor 1 - Offices 1	NO
03 First Floor 1 - Offices 2	NO

Shell and core configuration

Zone	Assumed shell?
03 First Floor 1 - Offices 3	NO
03 First Floor 1 - Offices	NO

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name	Standard value	Luminaire	Lamp	Display lamp	
01 Lower Ground Floor - Offices 1	100	60	-	-	1918
01 Lower Ground Floor - Offices	100	60	-	-	2264
03 First Floor 1 - Offices 1	100	60	-	-	1167
03 First Floor 1 - Offices 2	100	60	-	-	1195
03 First Floor 1 - Offices 3	100	60	-	-	2648
03 First Floor 1 - Offices	100	60	-	-	1086

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
01 Lower Ground Floor - Offices 1	NO (-17.7%)	NO
01 Lower Ground Floor - Offices	NO (-13.7%)	NO
03 First Floor 1 - Offices 1	NO (-13.6%)	NO
03 First Floor 1 - Offices 2	NO (-41.1%)	NO
03 First Floor 1 - Offices 3	NO (-23.2%)	NO
03 First Floor 1 - Offices	NO (-31.5%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	1680.7	1680.7
External area [m ²]	2181.1	2181.1
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	5	3
Average conductance [W/K]	896.2	832.27
Average U-value [W/m ² K]	0.41	0.38
Alpha value* [%]	11.49	11.2

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	2.35	1.31
Cooling	12.3	9.08
Auxiliary	4.5	2.7
Lighting	13.81	24.3
Hot water	6.39	3.34
Equipment*	42.19	42.19
TOTAL **	37.57	40.72

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	1.77	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	98.28	129.12
Primary energy* [kWh/m ²]	103.52	115.97
Total emissions [kg/m ²]	17.6	19.6

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity									
Actual	19.7	78.6	2.4	12.3	4.5	2.33	1.78	2.5	2.5
Notional	11.5	117.6	1.3	9.1	2.7	2.43	3.6	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.24	01 Lower Ground Floor - Offices 1_W_7
Floor	0.2	0.14	01 Lower Ground Floor - Offices 1_S_3
Roof	0.15	0.14	01 Lower Ground Floor - Offices_R_5
Windows, roof windows, and rooflights	1.5	1.4	01 Lower Ground Floor - Offices 1_G_8
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-Min} = Minimum individual element U-values [W/(m²K)]	
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

Project name

Clarendon Resident Facilities Be Clean

As designed

Date: Thu Dec 06 08:37:22 2018

Administrative information

Building Details

Address: Clarendon Resident Facilities, London, N22

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.4.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v5.4.0

BRUKL compliance check version: v5.4.b.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name:

Telephone number:

Address: , ,

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	20.5
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	20.5
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	19.3
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.25	0.25	01 Lower Ground Floor - Residents Facilities_P_7
Floor	0.25	0.14	0.14	01 Lower Ground Floor - Residents Facilities_S_3
Roof	0.25	0.14	0.14	01 Lower Ground Floor - Residents Facilities_R_5
Windows***, roof windows, and rooflights	2.2	1.4	1.4	01 Lower Ground Floor - Residents Facilities_G_15
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)] * There might be more than one surface where the maximum U-value occurs. ** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. *** Display windows and similar glazing are excluded from the U-value check. N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Project HVAC

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.5	2.5	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types ≤12 kW output, refer to EN 14825 for limiting standards.					

1- Project DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0.012
Standard value	N/A	N/A

1- CHP 1

	CHPQA quality index	CHP electrical efficiency
This building	110	0.4
Standard value	105	0.2

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
01 Lower Ground Floor - Residents Facilities	-	-	-	1.5	-	-	-	-	-		0.85	0.5

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
01 Lower Ground Floor - Residents Facilities	100	-	-	5541

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
01 Lower Ground Floor - Residents Facilities	NO (-72.8%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	935.5	935.5
External area [m ²]	1997.8	1997.8
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	5	3
Average conductance [W/K]	363.24	506.7
Average U-value [W/m ² K]	0.18	0.25
Alpha value* [%]	4.98	4.32

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	0.98	1.54
Cooling	10.8	7.13
Auxiliary	5.9	2.7
Lighting	18.24	27.8
Hot water	7.24	3.34
Equipment*	42.19	42.19
TOTAL **	41.39	42.5

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	1.77	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	77.27	105.85
Primary energy* [kWh/m ²]	113.67	121.31
Total emissions [kg/m ²]	19.3	20.5

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	8.3	69	1	10.8	5.9	2.33	1.78	2.5	2.5
	Notional	13.5	92.4	1.5	7.1	2.7	2.43	3.6	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.24	01 Lower Ground Floor - Residents Facilities_W_6
Floor	0.2	0.14	01 Lower Ground Floor - Residents Facilities_S_3
Roof	0.15	0.14	01 Lower Ground Floor - Residents Facilities_R_5
Windows, roof windows, and rooflights	1.5	1.4	01 Lower Ground Floor - Residents Facilities_G_15
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-Min} = Minimum individual element U-values [W/(m²K)]	
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

Project name

Shell and Core

Clarendon Restaurant Be Clean

As designed

Date: Wed Dec 05 17:56:29 2018

Administrative information

Building Details

Address: Clarendon Restaurant, London, N22

Owner Details

Name:

Telephone number:

Address: , ,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.4.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v5.4.0

BRUKL compliance check version: v5.4.b.0

Certifier details

Name:

Telephone number:

Address: , ,

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	80.9
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	80.9
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	56.9
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.25	0.25	01 Lower Ground Floor - Restaurant_P_6
Floor	0.25	0.14	0.14	01 Lower Ground Floor - Restaurant_S_3
Roof	0.25	0.14	0.14	01 Lower Ground Floor - Restaurant_R_5
Windows***, roof windows, and rooflights	2.2	1.4	1.4	01 Lower Ground Floor - Restaurant_G_10
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)]				
* There might be more than one surface where the maximum U-value occurs. ** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. *** Display windows and similar glazing are excluded from the U-value check. N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Project HVAC

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.5	2.5	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

1- Project DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0.007
Standard value	N/A	N/A

1- CHP 1

	CHPQA quality index	CHP electrical efficiency
This building	110	0.4
Standard value	105	0.2

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
01 Lower Ground Floor - Restaurant	-	-	-	1.5	-	-	-	-	-		0.85	0.5

Shell and core configuration

Zone	Assumed shell?
01 Lower Ground Floor - Restaurant	NO

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
01 Lower Ground Floor - Restaurant	-	100	50	306

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
01 Lower Ground Floor - Restaurant	NO (-25%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	129.5	129.5
External area [m ²]	297.3	297.3
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	5	5
Average conductance [W/K]	125.85	125.01
Average U-value [W/m ² K]	0.42	0.42
Alpha value* [%]	14.61	13.3

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
100	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	3.98	5.57
Cooling	45.77	33.05
Auxiliary	12.22	7.33
Lighting	24.13	54.34
Hot water	234.59	139.53
Equipment*	115.14	115.14
TOTAL **	246.53	239.82

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	74.15	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	325.81	477.13
Primary energy* [kWh/m ²]	322.85	470.44
Total emissions [kg/m ²]	56.9	80.9

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	33.3	292.5	4	45.8	12.2	2.33	1.78	2.5	2.5
	Notional	48.7	428.4	5.6	33.1	7.3	2.43	3.6	----	----

Key to terms	
Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.24	01 Lower Ground Floor - Restaurant_W_9
Floor	0.2	0.14	01 Lower Ground Floor - Restaurant_S_3
Roof	0.15	0.14	01 Lower Ground Floor - Restaurant_R_5
Windows, roof windows, and rooflights	1.5	1.4	01 Lower Ground Floor - Restaurant_G_10
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-Min} = Minimum individual element U-values [W/(m²K)]	
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

Project name

Shell and Core

Clarendon Retail Be Clean

As designed

Date: Wed Dec 05 18:09:34 2018

Administrative information

Building Details

Address: Clarendon Retail, London, N22

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.4.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v5.4.0

BRUKL compliance check version: v5.4.b.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name:

Telephone number:

Address: , ,

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	41
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	41
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	38.9
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.25	0.25	02 Lower Ground Floor - Retail Unit 3_P_6
Floor	0.25	0.14	0.14	02 Lower Ground Floor - Retail Unit 3_S_3
Roof	0.25	0.14	0.14	02 Lower Ground Floor - Retail Unit 3_R_5
Windows***, roof windows, and rooflights	2.2	1.4	1.4	02 Lower Ground Floor - Retail Unit 3_G_9
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)]				
* There might be more than one surface where the maximum U-value occurs. ** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. *** Display windows and similar glazing are excluded from the U-value check. N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Project HVAC

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.5	2.5	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

1- Project DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0.182
Standard value	N/A	N/A

1- CHP 1

	CHPQA quality index	CHP electrical efficiency
This building	110	0.4
Standard value	105	0.2

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
02 Lower Ground Floor - Retail Unit 3	-	-	-	1.5	-	-	-	-	-		0.85	0.5

Shell and core configuration

Zone	Assumed shell?
02 Lower Ground Floor - Retail Unit 3	NO

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
02 Lower Ground Floor - Retail Unit 3	-	100	50	849

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
02 Lower Ground Floor - Retail Unit 3	NO (-14.7%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	88.9	88.9
External area [m ²]	246.3	246.3
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	5	5
Average conductance [W/K]	106.13	97.71
Average U-value [W/m ² K]	0.43	0.4
Alpha value* [%]	15.92	12.54

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
100	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	10.19	4.97
Cooling	19.07	16.13
Auxiliary	7.04	3.78
Lighting	29.67	55.37
Hot water	23.88	1.96
Equipment*	20.26	20.26
TOTAL **	88.8	82.21

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	1.04	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	207.31	252.59
Primary energy* [kWh/m ²]	228.46	242.61
Total emissions [kg/m ²]	38.9	41

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	85.4	121.9	10.2	19.1	7	2.33	1.78	2.5	2.5
	Notional	43.5	209.1	5	16.1	3.8	2.43	3.6	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.24	02 Lower Ground Floor - Retail Unit 3_W_8
Floor	0.2	0.14	02 Lower Ground Floor - Retail Unit 3_S_3
Roof	0.15	0.14	02 Lower Ground Floor - Retail Unit 3_R_5
Windows, roof windows, and rooflights	1.5	1.4	02 Lower Ground Floor - Retail Unit 3_G_9
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-Min} = Minimum individual element U-values [W/(m²K)]	
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

Project name

Shell and Core

Clarendon Retail Units Be Clean

As designed

Date: Wed Dec 05 18:00:19 2018

Administrative information

Building Details

Address: Clarendon Retail Units, London, N22

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.4.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v5.4.0

BRUKL compliance check version: v5.4.b.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name:

Telephone number:

Address: , ,

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	41.3
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	41.3
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	35.6
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.25	0.25	01 Lower Ground Floor - Retail Unit 2_P_6
Floor	0.25	0.14	0.14	01 Lower Ground Floor - Retail Unit 2_S_3
Roof	0.25	0.14	0.14	01 Lower Ground Floor - Retail Unit 2_R_5
Windows***, roof windows, and rooflights	2.2	1.4	1.4	01 Lower Ground Floor - Retail Unit 2_G_10
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)]				
* There might be more than one surface where the maximum U-value occurs. ** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. *** Display windows and similar glazing are excluded from the U-value check. N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Project HVAC

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.5	2.5	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

1- Project DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0.047
Standard value	N/A	N/A

1- CHP 1

	CHPQA quality index	CHP electrical efficiency
This building	110	0.4
Standard value	105	0.2

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
01 Lower Ground Floor - Retail Unit 2	-	-	-	1.5	-	-	-	-	-		0.85	0.5
01 Lower Ground Floor - Retail Unit 1	-	-	-	1.5	-	-	-	-	-		0.85	0.5

Shell and core configuration

Zone	Assumed shell?
01 Lower Ground Floor - Retail Unit 2	NO
01 Lower Ground Floor - Retail Unit 1	NO

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
01 Lower Ground Floor - Retail Unit 2	-	100	50	1669

General lighting and display lighting		Luminous efficacy [lm/W]			
Zone name		Luminaire	Lamp	Display lamp	General lighting [W]
Standard value		60	60	22	
01 Lower Ground Floor - Retail Unit 1		-	100	50	1544

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
01 Lower Ground Floor - Retail Unit 2	NO (-17.5%)	NO
01 Lower Ground Floor - Retail Unit 1	NO (-4.9%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	344.2	344.2
External area [m ²]	704.1	704.1
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	5	3
Average conductance [W/K]	357.57	295.67
Average U-value [W/m ² K]	0.51	0.42
Alpha value* [%]	14.99	12.82

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area Building Type

100	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	7.49	2.81
Cooling	21.06	16.59
Auxiliary	7.04	3.78
Lighting	30.62	57.61
Hot water	8.46	1.96
Equipment*	20.26	20.26
TOTAL **	73.63	82.75

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	1.04	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	197.41	239.56
Primary energy* [kWh/m ²]	210.38	244.22
Total emissions [kg/m ²]	35.6	41.3

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	62.8	134.6	7.5	21.1	7	2.33	1.78	2.5	2.5
	Notional	24.6	215	2.8	16.6	3.8	2.43	3.6	----	----

Key to terms

- Heat dem [MJ/m2] = Heating energy demand
- Cool dem [MJ/m2] = Cooling energy demand
- Heat con [kWh/m2] = Heating energy consumption
- Cool con [kWh/m2] = Cooling energy consumption
- Aux con [kWh/m2] = Auxiliary energy consumption
- Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
- Cool SSEER = Cooling system seasonal energy efficiency ratio
- Heat gen SSEFF = Heating generator seasonal efficiency
- Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
- ST = System type
- HS = Heat source
- HFT = Heating fuel type
- CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
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Roof	0.15	0.14	01 Lower Ground Floor - Retail Unit 2_R_5
Windows, roof windows, and rooflights	1.5	1.4	01 Lower Ground Floor - Retail Unit 2_G_10
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-Min} = Minimum individual element U-values [W/(m²K)]	
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

Appendix J

Low Carbon and Renewable Energy Technologies Summary

1. INTRODUCTION

- > This Appendix is intended to provide the background information for the low carbon and renewable energy technologies that have been considered in the formulation of this Energy Statement.

- > The information provided here forms the basis for the project specific technical selection of low carbon/renewable energy technologies contained in the main section of this Energy Statement.

2. COMBINED HEAT AND POWER (CHP)

- > CHP is a form of decentralised energy generation that generally uses gas to generate electricity for local consumption, reducing the need for grid electricity and its associated high CO₂ emissions. As the CHP system is close to the point of energy demand, it is possible to use the heat that is generated during the electricity generation process. As both the electricity and heat from the generator is used, the efficiency of the system is increased above that of a conventional power plant where the heat is not utilised.

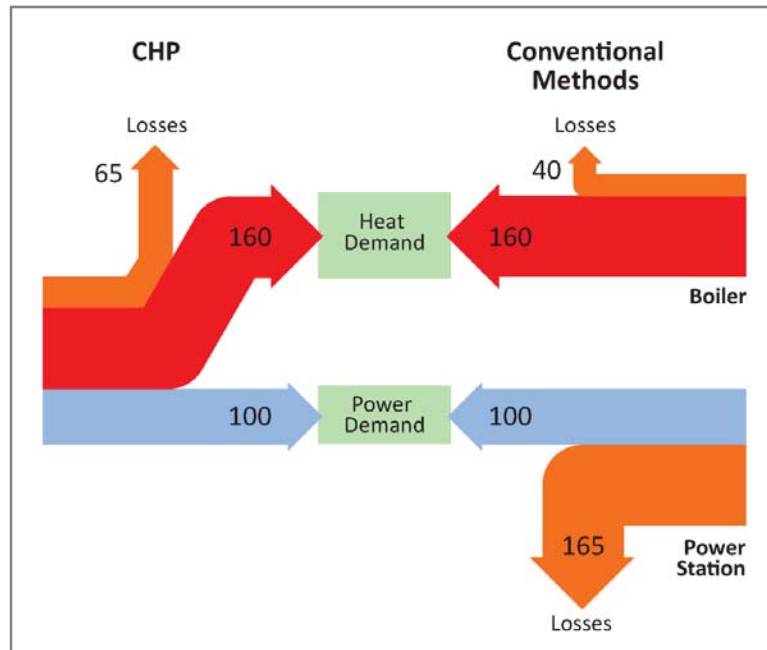


Diagram 1 – CHP Diagram

- > However, the overall efficiency of ~80% is still lower than the ~90% efficiency of a heat only gas boiler.
- > Where there are high thermal loads, CHP can be used within district heating networks to supply the required heat.
- > **Performance and Calculation Methodology: -**
 - > Most commonly sized on the heat load of a development, not the electrical load. This prevents an over-generation of heat.
 - > Require a high and relatively constant heat demand to be viable.
 - > CHP engines are best suited to providing the base heating load of a development (~year round hot water demand) with conventional gas boilers responding to the peak heating demand (~winter space heating). CHP engines are not able to effectively respond to peaks in demand.
 - > In general, CHP engines have an electrical efficiency of ~30% and a thermal efficiency of ~45%. Larger engines have a better heat to power ratio and are therefore able to reduce CO₂ emissions by greater amount.
 - > Electricity produced by the CHP engine displaces grid electricity which is given a carbon intensity of 0.519 kg per kWh.

> **Capital Cost: -**

- > Around £1,000 per kW of electrical output.
- > Relative cost reduces as the size of engine increases.
- > Generally best suited to larger sites, where there is a suitable economy of scale.

> **Running Costs/Savings: -**

- > CHP engines often struggle to provide cost-effective energy to dwellings on smaller residential schemes compared to conventional individual gas boilers.
- > Onsite use of CHP generated electricity; power Purchase Agreement with electricity Supply Company or Private Wire arrangement to local large non-domestic demand enhances economic case.

> **Land Use Issues and Space Required: -**

- > CHP engines require a plant room, and possibly an energy centre for large residential developments.
- > CHP engines require a flue to effectively disperse pollutants. This is best to rise to a minimum of 2m above the roofline of the tallest building.
- > Route for district heating pipe around the site must be safeguarded.

> **Operational Impacts/Issues: -**

- > Often run by Energy Services Company (ESCo) who maybe unenthusiastic about getting involved in small – medium scale schemes.
- > Can also be run in-house with specialist maintenance and customer services activities contracted out.
- > Issues with rights to dig up roads for district heating networks.
- > Emissions of oxides of nitrogen – ~500mg/kWh – 10 times higher than for a gas boiler. Specialist technologies exist (e.g. selective catalytic reduction) to reduce this to ~20mg/kWh if air quality issues require.

> **Embodied Energy: -** Comparable to that of a conventional gas boiler.

> **Funding Opportunities: -**

- > Tax relief for businesses under the Enhanced Capital Allowances scheme..

> **Reductions in Energy Achievable: -** Can provide some reductions in effective primary energy, but when distribution losses and other local losses are included more fuel is required.

> **Reductions in CO₂ Achievable: -** Can provide greater reductions in CO₂ than energy, aided by the emissions factor of grid displaced electricity of 0.519 kg CO₂/kWh. CO₂ reduction increase as size of engine increases.

> **Advantages: -**

- > Good reductions in overall primary energy and CO₂ emissions.

- > Most cost effective and appropriate strategy to achieve substantial CO₂ reductions on large schemes.
- > **Disadvantages:** -
 - > On smaller schemes often do not supply energy cost-effectively in comparison to conventional individual gas boilers.
 - > Requires sale of generated electricity to maximise cost effectiveness.

Application: - Best suited to larger developments.

3. COMBINED COOLING HEAT AND POWER (CCHP)

- > CCHP is a CHP system which additionally has the facility to transform heat into energy for cooling. This is done with an absorption chiller which utilises a heat source to provide the energy needed to drive a cooling system. As absorption chillers are far less efficient than conventional coolers (CoP of 0.7 compared to >4) they are generally only used where there is a current excess generation of heat. New CHP systems are generally sized to provide the year round base heating load only.
- > For this reason it is generally not suitable for new CHP systems to include cooling.
- > Where there are high thermal loads, CCHP can be used within district heating and cooling networks to supply the required heat and coolth.
- > **Performance and Calculation Methodology:** -
 - > Most commonly sized on the heat load of a development, not the electrical load. This prevents an over-generation of heat.
 - > Require a high and relatively constant heat and cooling demand to be viable.
 - > CCHP systems are best suited to providing the base loads of a development with conventional gas boilers and chillers responding to the peak demands. CCHP systems are not able to effectively respond to peaks in demand.
 - > In general, CHP engines have an electrical efficiency of ~30% and a thermal efficiency of ~45%.
 - > Absorption chillers have a CoP of ~0.7.
 - > Electricity produced by the CHP engine displaces grid electricity which is given a carbon intensity of 0.519 kg per kWh.
- > **Capital Cost:** -
 - > High in comparison to biomass boilers and increased further by inclusion of absorption chiller.
- > **Running Costs/Savings:** -

- > Coolth from absorption chillers is more expensive than from conventional systems unless heat used is genuine waste heat.
- > **Land Use Issues and Space Required: -**
 - > CCHP systems require a plant room, and possibly an energy centre for large residential developments.
 - > CHP engines require a flue to effectively disperse pollutants. This is best to rise to a minimum of 2m above the roofline of the tallest building. Additionally the absorption chiller requires either a cooling tower or dry cooler bed for heat rejection purposes.
 - > Heating and cooling distribution pipework required around the site.
- > **Operational Impacts/Issues: -**
 - > Often run by an EScO who are unenthusiastic about getting involved in small – medium scale schemes.
 - > Can also be run in-house with specialist maintenance and customer services activities contracted out.
 - > Issues with rights to dig up roads for heat networks.
 - > Emissions of oxides of nitrogen– ~500mg/kWh – 10 times higher than for gas boilers. Specialist technologies exist (e.g. selective catalytic reduction) to reduce this ~20mg/kWh if air quality issues require.
 - > Rejection of heat is higher than for conventional cooling, thus enforcing the urban heat island effect.
 - > Embodied Energy: - Comparable to conventional gas boilers.
- > **Funding Opportunities: -**
 - > Tax relief for businesses under Enhanced Capital Allowance scheme.
 - > Reductions in Energy Achievable: - Absorption cooling generally requires more energy than conventional chillers.
 - > Reductions in CO₂ Achievable: - Can provide greater reductions in CO₂ than energy, aided by the emissions factor of grid displaced electricity of 0.519 kg CO₂/kWh.
- > **Advantages: -**
 - > Reasonable reductions in overall primary energy and CO₂ emissions.
 - > Disadvantages: - More expensive to install than conventional chillers.
 - > Operational costs higher than for conventional chillers.
- > **Application: -** Best suited where there is genuine waste heat available.

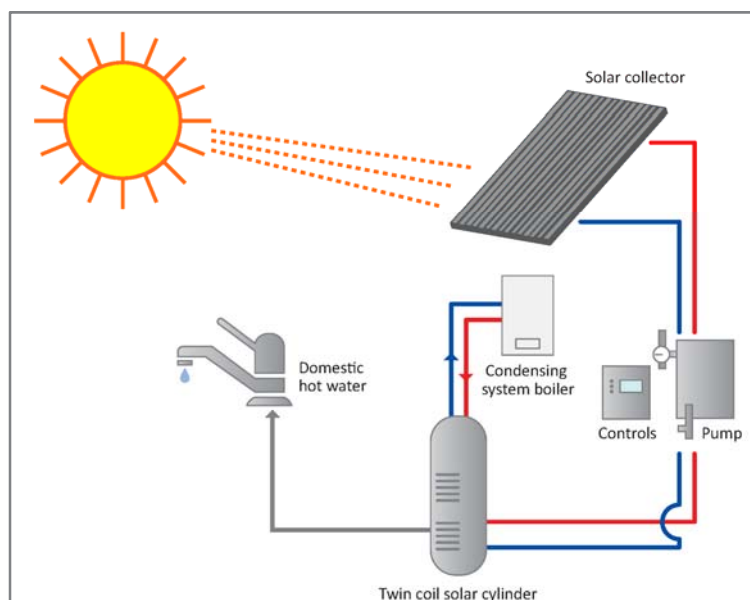
4. BIOMASS BOILERS

- > Biomass boilers generate heat on a renewable basis as they are run on biomass fuel which is almost carbon neutral. Fuel is generally wood chip or wood pellets. Wood pellets are slightly more expensive than wood chips but have a significantly higher calorific value and enable greater automation of the system.
- > Various other suitable fuels are available including organic materials including straw, dedicated energy crops, sewage sludge and animal litter. Each fuel tends to have its own advantages dependant on site requirements.
- > Can be used with district heating networks or as individual boilers on a house-by-house basis.
- > **Performance and Calculation Methodology: -**
 - > Biomass boilers are best suited to providing the base heating load of a development (~year round hot water demand) with conventional gas boilers responding to the peak heating demand (~winter space heating).
 - > Operate with an efficiency of around 90%.
 - > Small models available.
 - > Conflicts with CHP they are both best suited to providing the base heating load of a development. As such they should not be installed in tandem unless surplus hot water capacity is available. Special control measures would be required in this case.
- > **Capital Cost: -**
 - > Low in comparison to CHP.
 - > More suitable to smaller developments than CHP as installed cost is lower.
- > **Running Costs/Savings: -**
 - > Biomass fuel is more expensive than gas and as such heat being provided to dwellings is generally more expensive than alternatives.
- > **Land Use Issues and Space Required: -**
 - > Biomass boilers require a plant room and possibly separate energy centre for large residential developments.
 - > Require a flue to effectively disperse pollutants. This is best to rise to a minimum of 2m above the roofline of the tallest building. Additionally the absorption chiller requires either a cooling tower or dry cooler bed for heat rejection purposes.
 - > Fuel store will be required. This should be maximised to reduce fuel delivery frequency.
 - > Space must be available for delivery vehicle to park close to plant room.

- > Route for district heating pipe around the site must be safeguarded.
- > **Operational Impacts/Issues: -**
 - > Normally run on biomass, but can also work with biogas.
 - > Require some operational support and maintenance.
 - > Fuel deliveries required.
 - > Boiler and fuel store must be sited in proximity to space for delivery vehicle to park.
 - > Issues with rights to dig up roads, etc (for heat networks).
 - > Emissions of oxides of nitrogen – ~80-100mg/kWh.
 - > Emissions of particulate matter. To minimise this ceramic filter systems are required.
 - > Embodied Energy: - Comparable to conventional gas boiler.
- > **Funding Opportunities: -**
 - > Renewable Heat Incentive (RHI) provides incentive funds to developers of small or medium installations with a reasonable heat load that meet a minimum energy efficiency standard & meet the RHI eligibility criteria.
 - > Reductions in Energy Achievable: - No reduction in energy demand, but energy generated from a renewable fuel. Significant long term running costs (fuel).
 - > Reductions in CO₂ Achievable: - Can provide significant reductions in CO₂, but generally limited by the hot water load (base heating load).
 - > Advantages: - Reductions in CO₂ at low installed cost.
- > **Disadvantages: -**
 - > High long-term running costs, unless receiving RHI.
 - > Often do not supply energy cost-effectively in comparison to gas boilers.

5. SOLAR THERMAL PANELS

- > Solar Thermal Heating Systems contribute to the hot water demand



of a dwelling or building. Water or glycol (heat transfer fluid) is circulated to roof level where it is heated using solar energy before being returned to a thermal store in the plant room where heat is exchanged with water from the conventional system. Due to the seasonal availability of heat, solar thermal panels should be scaled to provide no more than 1/2 of the hot water load.

- > Can also be used to provide energy for space heating in highly insulated dwellings.
- > There are two types of solar thermal panel: evacuated tube collectors and flat plate collectors.
- > **Performance and Calculation Methodology: -**
 - > Evacuated Tube Collectors: ~60% efficiency.
 - > Flat Plate Collectors: ~50% efficiency.
 - > SAP Table H2 used for solar irradiation at different angles.
 - > Operate best on south facing roofs angled at 30-45° and free of shading, or on flat roofs on frames. East/West facing panels suffer a loss in performance of 15-20% depending on the angle of installation.
 - > Flat plate collectors cannot be installed horizontally as this would prevent operation of the water pump. Must therefore be angled and separated to avoid overshadowing each other.
- > **Capital Cost: -** Typically £2,500 per 4m² plus installation. Costs higher for evacuated tubes than flat plate collectors.
- > **Running Costs/Savings: -**
 - > Reduce reliance on gas and therefore reduce costs.
 - > Payback period of ~20 years per dwelling.
- > **Land Use Issues and Space Required: -**
 - > Installed on roof so no impact on land use.
 - > Requires hot water cylinders in dwellings.
 - > Due to amount of roof space required and distance from tank to panels, less suitable for dense developments of relatively high rise flats.
 - > Within permitted development rights unless in a conservation area where they must not be visible from the public highways.
 - > Dormer and Velux windows may conflict if energy/CO₂ reduction required is large.
- > **Operational Impacts/Issues: -** Biggest reductions achieved by people who operate their hot water system with consideration of the panels.
 - > Embodied Energy: - Carbon payback is ~2 years.
 - > Funding Opportunities: - none

- > **Reductions in Energy Achievable:** - Reduce primary energy demand by more per standard panel area than solar PV panels.
 - > Reductions in CO₂ Achievable: - Comparable to solar PV per m².
- > **Advantages:** - Virtually free fuel, low maintenance and reductions in energy/CO₂.
- > **Disadvantages:** - Benefits limited to maximum ~50% of hot water load.
 - > Higher Costs in comparison to PV
- > **Application:** - Best suited for small to medium housing developments ~1-100

6. SOLAR PHOTOVOLTAIC (PV) PANELS

- > Solar PV panels generate electricity by harnessing the power of the sun. They convert solar radiation into electricity which can be used on site or exported to the grid in times of excess generation.
- > **Performance and Calculation Methodology:** -
 - > The best PV panels operate with an efficiency approaching 20%. ~7m² of these high performance panels will produce 1kWp of electricity.
 - > Operate best on south facing roofs angled at 30-45° or on flat roofs on frames. Panels orientated east/west suffer from a loss in performance of 15-20% depending on the angle of installation.
 - > Must be free of any potential shading.
 - > Cannot be installed horizontally as would prevent self-cleaning. Must therefore be angled and separated to avoid overshadowing each other.
 - > Electricity produced displaces grid electricity which has a carbon intensity of 0.519 kg CO₂ per kWh.
- > **Capital Cost:** - ~£2,000 per kWp.
- > **Running Costs/Savings:** -
 - > Reduce reliance on grid electricity and therefore reduce running costs.
 - > At current electricity prices, payback period of ~60-70 years per dwelling.
 - > Feed-in tariff and Renewables Obligation Certificates (ROCs) payments required for maximum financial benefit.
- > **Land Use Issues and Space Required:** -
 - > Installed on roof so no impact on land use.

- > Due to amount of roof space required are less suitable for dense developments of relatively high rise flats.
- > Within permitted development rights unless in a conservation area where they must not be visible from the public highways.
- > Dormer and Velux windows may conflict if energy/CO₂ reduction required is large.
- > **Operational Impacts/Issues:** -
 - > Proportionately large arrays may need electrical infrastructure upgrade.
 - > Virtually maintenance free and panels are self-cleaning at angles in excess of 10 degrees.
 - > Provision for access to solar panels installed on flat roofs needs to be incorporated into the design of PV arrays layout as well as inclusion of spaces for inverters within the development.
 - > Quality of PV panels varies dramatically.
- > **Embodied Energy:** - Carbon payback of 2-5 years.
- > **Funding Opportunities:** - Financier utilising Feed-in-Tariffs.
- > **Reductions in Energy Achievable:** - Reduce energy demand by less per m² than solar thermal panels.
- > **Reductions in CO₂ Achievable:** - Provide greater percentage reductions in CO₂ than energy. Comparable to solar thermal per square metre.
- > **Advantages:** - Virtually free fuel, very low maintenance and good reductions in CO₂.
 - > Cheaper in comparison to solar thermal panels.
- > **Disadvantages:** -
 - > Slightly greater loss in performance than solar thermal panels when orientated away from south.
- > **Application:** Best suited for a variety of developments from single houses to multi apartment blocks and even whole estates.

7. GROUND SOURCE HEAT PUMPS (GSHPS)

- > Ground Source Heat Pumps work in much the same way as a refrigerator, converting low grade heat from a large 'reservoir' into higher temperature heat for input in a smaller space.

Electricity drives the pump which circulates a fluid (water/antifreeze mix or refrigerant) through a closed loop of underground pipe. This fluid absorbs the solar energy that is stored in the earth (which in the UK remains at a near constant temperature

of 12oC throughout the year) and carries it to a pump. A compressor in the heat pump upgrades the temperature of the fluid which can then be used for space heating and hot water.

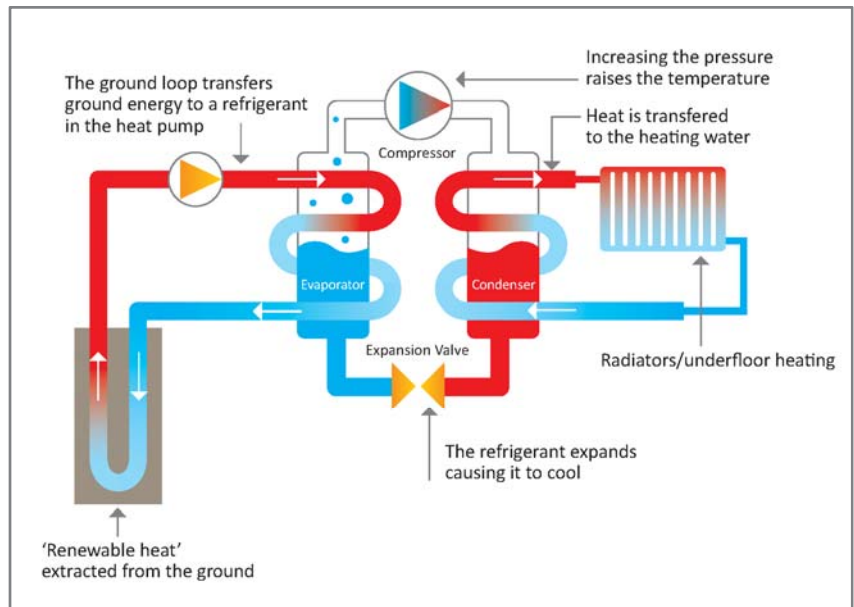


Diagram 3 – Ground Source Heat Pump

> **Performance and Calculation Methodology: -**

- > System requires electricity to drive the pump. Therefore displaces gas heating with electric, which has higher carbon intensity (gas: 0.216; electricity: 0.519).
- > As they are upgrading heat energy from the earth, GSHPs operate at 'efficiencies' in excess of 350%. This is limited in SAP unless Appendix Q rated model used.
- > Due to the lower temperature of the output of GSHPs compared to traditional gas boilers, GSHPs work best in well insulated buildings and with underfloor heating. They can, however, also be installed with oversized radiators, albeit with a consequent reduction in performance.

- > **Capital Cost:** - ~£7,500 per house. Additional costs if underfloor heating is to be installed.

> **Running Costs/Savings: -**

- > Electricity more expensive than gas, thus fuel costs not reduced as much as energy is reduced.
- > Payback period of ~20 years per dwelling.

> **Land Use Issues and Space Required: -**

- > Require extensive ground works to bury the coils that extract the low grade heat from the earth. They therefore require a large area for horizontal burial (40-100m long trench) or a vertical bore (50-100m) which is considerably more expensive but can be used where space is limited.
- > Best suited to new developments that have provision for large ground works already in place, to minimise ground work costs.
- > Must be sized correctly to prevent freezing of the ground during winter and consequent shutdown of the system.
- > May require planning permission for engineering works. Once buried, there is no external evidence of the GSHPs.

> **Operational Impacts/Issues: -**

- > Work best in well insulated houses.
- > Need immersion backup for hot water.
- > Highly reliable and require virtually no maintenance.
- > Problems if ground bore fails.
- > **Embodied Energy:** - Low, but as gas is being replaced with the more carbon intensive electricity, carbon payback is slowed. Carbon payback depends on CoP.
- > **Funding Opportunities:** - Renewable Heat Incentive (RHI) provides incentive funds to developers of small or medium installations with a reasonable heat load that meet a minimum energy efficiency standard & meet the RHI eligibility criteria.
- > **Reductions in Energy Achievable:** - Reduce energy demand by less per m² than solar thermal panels.
- > **Reductions in CO₂ Achievable:** - Provide greater %age reductions in CO₂ than energy. Comparable to solar thermal (esp. in SAP).
- > **Advantages:** - Large reductions in Energy. Currently receives benefit from SAP of an electrical baseline rather than gas.
- > **Disadvantages: -**
 - > Small reduction in CO₂. CoP limited in SAP. Only small cost savings.
 - > GSHPs are not entirely a 'renewable' technology as they require electricity to drive their pumps or compressors.
- > **Application:** - Best suited for small to medium developments ~1-100

8. AIR SOURCE HEAT PUMPS (ASHPS)

- > Air Source Heat Pumps work in much the same way as a refrigerator, converting low grade heat from a large 'reservoir' into higher temperature heat for input into a smaller space. Electricity drives the pump which extracts heat from the air as it flows over the coils in the heat pump unit. A compressor in the heat pump upgrades the temperature of the extracted energy which can then be used for space heating and hot water.

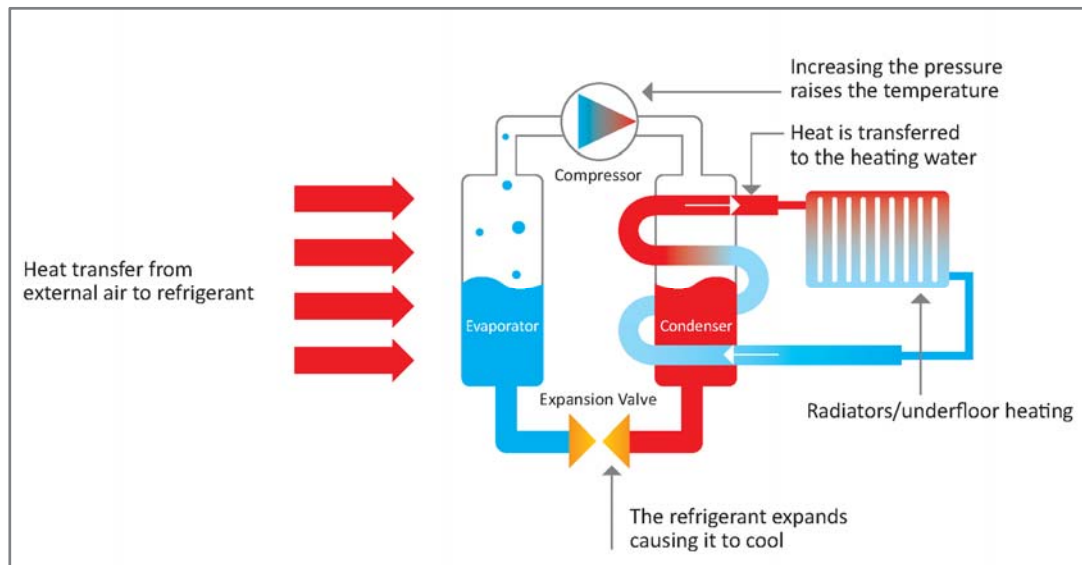


Diagram 4 – Air Source Heat Pump

- > Generally ASHPs are air-to-water devices but can also be air-to-air.
- > **Performance and Calculation Methodology: -**
 - > System requires electricity to drive the pump. Therefore displaces gas heating with electric, which has higher carbon intensity (gas: 0.216; electricity: 0.519).
 - > Performance defined by the Coefficient of Performance (CoP) which is a measure of electricity input to heat output. However, the concept of a CoP must be treated with caution as it is an instantaneous measurement and does not take account of varying external conditions throughout the year.
 - > As they are upgrading heat energy from the air, ASHPs operate at 'efficiencies' in excess of 250%. This is limited in SAP unless an Appendix Q rated model is used.
 - > British winter conditions (low temperatures and high humidity) lead to freezing of external unit. Reverse cycling defrosts the ASHP, but can substantially reduce performance when it is most needed. Performance under these conditions varies considerably between models. Vital that ASHP that has been proven in British winter conditions is installed.

- > Due to the lower temperature of the output of ASHPs compared to traditional gas boilers, ASHPs work best in well insulated buildings and with underfloor heating. They can, however, also be installed with oversized radiators, albeit with a consequent reduction in performance.
- > **Capital Cost:** - ~£2,000 per house.
- > **Running Costs/Savings:** -
 - > Electricity more expensive than gas, thus fuel costs not reduced as much as energy is reduced.
 - > Payback period of ~10 years per dwelling.
- > **Land Use Issues and Space Required:** -
 - > No need for external ground works, only a heat pump unit for the air to pass through.
 - > Minimal external visual evidence.
- > **Operational Impacts/Issues:** -
 - > Work best in well insulated houses.
 - > Unit must be sized correctly for each dwelling.
 - > Vital that ASHP model selected has been proven to maintain performance at the low temperature and high humidity conditions of the British winter.
 - > May need immersion backup for hot water.
 - > Highly reliable and require virtually no maintenance.
 - > Noise from ASHPs must be below 42 dB at a position one metre external to the centre point of any door or window in a habitable room. According to planning standards MCS020.
- > **Embodied Energy:** - Low. Carbon payback longer than for GSHPs as the CoP is lower.
- > **Funding Opportunities:** - Renewable Heat Incentive (RHI) provides incentive funds to developers of small or medium installations with a reasonable heat load that meet a minimum energy efficiency standard & meet the RHI eligibility criteria.
- > **Reductions in Energy Achievable:** - Large reductions in energy demand. Less so than GSHPs.
- > **Reductions in CO₂ Achievable:** - Provide smaller percentage reductions in CO₂ than energy. Less than GSHPs.
- > **Advantages:** - Large reductions in Energy. Currently receives benefit from SAP of an electrical fuel factor rather than a gas baseline.
- > **Disadvantages:** -
 - > Small reduction in CO₂ CoP limited in SAP. Only small cost savings.

- > ASHPs are not entirely a 'renewable' technology as they require electricity to drive their pumps or compressors.
 - > **Application:** - Best suited for small to medium developments ~1-100
-

9. WIND POWER

- > Wind energy installations can range from small domestic turbines (1kW) to large commercial turbines (140m tall, 2MW). There are also different designs and styles (horizontal or vertical axis; 1 blade to multiple blades) to suit the location. They generate clean electricity that can be provided for use on-site, or sold directly to the local electricity network
- > **Performance and Calculation Methodology:** -
 - > Power generated is proportional to the cube of the wind speed. Therefore, wind speed is critical.
 - > Horizontal axis turbines require $>\sim 6\text{m/s}$ to operate effectively and vertical axis turbines require $>\sim 4.5\text{m/s}$. The rated power of a turbine is often for wind speeds double these figures.
 - > Wind speeds for area from BERR's Wind Speed Database.
 - > Electricity produced displaces grid electricity which has a carbon intensity of 0.568 kg/kWh.
- > **Capital Cost:** -
 - > ~£1,000 per kW. Smaller models are more expensive per kW.
 - > Vertical axis turbines more expensive than horizontal.
- > **Running Costs/Savings:** -
 - > Reduce reliance on grid electricity and therefore reduce costs.
 - > Payback period of ~15-20 years per dwelling.
 - > Feed-in tariff and ROC payments required for maximum financial benefit.
- > **Land Use Issues and Space Required:** -
 - > Smaller models (<6kW) can be roof mounted.
 - > Must be higher than surrounding structures/trees.
 - > Planning permission required.
- > **Operational Impacts/Issues:** -
 - > Urban environments generally have low wind speeds and high turbulence which reduce the effectiveness of turbines.

- > Vertical axis turbines have a lower performance than horizontal axis turbines but work better in urban environments.
 - > Annual services required.
 - > Turbines rated in excess of 5kW may require the network to be strengthened and arrangements to be made with the local Distribution Network Operator and electricity supplier.
 - > Noise.
 - > **Embodied Energy:** - Carbon payback is ~1 year for most turbines.
 - > **Funding Opportunities:** - Financier utilising Feed-in-Tariffs.
 - > **Reductions in Energy Achievable:** - Significant reduction in reliance on grid electricity.
 - > **Reductions in CO₂ Achievable:** - Good. Greater reduction in CO₂ than PV for same investment.
 - > **Advantages:** - Virtually free fuel; reductions in CO₂.
 - > **Disadvantages:** -
 - > Expensive, although cheaper than PV for same return.
 - > Lack of suitable sites.
 - > Maintenance costs.
 - > Often not building integrated.
 - > **Application:** Best suited for small to large developments in rural open areas
-

10. HYDRO POWER

- > Hydro power harnesses the energy of falling water, converting the potential or kinetic energy of water into electricity through use of a hydro turbine. Micro hydro schemes (<100kW) tend to be 'run-of-river' developments, taking the flow of the river that is available at any given time and not relying on a reservoir of stored water. They generate clean electricity that can be provided for use on-site, or sold directly to the local electricity network.
- > **Performance and Calculation Methodology:** -
 - > Flow rates at particular sites from National River Flow Archive held by Centre for Ecology and Hydrology.
 - > Electricity produced displaces grid electricity which has a carbon intensity of 0.568 kg/kWh.
- > **Capital Cost:** -

- > £3,000 - £5,000 per kW.
- > Particularly cost effective on sites of old water mills where much of the infrastructure is in place.
- > **Running Costs/Savings: -**
 - > Reduce reliance on grid electricity and therefore reduce costs.
 - > Payback period of ~10-15 years per dwelling
 - > Feed-in tariff and ROC payments required for maximum financial benefit.
- > **Land Use Issues and Space Required: -**
 - > Require suitable water resource.
 - > Visual intrusion of scheme.
 - > Special requirements where river populated by migrating species of fish.
 - > Planning permission will require various consents and licences including an Environmental Statement and Abstraction Licence.
- > **Operational Impacts/Issues: -**
 - > Routine inspections and annual service required.
 - > Automatic cleaners should be installed to prevent intake of rubbish.
- > **Embodied Energy: -** Carbon payback for small schemes of ~1 year.
- > **Funding Opportunities: -** Financier utilising Feed-in-Tariffs.
- > **Reductions in Energy Achievable: -** significant reduction in reliance on grid electricity.
- > **Reductions in CO₂ Achievable: -** High.
- > **Advantages: -** Virtually free fuel, reductions in CO₂.
- > **Disadvantages: -**
 - > Expensive, but good payback period.
 - > Lack of suitable sites.
 - > Planning obstructions.
- > **Application: -** Best suited to medium to larger developments in rural places ~ 100+ units

Appendix K

Summary CO₂ Emissions Rates – *Be Green*

Appendix K

CO₂ Emissions at Be Green Stage

Unit Type Description	Individual			Total				Emissions Rate Improvement
	Unit Floor Area	Dwelling Emissions Rate	Target Emissions Rate	Number of Units	Total Floor Area	Dwelling Emissions Rate	Target Emissions Rate	
	m ²	kg CO ₂ /m ² /year	kg CO ₂ /m ² /year		m ²	kg CO ₂ /year	kg CO ₂ /year	-
Domestic								
1 BED - Exposed Floor	50	10.9	17.2	16	802	8,710	13,783	36.8%
1 BED - Mid Floor	50	10.2	15.5	56	2,808	28,759	43,601	34.0%
1 BED - Top Floor	50	12.4	19.1	12	602	7,461	11,483	35.0%
2 BED - Exposed Floor	64	11.6	18.5	30	1,909	22,213	35,272	37.0%
2 BED - Mid Floor	64	10.3	15.7	182	11,581	119,510	182,149	34.4%
2 BED - Top Floor	64	12.1	18.7	34	2,163	26,154	40,396	35.3%
3 BED - Exposed Floor	80	10.8	16.2	2	161	1,738	2,596	33.0%
3 BED - Mid Floor	80	9.4	14.1	13	1,044	9,827	14,678	33.0%
3 BED - Top Floor	80	11.0	16.5	2	161	1,763	2,645	33.4%
4 BED - Exposed Floor	95	9.8	14.5	2	190	1,865	2,766	32.6%
4 BED - Mid Floor	95	8.4	12.4	13	1,237	10,432	15,358	32.1%
4 BED - Top Floor	95	10.2	15.7	2	190	1,943	2,980	34.8%
MANHATTAN - Exposed Floor	40	11.2	18.4	9	363	4,053	6,666	39.2%
MANHATTAN - Mid Floor	40	10.5	16.9	58	2,336	24,482	39,588	38.2%
MANHATTAN - Top Floor	40	12.6	20.1	8	322	4,049	6,492	37.6%
			Subtotal	439	25,869	272,959	420,454	35.1%
Non-Domestic								
Café	279	42.6	80.0	1	279	11,890	22,328	46.8%
Office	1,681	13.4	19.6	1	1,681	22,521	32,942	31.6%
Resident Facilities	936	15.8	20.5	1	936	14,781	19,178	22.9%
Restaurant	130	42.2	80.9	1	130	5,465	10,477	47.8%
Retail	89	31.1	41.0	1	89	2,765	3,645	24.1%
Retail Units	344	27.8	41.3	1	344	9,569	14,215	32.7%
			Subtotal		3,458	66,990	102,784	34.8%
Total for All Units					29,327	339,950	523,238	35.0%

Appendix L

BRUKL Outputs – *Be Green*

Project name

Shell and Core

Clarendon Cafe Be Green

As designed

Date: Wed Dec 05 18:02:33 2018

Administrative information

Building Details

Address: Clarendon Cafe, London, N22

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.4.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v5.4.0

BRUKL compliance check version: v5.4.b.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name:

Telephone number:

Address: , ,

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	80
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	80
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	42.6
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.25	0.25	02 Lower Ground Floor - Kitchen_P_8
Floor	0.25	0.14	0.14	02 Lower Ground Floor - Kitchen_S_3
Roof	0.25	0.14	0.14	02 Lower Ground Floor - Cafe_R_5
Windows***, roof windows, and rooflights	2.2	1.4	1.4	02 Lower Ground Floor - Cafe_G_7
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)]				
* There might be more than one surface where the maximum U-value occurs. ** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. *** Display windows and similar glazing are excluded from the U-value check. N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Project HVAC

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	3.5	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types ≤12 kW output, refer to EN 14825 for limiting standards.					

1- Project DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0.004
Standard value	N/A	N/A

1- CHP 1

	CHPQA quality index	CHP electrical efficiency
This building	110	0.4
Standard value	105	0.2

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
02 Lower Ground Floor - Kitchen	0.3	-	-	-	-	-	-	-	-	-	-	N/A
02 Lower Ground Floor - WCs	0.3	-	-	-	-	-	-	-	-	-	-	N/A
02 Lower Ground Floor - Cafe	-	-	-	1.5	-	-	-	-	-	-	0.85	0.5

Shell and core configuration

Zone	Assumed shell?
02 Lower Ground Floor - Kitchen	NO
02 Lower Ground Floor - WCs	NO
02 Lower Ground Floor - Cafe	NO

General lighting and display lighting		Luminous efficacy [lm/W]			
Zone name		Luminaire	Lamp	Display lamp	General lighting [W]
Standard value		60	60	22	
02 Lower Ground Floor - Kitchen		-	100	-	338
02 Lower Ground Floor - WCs		-	100	-	58
02 Lower Ground Floor - Cafe		-	100	50	557

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
02 Lower Ground Floor - Kitchen	N/A	N/A
02 Lower Ground Floor - WCs	N/A	N/A
02 Lower Ground Floor - Cafe	NO (-15.5%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	279.1	279.1
External area [m ²]	617	617
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	5	3
Average conductance [W/K]	262.97	255.52
Average U-value [W/m ² K]	0.43	0.41
Alpha value* [%]	13.21	12.51

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
100	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	3.17	6.53
Cooling	21.24	35.97
Auxiliary	11.99	8.5
Lighting	28.12	56.95
Hot water	192.31	117.6
Equipment*	129.28	129.28
TOTAL **	194.34	225.54

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	62.5	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	368.3	523.27
Primary energy* [kWh/m ²]	240.85	466.57
Total emissions [kg/m ²]	42.6	80

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	42.6	325.7	3.2	21.2	12	3.73	4.26	4	6
	Notional	57.1	466.2	6.5	36	8.5	2.43	3.6	----	----

Key to terms

- Heat dem [MJ/m2] = Heating energy demand
- Cool dem [MJ/m2] = Cooling energy demand
- Heat con [kWh/m2] = Heating energy consumption
- Cool con [kWh/m2] = Cooling energy consumption
- Aux con [kWh/m2] = Auxiliary energy consumption
- Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
- Cool SSEER = Cooling system seasonal energy efficiency ratio
- Heat gen SSEFF = Heating generator seasonal efficiency
- Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
- ST = System type
- HS = Heat source
- HFT = Heating fuel type
- CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.24	02 Lower Ground Floor - Cafe_W_6
Floor	0.2	0.14	02 Lower Ground Floor - Kitchen_S_3
Roof	0.15	0.14	02 Lower Ground Floor - Cafe_R_5
Windows, roof windows, and rooflights	1.5	1.4	02 Lower Ground Floor - Cafe_G_7
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-Min} = Minimum individual element U-values [W/(m²K)]	
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

Project name

Shell and Core

Clarendon Offices Be Green

As designed

Date: Wed Dec 05 17:41:10 2018

Administrative information

Building Details

Address: Clarendon Offices, London, N22

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.4.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v5.4.0

BRUKL compliance check version: v5.4.b.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name:

Telephone number:

Address: , ,

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	19.6
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	19.6
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	13.4
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.24	0.25	01 Lower Ground Floor - Offices 1_P_6
Floor	0.25	0.16	0.25	03 First Floor 1 - Offices 1_F_4
Roof	0.25	0.14	0.14	01 Lower Ground Floor - Offices_R_5
Windows***, roof windows, and rooflights	2.2	1.4	1.4	01 Lower Ground Floor - Offices 1_G_8
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)]				
* There might be more than one surface where the maximum U-value occurs. ** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. *** Display windows and similar glazing are excluded from the U-value check. N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Project HVAC

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	3.5	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types ≤12 kW output, refer to EN 14825 for limiting standards.					

1- Project DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0.006
Standard value	N/A	N/A

1- CHP 1

	CHPQA quality index	CHP electrical efficiency
This building	110	0.4
Standard value	105	0.2

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
01 Lower Ground Floor - Offices 1	-	-	-	1.5	-	-	-	-	-		0.85	0.5
01 Lower Ground Floor - Offices	-	-	-	1.5	-	-	-	-	-		0.85	0.5
03 First Floor 1 - Offices 1	-	-	-	1.5	-	-	-	-	-		0.85	0.5
03 First Floor 1 - Offices 2	-	-	-	1.5	-	-	-	-	-		0.85	0.5
03 First Floor 1 - Offices 3	-	-	-	1.5	-	-	-	-	-		0.85	0.5
03 First Floor 1 - Offices	-	-	-	1.5	-	-	-	-	-		0.85	0.5

Shell and core configuration

Zone	Assumed shell?
01 Lower Ground Floor - Offices 1	NO
01 Lower Ground Floor - Offices	NO
03 First Floor 1 - Offices 1	NO
03 First Floor 1 - Offices 2	NO

Shell and core configuration

Zone	Assumed shell?
03 First Floor 1 - Offices 3	NO
03 First Floor 1 - Offices	NO

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name	Standard value	Luminaire	Lamp	Display lamp	
01 Lower Ground Floor - Offices 1	100	60	-	-	1918
01 Lower Ground Floor - Offices	100	60	-	-	2264
03 First Floor 1 - Offices 1	100	60	-	-	1167
03 First Floor 1 - Offices 2	100	60	-	-	1195
03 First Floor 1 - Offices 3	100	60	-	-	2648
03 First Floor 1 - Offices	100	60	-	-	1086

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
01 Lower Ground Floor - Offices 1	NO (-17.7%)	NO
01 Lower Ground Floor - Offices	NO (-13.7%)	NO
03 First Floor 1 - Offices 1	NO (-13.6%)	NO
03 First Floor 1 - Offices 2	NO (-41.1%)	NO
03 First Floor 1 - Offices 3	NO (-23.2%)	NO
03 First Floor 1 - Offices	NO (-31.5%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	1680.7	1680.7
External area [m ²]	2181.1	2181.1
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	5	3
Average conductance [W/K]	896.2	832.27
Average U-value [W/m ² K]	0.41	0.38
Alpha value* [%]	11.49	11.2

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	1.47	1.31
Cooling	5.12	9.08
Auxiliary	4.5	2.7
Lighting	13.81	24.3
Hot water	6.39	3.34
Equipment*	42.19	42.19
TOTAL **	29.52	40.72

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	1.77	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	98.28	129.12
Primary energy* [kWh/m ²]	78.79	115.97
Total emissions [kg/m ²]	13.4	19.6

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	19.7	78.6	1.5	5.1	4.5	3.73	4.26	4	6
	Notional	11.5	117.6	1.3	9.1	2.7	2.43	3.6	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.24	01 Lower Ground Floor - Offices 1_W_7
Floor	0.2	0.14	01 Lower Ground Floor - Offices 1_S_3
Roof	0.15	0.14	01 Lower Ground Floor - Offices_R_5
Windows, roof windows, and rooflights	1.5	1.4	01 Lower Ground Floor - Offices 1_G_8
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-Min} = Minimum individual element U-values [W/(m²K)]	
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

Project name

Clarendon Resident Facilities Be Green**As designed****Date:** Thu Dec 06 08:38:30 2018**Administrative information****Building Details****Address:** Clarendon Resident Facilities, London, N22**Certification tool****Calculation engine:** SBEM**Calculation engine version:** v5.4.b.0**Interface to calculation engine:** DesignBuilder SBEM**Interface to calculation engine version:** v5.4.0**BRUKL compliance check version:** v5.4.b.0**Owner Details****Name:****Telephone number:****Address:** , ,**Certifier details****Name:****Telephone number:****Address:** , ,**Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target**

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	20.5
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	20.5
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	15.8
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.25	0.25	01 Lower Ground Floor - Residents Facilities_P_7
Floor	0.25	0.14	0.14	01 Lower Ground Floor - Residents Facilities_S_3
Roof	0.25	0.14	0.14	01 Lower Ground Floor - Residents Facilities_R_5
Windows***, roof windows, and rooflights	2.2	1.4	1.4	01 Lower Ground Floor - Residents Facilities_G_15
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)] * There might be more than one surface where the maximum U-value occurs. ** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. *** Display windows and similar glazing are excluded from the U-value check. N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Project HVAC

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	3.5	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types ≤12 kW output, refer to EN 14825 for limiting standards.					

1- Project DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0.012
Standard value	N/A	N/A

1- CHP 1

	CHPQA quality index	CHP electrical efficiency
This building	110	0.4
Standard value	105	0.2

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
01 Lower Ground Floor - Residents Facilities	-	-	-	1.5	-	-	-	-	-		0.85	0.5

General lighting and display lighting

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
Standard value		60	60	22	
01 Lower Ground Floor - Residents Facilities		100	-	-	5541

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
01 Lower Ground Floor - Residents Facilities	NO (-72.8%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	935.5	935.5
External area [m ²]	1997.8	1997.8
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	5	3
Average conductance [W/K]	363.24	506.7
Average U-value [W/m ² K]	0.18	0.25
Alpha value* [%]	4.98	4.32

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	0.62	1.54
Cooling	4.5	7.13
Auxiliary	5.9	2.7
Lighting	18.24	27.8
Hot water	7.24	3.34
Equipment*	42.19	42.19
TOTAL **	34.72	42.5

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	1.77	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	77.27	105.85
Primary energy* [kWh/m ²]	93.19	121.31
Total emissions [kg/m ²]	15.8	20.5

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	8.3	69	0.6	4.5	5.9	3.73	4.26	4	6
	Notional	13.5	92.4	1.5	7.1	2.7	2.43	3.6	----	----

Key to terms

- Heat dem [MJ/m2] = Heating energy demand
- Cool dem [MJ/m2] = Cooling energy demand
- Heat con [kWh/m2] = Heating energy consumption
- Cool con [kWh/m2] = Cooling energy consumption
- Aux con [kWh/m2] = Auxiliary energy consumption
- Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
- Cool SSEER = Cooling system seasonal energy efficiency ratio
- Heat gen SSEFF = Heating generator seasonal efficiency
- Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
- ST = System type
- HS = Heat source
- HFT = Heating fuel type
- CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.24	01 Lower Ground Floor - Residents Facilities_W_6
Floor	0.2	0.14	01 Lower Ground Floor - Residents Facilities_S_3
Roof	0.15	0.14	01 Lower Ground Floor - Residents Facilities_R_5
Windows, roof windows, and rooflights	1.5	1.4	01 Lower Ground Floor - Residents Facilities_G_15
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-Min} = Minimum individual element U-values [W/(m²K)]	
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

Project name

Shell and Core

Clarendon Restaurant Be Green

As designed

Date: Wed Dec 05 17:54:51 2018

Administrative information

Building Details

Address: Clarendon Restaurant, London, N22

Owner Details

Name:

Telephone number:

Address: , ,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.4.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v5.4.0

BRUKL compliance check version: v5.4.b.0

Certifier details

Name:

Telephone number:

Address: , ,

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	80.9
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	80.9
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	42.2
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.25	0.25	01 Lower Ground Floor - Restaurant_P_6
Floor	0.25	0.14	0.14	01 Lower Ground Floor - Restaurant_S_3
Roof	0.25	0.14	0.14	01 Lower Ground Floor - Restaurant_R_5
Windows***, roof windows, and rooflights	2.2	1.4	1.4	01 Lower Ground Floor - Restaurant_G_10
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)]				
* There might be more than one surface where the maximum U-value occurs. ** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. *** Display windows and similar glazing are excluded from the U-value check. N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Project HVAC

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	3.5	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

1- Project DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0.007
Standard value	N/A	N/A

1- CHP 1

	CHPQA quality index	CHP electrical efficiency
This building	110	0.4
Standard value	105	0.2

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
01 Lower Ground Floor - Restaurant	-	-	-	1.5	-	-	-	-	-		0.85	0.5

Shell and core configuration

Zone	Assumed shell?
01 Lower Ground Floor - Restaurant	NO

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
01 Lower Ground Floor - Restaurant	-	100	50	306

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
01 Lower Ground Floor - Restaurant	NO (-25%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	129.5	129.5
External area [m ²]	297.3	297.3
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	5	5
Average conductance [W/K]	125.85	125.01
Average U-value [W/m ² K]	0.42	0.42
Alpha value* [%]	14.61	13.3

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
100	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	2.49	5.57
Cooling	19.07	33.05
Auxiliary	12.22	7.33
Lighting	24.13	54.34
Hot water	234.59	139.53
Equipment*	115.14	115.14
TOTAL **	218.34	239.82

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	74.15	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	325.81	477.13
Primary energy* [kWh/m ²]	236.31	470.44
Total emissions [kg/m ²]	42.2	80.9

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	33.3	292.5	2.5	19.1	12.2	3.73	4.26	4	6
	Notional	48.7	428.4	5.6	33.1	7.3	2.43	3.6	----	----

Key to terms

- Heat dem [MJ/m2] = Heating energy demand
- Cool dem [MJ/m2] = Cooling energy demand
- Heat con [kWh/m2] = Heating energy consumption
- Cool con [kWh/m2] = Cooling energy consumption
- Aux con [kWh/m2] = Auxiliary energy consumption
- Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
- Cool SSEER = Cooling system seasonal energy efficiency ratio
- Heat gen SSEFF = Heating generator seasonal efficiency
- Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
- ST = System type
- HS = Heat source
- HFT = Heating fuel type
- CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.24	01 Lower Ground Floor - Restaurant_W_9
Floor	0.2	0.14	01 Lower Ground Floor - Restaurant_S_3
Roof	0.15	0.14	01 Lower Ground Floor - Restaurant_R_5
Windows, roof windows, and rooflights	1.5	1.4	01 Lower Ground Floor - Restaurant_G_10
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-Min} = Minimum individual element U-values [W/(m²K)]	
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

Project name

Shell and Core

Clarendon Retail Be Clean

As designed

Date: Wed Dec 05 18:10:28 2018

Administrative information

Building Details

Address: Clarendon Retail, London, N22

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.4.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v5.4.0

BRUKL compliance check version: v5.4.b.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name:

Telephone number:

Address: , ,

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	41
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	41
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	31.1
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.25	0.25	02 Lower Ground Floor - Retail Unit 3_P_6
Floor	0.25	0.14	0.14	02 Lower Ground Floor - Retail Unit 3_S_3
Roof	0.25	0.14	0.14	02 Lower Ground Floor - Retail Unit 3_R_5
Windows***, roof windows, and rooflights	2.2	1.4	1.4	02 Lower Ground Floor - Retail Unit 3_G_9
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)] * There might be more than one surface where the maximum U-value occurs. ** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. *** Display windows and similar glazing are excluded from the U-value check. N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Project HVAC

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	3.5	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

1- Project DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0.182
Standard value	N/A	N/A

1- CHP 1

	CHPQA quality index	CHP electrical efficiency
This building	110	0.4
Standard value	105	0.2

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
02 Lower Ground Floor - Retail Unit 3	-	-	-	1.5	-	-	-	-	-		0.85	0.5

Shell and core configuration

Zone	Assumed shell?
02 Lower Ground Floor - Retail Unit 3	NO

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
02 Lower Ground Floor - Retail Unit 3	-	100	50	849

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
02 Lower Ground Floor - Retail Unit 3	NO (-14.7%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	88.9	88.9
External area [m ²]	246.3	246.3
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	5	5
Average conductance [W/K]	106.13	97.71
Average U-value [W/m ² K]	0.43	0.4
Alpha value* [%]	15.92	12.54

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area Building Type

100	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	6.37	4.97
Cooling	7.95	16.13
Auxiliary	7.04	3.78
Lighting	29.67	55.37
Hot water	23.88	1.96
Equipment*	20.26	20.26
TOTAL **	73.86	82.21

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	1.04	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	207.31	252.59
Primary energy* [kWh/m ²]	182.58	242.61
Total emissions [kg/m ²]	31.1	41

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	85.4	121.9	6.4	7.9	7	3.73	4.26	4	6
	Notional	43.5	209.1	5	16.1	3.8	2.43	3.6	----	----

Key to terms	
Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.24	02 Lower Ground Floor - Retail Unit 3_W_8
Floor	0.2	0.14	02 Lower Ground Floor - Retail Unit 3_S_3
Roof	0.15	0.14	02 Lower Ground Floor - Retail Unit 3_R_5
Windows, roof windows, and rooflights	1.5	1.4	02 Lower Ground Floor - Retail Unit 3_G_9
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-Min} = Minimum individual element U-values [W/(m²K)]	
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

Project name

Shell and Core

Clarendon Retail Units Be Green

As designed

Date: Wed Dec 05 18:01:10 2018

Administrative information

Building Details

Address: Clarendon Retail Units, London, N22

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.4.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v5.4.0

BRUKL compliance check version: v5.4.b.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name:

Telephone number:

Address: , ,

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	41.3
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	41.3
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	27.8
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.25	0.25	01 Lower Ground Floor - Retail Unit 2_P_6
Floor	0.25	0.14	0.14	01 Lower Ground Floor - Retail Unit 2_S_3
Roof	0.25	0.14	0.14	01 Lower Ground Floor - Retail Unit 2_R_5
Windows***, roof windows, and rooflights	2.2	1.4	1.4	01 Lower Ground Floor - Retail Unit 2_G_10
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)]				
* There might be more than one surface where the maximum U-value occurs. ** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. *** Display windows and similar glazing are excluded from the U-value check. N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Project HVAC

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	3.5	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

1- Project DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0.047
Standard value	N/A	N/A

1- CHP 1

	CHPQA quality index	CHP electrical efficiency
This building	110	0.4
Standard value	105	0.2

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
01 Lower Ground Floor - Retail Unit 2	-	-	-	1.5	-	-	-	-	-		0.85	0.5
01 Lower Ground Floor - Retail Unit 1	-	-	-	1.5	-	-	-	-	-		0.85	0.5

Shell and core configuration

Zone	Assumed shell?
01 Lower Ground Floor - Retail Unit 2	NO
01 Lower Ground Floor - Retail Unit 1	NO

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
01 Lower Ground Floor - Retail Unit 2	-	100	50	1669

General lighting and display lighting		Luminous efficacy [lm/W]			
Zone name		Luminaire	Lamp	Display lamp	General lighting [W]
Standard value		60	60	22	
01 Lower Ground Floor - Retail Unit 1		-	100	50	1544

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
01 Lower Ground Floor - Retail Unit 2	NO (-17.5%)	NO
01 Lower Ground Floor - Retail Unit 1	NO (-4.9%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	344.2	344.2
External area [m ²]	704.1	704.1
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	5	3
Average conductance [W/K]	357.57	295.67
Average U-value [W/m ² K]	0.51	0.42
Alpha value* [%]	14.99	12.82

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area Building Type

100	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	4.68	2.81
Cooling	8.77	16.59
Auxiliary	7.04	3.78
Lighting	30.62	57.61
Hot water	8.46	1.96
Equipment*	20.26	20.26
TOTAL **	58.53	82.75

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	1.04	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	197.41	239.56
Primary energy* [kWh/m ²]	164.05	244.22
Total emissions [kg/m ²]	27.8	41.3

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	62.8	134.6	4.7	8.8	7	3.73	4.26	4	6
	Notional	24.6	215	2.8	16.6	3.8	2.43	3.6	----	----

Key to terms	
Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.24	01 Lower Ground Floor - Retail Unit 2_W_9
Floor	0.2	0.14	01 Lower Ground Floor - Retail Unit 2_S_3
Roof	0.15	0.14	01 Lower Ground Floor - Retail Unit 2_R_5
Windows, roof windows, and rooflights	1.5	1.4	01 Lower Ground Floor - Retail Unit 2_G_10
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-Min} = Minimum individual element U-values [W/(m²K)]	
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5