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15 Lyndhurst Terrace

Energy Statement

Mar-17



Project	15 Lyndhurst Terrace
MW Reference	J2229- 15 Lyndhurst Terrace
Location	Camden
Local Authority	London Borough of Camden
Report Scope	Energy Statement
Quantity of Residential Units	1
Other	N/A

Issue 01 For Planning

Date21/03/2017AuthorAlex Mozaffari

Checked by Fergus Traynor

Disclaimer

The performances of renewable systems, especially wind and solar, are difficult to predict with any certainty. This is due to the variability of environmental conditions from location to location and from year to year. As such all budget/cost and figures, which are based upon the best available information, are to be taken as an estimation only and should not be considered as a guarantee. This report relates to pre-planning stage therefore final specification must be provided by an M & E consultant after stage C.

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Executive Summary

15 Lyndhurst Terrace development comprises one residential detached house and is located in Camden.

Mendick Waring have been appointed to produce an Energy Strategy identifying how the development will address the policies and targets set out by London Borough of Camden.

In line with Camden Policy, mitigation against climate change includes carbon reduction targets for residential buildings; Policy CC1 seeks the fullest contribution to minimising carbon dioxide emissions in accordance with a three-part energy hierarchy; be lean, be clean and be green. The policy seeks for a 19% improvement on Part L1A 2013 building regulations in terms of minimising CO₂ emissions. In light of this, the enclosed strategy seeks to demonstrate and incorporate feasible design elements to maximise CO₂ saving associated with this development.

This strategy also demonstrates that the development will achieve compliance with 2013 Building Regulations through Energy efficiency and FEE (fabric energy efficiency).

Passive design measures and 2 kWp of photovoltaic panels have been proposed for this development. This will result in 29.3% of CO₂ reduction compared to the Baseline building regulation. The PV panels will be installed on the roof. This is subject to further detailed investigation and calculation. The CO₂ reduction by photovoltaic panels is 20.4% of the total Carbon Dioxide reduction of the development. As the result, the development complies with Policy CC1, Supplementary Planning Guidance and Building Regulations Part L 2013.

- It should be noted that this strategy has been completed as follows:
 - All new fabric elements proposed will be designed to achieve average fabric performance 30% or more above minimum standard as defined under AD Part L1A 2013.

Table 1. Building fabric specifications

Building Element	New Elements Part L minimum standard U-value	Design U- values	% improvement
Floors	0.25 W/m ² K	0.10 W/m ² K	60%
Roofs	0.20 W/m ² K	0.11 W/m ² K	45%
External Walls	0.30 W/m ² K	0.15 W/m ² K	50%
Glazing	2.00 W/m ² K	1.5 W/m ² K	25%
Doors	2.00 W/m ² K	1.4 W/m ² K	30%
Air permeability	10.0 m ³ /(h*m ²)	4.00 m ³ /(h*m ²)	60%



1 Introduction

The proposed development is one residential detached house. The building comprises basement, ground floor, upper ground floor and first floor. The plans and layouts are shown in Figures 1-3.

Proposed Development



Figure 1 – Proposed basement floor plan

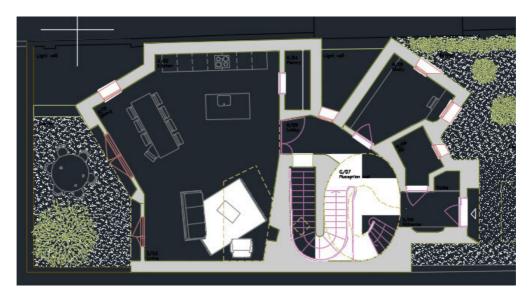


Figure 2 – Proposed Upper Ground floor plan



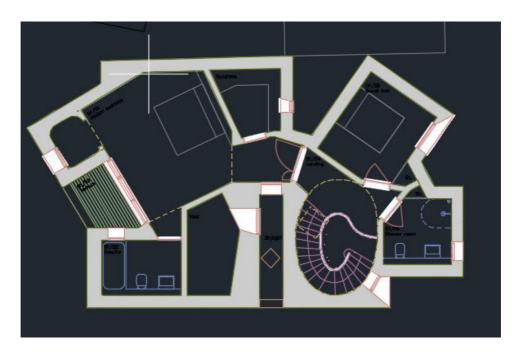


Figure 3 – Proposed first floor plan



2 Planning Policy Guidance and Legislation

London Borough of Camden Policy, <u>Climate Change Mitigation and Sustainable Design</u>, June 2016, requires the following policies to be addressed for residential buildings:

Local Plan approach

The Camden Local Plan seeks to adopt pro-active strategies to mitigate and adapt to climate change in accordance with the NPPF and London Plan. This section outlines the approach in the Local Plan to climate change mitigation (specifically carbon dioxide reduction) and sustainable design.

· Climate change mitigation

Local Plan <u>Policy CS13</u> Tackling climate change through promoting higher environmental Standards

The Council will require all development to take measures to minimise the effects of, and adapt to, climate change and encourage all development to meet the highest feasible environmental standards that are financially viable during construction and occupation by:

- a) ensuring patterns of land use that minimise the need to travel by car and help support local energy networks;
- b) promoting the efficient use of land and buildings;
- c) minimising carbon emissions from the redevelopment, construction and occupation of buildings by implementing, in order, all the elements of the following energy hierarchy:
 - ensuring developments use less energy,
 - generating renewable energy on-site; and
 - d) ensuring buildings and spaces are designed to cope with, and minimise the effects of, climate change.

Sustainable Design and Construction DP22

The Council will require development to incorporate sustainable design and construction measures. Schemes must:

- a) demonstrate how sustainable development principles, including the relevant measures set out in paragraph 22.5, have been incorporated into the design and proposed implementation; and
- b) incorporate green or brown roofs and green walls wherever suitable.



In addition to above, London Borough of Camden <u>Supplementary Planning Guidance</u> also requires the following:

Policy 6. Renewable energy

 All developments are to target at least a 20% reduction in carbon dioxide emissions through the installation of on-site renewable energy technologies. Special consideration will be given to heritage buildings and features to ensure that their historic and architectural features are preserved.



3 Low and Zero Carbon Technologies

- Given the requirement to achieve a number of Building standards and requirements, design development has been undertaken as part of the RIBA Stage 1 / 2 process. As part of this process, a number of technologies have been considered, with feasibility / viability and practicality considered given the various design considerations.
- In light of this, a feasibility study has been undertaken, identifying the following:
 - a) Appropriate technologies
 - b) Energy generated from Low and Zero Carbon Technologies per annum
 - c) Available funding grants
 - d) Life cycle cost of specification (including allowances for payback)
 - e) Local planning criteria (inc preferred solutions)
 - f) Feasibility of exporting heat / electricity from chosen system
- In order to fully identify appropriate technologies, an initial evaluation has been undertaken based on the expected baseline energy demand. Baseline Energy is calculated on a development with identical geometry built to meet Building Regulations, thus using standard building fabric parameters and notional heating systems.

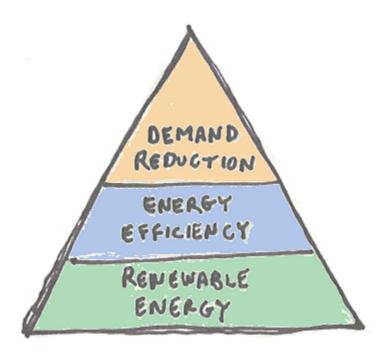


Figure 4 - Energy Hierarchy



3.1 Combined Heat & Power (CHP) Technology

CHP effectively uses waste heat from the electricity generation process to provide useful heat for space and water heating; the advantage of this system is that it leads to higher system efficiencies when compared to a typical supply arrangement of grid-imported electricity and conventional boilers. A further advantage is that because electricity is generated close to the point of use, the losses incurred in High Voltage (HV) transmission are avoided. CHP is considered as a low carbon technology when fired by gas or fuel oil to generate electricity and provide heating and hot water. At this scale, a gas-fired reciprocating engine CHP is the preferred technology due to efficiency, maintenance and plant space considerations, and is well-proven with many successful installations in UK. CHP systems offer optimum carbon and cost savings when matched to the site electricity and heat load profiles such that the units see a high utilisation and make a significant contribution to the site's annual energy demands.

CHP units should be replaced every 15-17 years, with replacement timeframes subject to alteration pending regular maintenance and part failure.

Given that 15 Lyndhurst Terrace is a single detached House and the scheme will have efficient boilers, the use of CHP is not a viable solution.

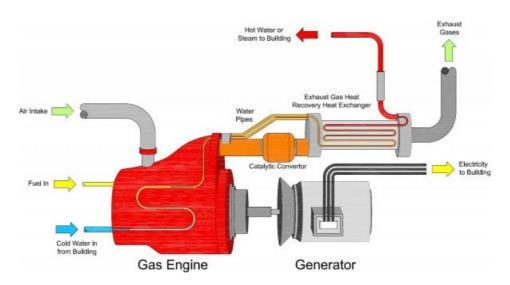


Figure 5 - CHP Technology



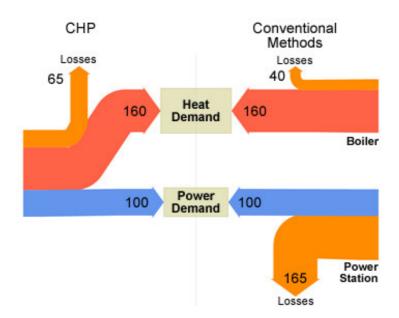


Figure 6 - CHP System Schematic

3.2 Wind Energy

Although wind turbines can generate up to 3MW of electricity, smaller units are available generating between 0.5 kW to 6.0 kW. The area would need to be accessed to establish the practicality of installing a wind turbine. Electricity is generated in DC and requires an inverter to convert to AC to operate domestic appliances. Where electricity is generated but not required, it can be sold to the local electricity company,

Given the location and the wind speed available provides minimal feasible electrical generation and as such has been discounted. It should also be noted, the proposed extension is surrounded by the other buildings the incorporation of wind turbine will likely to operate at low capacity, subject to periods of non-operation, grid connection, noise and take long time before achieving payback on the initial costs.

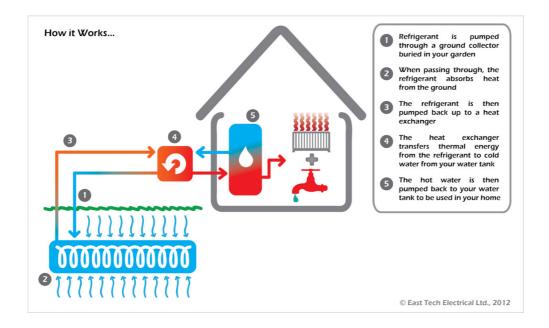




3.3 Ground Source Heat Pump

A Ground Source Heat Pump (GSHP) transfers energy from the ground to the building to provide space heating or pre-heating of domestic hot water. Unlike wind and solar heating it requires an electrical input, however, the heat recovered is three to four times the required electrical input. Heat is transferred from the ground using a ground loop, which can either be within a vertical borehole arrangement or laid as coils in a horizontal trench. The heat pump works in the same way as a domestic refrigerator in reverse, by extracting heat from the borehole/trench to evaporate the refrigerant on the heat pump circuit. Heat is then input to the building as the refrigerant condenses.

Any proposed GSHP would require the use of a large number of vertical boreholes across the site. Given the small foot print of the development site, the piling of the foundations that run below ground, this has been discounted owing to practical constraints associated with GSHP.

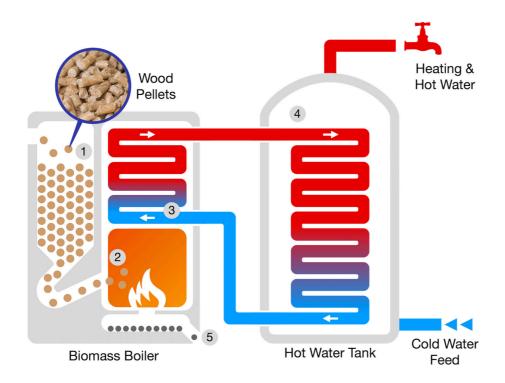




3.4 Biomass

Biomass boilers burn renewable fuel to generate hot water for direct use, or for heating purposes. The fuel they burn is renewable because it is in a constant carbon cycle. There are three main forms of biomass boilers available, namely those using wood chips as fuel, those using wood pellets as fuel and those using wood logs

The operation and installation of Biomass requires additional plant space for the storage of solid fuel and design of access routes for delivery of fuel. Given the urban location of the development, this has been discounted owing to practical constraints associated with Biomass.





3.5 Air Source Heat Pumps

Air Source Heat Pumps (ASHP) provides an efficient method of heating and cooling requirements. Heat is absorbed from the air into liquid via a heat exchanger where 'useful' heat is extracted and absorbed. Low grade heat is then extracted by a refrigeration system, compressed and concentrated to temperatures suitable for space heating and hot water requirements.

While ASHP utilise electricity to generate this process, the heat gained is taken directly from the available air and produces fewer greenhouse gases when compared to a conventional gas system.

ASHP have been classified as a renewable system under the European Directive on '*Promotion of Renewable Energy Sources*' and Policy 5.7 '*Renewable Energy*' of the London Plan 2015.

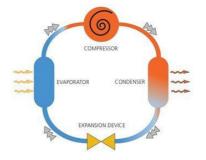
ASHP and associated plant require annual maintenance and adequate space for condensing units. Expected lifetimes range from 7-10 years, however, this will be subject to maintenance programmes and information provided at detailed design stage.

ASHP do generate noise as a result of operation, however, with careful consideration during design proposals, can be mitigated through the use of acoustic attenuation.

ASHP provide the most efficient method of providing the cooling requirements in hotels because of heat pumps high efficiency. They produce less CO₂ emissions than other systems that run on Gas, LPG or Oil. Air source heat pumps work in reverse cycle to provide cooling. Therefore, cooling and heating can be provided simultaneously.

This technology has been considered to be unviable for this scheme due to cost and technical requirement to provide 100% of the heating and hot water demand.







3.6 Photovoltaics

Photovoltaic (PV) panels create electricity from solar radiation with efficiency ranging between 5 and 19%. PV modules generally require minimal maintenance, usually consisting of a visual inspection and associated electrical testing. They have no moving parts and an expected lifetime of over 30-40 years. Manufacturers typically offer a warranty on power output of 20-25 years. PV modules have no operating emissions and produce no noise, making them the most benign zero-carbon technology.

Following a review of available roof area, the provision of PV placement should be considered in context, noting any issues resulting from external plant, access and architectural aesthetics. An initial investigation has been carried out in conjunction with the architect, in order to identify a suitable position for installation of PV arrays at roof level.

2 kWp of photovoltaic panels are proposed to provide approximately 1,647 kWh of electricity for the development.





3.7 Solar Thermal Collectors

Solar thermal collectors utilise solar radiation to heat water for use in water heating of a building. The radiation is converted using a solar collector, of which there are two main types available: Flat Plate and Evacuated Tube collectors. Evacuated tube systems occupy a smaller area and are more efficient, but also generally more expensive. Flat plate systems are cheaper to install but generally less efficient.

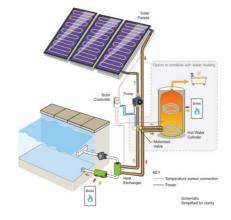
The solar coverage indicates what percentage of the annual domestic hot water energy requirement can be covered by a solar water heating system. The higher the solar coverage, the more conventional energy usage can be offset, but can cause excess heat generation in the peak summer months and generally lower the average collector efficiency. Therefore, solar coverage's of 40-70% are recommended for most domestic applications and up to 40% in non-domestic buildings.

Solar thermal systems in the UK normally operate with a back-up fuel source, such as gas or electricity. The solar system pre-heats the water up to a maximum hot water temperature. If there is not enough solar power available to fully meet the required hot water load, then the back-up fuel system fires up to meet this short fall. The optimum orientation for a solar collector in the UK is a south facing surface, tilted at an angle of 30° from the horizontal. However, orientation is not critical, with azimuths of +/-30° from South and angles of +/-20° from 30° still achieve reasonable outputs.

In order for the solar water heating system to run safely and efficiently, a series of temperature sensors are connected to a digital solar controller to switch the system on or off according to the solar energy available. The roof area required depends on the efficiency of the modules specified and will vary depending on the product selected. This will be determined by the relevant contractor.

The limited available roof area of the development will be used to install photovoltaic panels.







Energy Modelling

The proposed development looks to integrate low U-values, a high performance building thermal envelope for the built fabric and provide the necessary improvements to minimise CO2 of the scheme.

The internal lighting should be designed to have luminous efficacy of ≥ 45 lumens/watt in all domestic spaces.

The scheme's water use should be ≤125 litres/person/day.

Government approved software (NHER Plan Assessor 6.2.1) has been used to calculate energy consumption based on SAP methodology (2012) and Part L1A 2013.

4.1 **Specifications**

The following specification has been used to model energy efficiency for the development:

Project: 15 Lyndhurst Terrace

Project No: J2229

Engineer: Alex Mozaffari

Date: Building Regs:	07/03/2016 2013 Part L1A		
Status:	As Designed		
Element	U-Value ((W/m²K)	Construction
Ground Floor	0.	10	Solid
Exposed Floor	N,	/A	Solid
Exposed Wall & Semi-exposed Wall	0.	15	Cavity
Party Wall	0.4	00	
Exposed Roof & Semi-exposed Roof	0.	11	Flat
Doors	1.	50	draught proofing.
Windows	1.	40	Double Glazed (low-e), soft coating, argon filled, gap of 16mm or more, draught proofing, G-Value of 0.63
Fabric Efficienc	у		Details
Thermal Mass Par	rameter	Medium	
Thormal Pridging		ACD used	

Fabric Efficiency	Details
Thermal Mass Parameter	Medium
Thermal Bridging	ACD used
Design air permeability	4 m³/hm²



Building Service	Details
Ventilation	MEV
Dwelling Heating System	Boiler, Regular, Mains Gas (efficiency 93.4%)
Heat Distribution System	Pre-insulated medium temp variable flow (1991 or later)
Heating Controls	Time and temperature zone control - plumbing circuit
Secondary Heating	None
Hot water	From main
PV	2 kWp
Solar Water Heating	N/A
Other Renewables	N/A
Internal Lighting	100% have luminous efficacy of ≥ 45 lumens/watt



5 Calculation Results

This section of the report presents the calculation results following the Energy Hierarchy:

Be Lean: Energy Efficiency

Be Clean: N/A

• Be Green: Use Renewable Technology

5.1 Be Lean

The impact of passive design strategy, including insulation, low air permeability and energy efficient windows is shown in Figure 7 below. The Dwelling Emissions Rate (DER) is 3.9% below the Target Emissions Rate (TER). This is prior to inclusion of any renewable technologies.

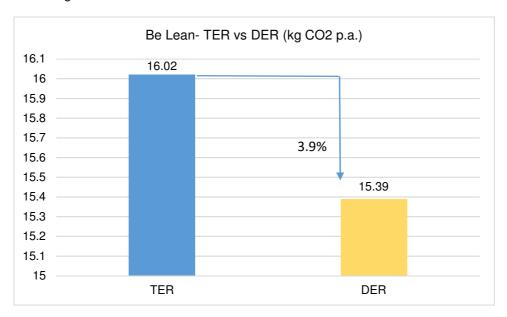


Figure 7. Be Lean- TER vs DER.

5.2 Be Green

The final step in the Energy Hierarchy methodology, is to include renewable technology. A feasibility study of all renewable technologies has been carried out. Photovoltaic panels have been considered most viable to provide electricity demand of the development. As the result, The CO₂ emissions of the scheme has been reduced by over 29.3% compared to the Notional Building. This is shown in Figure 10. The scheme exceeds the 19% CO₂ reduction required in Policy CC1 of Camden Climate Change Mitigation Policy.



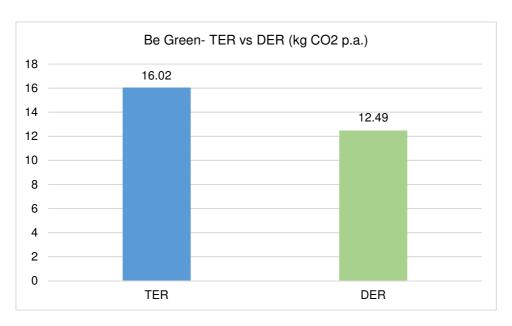


Figure 8. Be Green- TER vs DER.

5.3 Total Energy Demand and CO₂ Analysis

Space heating and hot water stand for 94% of the total energy demand of this development, as shown in Figure 9.

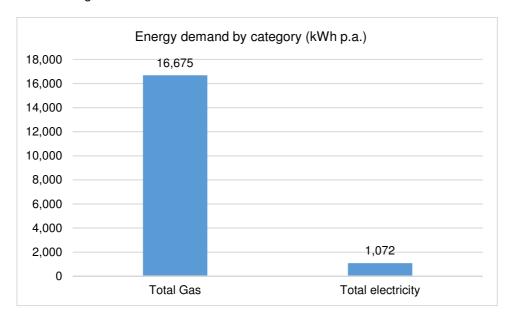


Figure 9. Be Green- TER vs DER.

In Be Green Scenario, 2 kWp of PV panels have been proposed to be installed on the available roof area. This amount of PV will generate 1,647 kWh of electricity which is 54% more than the electricity demand per year for lighting, fans and control. <u>The total CO₂ reduction of the PV panels is calculated to 855 kg p.a. This is 20.4% of the total Carbon Dioxide reduction of the development.</u>

20



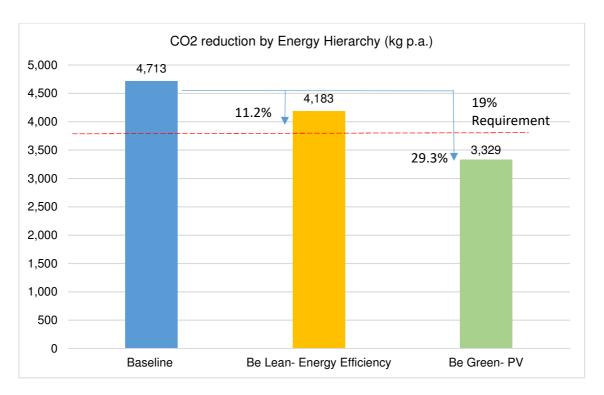


Figure 10. Total CO₂ reduction of the development.

The total CO₂ reduction of the development after energy efficiency and inclusion of 2 kWp of PV panels is 1,038 kg per year. This is equivalent to 29.3% Carbon Dioxide reduction, compared to the baseline.

5.4 Comparison of the Existing- and the Proposed Building

As presented in section 5.1 of this report, the proposed 15 Lyndhurst building is incorporating passive design measures and photovoltaic panels to reduce its CO₂ emissions. SAP calculation has also been carried out for the existing building to quantify the improvement, shown in Figure 11. The thermal performance of the proposed building has improvement significantly.

For instance, the solid wall with a typical U-value of 2.7 W/m²K has been replaced with a fabric value of 0.15 W/m²K, an employment by 170%.

As the result, compared to the existing building, the total CO_2 emissions of the proposed building is reduced from 11,595 kg p.a. to 3,329 kg p.a.



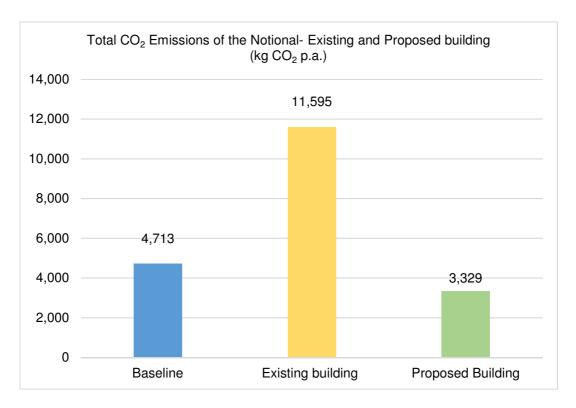


Figure 11. Total CO₂ emissions of the existing- and proposed building



6 Conclusion

The strategy is based on the Mayor of London's Energy Hierarchy, as follows:

- Use less energy (be lean)
- Use Renewable Technology (Be Green)

Improving the building fabric efficiency on the thermal envelope and incorporating 2 kWp of photovoltaic panels, results in a <u>reduction in CO₂ emissions of approximately 29.3% when measured against Part L1A 2013 Building Regulations. PV panels stand for 20.4% of the Carbon Dioxide reduction.</u>

Compared to the existing building, the proposed 15 Lyndhurst Terrace has reduced its CO₂ emissions by over 245%.

In line with Building Control the strategy demonstrates that the development will achieve compliance with 2013 Building Regulations through Energy efficiency and FEE (fabric energy efficiency) including thermal bridging calculations.

• The following table and chart detail the reductions in CO₂ emission reductions as a result of following the energy hierarchy.

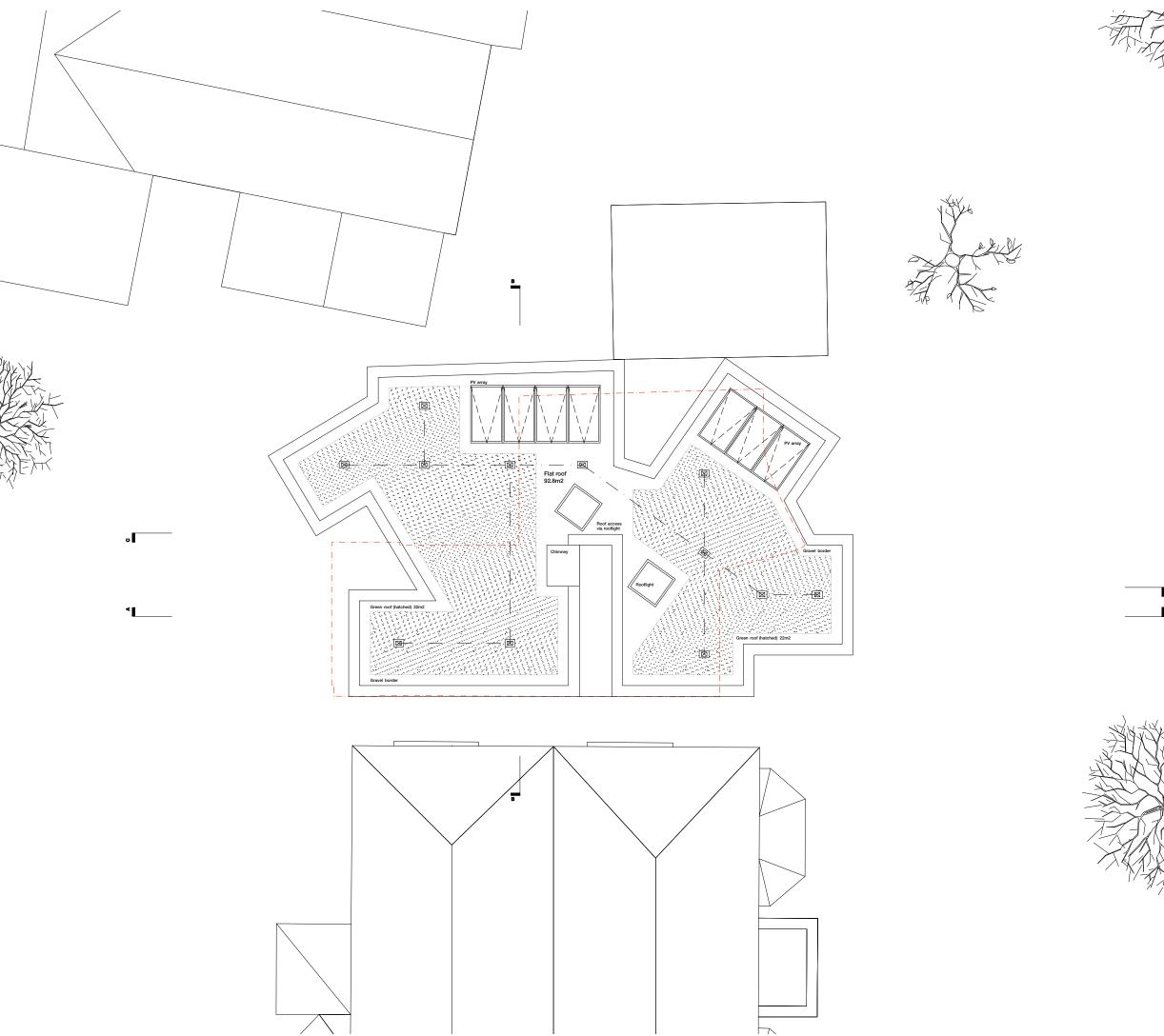
Table 2 – Energy Hierarchy Chart

ENERGY HIERARCHY	CO2 EMISSIONS / ANNUM (kg p.a.)	% IMPROVEMENTS
Baseline	4,713	-
Be Lean	4,183	11.2%
Be Green	3,329	29.3%
Overall Saving (kg p.a.)		1,384

It can be concluded that the London Borough of Camden's planning policy CC1 of the <u>Climate Change Mitigation and Sustainable Design and policy 6 of the Supplementary Planning</u>
Guidance have been met.

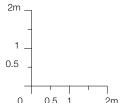


Appendix 1- PV layout









Sergison Bates architects LP Proposed Roof Plan

15 Lyndhurst Terrace, NW3 Issued for planning

Architects	Date	Scale
Sergison Bates architects 34 Clerkenwell Close London EC1R 0AU United Kingdom	Nov 2016	1:100@A
Tel +44 (0)20 7255 1564 e-mail studio @sergisonbates.co.uk		

305/4203a

V U3/U3/12	Groon roof DV	s and mansafe added
A 02/03/17	Green 1001, FV	s and mansale added

Do not scale from this drawing All dimensions to be verified on site Limited Liability Partnership Registered in England & Wales No. OC317501 Registered office as above



Appendix 2- Be Lean

L1A 2013 - Regulations Compliance Report

Design - Draft



This design draft submission provides evidence towards compliance with Part L of the Building Regulations, in accordance with Appendix C of AD L1A. It has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the 'as built' property. This report covers only items included within the SAP and is not a complete report of regulations compliance.

Assessor name	Ms Rachell wootliff	Assessor number	8847
Client		Last modified	13/03/2017
Address	1, London		

Fuel = N/A Fuel factor = 1.0 TER = 16.02 DER = 15.39 DER 15.39 < TE	00 R 16.02 FEE 68.06	g does not exceed the target	Authorised SAP Assessor Authorised SAP Assessor Authorised SAP Assessor Authorised SAP Assessor	OK? Passed
Fuel = N/A Fuel factor = 1.0 TER = 16.02 DER = 15.39 DER 15.39 < TE	00 R 16.02 FEE 68.06	g does not exceed the target	Authorised SAP Assessor Authorised SAP Assessor	
Fuel = N/A Fuel factor = 1.0 TER = 16.02 DER = 15.39 DER 15.39 < TE	00 R 16.02 FEE 68.06		Authorised SAP Assessor Authorised SAP Assessor	
DER 15.39 < TE DFEE 53.33 < TI	FEE 68.06		Authorised SAP Assessor	
DFEE 53.33 < TI	FEE 68.06			
1			Authorised SAP Assessor	Passed
e building fabric	and the heating he			
	and the heating, no	ot water and fixed lighting systems shou	ıld be no worse than the desigr	n limits
Element Wall Party wall Floor Roof Openings	Weighted average 0.15 (max 0.30) (no party wall) 0.10 (max 0.25) 0.11 (max 0.20) 1.41 (max 2.00)	e Highest 0.15 (max 0.70) 0.10 (max 0.70) 0.11 (max 0.35) 1.50 (max 3.30)	Authorised SAP Assessor	Passed
Thermal bridgir junction	ng calculated from I	inear thermal transmittances for each	Authorised SAP Assessor	
Mains gas, Regi Ravenheat CSI S Efficiency = 90. Minimum = 88.	ular boiler from dat System A 10% - SEDBUK 2009 00%		Authorised SAP Assessor	Passed
Declared cylind Maximum pern	ler loss = 0.17kWh/o nitted cylinder loss :	= 3.18kWh/day	Authorised SAP Assessor	Passed
Time and temp Hot water cont Boiler interlock	erature zone contro rol: (main system 1)	ol - plumbing circuit	Authorised SAP Assessor	Passed
	Wall Party wall Floor Roof Openings Thermal bridging junction Main heating some Mains gas, Reg Ravenheat CSI Efficiency = 90. Minimum = 88. Secondary heat Cylinder volum Boleclared cylind Maximum perm Primary hot was Space heating of Time and temp Hot water cont Boiler interlock Cylinder therm	Wall 0.15 (max 0.30) Party wall (no party wall) Floor 0.10 (max 0.25) Roof 0.11 (max 0.20) Openings 1.41 (max 2.00) Thermal bridging calculated from I junction Main heating system: Mains gas, Regular boiler from dat Ravenheat CSI System A Efficiency = 90.10% - SEDBUK 2009 Minimum = 88.00% Secondary heating system: None Cylinder volume = 300.00 litres Declared cylinder loss = 0.17kWh/r Maximum permitted cylinder loss Primary hot water pipes are not in	Wall 0.15 (max 0.30) 0.15 (max 0.70) Party wall (no party wall) Floor 0.10 (max 0.25) 0.10 (max 0.70) Roof 0.11 (max 0.20) 0.11 (max 0.35) Openings 1.41 (max 2.00) 1.50 (max 3.30) Thermal bridging calculated from linear thermal transmittances for each junction Main heating system: Mains gas, Regular boiler from database Ravenheat CSI System A Efficiency = 90.10% - SEDBUK 2009 Minimum = 88.00% Secondary heating system: None Cylinder volume = 300.00 litres Declared cylinder loss = 0.17kWh/day Maximum permitted cylinder loss = 3.18kWh/day Primary hot water pipes are not insulated Space heating control: Time and temperature zone control - plumbing circuit Hot water control: Boiler interlock (main system 1) Cylinder thermostat	Wall 0.15 (max 0.30) 0.15 (max 0.70) Party wall (no party wall) Floor 0.10 (max 0.25) 0.10 (max 0.70) Roof 0.11 (max 0.20) 0.11 (max 0.35) Openings 1.41 (max 2.00) 1.50 (max 3.30) Thermal bridging calculated from linear thermal transmittances for each junction Main heating system: Main heating system: Mains gas, Regular boiler from database Ravenheat CSI System A Efficiency = 90.10% - SEDBUK 2009 Minimum = 88.00% Secondary heating system: None Cylinder volume = 300.00 litres Declared cylinder loss = 0.17kWh/day Maximum permitted cylinder loss = 3.18kWh/day Primary hot water pipes are not insulated Space heating control: Time and temperature zone control - plumbing circuit Hot water control: Boiler interlock (main system 1) Cylinder thermostat

Check	Evidence	Produced by	OK?
Fixed internal lighting			
Does fixed internal lighting comp with paragraphs 42 to 44?	oly Schedule of installed fixed internal lighting Standard lights = 0 Low energy lights = 20 Percentage of low energy lights = 100% Minimum = 75 %	Authorised SAP Assessor	Passed
Criterion 3: the dwelling has ann	ropriate passive control measures to limit solar gains		
Does the dwelling have a strong tendency to high summertime temperatures?	Overheating risk (June) = Not significant (19.25°) Overheating risk (July) = Slight (21°) Overheating risk (August) = Slight (20.69°) Region = Thames Thermal mass parameter = 250.00 Ventilation rate in hot weather = 2.50 ach Blinds/curtains = None	Authorised SAP Assessor	Passed
Criterion 4: the performance of t	he dwelling, as designed, is consistent with the DER		
Design air permeability (m³/(h.m²) at 50Pa)	Design air permeability = 4.00 Max air permeability = 10.00	Authorised SAP Assessor	Passed
Mechanical ventilation system Specific fan power (SFP)	Mechanical extract ventilation: SFP = 0.18 W/(litre/sec) Max SFP = 0.7 W/(litre/sec)	Authorised SAP Assessor	Passed
Have the key features of the design been included (or bettere in practice?	The following floors have a U-value less than 0.13W/m²K: d) • Floor 1 (0.10) The following roofs have a U-value less than 0.13W/m²K: • Roof 1 (0.11) • Roof 2 (0.11) • Roof 3 (0.11) Thermal bridging y value (0.033) is less than 0.04 Space cooling is specified	Authorised SAP Assessor	

Sap 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	Ms Rachell wootliff	Assessor number	8847
Client		Last modified	13/03/2017
Address	1, London		

Address	1, Londo	n										
1. Overall dwelling dimer	nsions											
				A	rea (m²)			rage storey eight (m)		Vo	olume (m³)	
Lowest occupied					120.21	(1a) x		3.00	(2a) =		360.63	(3a)
+1					94.70	(1b) x		3.50	(2b) =		331.45	(3b)
+2					79.35	(1c) x		2.70	(2c) =		214.25	(3c)
Total floor area	(1a)	+ (1b) + (1	c) + (1d)(1n)) = [294.26	(4)						
Dwelling volume							(3a) + (3b) + (3	c) + (3d)(3n) =	906.33	(5)
2. Ventilation rate												
										m	³ per hour	
Number of chimneys								1	x 40 =	=	40	(6a)
Number of open flues								1	x 20 :	=	20	(6b)
Number of intermittent far	าร							0	x 10 :	=	0	(7a)
Number of passive vents								0	x 10 :	=	0	(7b)
Number of flueless gas fire	S							1	x 40 =	=	40	(7c)
										Air	changes pe hour	r
Infiltration due to chimney	s, flues, fans	s, PSVs		(6a)	+ (6b) + (7a	a) + (7b) + (7c) =	100	÷ (5)	=	0.11	(8)
If a pressurisation test has	been carried	d out or is i	ntended, prod	eed to (1	17), otherw	ise continue	e from (9)	to (16)				
Air permeability value, q50	, expressed	in cubic m	etres per hou	r per squ	are metre	of envelope	area				4.00	(17)
If based on air permeability	y value, ther	n (18) = [(17	7) ÷ 20] + (8),	otherwis	se (18) = (16	5)					0.31	(18)
Number of sides on which	the dwelling	g is sheltere	ed .								2	(19)
Shelter factor								1 -	[0.075 x (1	L9)] =	0.85	(20)
Infiltration rate incorporati	ing shelter f	actor							(18) x (20) =	0.26	(21)
Infiltration rate modified for	or monthly v	wind speed	:									
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind spe	ed from Tab	ole 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 (a	allowing for	shelter and	wind factor)	(21) x (2	2a)m						_	_
0.34	0.33	0.32	0.29	0.28	0.25	0.25	0.24	0.26	0.28	0.30	0.31	(22b)



Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system

0.58

0.59

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

0.54

0.53

c) whole house extract ventilation or positive input ventilation from outside

0.57

0.55

0.50

N/A

0.56

(23a)

(23c)

(24c)

0.50

0.50

0.50

0.51

0.53

3.68

3.80

3.68

3.80

3.80

3.68

3.80

3.80

3.43

3.80

3.68

3.80

(56)

If the vessel co	ntains dedica	ated solar st	torage or d	ledicated V	VWHRS (56))m x [(47) -	Vs] ÷ (47),	else (56)				
	3.80	3.43	3.80	3.68	3.80	3.68	3.80	3.80	3.68	3.80	3.68	3.80
Primary circuit	loss for each	month froi	m Table 3	!	•	•		•	•	!	•	
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Combi loss for	each month	from Table	3a, 3b or 3	С								,
	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 requ				1	ļ.				ļ.		1 2.00	, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
	180.64	158.10	163.40	142.82	137.31	118.89	110.56	126.31	127.65	148.28	161.38	175.06
Solar DHW inp				-	'	120.00	1 110.00	1 120.01		1 10:20	102.00	1 27 3.00
Solar Britt IIIp	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 w		I		1	1		0.00	0.00	0.00	0.00	0.00	0.00
Output from W	180.64	158.10	163.40	142.82	137.31	118.89	110.56	126.31	127.65	148.28	161.38	175.06
	180.04	138.10	103.40	142.02	137.31	110.09	110.50	120.31	127.03	Σ(64)1	'	1750.38
Heat gains fron	n water heat	ing (k\N/h/m	onth) 0.25	5 v [N 95 v	(15)m ± (61	\ml + 0 8 v	· [(46)m + (57\m ± (50)	\ml	2(04)1	12 –	1/30.36
rieat gairis iron	61.84	· ·	-	1	1	1				51.08	FF 20	F0.00 //
	01.84	54.17	56.11	49.21	47.43	41.25	38.54	43.77	44.16	51.08	55.38	59.98 (
5. Internal gai	ins											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabolic gain	s (Table 5)											
	187.47	187.47	187.47	187.47	187.47	187.47	187.47	187.47	187.47	187.47	187.47	187.47
Lighting gains (calculated in	Appendix L	., equation	L9 or L9a),	, also see Ta	able 5	•			•	•	
	104.45	92.77	75.44	57.12	42.70	36.05	38.95	50.63	67.95	86.28	100.70	107.35
Appliance gains	s (calculated	in Appendi	x L, equatio	on L13 or L	13a), also se	ee Table 5					•	
	677.01	684.04	666.34	628.65	581.07	536.36	506.49	499.46	517.17	554.85	602.43	647.14
Cooking gains (calculated in											
	caiculateu II	i Appendix l	L, equation	L15 or L15	sa), also see	Table 5						
	56.87	56.87	L, equation ————————————————————————————————————	1	5a), also see		56.87	56.87	56.87	56.87	56.87	56.87 ((
Pump and fan s	56.87	56.87	<u> </u>	L15 or L15 56.87		Table 5 56.87	56.87	56.87	56.87	56.87	56.87	56.87
Pump and fan g	56.87	56.87 5a)	56.87	56.87	56.87	56.87						,
·	56.87 gains (Table 9	56.87 5a)	<u> </u>	1			3.00	3.00	3.00	3.00	3.00	3.00 (
Pump and fan g Losses e.g. eva	56.87 gains (Table 9	56.87 5a) 3.00 ble 5)	3.00	3.00	56.87	3.00	3.00	3.00	3.00	3.00	3.00	3.00 (
Losses e.g. eva	56.87 gains (Table 9 3.00 poration (Tal	56.87 5a) 3.00 ble 5)	56.87	56.87	56.87	56.87						,
·	56.87 gains (Table 9 3.00 poration (Table 1-124.98 gains (Table	56.87 5a) 3.00 ble 5) -124.98	3.00 -124.98	3.00 -124.98	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00 (
Losses e.g. eva	56.87 gains (Table 9 3.00 poration (Tal -124.98 gains (Table 83.12	56.87 5a) 3.00 ble 5) -124.98 5) 80.61	56.87 3.00 -124.98	3.00 -124.98	3.00 -124.98	3.00 -124.98 57.29	3.00	3.00	3.00	3.00	3.00	3.00 (
Losses e.g. eva	56.87 gains (Table 9 3.00 poration (Tale 1-124.98 gains (Table 1-124.98 gains (Table 1-124.98) gains (Table 1-124.98)	56.87 5a) 3.00 ble 5) -124.98 5) 80.61 + (67)m + (6	56.87 3.00 -124.98 75.41 8)m + (69)	3.00 -124.98 68.34 m + (70)m	3.00 -124.98 63.75 + (71)m + (7	56.87 3.00 -124.98 57.29 72)m	3.00 -124.98 51.80	3.00	3.00	3.00 -124.98 68.65	3.00 -124.98 76.92	3.00 (**
Losses e.g. eva	56.87 gains (Table 9 3.00 poration (Tal -124.98 gains (Table 83.12	56.87 5a) 3.00 ble 5) -124.98 5) 80.61	56.87 3.00 -124.98	3.00 -124.98	3.00 -124.98	3.00 -124.98 57.29	3.00	3.00	3.00	3.00	3.00	3.00 (
Losses e.g. eva	56.87 gains (Table 9 3.00 poration (Table 9 -124.98 gains (Table 9 83.12 gains (66)m -	56.87 5a) 3.00 ble 5) -124.98 5) 80.61 + (67)m + (6	56.87 3.00 -124.98 75.41 8)m + (69)	3.00 -124.98 68.34 m + (70)m	3.00 -124.98 63.75 + (71)m + (7	56.87 3.00 -124.98 57.29 72)m	3.00 -124.98 51.80	3.00	3.00	3.00 -124.98 68.65	3.00 -124.98 76.92	3.00 (**
Losses e.g. eva Water heating Total internal g	56.87 gains (Table 9 3.00 poration (Table 9 -124.98 gains (Table 9 83.12 gains (66)m -	56.87 5a) 3.00 ble 5) -124.98 5) 80.61 + (67)m + (6	3.00 -124.98 75.41 8)m + (69) 939.55	56.87 3.00 -124.98 68.34 m+(70)m 876.47	56.87 3.00 -124.98 63.75 + (71)m + (71	56.87 3.00 -124.98 57.29 752.05	3.00 -124.98 51.80 719.59	3.00 -124.98 58.83 731.28	3.00 -124.98 61.34 768.81	3.00 -124.98 68.65 832.15	3.00 -124.98 76.92 902.40	3.00 (** -124.98 (** 80.62 (** 957.48 (**
Losses e.g. eva Water heating Total internal g	56.87 gains (Table 9 3.00 poration (Table 9 -124.98 gains (Table 9 83.12 gains (66)m -	56.87 5a) 3.00 ble 5) -124.98 5) 80.61 + (67)m + (6	56.87 3.00 -124.98 75.41 8)m + (69)	56.87 3.00 -124.98 68.34 m+(70)m 876.47	3.00 -124.98 63.75 + (71)m + (3) 809.88	56.87 3.00 -124.98 57.29 752.05	3.00 -124.98 51.80 719.59	3.00 -124.98 58.83 731.28	3.00 -124.98 61.34 768.81	3.00 -124.98 68.65 832.15	3.00 -124.98 76.92 902.40	3.00 (** -124.98 (** 80.62 (** 957.48 (**
Losses e.g. eva Water heating Total internal g	56.87 gains (Table 9 3.00 poration (Table 9 -124.98 gains (Table 9 83.12 gains (66)m -	56.87 5a) 3.00 ble 5) -124.98 5) 80.61 + (67)m + (6	3.00 -124.98 75.41 8)m + (69) 939.55 Access f	56.87 3.00 -124.98 68.34 m+(70)m 876.47	56.87 3.00 -124.98 63.75 + (71)m + (71	56.87 3.00 -124.98 57.29 752.05 Sol	3.00 -124.98 51.80 719.59 ar flux V/m²	3.00 -124.98 58.83 731.28	3.00 -124.98 61.34 768.81 g ific data	3.00 -124.98 68.65 832.15	3.00 -124.98 76.92 902.40	3.00 (** -124.98 (** 80.62 (** 957.48 (** Gains W
Losses e.g. eva Water heating Total internal g 6. Solar gains	56.87 gains (Table 9 3.00 poration (Table 9 -124.98 gains (Table 9 83.12 gains (66)m -	56.87 5a) 3.00 ble 5) -124.98 5) 80.61 + (67)m + (6	56.87 3.00 -124.98 75.41 8)m + (69) 939.55 Access f Table	56.87 3.00 -124.98 68.34 m + (70)m 876.47 factor 6d	56.87 3.00 -124.98 63.75 + (71)m + (71	56.87 3.00 -124.98 57.29 752.05 Sol	3.00 -124.98 51.80 719.59 ar flux v/m² 1.28 x	3.00 -124.98 58.83 731.28 spec or T	3.00 -124.98 61.34 768.81 g ific data able 6b 0.60 x	3.00 -124.98 68.65 832.15 FF specific c or Table 0.80	3.00 -124.98 76.92 902.40 data e 6c	3.00 (** -124.98 (** 80.62 (** 957.48 (** Gains W 20.38 (**
Losses e.g. eva Water heating Total internal g 6. Solar gains NorthEast SouthEast	56.87 gains (Table 9 3.00 poration (Table 9 -124.98 gains (Table 9 83.12 gains (66)m -	56.87 5a) 3.00 ble 5) -124.98 5) 80.61 + (67)m + (6	56.87 3.00 -124.98 75.41 8)m + (69) 939.55 Access f Table 0.7	56.87 3.00 -124.98 68.34 m+(70)m 876.47 factor 6d 7 x 7 x	56.87 3.00 -124.98 63.75 + (71)m + (71	56.87 3.00 -124.98 57.29 752.05 Sol W x 1 x 3	3.00 -124.98 51.80 719.59 ar flux V/m² 1.28 x 6.79 x	3.00 -124.98 58.83 731.28 spec or T 0.9 x	3.00 -124.98 61.34 768.81 g ific data able 6b 0.60 x	3.00 -124.98 68.65 832.15 FF specific or Table 1 0.80 1 0.80	3.00 -124.98 76.92 902.40 data e 6c = [3.00 (** -124.98 (** 80.62 (** 957.48 (** Gains W 20.38 (** 87.88 (**
Losses e.g. eva Water heating Total internal g 6. Solar gains NorthEast SouthEast NorthWest	56.87 gains (Table 9 3.00 poration (Table 9 -124.98 gains (Table 9 83.12 gains (66)m -	56.87 5a) 3.00 ble 5) -124.98 5) 80.61 + (67)m + (6	56.87 3.00 -124.98 75.41 8)m + (69) 939.55 Access f Table 0.7 0.7	56.87 3.00 -124.98 68.34 m+(70)m 876.47 factor 6d 7 x [7 x [7 x [56.87 3.00 -124.98 63.75 + (71)m + (1) 809.88 Area m² 5.43 7.18 2.40	56.87 3.00 -124.98 57.29 752.05 Sol W x 1 x 3 x 1	3.00 -124.98 51.80 719.59 ar flux V/m² 1.28 x 1.28 x	3.00 -124.98 58.83 731.28 spec or T 0.9 x	3.00 -124.98 61.34 768.81 gific data able 6b 0.60	3.00 -124.98 68.65 832.15 FF specific or Table 0.80 0.80 0.80	3.00 -124.98 76.92 902.40 data e 6c = [3.00 (** 3.00 (** 3.00 (** 80.62 (** 957.48 (** Gains W 20.38 (** 87.88 (** 9.01 (**
Losses e.g. eva Water heating Total internal g 6. Solar gains NorthEast SouthEast NorthWest SouthWest	56.87 gains (Table 9 3.00 poration (Table 9 -124.98 gains (Table 9 83.12 gains (66)m -	56.87 5a) 3.00 ble 5) -124.98 5) 80.61 + (67)m + (6	56.87 3.00 -124.98 75.41 8)m + (69) 939.55 Access f Table 0.7 0.7 0.7	56.87 3.00 -124.98 68.34 m+(70)m 876.47 factor 6d 7	56.87 3.00 -124.98 63.75 + (71)m + (71	56.87 3.00 -124.98 57.29 752.05 Sol W x 1 x 3 x 1 x 3	3.00 -124.98 51.80 719.59 ar flux V/m² 1.28	3.00 -124.98 58.83 731.28 spec or T 0.9 x 0.9 x 0.9 x 0.9 x	3.00 -124.98 61.34 768.81 g ific data able 6b 0.60 x 0.60 x 0.60 x	3.00 -124.98 68.65 832.15 FF specific cor Table 2 0.80 2 0.80 3 0.80 4 0.80	3.00 -124.98 76.92 902.40 data e 6c = [3.00 (** -124.98 (** 80.62 (** 957.48 (** Gains W 20.38 (** 87.88 (** 9.01 (** 190.07 (**
Losses e.g. eva Water heating Total internal g 6. Solar gains NorthEast SouthEast NorthWest	56.87 gains (Table 9 3.00 poration (Table 9 -124.98 gains (Table 9 83.12 gains (66)m -	56.87 5a) 3.00 ble 5) -124.98 5) 80.61 + (67)m + (6	56.87 3.00 -124.98 75.41 8)m + (69) 939.55 Access f Table 0.7 0.7	56.87 3.00 -124.98 68.34 m+(70)m 876.47 factor 6d 7	56.87 3.00 -124.98 63.75 + (71)m + (1) 809.88 Area m² 5.43 7.18 2.40	56.87 3.00 -124.98 57.29 752.05 Sol W x 1 x 3 x 1 x 3	3.00 -124.98 51.80 719.59 ar flux V/m² 1.28	3.00 -124.98 58.83 731.28 spec or T 0.9 x 0.9 x 0.9 x 0.9 x 0.9 x	3.00 -124.98 61.34 768.81 gific data able 6b 0.60	3.00 -124.98 68.65 832.15 FF specific or Table 0.80 0.80 0.80 0.80	3.00 -124.98 76.92 902.40 data e 6c = [3.00 (** 3.00 (** 3.00 (** 80.62 (** 957.48 (** Gains W 20.38 (** 87.88 (** 9.01 (**
Losses e.g. eva Water heating Total internal g 6. Solar gains NorthEast SouthEast NorthWest SouthWest	56.87 gains (Table 9 3.00 poration (Table 9 -124.98 gains (Table 9 83.12 gains (66)m -	56.87 5a) 3.00 ble 5) -124.98 5) 80.61 + (67)m + (6	56.87 3.00 -124.98 75.41 8)m + (69) 939.55 Access f Table 0.7 0.7 0.7	56.87 3.00 -124.98 68.34 m+(70)m 876.47 factor 6d 7	56.87 3.00 -124.98 63.75 + (71)m + (71	56.87 3.00 -124.98 57.29 752.05 Sol V x	3.00 -124.98 51.80 719.59 ar flux V/m² 1.28	3.00 -124.98 58.83 731.28 spec or T 0.9 x 0.9 x 0.9 x 0.9 x 0.9 x	3.00 -124.98 61.34 768.81 g ific data able 6b 0.60 x 0.60 x 0.60 x	3.00 -124.98 68.65 832.15 FF specific or Table 0.80 0.80 0.80 0.80 0.80	3.00 -124.98 76.92 902.40 data e 6c = [3.00 (** -124.98 (** 80.62 (** 957.48 (** Gains W 20.38 (** 87.88 (** 9.01 (** 190.07 (**
Losses e.g. eva Water heating Total internal g 6. Solar gains NorthEast SouthEast NorthWest SouthWest West	56.87 gains (Table 9 3.00 poration (Table 9 -124.98 gains (Table 9 83.12 gains (66)m -	56.87 5a) 3.00 ble 5) -124.98 5) 80.61 + (67)m + (6	56.87 3.00 -124.98 75.41 8)m + (69) 939.55 Access f Table 0.7 0.7 0.7 0.7	56.87 3.00 -124.98 68.34 m + (70)m 876.47 factor 6d 7	56.87 3.00 -124.98 63.75 + (71)m + (71	56.87 3.00 -124.98 57.29 752.05 Sol W x	3.00 -124.98 51.80 719.59 ar flux y/m² 1.28	3.00 -124.98 58.83 731.28 spec or T 0.9 x 0.9 x 0.9 x 0.9 x 0.9 x 0.9 x	3.00 -124.98 61.34 768.81 gific data rable 6b 0.60	3.00 -124.98 68.65 832.15 FF specific c or Table 2 0.80 2 0.80 3 0.80 4 0.80 4 0.80	3.00 -124.98 76.92 902.40 data e 6c = [3.00 (-124.98 (80.62 (957.48 (Gains W 20.38 (87.88 (190.07 (23.52 (((((((((((((
Losses e.g. eva Water heating Total internal g 6. Solar gains NorthEast SouthEast NorthWest SouthWest West East	56.87 gains (Table 9 3.00 poration (Tal -124.98 gains (Table 83.12 gains (66)m - 986.94	56.87 5a) 3.00 ble 5) -124.98 5) 80.61 + (67)m + (6 979.78	56.87 3.00 -124.98 75.41 8)m + (69)i 939.55 Access f Table 0.7 0.7 0.7 0.7	56.87 3.00 -124.98 68.34 m + (70)m 876.47 factor 6d 7	56.87 3.00 -124.98 63.75 + (71)m + (71	56.87 3.00 -124.98 57.29 752.05 Sol W x	3.00 -124.98 51.80 719.59 ar flux y/m² 1.28	3.00 -124.98 58.83 731.28 spec or T 0.9 x 0.9 x 0.9 x 0.9 x 0.9 x 0.9 x	3.00 -124.98 61.34 768.81 g ific data fable 6b 0.60 x 0.60 x 0.60 x 0.60 x 0.60 x	3.00 -124.98 68.65 832.15 FF specific or Table 0.80 0.80 0.80 0.80 0.80 0.80	3.00 -124.98 76.92 902.40 data e 6c = [3.00 (** 3.00 (** 80.62 (** 957.48 (** Gains W 20.38 (** 9.01 (** 190.07 (** 23.52 (** 36.39 (** ** ** ** ** ** ** ** ** ** ** ** **
Losses e.g. eva Water heating Total internal g 6. Solar gains NorthEast SouthEast NorthWest SouthWest West East North	56.87 gains (Table 9 3.00 poration (Tal -124.98 gains (Table 83.12 gains (66)m - 986.94	56.87 5a) 3.00 ble 5) -124.98 5) 80.61 + (67)m + (6 979.78	56.87 3.00 -124.98 75.41 8)m + (69)i 939.55 Access f Table 0.7 0.7 0.7 0.7	56.87 3.00 -124.98 68.34 m + (70)m 876.47 factor 6d 7	56.87 3.00 -124.98 63.75 + (71)m + (71	56.87 3.00 -124.98 57.29 752.05 Sol W x	3.00 -124.98 51.80 719.59 ar flux y/m² 1.28	3.00 -124.98 58.83 731.28 spec or T 0.9 x 0.9 x 0.9 x 0.9 x 0.9 x 0.9 x	3.00 -124.98 61.34 768.81 g ific data fable 6b 0.60 x 0.60 x 0.60 x 0.60 x 0.60 x	3.00 -124.98 68.65 832.15 FF specific or Table 0.80 0.80 0.80 0.80 0.80 0.80	3.00 -124.98 76.92 902.40 data e 6c = [3.00 (** 3.00 (** 80.62 (** 957.48 (** Gains W 20.38 (** 9.01 (** 190.07 (** 23.52 (** 36.39 (** ** ** ** ** ** ** ** ** ** ** ** **

	1367.10	1654.92	1930.05	2204.94	2382.52	2348.48	2244.24	2069.76	1876.44	1596.94	1362.93	1279.37	(84
'. Mean inter	rnal tempera	ture (heatii	ng season)										
emperature d	luring heatin	g periods in	the living a	area from T	āble 9, Th1	ı(°C)						21.00	(85
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tilisation facto	or for gains f	or living are	a n1,m (se	e Table 9a)	1								_
	1.00	1.00	0.99	0.98	0.92	0.78	0.61	0.67	0.90	0.99	1.00	1.00	(86
ean internal	temp of livin	g area T1 (s	teps 3 to 7	in Table 90	:)								_
	19.90	20.02	20.22	20.50	20.74	20.90	20.94	20.93	20.82	20.50	20.16	19.90	(8
emperature d	_		1	_		<i>∍,</i> Th2(°C)						,	,
	19.94	19.95	19.95	19.98	19.99	20.01	20.01	20.01	20.00	19.99	19.97	19.96	(8
tilisation facto	_			1									7
	1.00	1.00	0.99	0.97	0.89	0.69	0.48	0.55	0.85	0.98	1.00	1.00	(89
lean internal												T	٦,,
	18.45	18.64	18.94	19.36	19.69	19.90	19.93	19.93	19.81	19.37	18.87	18.47] (9)] (0
ving area frac		. f = + l= = l=	مال ماريمال	~ £1 A T1 .	./1 fl \\	T2			LIV	ing area ÷	(4) =	0.16	(9:
lean internal	18.69	1	19.15	- I	19.86		20.10	20.00	10.08	10.56	10.00	10.70	7 (0:
pply adjustme		18.87		19.55	!	20.06		20.09	19.98	19.56	19.08	18.70	(9:
ppiy aujustiile	18.54	18.72	19.00	19.40	19.71	19.91	19.95	19.94	19.83	19.41	18.93	18.55	(9:
	16.54	18.72	19.00	19.40	19.71	19.91	19.93	19.94	19.83	19.41	18.93	18.55] (3.
8. Space heati	ing requiren	nent											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tilisation facto	or for gains,	ηm											
	1.00	1.00	0.99	0.96	0.88	0.68	0.47	0.54	0.83	0.98	1.00	1.00	(94
seful gains, ηι	mGm, W (94	I)m x (84)m	I										
	1365.34	1649.15	1909.69	2121.26	2088.64	1599.14	1057.89	1109.42	1563.98	1562.60	1358.91	1278.22	(9
1onthly averag	ge external t	emperature	from Table	e 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
eat loss rate f				, W [(39)m	ı x [(93)m -	(96)m]							7
	4913.89	4740.22	4263.27	3477.84	2638.79	1697.01	1069.29	1131.19	1851.91	2900.18	3941.48	4839.24	(9
pace heating r		, kWh/mon	th 0.024 v	[(97)m - (9)	[\mal \(/ / / / / / / / / / / / / / / / / /	m							
								1				1	-
	2640.12	2077.20	1751.07	976.74	409.32	0.00	0.00	0.00	0.00	995.16	1859.45	2649.40	
		2077.20	1751.07				0.00	0.00		3)15, 10	.12 = 13	3358.45	_
pace heating r		2077.20	1751.07				0.00	0.00		3)15, 10	.12 = 13	1	_
_	requirement	2077.20 kWh/m²/ye	1751.07				0.00	0.00		3)15, 10	.12 = 13	3358.45]] (98] (99
_	requirement	2077.20 kWh/m²/ye	1751.07				0.00	0.00		3)15, 10	.12 = 13	3358.45	_
8c. Space coo	requirement ling requirer Jan	2077.20 kWh/m²/ye	1751.07 ear	976.74	409.32	0.00			∑(98	(98)	12 = 13 ÷ (4)	3358.45 45.40	_
Bc. Space coo	requirement ling requirer Jan	2077.20 kWh/m²/ye	1751.07 ear	976.74	409.32	0.00			∑(98	(98)	12 = 13 ÷ (4)	3358.45 45.40	(99
Bc. Space coo eat loss rate L	requirement ling requirer Jan Lm 0.00	2077.20 kWh/m²/ye ment Feb 0.00	1751.07 ear Mar	976.74 Apr	409.32 May	0.00 Jun	Jul	Aug	∑(98 Sep	(98) Oct	12 = 13 ÷ (4)	3358.45 45.40 Dec	(99
Sc. Space coo	requirement ling requirer Jan Lm 0.00	2077.20 kWh/m²/ye ment Feb 0.00	1751.07 ear Mar	976.74 Apr	409.32 May	0.00 Jun	Jul	Aug	∑(98 Sep	(98) Oct	12 = 13 ÷ (4)	3358.45 45.40 Dec	(99)
eat loss rate L	requirement Jan Lm 0.00 or for loss nr	2077.20 kWh/m²/ye ment Feb 0.00 m 0.00	1751.07 ear Mar 0.00	976.74 Apr 0.00	May 0.00	Jun 3002.38	Jul 2363.58	Aug 2426.10	∑(98 Sep	(98) Oct	12 = 13 ÷ (4) Nov	3358.45 45.40 Dec	(99)
eat loss rate L	requirement Jan Lm 0.00 or for loss nr	2077.20 kWh/m²/ye ment Feb 0.00 m 0.00	1751.07 ear Mar 0.00	976.74 Apr 0.00	May 0.00	Jun 3002.38	Jul 2363.58	Aug 2426.10	∑(98 Sep	(98) Oct	12 = 13 ÷ (4) Nov	3358.45 45.40 Dec	(10)
pace heating rate Latins rate Latins factors f	Jan Lm 0.00 or for loss ηr 0.00 Lm (watts) (2077.20 kWh/m²/ye ment Feb 0.00 m 0.00 100)m x (10	Mar 0.00 0.00 0.00	Apr 0.00	May 0.00	Jun 3002.38	Jul 2363.58	Aug 2426.10 0.82	∑(98 Sep 0.00	(98) Oct 0.00	12 = 13 ÷ (4) Nov 0.00	3358.45 45.40 Dec 0.00	(10)
eat loss rate L tilisation factors	Jan Lm 0.00 or for loss ηr 0.00 Lm (watts) (2077.20 kWh/m²/ye ment Feb 0.00 m 0.00 100)m x (10	Mar 0.00 0.00 0.00	Apr 0.00	May 0.00	Jun 3002.38	Jul 2363.58	Aug 2426.10 0.82	∑(98 Sep 0.00	(98) Oct 0.00	12 = 13 ÷ (4) Nov 0.00	3358.45 45.40 Dec 0.00	(10)
eat loss rate L tilisation factors	requirement Jan Lm 0.00 or for loss nr 0.00 Lm (watts) (0.00	2077.20 kWh/m²/ye ment Feb 0.00 100)m x (10 0.00 0.00	Mar 0.00 0.00 0.00 0.00 0.00	Apr 0.00 0.00 0.00	May 0.00 0.00 0.00	Jun 3002.38 0.78 2333.51	Jul 2363.58 0.86 2039.27 2498.65	Aug 2426.10 0.82 1979.14	∑(98 Sep 0.00 0.00	Oct 0.00 0.00	12 = 13 ÷ (4) Nov 0.00 0.00	3358.45 45.40 Dec 0.00 0.00	(10)
eat loss rate L tilisation factorseful loss nml	requirement Jan Lm 0.00 or for loss nr 0.00 Lm (watts) (0.00	2077.20 kWh/m²/ye ment Feb 0.00 100)m x (10 0.00 0.00	Mar 0.00 0.00 0.00 0.00 0.00	Apr 0.00 0.00 0.00	May 0.00 0.00 0.00	Jun 3002.38 0.78 2333.51	Jul 2363.58 0.86 2039.27 2498.65	Aug 2426.10 0.82 1979.14	∑(98 Sep 0.00 0.00	Oct 0.00 0.00	12 = 13 ÷ (4) Nov 0.00 0.00	3358.45 45.40 Dec 0.00 0.00	_

Cooled fraction									CO	oled area ÷	(4) =	0.85	(105)
Intermittency fa		10)								0.00 0.00	('	0.00	_ (200)
, , , , , ,	0.00	0.00	0.00	0.00	0.00	0.25	0.25	0.25	0.00	0.00	0.00	0.00	7
			1 2.22			1 3.25				Σ(106)6		0.75	(106)
Space cooling re	eguirement	(104)m x (1	105) x (106)	m						2(100)0	0	0.75	_ (100)
opace coog	0.00	0.00	0.00	0.00	0.00	43.05	72.59	49.56	0.00	0.00	0.00	0.00	7
	0.00	0.00	1 0.00	0.00	1 0.00	10.00	72.00	13.50	0.00	Σ(107)6		165.20	(107)
Space cooling re	equirement	kWh/m²/ve	ear							(107) ÷		0.56	(108)
	9a. Energy requirements - individual heating systems including micro-CHP												
9a. Energy req	uirements -	individual	heating sys	stems inclu	uding micro	-СНР							
Space heating													
Fraction of space	ce heat from	secondary	/suppleme	ntary syste	m (table 11	.)						0.00	(201)
Fraction of space	e heat from	main syste	em(s)							1 - (2	01) =	1.00	(202)
Fraction of space	ce heat from	main syste	em 2									0.00	(202)
Fraction of tota	I space heat	from main	system 1						(20	02) x [1- (20	3)] =	1.00	(204)
Fraction of tota	I space heat	from main	system 2							(202) x (2	03) =	0.00	(205)
Efficiency of ma	ain system 1	(%)										91.10	(206)
Cooling system	energy effic	iency ratio	(Table 10c)									3.38	(209)
- ,	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating f	uel (main sy	stem 1), kV	Vh/month										
,	2898.05	2280.13	1922.14	1072.17	449.31	0.00	0.00	0.00	0.00	1092.38	2041.11	2908.23	
		!	.!		'				Σ(21	1)15, 10	٠	14663.50	(211)
Water heating										•			_ ` '
Efficiency of wa	iter heater												
	90.33	90.25	90.08	89.58	88.15	80.40	80.40	80.40	80.40	89.55	90.14	90.35	(217)
Water heating f	fuel, kWh/m	onth			'					•	•	<u>'</u>	
_	199.98	175.18	181.40	159.43	155.76	147.87	137.51	157.10	158.77	165.57	179.03	193.75	7
										∑(219a)1	' _	2011.34	(219)
Space cooling fu	uel, kWh/mo	onth								2((===)
0	0.00	0.00	0.00	0.00	0.00	12.76	21.51	14.68	0.00	0.00	0.00	0.00	7
										Σ(221)6	· –	48.95	(221)
Annual totals										2(===)0		.0.00	(===/
Space heating f	uel - main sv	ıstem 1										14663.50	
Water heating f		,500111 2										2011.34	_
Space cooling fu												48.95	_
Electricity for po		and electric	keen-hot (Table 4f)								40.93	_
mechanical					o input from	n outside			258.74	٦			(230a)
						ii outside							
central heat		water pun	np within w	arm air ne	ating unit				30.00] 7			(230c)
boiler flue fa		1							45.00	J		222 = -	(230e)
Total electricity		-	ear									333.74	(231)
Electricity for lig												737.83	(232)
Total delivered	energy for a	ıll uses						(211)(221	.) + (231) +	(232)(23	7b) =	17795.36	(238)
10a. Fuel costs	s - ind <u>ividua</u>	I heating sy	ystem <u>s incl</u>	uding micr	o-CHP								
						Fuel		Fu	el price			Fuel	
					kV	Wh/year			•		C	ost £/year	

	Fuel kWh/year		Fuel price		Fuel cost £/year		
Space heating - main system 1	14663.50	x	3.48	x 0.01 =	510.29	(240)	
Water heating	2011.34	x	3.48	x 0.01 =	69.99	(247)	
Space cooling	48.95	x	13.19	x 0.01 =	6.46	(248)	

Additional standing charges					120.00	(251)
Total energy cost			(240)(242) + ((245)(254) =	848.08	(255)
11a. SAP rating - individual heating systems including mi	сго-СНР					
Energy cost deflator (Table 12)					0.42	(256)
Energy cost factor (ECF)					1.05	(257)
SAP value					85.35	
SAP rating (section 13)					85	(258)
SAP band					В	
12a. CO ₂ emissions - individual heating systems including	g micro-CHP					
	Energy kWh/year		Emission factor kg CO₂/kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	14663.50	x	0.22	=	3167.32	(261)
Water heating	2011.34	x	0.22	=	434.45	(264)
Space and water heating			(261) + (262) + (263) + (264) =	3601.77	(265)
Space cooling	48.95	x	0.52	=	25.40	(266)
Pumps and fans	333.74	x	0.52	=	173.21	(267)
Electricity for lighting	737.83	x	0.52	=	382.93	(268)
Total CO ₂ , kg/year				(265)(271) =	4183.31	(272)
Dwelling CO₂ emission rate				(272) ÷ (4) =	14.22	(273)
El value					83.48	
El rating (section 14)					83	(274)
El band					В	
13a. Primary energy - individual heating systems including	ng micro-CHP					
	Energy kWh/year		Primary factor		Primary Energy kWh/year	′
Space heating - main system 1	14663.50	×	1.22	=	17889.48	(261)
Water heating	2011.34	x	1.22	=	2453.84	(264)
Space and water heating			(261) + (262) + (263) + (264) =	20343.31	(265)
Space cooling	48.95	x	3.07	=	150.27	(266)
Pumps and fans	333.74	x	3.07	=	1024.57	(267)
Electricity for lighting	737.83	x	3.07	=	2265.14	(268)
Primary energy kWh/year					23783.29	(272)
Dwelling primary energy rate kWh/m2/year					80.82	(273)

333.74

737.83

Pumps and fans
Electricity for lighting

13.19

13.19

x 0.01 =

x 0.01 =

44.02

97.32

(249)

(250)

Dfee 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	Ms Rachell wootliff	Assessor number	8847
Client		Last modified	13/03/2017
Address	1, London		

Address	1, Londor	า										
1. Overall dwelling dimen	sions											
				A	rea (m²)			rage storey eight (m)		V	olume (m³)	
Lowest occupied					120.21] (1a) x		3.00	(2a) =		360.63	(3a)
+1					94.70	(1b) x		3.50	(2b) =		331.45	(3b)
+2					79.35] (1c) x		2.70	(2c) =		214.25	(3c)
Total floor area	(1a)	+ (1b) + (1	c) + (1d)(1ı	n) =	294.26	(4)						
Dwelling volume							(3a)	+ (3b) + (3	c) + (3d)(3n) =	906.33	(5)
2. Ventilation rate												
										n	³ per hour	
Number of chimneys								1	x 40	=	40	(6a)
Number of open flues								1	x 20	=	20	(6b)
Number of intermittent far	ıs							4	x 10	=	40	(7a)
Number of passive vents								0	x 10	=	0	(7b)
Number of flueless gas fire	s							1	x 40	=	40	(7c)
										Air	changes pe hour	r
Infiltration due to chimney	s, flues, fans	, PSVs		(6a)	+ (6b) + (7a	a) + (7b) + (7c) =	140	÷ (5)	=	0.15	(8)
If a pressurisation test has	been carried	out or is i	ntended, pro	ceed to (1	17), otherw	ise continue	e from (9) t	0 (16)				
Air permeability value, q50	, expressed	in cubic m	etres per ho	ur per squ	are metre	of envelope	e area				4.00	(17)
If based on air permeability	value, then	(18) = [(1 7	7) ÷ 20] + (8)	, otherwis	se (18) = (16	5)					0.35	(18)
Number of sides on which t	the dwelling	is sheltere	ed								2	(19)
Shelter factor								1 -	[0.075 x (2	L9)] =	0.85	(20)
Infiltration rate incorporati	ng shelter fa	actor							(18) x (20) =	0.30	(21)
Infiltration rate modified fo	or monthly w	vind speed	:									
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind spee	ed from Tab	le 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 (a	llowing for	shelter and	wind factor	·) (21) x (2	2a)m							_
0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.30	0.32	0.34	0.35	(22b)



Calculate effective air change rate for the applicable case:

0.57

If mechanical ventilation: air change rate through system

0.57

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

0.55

0.55

0.57

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

0.56

N/A

N/A

0.56

(23a)

(23c)

(24d)

0.54

0.54

0.54

0.55

0.55

3.80

3.68

3.68

3.80

3.80

3.68

3.80

3.80

3.43

3.80

3.68

3.80

(56)

Section Sect	If the vessel co	ntains dedicate	ed solar st	orage or d	edicated W	VWHRS (56)	m x [(47) -	Vs] ÷ (47),	else (56)					
Combi 100 0.00		3.80	3.43	3.80	3.68	3.80	3.68	3.80	3.80	3.68	3.80	3.68	3.80	(57)
Campill loss for each month from Table 3-3,3 bor 3	Primary circuit	loss for each m	nonth fron	n Table 3		'	!	!	•	•			'	
Campill for sign reach month from Table 3 a, 31 or 3		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)
Column C	Combi loss for	each month fro	m Table 3	3a, 3b or 3	С									1 , ,
The linear required for water investign calculated to section to 18.0 a. 8 18.0 a 18.0 a		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)
18.06 18.10 163.40 142.82 37.31 118.89 110.56 126.31 27.65 148.28 161.38 17.50 (32) 28.02	Total heat regu					ļ.		1	1	1] (/
Solar DHW Input Calculated							1		1		148 28	161 38	175.06	(62)
Note	Solar DHW inni		-			!	110.03	110.50	120.51	127.03	140.20	101.50	173.00] (02)
Output from water heater for each morniting (Whithing Figure 1) (82) mornish (1) (82) morn	Solar Bill mpe						0.00	0.00	0.00	0.00	0.00	0.00	0.00	(62)
	Output from w					1		0.00	0.00	0.00	0.00	0.00	0.00] (03)
	Output Irom w		-			1		106.76	122 51	122.07	144.49	157.71	171.26	1
March Sample March Mar		170.84	154.00	159.60	139.14	133.51	115.21	100.76	122.51	123.97]
Solution	Heat asing from	. water beating	~ (IdA/b /m	onth) 0 30	- v [0 0F v	/45\m + /61	\ml . 0.0 v	· [/46)	57\m , /50	\m_1	∑(64)1	.12 =	1705.65] (64)
Substraint Su	Heat gains from			-		1						1		1 (0-)
May		37.58	32.87	33.92	29.57	28.37	24.48	22.69	26.03	26.34	30.70	33.51	36.39] (65)
May	5. Internal gai	ns												
Metabolic gains (Table 5)			Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 41.78	Metabolic gains	s (Table 5)			-	-								
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 41.78	· ·		156.22	156.22	156.22	156.22	156.22	156.22	156.22	156.22	156.22	156.22	156.22	(66)
41.78 37.11 30.18 22.85 17.08 14.42 15.58 20.25 27.18 34.51 40.28 42.94 (67)	Lighting gains (-			·] (/
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 453.60 458.31 446.45 421.19 389.32 359.36 339.35 334.64 36.50 371.75 403.63 433.59 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 38.62 38.	0 - 00 - (15 58	20.25	27 18	34 51	40.28	42 94	(67)
453.60 458.31 446.45 421.19 389.32 359.36 339.35 334.64 346.50 371.75 403.63 433.59 (88)	Annliance gains					1		13.30	20.23	27.10	3 1.31	10.20	12.51] (0,)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 69) Pump and fan gains (Table 53) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	Appliance Banic							339 35	334.64	346 50	371 75	403.63	/33.50	(68)
38.62 38	Cooking gains (!		333.33	334.04	340.30	371.73	1 403.03	433.33] (00)
Pump and fan gains (Table 5a) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	COOKING gains ('				29.62	20.62	20.62	20.62	20.62	20.62	1 (60)
0.00 0.00	Dump and fan a		-	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02] (69)
124.98 124.98	rullip allu lali g	, , , ,		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00] (70)
124.98 -12	Laccac a a ava		I	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00] (70)
Water heating gains (Table 5) 50.51	Losses e.g. evap			424.00	124.00	121.00	124.00	121.00	124.00	124.00	124.00	124.00	12400	1 (74)
So.51 48.91 45.58 41.07 38.13 34.00 30.49 34.99 36.59 41.27 46.55 48.91 (72)	Makes beektee			-124.98	-124.98	-124.98	-124.98	-124.98	-124.98	-124.98	-124.98	-124.98	-124.98] (71)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m 615.75 614.19 592.08 554.97 514.40 477.65 455.28 459.75 480.14 517.40 560.32 595.31 (73) 6. Solar gains Access factor Table 6d m² W/m² specific data or Table 6b or Table 6c or Tab	water neating (T	1		T -		1
6. Solar gains Access factor Table 6d M² Solar flux W/m² Specific data or Table 6b SouthEast 0.77 x 5.43 x 11.28 x 0.9 x 0.60 x 0.80 = 20.38 (77) NorthWest 0.77 x 15.53 x 36.79 x 0.9 x 0.60 x 0.80 = 9.01 (81) SouthWest 0.77 x 3.60 x 19.64 x 0.9 x 0.9 x 0.60 x 0.80 = 190.07 (79) West 0.77 x 3.60 x 19.64 x 0.9 x 0.60 x 0.80 = 23.52 (80) East 0.77 x 3.65 x 10.63 x 0.9 x 0.60 x 0.80 = 36.39 (76) North Solar gains in watts Σ(74)m(82)m								30.49	34.99	36.59	41.27	46.55	48.91] (72)
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 5.43 x 11.28 x 0.9 x 0.60 x 0.80 = 20.38 (75) SouthEast 0.77 x 7.18 x 36.79 x 0.9 x 0.60 x 0.80 = 87.88 (77) NorthWest 0.77 x 15.53 x 36.79 x 0.9 x 0.60 x 0.80 = 9.01 (81) SouthWest 0.77 x 15.53 x 36.79 x 0.9 x 0.60 x 0.80 = 190.07 (79) West 0.77 x 5.57 x 19.64 x 0.9 x 0.60 x 0.80 = 23.52 (80) East 0.77 x 3.65 x 10.63 x 0.9 x 0.60 x 0.80 <td< td=""><td>Total internal g</td><td></td><td></td><td></td><td></td><td></td><td></td><td>1</td><td></td><td>1</td><td>1</td><td></td><td></td><td>1</td></td<>	Total internal g							1		1	1			1
Access factor Table 6d Area m² Solar flux W/m² g specific data or Table 6b FF specific data or Table 6c Gains W w/m² NorthEast 0.77 x 5.43 x 11.28 x 0.9 x 0.60 x 0.80 = 20.38 (75) SouthEast 0.77 x 7.18 x 36.79 x 0.9 x 0.60 x 0.80 = 87.88 (77) NorthWest 0.77 x 15.53 x 36.79 x 0.9 x 0.60 x 0.80 = 9.01 (81) SouthWest 0.77 x 15.53 x 36.79 x 0.9 x 0.60 x 0.80 = 190.07 (79) West 0.77 x 5.57 x 19.64 x 0.9 x 0.60 x 0.80 = 23.52 (80) Feast 0.77 x 5.57 x 19.64 x 0.9 x 0.60 x 0.80 = 12.91 (74)		615.75	614.19	592.08	554.97	514.40	477.65	455.28	459.75	480.14	517.40	560.32	595.31	J (73)
Access factor Table 6d	6. Solar gains													
NorthEast 0.77 x 5.43 x 11.28 x 0.9 x 0.60 x 0.80 = 20.38 (75)				Access f	actor	Area	Sol	ar flux		g	FF		Gains	
NorthEast 0.77 x 5.43 x 11.28 x 0.9 x 0.60 x 0.80 = 20.38 (75) SouthEast 0.77 x 7.18 x 36.79 x 0.9 x 0.60 x 0.80 = 87.88 (77) NorthWest 0.77 x 2.40 x 11.28 x 0.9 x 0.60 x 0.80 = 9.01 (81) SouthWest 0.77 x 15.53 x 36.79 x 0.9 x 0.60 x 0.80 = 190.07 (79) West 0.77 x 3.60 x 19.64 x 0.9 x 0.60 x 0.80 = 23.52 (80) East 0.77 x 5.57 x 19.64 x 0.9 x 0.60 x 0.80 = 36.39 (76) North 0.77 x 3.65 x 10.63 x 0.9 x 0.60 x 0.80 = 12.91 (74) Solar gains in watts ∑(74)m(82)m									spec			data		
SouthEast 0.77 x 7.18 x 36.79 x 0.9 x 0.60 x 0.80 = 87.88 (77) NorthWest 0.77 x 2.40 x 11.28 x 0.9 x 0.60 x 0.80 = 9.01 (81) SouthWest 0.77 x 15.53 x 36.79 x 0.9 x 0.60 x 0.80 = 190.07 (79) West 0.77 x 3.60 x 19.64 x 0.9 x 0.60 x 0.80 = 23.52 (80) East 0.77 x 5.57 x 19.64 x 0.9 x 0.60 x 0.80 = 36.39 (76) North 0.77 x 3.65 x 10.63 x 0.9 x 0.60 x 0.80 = 12.91 (74) Solar gains in watts Σ(74)m(82)m									or T	able 6b	or Table	e 6c		
NorthWest 0.77 x 2.40 x 11.28 x 0.9 x 0.60 x 0.80 = 9.01 (81) SouthWest 0.77 x 15.53 x 36.79 x 0.9 x 0.60 x 0.80 = 190.07 (79) West 0.77 x 3.60 x 19.64 x 0.9 x 0.60 x 0.80 = 23.52 (80) East 0.77 x 5.57 x 19.64 x 0.9 x 0.60 x 0.80 = 36.39 (76) North 0.77 x 3.65 x 10.63 x 0.9 x 0.60 x 0.80 = 12.91 (74) Solar gains in watts Σ(74)m(82)m	NorthEast			0.7	7 x	5.43	x1	1.28 x	0.9 x	0.60 x	0.80	=	20.38	[(75)
SouthWest 0.77 x 15.53 x 36.79 x 0.9 x 0.60 x 0.80 = 190.07 (79) West 0.77 x 3.60 x 19.64 x 0.9 x 0.60 x 0.80 = 23.52 (80) East 0.77 x 5.57 x 19.64 x 0.9 x 0.60 x 0.80 = 36.39 (76) North 0.77 x 3.65 x 10.63 x 0.9 x 0.60 x 0.80 = 12.91 (74) Solar gains in watts Σ(74)m(82)m 380.16 675.14 990.50 1328.47 1572.64 1596.43 1524.65 1338.48 1107.63 764.80 460.52 321.90 (83)	SouthEast			0.7	7 x	7.18	x 3	6.79 x	0.9 x	0.60 x	0.80	=	87.88	(77)
West 0.77 x 3.60 x 19.64 x 0.9 x 0.60 x 0.80 = 23.52 (80) East 0.77 x 5.57 x 19.64 x 0.9 x 0.60 x 0.80 = 36.39 (76) North 0.77 x 3.65 x 10.63 x 0.9 x 0.60 x 0.80 = 12.91 (74) Solar gains in watts Σ(74)m(82)m 380.16 675.14 990.50 1328.47 1572.64 1596.43 1524.65 1338.48 1107.63 764.80 460.52 321.90 (83)	NorthWest			0.7	7 x	2.40	x 1	1.28 x	0.9 x	0.60 x	0.80	=	9.01	(81)
East 0.77 x 5.57 x 19.64 x 0.9 x 0.60 x 0.80 = 36.39 (76) North 0.77 x 3.65 x 10.63 x 0.9 x 0.60 x 0.80 = 12.91 (74) Solar gains in watts Σ(74)m(82)m 380.16 675.14 990.50 1328.47 1572.64 1596.43 1524.65 1338.48 1107.63 764.80 460.52 321.90 (83)	SouthWest			0.7	7 x	15.53	x3	6.79 x	0.9 x	0.60 x	0.80	= [190.07	(79)
North	West			0.7	7 x [3.60	x1	9.64 x	0.9 x	0.60 x	0.80	=	23.52	(80)
North	East			0.7	7 x	5.57	x 1	9.64 x	0.9 x	0.60 x	0.80		36.39	(76)
Solar gains in watts Σ(74)m(82)m 380.16 675.14 990.50 1328.47 1572.64 1596.43 1524.65 1338.48 1107.63 764.80 460.52 321.90 (83)	North			0.7	7 x	3.65	_ x _ 1			0.60 x	0.80	<u> </u>	12.91	7
380.16 675.14 990.50 1328.47 1572.64 1596.43 1524.65 1338.48 1107.63 764.80 460.52 321.90 (83)		atts ∑(74)m((82)m											, , ,
	5			000.50	1220 47	1572.64	1506.42	152465	1220 /0	1107 63	764.90	460.52	224.00	(83)
rosar carros miscritar ana solar 17 sun 1 10 sun		38U.ID	0/514	990.50	1320.47	1 13//.04	1090.45	1324.03	1330.40		/04.60	400.37	321.90	

	995.91	1289.33	1582.57	1883.45	2087.03	2074.08	1979.93	1798.23	1587.76	1282.19	1020.84	917.20 (84)
7. Mean inter	nal tempera	ature (heati	ng season)									
Temperature d					Γable 9, Th1	.(°C)						21.00 (85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation facto	or for gains	for living are	ea n1,m (se	ee Table 9a))							
	1.00	1.00	1.00	0.99	0.95	0.85	0.69	0.76	0.95	1.00	1.00	1.00 (86)
Mean internal t	temp of livir	ng area T1 (s	steps 3 to 7	in Table 9	c)							
	19.50	19.66	19.93	20.30	20.64	20.88	20.97	20.95	20.75	20.29	19.83	19.48 (87)
Temperature d	uring heatin	ng periods in	the rest o	f dwelling f	rom Table 9	9, Th2(°C)						
	19.95	19.95	19.96	19.97	19.97	19.98	19.98	19.98	19.98	19.97	19.97	19.96 (88)
Utilisation facto	or for gains	for rest of d	welling n2,	m.								
	1.00	1.00	1.00	0.98	0.93	0.77	0.55	0.63	0.91	0.99	1.00	1.00 (89)
Mean internal t	temperature	e in the rest	of dwelling	g T2 (follow	steps 3 to	7 in Table 9	9c)					
	18.57	18.73	19.00	19.37	19.70	19.92	19.97	19.96	19.81	19.37	18.91	18.55 (90)
Living area frac	tion								Liv	ving area ÷	(4) =	0.16 (91)
Mean internal t	temperature	e for the wh	ole dwellir	ng fLA x T1 -	+(1 - fLA) x ⁻	Γ2						
	18.72	18.88	19.16	19.52	19.86	20.08	20.13	20.13	19.97	19.52	19.06	18.71 (92)
Apply adjustme				1						ı		
	18.72	18.88	19.16	19.52	19.86	20.08	20.13	20.13	19.97	19.52	19.06	18.71 (93)
8. Space heati	ng requiren	nent										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation facto	or for gains,	ηm		·	·							
	1.00	1.00	1.00	0.98	0.93	0.78	0.57	0.65	0.91	0.99	1.00	1.00 (94)
Useful gains, ηr	mGm, W (9	4)m x (84)m		•								
	995.64	1287.96	1575.87	1847.52	1930.66	1609.49	1137.52	1170.50	1443.23	1272.09	1020.09	917.04 (95)
Monthly averag	ge external t	temperature	e from Tab	le 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 f	or mean int	ernal tempe	erature, Lm	n, W [(39)m	n x [(93)m -	(96)m]						
	4921.82	4760.94	4297.77	3566.12	2732.05	1815.28	1171.68	1232.86	1952.02	2989.08	4023.56	4902.52 (97)
Space heating r	equirement	t, kWh/mon	th 0.024 x	[(97)m - (9	5)m] x (41)	m						
	2921.08	2333.84	2025.10	1237.39	596.24	0.00	0.00	0.00	0.00	1277.44	2162.49	2965.20
									∑(98	3)15, 10	.12 = 1	5518.78 (98)
Space heating r	equirement	t kWh/m²/y	ear							(98)	÷ (4)	52.74 (99)
8c. Space cool	ling require	ment										
our opuse coor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat loss rate L			widi	- Al	y	Jui1	J 41	aws	JCP		1100	
	0.00	0.00	0.00	0.00	0.00	3115.88	2452.92	2514.38	0.00	0.00	0.00	0.00 (100
Utilisation facto		ļ	3.00	3.50	J 3.00	1 3113.00	1 2 .32.32	1 2317.30	0.00	1 3.00	1 0.00	
	0.00	0.00	0.00	0.00	0.00	0.75	0.84	0.79	0.00	0.00	0.00	0.00 (10:
Useful loss ηml		1			1 2.20			1 2	, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		1 2:20	,
	0.00	0.00	0.00	0.00	0.00	2339.89	2061.54	1988.27	0.00	0.00	0.00	0.00 (102
Gains		<u>,</u>	1	<u> </u>							· · · · ·	, (200
	0.00	0.00	0.00	0.00	0.00	2591.72	2477.34	2268.89	0.00	0.00	0.00	0.00 (103
Space cooling r				1		l	1	!			1	, (200
. 3	0.00	0.00	0.00	0.00	0.00	181.32	309.35	208.78	0.00	0.00	0.00	0.00
		1								Σ(104)6		699.46 (104
										,-		

cooled area ÷ (4) =

1.00

(105)

Intermittency factor (Table 10)

 $\Sigma(106)6...8 = 0.75$ (106)

Space cooling requirement (104)m x (105) x (106)m

 0.00
 0.00
 0.00
 0.00
 45.33
 77.34
 52.20
 0.00
 0.00
 0.00
 0.00

 $\Sigma(107)6...8 = 174.86$ (107)

Space cooling requirement kWh/m²/year

 $(107) \div (4) = 0.59$ (108)

8f. Fabric energy efficiency

Dwelling Fabric Energy Efficiency (DFEE)

(99) + (108) = 53.33 (109)

Tfee 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	Ms Rachell wootliff	Assessor number	8847
Client		Last modified	13/03/2017
Address	1, London		

Address		1, Londo	n										
1. Overall dwellin	ng dimens	sions											
					А	rea (m²)			rage storey eight (m)		Vo	lume (m³)	
Lowest occupied						120.21	(1a) x		3.00] (2a) =		360.63	(3a)
+1						94.70] (1b) x		3.50	(2b) =		331.45	(3b)
+2						79.35] (1c) x		2.70	(2c) =		214.25	(3c)
Total floor area		(1a)	+ (1b) + (1	c) + (1d)(1	Ln) =	294.26	(4)						
Dwelling volume								(3a)) + (3b) + (3	c) + (3d)(3n) =	906.33	(5)
2. Ventilation rat	е												
											m ⁱ	³ per hour	
Number of chimne	eys								0	x 40 =	=	0	(6a)
Number of open fl	ues								0	x 20 =	=	0	(6b)
Number of intermi	ittent fan:	s							4	x 10 =	=	40	(7a)
Number of passive	vents								0	x 10 =	=	0	(7b)
Number of flueless	gas fires								0	x 40 =	=	0	(7c)
											Air	changes pe hour	r
Infiltration due to	chimneys	, flues, fan	s, PSVs		(6a)	+ (6b) + (7a	a) + (7b) + (7c) =	40	÷ (5) :	=	0.04	(8)
If a pressurisation	test has b	een carrie	d out or is i	ntended, pr	roceed to (17), otherw	ise continu	e from (9) t	to (16)				
Air permeability va	alue, q50,	expressed	in cubic m	etres per ho	our per squ	are metre	of envelope	e area				5.00	(17)
If based on air peri	meability	value, the	n (18) = [(1	7) ÷ 20] + (8	s), otherwi	se (18) = (1	6)					0.29	(18)
Number of sides or	n which t	he dwellin	g is sheltere	ed								2	(19)
Shelter factor									1 -	[0.075 x (1	.9)] = [0.85	(20)
Infiltration rate inc	orporatin	ng shelter f	actor							(18) x (20) =	0.25	(21)
Infiltration rate mo	odified for	r monthly v	wind speed	:									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average v	vind spee	d from Tab	ole 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)



0.32

0.55

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

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

0.31

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

0.55

0.28

0.54

0.27

0.54

0.31

If mechanical ventilation: air change rate through system

0.55

Calculate effective air change rate for the applicable case:

0.53

0.24

0.24

0.53

0.23

0.53

0.25

0.53

0.27

0.54

0.28

0.54

0.29

0.54

N/A

N/A

(22b)

(23a)

(23c)

(24d)

22.58

22.58

23.33

23.33

22.58

23.33

23.33

21.07

23.33

22.58

23.33

(56)

	ntains dedic	ated solar st	orage or d	edicated W	/WHRS (56)	m x [(47) -	Vs] ÷ (47),	else (56)				
	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33 (57)
Primary circuit I		n month fror	m 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 e												
	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 requ							ļ.	!				(00)
	223.43	196.75	206.20	184.24	180.11	160.30	153.35	169.10	169.06	191.07	202.80	217.85 (62)
Solar DHW inpu		-										(02)
	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 wa		1				I.	0.00	0.00	0.00	0.00	0.00	0.00 (00)
output from we	176.84	154.66	159.60	139.14	133.51	115.21	106.76	122.51	123.97	144.48	157.71	171.26
	170.04	154.00	133.00	139.14	133.31	113.21	100.70	122.51	123.97	Σ(64)1		
Heat gains from	water heat	ting (k\Mh/m	onth) 0.21	5 v [0 05 v l	(15)m ± (61	\m] + 0 0 v	([(16)m + [57)m + (50)	ıml	2(64)1	.12 –	1705.65 (64)
neat gains iron		1 1		- '			1		-	20.70	22.54	26.20 (65)
	37.58	32.87	33.92	29.57	28.37	24.48	22.69	26.03	26.34	30.70	33.51	36.39 (65)
5. Internal gain	ns											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabolic gains	s (Table 5)			-								
· ·	156.22	156.22	156.22	156.22	156.22	156.22	156.22	156.22	156.22	156.22	156.22	156.22 (66)
Lighting gains (o		1										(00)
8	42.91	38.11	30.99	23.46	17.54	14.81	16.00	20.80	27.92	35.44	41.37	44.10 (67)
Appliance gains							10.00	20.00	27.32	33.44	41.57	1 44.10 (07)
Appliance gains	453.60	458.31	446.45	421.19	389.32	359.36	339.35	334.64	346.50	371.75	403.63	433.59 (68)
Cooking gains (339.33	334.04	340.30	3/1./3	403.03	455.59 (08)
Cooking gains (20.62	20.62	20.62	20.62	20.62	20.62 (60)
5	38.62	38.62	38.62	38.62	38.62	38.62	38.62	38.62	38.62	38.62	38.62	38.62 (69)
Pump and fan g												(-0)
	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. evap	,	, , , , , , , , , , , , , , , , , , , 						1	1		ı	
	-124.98	-124.98	-124.98	-124.98	-124.98	-124.98	-124.98	-124.98	-124.98	-124.98	-124.98	-124.98 (71)
Water heating g	gains (Table											
	50.51	48.91										
Total internal -		40.91	45.58	41.07	38.13	34.00	30.49	34.99	36.59	41.27	46.55	48.91 (72)
rotal internal ga	ains (66)m	+ (67)m + (6					30.49	34.99	36.59	41.27	46.55	48.91 (72)
rotai internai ga	616.88						30.49	34.99	36.59	41.27 518.33	46.55	48.91 (72) 596.47 (73)
·	, ,	+ (67)m + (6	8)m + (69)	m + (70)m -	+ (71)m + (7	72)m						
6. Solar gains	, ,	+ (67)m + (6	8)m + (69) 592.89	m + (70)m - 555.59	+ (71)m + (7 514.86	72)m 478.04	455.71		480.87	518.33		596.47 (73)
	, ,	+ (67)m + (6	8)m + (69)	m + (70)m - 555.59	+ (71)m + (7	72)m 478.04 Sol		460.29			561.41	
	, ,	+ (67)m + (6	8)m + (69) 592.89 Access f	m + (70)m - 555.59	+ (71)m + (7 514.86	72)m 478.04 Sol	455.71 ar flux	460.29	480.87	518.33 FF	561.41	596.47 (73) Gains
	, ,	+ (67)m + (6	8)m + (69) 592.89 Access f	m + (70)m - 555.59 factor 6d	+ (71)m + (7 514.86	72)m 478.04 Sol:	455.71 ar flux V/m²	460.29 spec or T	480.87 g ific data	518.33 FF specific o	561.41	596.47 (73) Gains
6. Solar gains	, ,	+ (67)m + (6	8)m + (69) 592.89 Access f Table	m + (70)m - 555.59 Factor 6d	+ (71)m + (7 514.86 Area m ²	72)m 478.04 Sola V	455.71 lar flux V/m²	\$pec or T	g ific data able 6b	518.33 FF specific cor Table 0.70	561.41	596.47 (73) Gains W
6. Solar gains NorthEast	, ,	+ (67)m + (6	8)m + (69) 592.89 Access f Table	m + (70)m - 555.59 Factor 6d 7 x 7	+ (71)m + (7 514.86 Area m ² 5.43	72)m 478.04 Sol: W x 1 x 3	455.71 lar flux v/m² 1.28 x 66.79 x	spec or T 0.9 x	g ific data able 6b 0.63 x	FF specific c or Table 0.70 0.70	561.41	Gains W (75)
6. Solar gains NorthEast SouthEast	, ,	+ (67)m + (6	8)m + (69) 592.89 Access f Table 0.7	iactor 6d x 7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x	+ (71)m + (7 514.86 Area m ² 5.43 7.18	72)m 478.04 Soli X 1 X 3 X 1	455.71 lar flux V/m² 1.28 x 1.28 x	spec or T 0.9 x (0.9 x	g ific data able 6b 0.63 x 0.63 x	518.33 FF specific c or Table 0.70 0.70 0.70	561.41 data 6c =	Gains W (75) 80.74 (77)
6. Solar gains NorthEast SouthEast NorthWest	, ,	+ (67)m + (6	8)m + (69) 592.89 Access f Table 0.7 0.7	7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x	+ (71)m + (7 514.86 Area m ² 5.43 7.18 2.40	72)m 478.04 Sola X 1 X 3 X 1 X 3	455.71 lar flux V/m² 1.28	spec or T 0.9 x (0.9 x (0.9 x (0.9 x (g ific data able 6b 0.63 x 0.63 x	518.33 FF specific c or Table 0.70 0.70 0.70 0.70	561.41 data 66c = [Gains W 18.72 (75) 80.74 (77) 8.28 (81)
6. Solar gains NorthEast SouthEast NorthWest SouthWest	, ,	+ (67)m + (6	8)m + (69) 592.89 Access f Table 0.7 0.7 0.7	iactor 6d x 7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x	+ (71)m + (7 514.86 Area m ² 5.43 7.18 2.40 15.53	72)m 478.04 Soli W x 1 x 3 x 1 x 3 x 1	455.71 lar flux V/m² 1.28	spec or T 0.9 x (0.9 x	g ific data able 6b 0.63	518.33 FF specific or Table 0.70 0.70 0.70 0.70	561.41 data 66c = [Gains W 18.72 (75) 80.74 (77) 8.28 (81) 174.63 (79) 21.61 (80)
6. Solar gains NorthEast SouthEast NorthWest SouthWest West East	, ,	+ (67)m + (6	8)m + (69) 592.89 Access f Table 0.7 0.7 0.7 0.7 0.7	7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x	+ (71)m + (7 514.86 Area m² 5.43 7.18 2.40 15.53 3.60 5.57	Sola X 1 X 3 X 1 X 1 X 1 X 1 X 1 X 1 X 1 X 1	455.71 lar flux V/m² 1.28	spec or T 0.9 x (0.9 x	g ific data able 6b 0.63	518.33 FF specific c or Table 0.70 0.70 0.70 0.70 0.70 0.70	561.41	Gains W 18.72 (75) 80.74 (77) 8.28 (81) 174.63 (79) 21.61 (80) 33.43 (76)
6. Solar gains NorthEast SouthEast NorthWest SouthWest West East North	616.88	+ (67)m + (6 615.19	8)m + (69) 592.89 Access f Table 0.7 0.7 0.7 0.7	7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x	+ (71)m + (7 514.86 Area m ² 5.43 7.18 2.40 15.53 3.60	Sola X 1 X 3 X 1 X 1 X 1 X 1 X 1 X 1 X 1 X 1	455.71 lar flux V/m² 1.28	spec or T 0.9 x (0.9 x	g ific data able 6b 0.63	518.33 FF specific c or Table 0.70 0.70 0.70 0.70 0.70 0.70	561.41 data 66c = [Gains W 18.72 (75) 80.74 (77) 8.28 (81) 174.63 (79) 21.61 (80)
6. Solar gains NorthEast SouthEast NorthWest SouthWest West East	616.88	+ (67)m + (6 615.19	8)m + (69) 592.89 Access f Table 0.7 0.7 0.7 0.7 0.7 0.7	7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x	+ (71)m + (7 514.86 Area m² 5.43 7.18 2.40 15.53 3.60 5.57 3.65	72)m 478.04 Soli X 1 X 3 X 1 X 1 X 1 X 1 X 1	455.71 lar flux V/m² 1.28	spec or T 0.9 x (0.9 x	g ific data able 6b 0.63	518.33 FF specific c or Table 0.70 0.70 0.70 0.70 0.70 0.70 0.70	561.41 data 66c = [Gains W 18.72 (75) 80.74 (77) 8.28 (81) 174.63 (79) 21.61 (80) 33.43 (76) 11.86 (74)
6. Solar gains NorthEast SouthEast NorthWest SouthWest West East North	616.88 atts Σ(74)m 349.27	n(82)m	8)m + (69) 592.89 Access f Table 0.7 0.7 0.7 0.7 0.7 0.7 910.02	7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x	+ (71)m + (7 514.86 Area m² 5.43 7.18 2.40 15.53 3.60 5.57	Sola X 1 X 3 X 1 X 1 X 1 X 1 X 1 X 1 X 1 X 1	455.71 lar flux V/m² 1.28	spec or T 0.9 x (0.9 x	g ific data able 6b 0.63	518.33 FF specific c or Table 0.70 0.70 0.70 0.70 0.70 0.70	561.41 data 66c = [Gains W 18.72 (75) 80.74 (77) 8.28 (81) 174.63 (79) 21.61 (80) 33.43 (76)

	966.15	1235.47	1502.91	1776.13	1959.72	1944.76	1856.48	1690.02	1498.50	1220.99	984.51	892.21 (84)
7. Mean intern	nal tempera	iture (heati	ng season)									
Temperature du	•			area from T	able 9, Th1	.(°C)						21.00 (85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation facto	or for gains f	for living are	ea n1,m (se	e Table 9a)								
	1.00	1.00	1.00	0.99	0.97	0.89	0.75	0.82	0.96	1.00	1.00	1.00 (86)
Mean internal t	emp of livin	ig area T1 (s	teps 3 to 7	in Table 9c)							
	19.39	19.54	19.81	20.18	20.54	20.82	20.94	20.92	20.67	20.20	19.72	19.36 (87)
Temperature du	uring heatin	g periods in	the rest o	f dwelling fr	om Table 9	9, Th2(°C)						
	19.89	19.89	19.89	19.90	19.90	19.90	19.90	19.90	19.90	19.90	19.89	19.89 (88)
Utilisation facto	or for gains f	for rest of d	welling n2,	m								
	1.00	1.00	1.00	0.99	0.95	0.82	0.61	0.69	0.93	0.99	1.00	1.00 (89)
Mean internal t	emperature	in the rest	of dwelling	g T2 (follow	steps 3 to	7 in Table 9	9c)					
	18.40	18.56	18.83	19.20	19.55	19.80	19.89	19.87	19.68	19.22	18.75	18.38 (90)
Living area fract	tion								Liv	ving area ÷	(4) =	0.16 (91)
Mean internal t	emperature	for the wh	ole dwellin	g fLA x T1 +	(1 - fLA) x 1	Γ2						
	18.56	18.72	18.99	19.36	19.71	19.97	20.06	20.05	19.85	19.38	18.91	18.54 (92)
Apply adjustme	nt to the m	ean interna	l temperati	ure from Ta	ble 4e whe	re appropr	riate					
	18.56	18.72	18.99	19.36	19.71	19.97	20.06	20.05	19.85	19.38	18.91	18.54 (93)
8. Space heati	ng requiren	nent										
o. Space neutr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation facto			widi	Aþ.	way	Juli	Jui	Aug	ЗСР	Ott	1101	Dec
otinisation racte	1.00	1.00	1.00	0.99	0.94	0.82	0.63	0.71	0.93	0.99	1.00	1.00 (94)
Useful gains, ηπ		1		0.55	0.54	0.02	0.03	0.71	0.55	0.55	1.00	1.00 (54)
oserai gamis, ipi	965.88	1234.27	1497.62	1750.15	1849.81	1602.66	1176.30	1196.15	1394.02	1213.07	983.82	892.04 (95)
Monthly averag			l .		10 13.01	1002.00	1170.30	1130.13	133 1.02	1213.07	303.02	032.01
,	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 fo			I.				20.00	200			7.20	
	5218.59	5048.22	4555.01	3785.88	2896.62	1929.46	1242.84	1307.91	2068.98	3175.26	4280.57	5214.72 (97)
Space heating r											1 1 2 2 3 1 2 1	(01)
, ,	3164.02	2562.97	2274.70	1465.72	778.83	0.00	0.00	0.00	0.00	1459.87	2373.66	3216.07
										3)15, 10		7295.85 (98)
Space heating r	equirement	: kWh/m²/y	ear						_,		÷ (4)	58.78 (99)
8c. Space cool	ing requirer											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat loss rate L						-	1	1		1	1	
	0.00	0.00	0.00	0.00	0.00	3376.27	2657.92	2726.42	0.00	0.00	0.00	0.00 (100
Utilisation facto							Т .	Γ -		T .	ı	
	0.00	0.00	0.00	0.00	0.00	0.67	0.77	0.72	0.00	0.00	0.00	0.00 (101
Useful loss ηmL		1					1			I		
Calar	0.00	0.00	0.00	0.00	0.00	2272.45	2045.35	1951.10	0.00	0.00	0.00	0.00 (102
Gains	0.55	1 00-	0.05	0.05	0.05		2222	24.52 :=	0.05			0.00
Connection !!	0.00	0.00	0.00	0.00	0.00	2441.09	2333.60	2143.15	0.00	0.00	0.00	0.00 (103
Space cooling re	_	1	_		-							
	0.00	0.00	0.00	0.00	0.00	121.42	214.46	142.88	0.00	0.00	0.00	0.00
										∑(104)6	8 =	478.76 (104

cooled area ÷ (4) =

1.00

(105

(109)

Intermittency factor (Table 10)

0.00 0.00 0.00 0.00 0.05 0.	5 0.25 0.00 0.00 0.00	0.00

 $\Sigma(106)6...8 = 0.75$ (106)

Space cooling requirement (104)m x (105) x (106)m

 $\Sigma(107)6...8 = 119.69$ (107)

Space cooling requirement kWh/m²/year

 $(107) \div (4) = 0.41$ (108)

8f. Fabric energy efficiency

Target Fabric Energy Efficiency (TFEE)

[(99) + (108)] * 1.15 = 68.06



Appendix 3- Be Green

L1A 2013 - Regulations Compliance Report

Design - Draft



This design draft submission provides evidence towards compliance with Part L of the Building Regulations, in accordance with Appendix C of AD L1A. It has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the 'as built' property. This report covers only items included within the SAP and is not a complete report of regulations compliance.

Assessor name	Ms Rachell wootliff	Assessor number	8847
Client		Last modified	25/02/2017
Address	1, London		

on		
Evidence	Produced by	OK?
ide emission from proposed dwelling does not exceed the target		
Fuel = N/A Fuel factor = 1.00 TER = 16.02	Authorised SAP Assessor	
DER = 12.49	Authorised SAP Assessor	
DER 12.49 < TER 16.02	Authorised SAP Assessor	Passed
DFEE 53.33 < TFEE 68.06	Authorised SAP Assessor	Passed
e building fabric and the heating, hot water and fixed lighting systems should	d be no worse than the design	limits
Element Weighted average Highest Wall 0.15 (max 0.30) 0.15 (max 0.70) Party wall (no party wall) Floor 0.10 (max 0.25) 0.10 (max 0.70) Roof 0.11 (max 0.20) 0.11 (max 0.35) Openings 1.41 (max 2.00) 1.50 (max 3.30)	Authorised SAP Assessor	Passed
Thermal bridging calculated from linear thermal transmittances for each junction	Authorised SAP Assessor	
Main heating system: Mains gas, Regular boiler from database Ravenheat CSI System A Efficiency = 90.10% - SEDBUK 2009 Minimum = 88.00% Secondary heating system: None	Authorised SAP Assessor	Passed
Cylinder volume = 300.00 litres s Declared cylinder loss = 0.17kWh/day Maximum permitted cylinder loss = 3.18kWh/day Primary hot water pipes are not insulated	Authorised SAP Assessor	Passed
Space heating control: Time and temperature zone control - plumbing circuit	Authorised SAP Assessor	Passed
i	Evidence de emission from proposed dwelling does not exceed the target Fuel = N/A Fuel factor = 1.00 TER = 16.02 DER = 12.49 DER 12.49 < TER 16.02 DFEE 53.33 < TFEE 68.06 e building fabric and the heating, hot water and fixed lighting systems should Element Weighted average Highest Wall 0.15 (max 0.30) 0.15 (max 0.70) Party wall (no party wall) Floor 0.10 (max 0.25) 0.10 (max 0.70) Roof 0.11 (max 0.20) 0.11 (max 0.35) Openings 1.41 (max 2.00) 1.50 (max 3.30) Thermal bridging calculated from linear thermal transmittances for each junction Main heating system: Mains gas, Regular boiler from database Ravenheat CSI System A Efficiency = 90.10% - SEDBUK 2009 Minimum = 88.00% Secondary heating system: None Cylinder volume = 300.00 litres Declared cylinder loss = 0.17kWh/day Maximum permitted cylinder loss = 3.18kWh/day Primary hot water pipes are not insulated Space heating control:	Evidence Produced by de emission from proposed dwelling does not exceed the target Fuel = N/A Fuel factor = 1.00 TER = 16.02 DER = 12.49 Authorised SAP Assessor DER 12.49 < TER 16.02 Authorised SAP Assessor DEE 53.33 < TFEE 68.06 Authorised SAP Assessor Authorised SAP Assessor DEE 53.33 < TFEE 68.06 Authorised SAP Assessor Wall 0.15 (max 0.30) 0.15 (max 0.70) Party wall (no party wall) Floor 0.10 (max 0.25) 0.10 (max 0.70) Roof 0.11 (max 0.20) 0.11 (max 0.35) Openings 1.41 (max 2.00) 1.50 (max 3.30) Thermal bridging calculated from linear thermal transmittances for each junction Main heating system: Main heating system: Authorised SAP Assessor Mains gas, Regular boiler from database Ravenheat CSI System A Efficiency = 90.10% - SEDBUK 2009 Minimum = 88.00% Secondary heating rose = 0.17kWh/day Maximum permitted cylinder loss = 0.17kWh/day Maximum permitted cylinder loss = 0.17kWh/day Maximum permitted cylinder loss = 3.18kWh/day Primary hot water pipes are not insulated Space heating control: Authorised SAP Assessor

Check	Evid	ence	Proc	duced by	OK?
Fixed inter	rnal lighting				
Does fixed intern with paragraphs	42 to 44? Stan Low Perc	edule of installed fixed internal lighting dard lights = 0 energy lights = 20 entage of low energy lights = 100% imum = 75 %	Autl	norised SAP Assessor	Passed
Criterion 3: the d	lwelling has appropriat	e passive control measures to limit solar gains			
Does the dwelling strong tendency summertime tem	to high Ove nperatures? Ove Regi The Ven	rheating risk (June) = Not significant (19.25°) rheating risk (July) = Slight (21°) rheating risk (August) = Slight (20.69°) on = Thames rmal mass parameter = 250.00 tilation rate in hot weather = 2.50 ach ds/curtains = None	Autl	norised SAP Assessor	Passed
Criterion 4: the p	erformance of the dw	elling, as designed, is consistent with the DER			
Design air perme (m³/(h.m²) at 50P	•	gn air permeability = 4.00 air permeability = 10.00	Autl	norised SAP Assessor	Passed
Mechanical venti Specific fan powe	er (SFP) SFP	hanical extract ventilation: = 0.18 W/(litre/sec) SFP = 0.7 W/(litre/sec)	Auth	norised SAP Assessor	Passed
Have the key feat design been inclu in practice?	uded (or bettered) The The The The The The The Spac	following floors have a U-value less than 0.13W/m²K: Floor 1 (0.10) following roofs have a U-value less than 0.13W/m²K: Roof 1 (0.11) Roof 2 (0.11) Roof 3 (0.11) Imal bridging y value (0.033) is less than 0.04 the cooling is specified of the following low carbon or renewable technologies: Photovoltaic array	Autl	norised SAP Assessor	

Sap 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	Ms Rachell wootliff	Assessor number	8847
Client		Last modified	25/02/2017
Address	1, London		

1. Overall dwelling dime	ensions			
		Area (m²)	Average storey height (m)	Volume (m³)
Lowest occupied		120.21 (1a) x	3.00 (2a) =	360.63 (3a)
+1		94.70 (1b) x	3.50 (2b) =	331.45 (3b)
+2		79.35 (1c) x	2.70 (2c) =	214.25 (3c)
Total floor area	(1a) + (1b) + (1c) + (1d)	(1n) = 294.26 (4)		
Dwelling volume			(3a) + (3b) + (3c) + (3d)(3n) = 906.33 (5)
2. Ventilation rate				
				m³ per hour
Number of chimneys			1 x 40	= 40 (6a)
Number of open flues			1 x 20	= 20 (6b)
Number of intermittent fa	ans		0 x 10	= 0 (7a)
Number of passive vents			0 x 10	= 0 (7b)
Number of flueless gas fir	res		1 x 40	= 40 (7c)
				Air changes per hour
Infiltration due to chimne	eys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 100 ÷ (5)	= 0.11 (8)
If a pressurisation test ha	s been carried out or is intended	l, proceed to (17), otherwise continu	e from (9) to (16)	
Air permeability value, q5	50, expressed in cubic metres pe	r hour per square metre of envelope	e area	4.00 (17)
If based on air permeabili	ity value, then (18) = [(17) ÷ 20]	+ (8), otherwise (18) = (16)		0.31 (18)
Number of sides on which	h the dwelling is sheltered			2 (19)

Infiltration rate incorporating shelter factor

Shelter factor

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average	wind spee	d from Tab	le 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													
	0.34	0.33	0.32	0.29	0.28	0.25	0.25	0.24	0.26	0.28	0.30	0.31	(22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system

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

) whole hou	whole house extract ventilation or positive input ventilation from outside												
	0.59	0.58	0.57	0.54	0.53	0.50	0.50	0.50	0.51	0.53	0.55	0.56	(24c)



0.50

N/A

0.85

0.26

1 - [0.075 x (19)] =

(18) x (20) =

(23a)

(23c)

3.68

3.68

3.80

3.80

3.68

3.80

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

3.43

3.80

3.68

3.80

3.80

(56)

If the vessel co	ontains dedica	ated solar st	torage or d	edicated W	/WHRS (56)	m x [(47) -	Vs] ÷ (47),	else (56)					
	3.80	3.43	3.80	3.68	3.80	3.68	3.80	3.80	3.68	3.80	3.68	3.80	(57)
Primary circuit	loss for each	month froi	m Table 3		•	!	!		-1-	!	•		
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)
Combi loss for	each month	from Table	3a, 3b or 3	С									. ,
	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 requ				ļ.			1	1	1		1 5.55		(/
	180.64	158.10	163.40	142.82	137.31	118.89	110.56	126.31	127.65	148.28	161.38	175.06	(62)
Solar DHW inp				_	1	110.00	120.00	1 120.01		1 10.20	102.00	270.00	(02)
20.0. 2p	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 w		I		l .	1		0.00	0.00	0.00	0.00	0.00	0.00	(03)
Output from w	180.64	158.10	163.40	142.82	137.31	118.89	110.56	126.31	127.65	148.28	161.38	175.06	
	180.04	138.10	103.40	142.02	137.31	110.09	110.50	120.31	127.03				(EA)
Hoat gains from	m water heat	ing (k\\/h/m	onth) 0.21	= v [0 0E v	(15)m ± (61	\m] + 0 0 v	[(46)m + (57)m + (50)	\ml	∑(64)1	12 –	1/30.36	(64)
Heat gains fror		· ·	-	1						F4.00	FF 20	F0.00	(CE)
	61.84	54.17	56.11	49.21	47.43	41.25	38.54	43.77	44.16	51.08	55.38	59.98	(65)
5. Internal ga	ins												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gain	ıs (Table 5)												
	187.47	187.47	187.47	187.47	187.47	187.47	187.47	187.47	187.47	187.47	187.47	187.47	(66)
Lighting gains ((calculated in	Appendix L	., equation	L9 or L9a),	also see Ta	ıble 5					•		
	104.45	92.77	75.44	57.12	42.70	36.05	38.95	50.63	67.95	86.28	100.70	107.35	(67)
Appliance gain	s (calculated	in Appendi	x L, equation	on L13 or Li	13a), also se	ee Table 5							` ,
	677.01	684.04		ı									
		1 084.04 1	666.34	628.65	581.07	536.36	506.49	499.46	517.17	554.85	602.43	647.14	(68)
Cooking gains (666.34	628.65 L15 or L15	581.07 a). also see	536.36 Table 5	506.49	499.46	517.17	554.85	602.43	647.14	(68)
Cooking gains ((calculated in	n Appendix I	L, equation	L15 or L15	a), also see	Table 5							
	(calculated in 56.87	56.87					56.87	56.87	56.87	56.87	56.87		(68) (69)
Cooking gains ((calculated in 56.87	56.87 5a)	_, equation 56.87	L15 or L15 56.87	a), also see 56.87	Table 5 56.87	56.87	56.87	56.87	56.87	56.87	56.87	(69)
Pump and fan g	(calculated in 56.87 gains (Table !	56.87 56.87 5a)	L, equation	L15 or L15	a), also see	Table 5						56.87	
	(calculated in 56.87 gains (Table 9 3.00 poration (Tal	56.87 56.87 5a) 3.00 ble 5)	56.87 3.00	L15 or L15 56.87 3.00	a), also see 56.87	Table 5 56.87 3.00	3.00	3.00	3.00	3.00	3.00	3.00	(69) (70)
Pump and fan g	56.87 gains (Table 9 3.00 sporation (Tal	56.87 56.87 5a) 3.00 ble 5)	_, equation 56.87	L15 or L15 56.87	a), also see 56.87	Table 5 56.87	56.87	56.87	56.87	56.87	56.87	3.00	(69)
Pump and fan g	(calculated in 56.87) gains (Table 9 3.00) poration (Table 9 124.98) gains (Table 9 124.98)	56.87 56.87 5a) 3.00 ble 5) -124.98	3.00 -124.98	15 or L15 56.87 3.00	a), also see 56.87 3.00 -124.98	Table 5 56.87 3.00 -124.98	3.00	3.00 -124.98	3.00	3.00	3.00	3.00	(69) (70) (71)
Pump and fan a Losses e.g. eva Water heating	(calculated in 56.87 gains (Table 9 3.00 poration (Tale 124.98 gains (Table 83.12	3.00 ble 5) -124.98 80.61	3.00 -124.98	L15 or L15 56.87 3.00 -124.98	a), also see 56.87 3.00 -124.98	Table 5 56.87 3.00 -124.98	3.00	3.00	3.00	3.00	3.00	3.00	(69) (70)
Pump and fan g	(calculated in 56.87) gains (Table 9 3.00) poration (Tal -124.98) gains (Table 83.12) gains (66)m -	3.00 ble 5) -124.98 50.61 + (67)m + (6	3.00 -124.98 75.41 8)m + (69)	15 or L15 56.87 3.00 -124.98 68.34 m + (70)m	a), also see 56.87 3.00 -124.98 63.75 + (71)m + (7	Table 5 56.87 3.00 -124.98 57.29 72)m	3.00 -124.98 51.80	3.00 -124.98 58.83	3.00 -124.98 61.34	3.00 -124.98 68.65	3.00 -124.98 76.92	3.00 -124.98 80.62	(69) (70) (71) (72)
Pump and fan a Losses e.g. eva Water heating	(calculated in 56.87 gains (Table 9 3.00 poration (Tale 124.98 gains (Table 83.12	3.00 ble 5) -124.98 80.61	3.00 -124.98	L15 or L15 56.87 3.00 -124.98	a), also see 56.87 3.00 -124.98	Table 5 56.87 3.00 -124.98	3.00	3.00 -124.98	3.00	3.00	3.00	3.00 -124.98 80.62	(69) (70) (71)
Pump and fan a Losses e.g. eva Water heating	(calculated in 56.87) gains (Table 93.00) sporation (Tal -124.98) gains (Table 83.12) gains (66)m -1986.94	3.00 ble 5) -124.98 50.61 + (67)m + (6	3.00 -124.98 75.41 8)m + (69)	15 or L15 56.87 3.00 -124.98 68.34 m + (70)m	a), also see 56.87 3.00 -124.98 63.75 + (71)m + (7	Table 5 56.87 3.00 -124.98 57.29 72)m	3.00 -124.98 51.80	3.00 -124.98 58.83	3.00 -124.98 61.34	3.00 -124.98 68.65	3.00 -124.98 76.92	3.00 -124.98 80.62	(69) (70) (71) (72)
Pump and fan g Losses e.g. eva Water heating Total internal g	(calculated in 56.87) gains (Table 93.00) sporation (Tal -124.98) gains (Table 83.12) gains (66)m -1986.94	3.00 ble 5) -124.98 50.61 + (67)m + (6	3.00 -124.98 75.41 8)m + (69)	3.00 -124.98 68.34 m + (70)m -	a), also see 56.87 3.00 -124.98 63.75 + (71)m + (7) 809.88	Table 5 56.87 3.00 -124.98 57.29 752.05	3.00 -124.98 51.80	3.00 -124.98 58.83	3.00 -124.98 61.34	3.00 -124.98 68.65	3.00 -124.98 76.92	3.00 -124.98 80.62	(69) (70) (71) (72)
Pump and fan g Losses e.g. eva Water heating Total internal g	(calculated in 56.87) gains (Table 93.00) sporation (Tal -124.98) gains (Table 83.12) gains (66)m -1986.94	3.00 ble 5) -124.98 50.61 + (67)m + (6	3.00 -124.98 75.41 8)m + (69)	3.00 -124.98 68.34 m+(70)m 876.47	a), also see 56.87 3.00 -124.98 63.75 + (71)m + (7) 809.88	Table 5 56.87 3.00 -124.98 57.29 752.05	56.87 3.00 -124.98 51.80 719.59	56.87 3.00 -124.98 58.83 731.28	56.87 3.00 -124.98 61.34 768.81	3.00 -124.98 68.65 832.15	56.87 3.00 -124.98 76.92 902.40	3.00 -124.98 80.62	(69) (70) (71) (72)
Pump and fan g Losses e.g. eva Water heating Total internal g	(calculated in 56.87) gains (Table 93.00) sporation (Tal -124.98) gains (Table 83.12) gains (66)m -1986.94	3.00 ble 5) -124.98 50.61 + (67)m + (6	3.00 -124.98 75.41 8)m + (69) 939.55 Access f	1.15 or L15 56.87 3.00 -124.98 68.34 m + (70)m = 876.47	a), also see 56.87 3.00 -124.98 63.75 + (71)m + (71)m + (71)m + (72)m + (72	Table 5 56.87 3.00 -124.98 57.29 752.05	56.87 3.00 -124.98 51.80 719.59 ar flux	56.87 3.00 -124.98 58.83 731.28 spec	3.00 -124.98 61.34 768.81 g iffic data	56.87 3.00 -124.98 68.65 832.15 FF specific or Table	56.87 3.00 -124.98 76.92 902.40 data	3.00 -124.98 80.62 957.48 Gains W	(69) (70) (71) (72) (73)
Pump and fan g Losses e.g. eva Water heating Total internal g 6. Solar gains	(calculated in 56.87) gains (Table 93.00) sporation (Tal -124.98) gains (Table 83.12) gains (66)m -1986.94	3.00 ble 5) -124.98 50.61 + (67)m + (6	3.00 -124.98 75.41 8)m + (69) 939.55 Access f Table	1.15 or L15 56.87 3.00 -124.98 68.34 m + (70)m 876.47 6d 7 x	a), also see 56.87 3.00 -124.98 63.75 + (71)m + (78) 809.88 Area m² 5.43	Table 5 56.87 3.00 -124.98 57.29 752.05 Sol	56.87 3.00 -124.98 51.80 719.59 ar flux y/m² 1.28 x	56.87 3.00 -124.98 58.83 731.28 spec or T	56.87 3.00 -124.98 61.34 768.81 g ific data able 6b 0.60 x	56.87 3.00 -124.98 68.65 832.15 FF specific or Table 0.80	56.87 3.00 -124.98 76.92 902.40 data e 6c	3.00 -124.98 80.62 957.48 Gains W 20.38	(69) (70) (71) (72) (73)
Pump and fan g Losses e.g. eva Water heating Total internal g	(calculated in 56.87) gains (Table 93.00) sporation (Tal -124.98) gains (Table 83.12) gains (66)m -1986.94	3.00 ble 5) -124.98 50.61 + (67)m + (6	75.41 8)m + (69) 939.55 Access f Table	15 or L15 56.87 3.00 -124.98 68.34 m + (70)m 876.47 factor 6d 7 x 7 x	a), also see 56.87 3.00 -124.98 63.75 + (71)m + (71	Table 5 56.87 3.00 -124.98 57.29 752.05 Sol W	56.87 3.00 -124.98 51.80 719.59 ar flux V/m² 1.28 x 6.79 x	56.87 3.00 -124.98 58.83 731.28 spec or T 0.9 x 0.9 x	3.00 -124.98 61.34 768.81 g iffic data	56.87 3.00 -124.98 68.65 832.15 FF specific or Table 1 0.80 1 0.80	56.87 3.00 -124.98 76.92 902.40 data 6c = [3.00 -124.98 80.62 957.48 Gains W 20.38 87.88	(69) (70) (71) (72) (73) (75) (77)
Pump and fan g Losses e.g. eva Water heating Total internal g 6. Solar gains	(calculated in 56.87) gains (Table 93.00) sporation (Tal -124.98) gains (Table 83.12) gains (66)m -1986.94	3.00 ble 5) -124.98 50.61 + (67)m + (6	3.00 -124.98 75.41 8)m + (69) 939.55 Access f Table	15 or L15 56.87 3.00 -124.98 68.34 m + (70)m 876.47 factor 6d 7 x 7 x	a), also see 56.87 3.00 -124.98 63.75 + (71)m + (78) 809.88 Area m² 5.43	Table 5 56.87 3.00 -124.98 57.29 752.05 Sol W	56.87 3.00 -124.98 51.80 719.59 ar flux V/m² 1.28 x 6.79 x	56.87 3.00 -124.98 58.83 731.28 spec or T 0.9 x 0.9 x	56.87 3.00 -124.98 61.34 768.81 g ific data able 6b 0.60 x	56.87 3.00 -124.98 68.65 832.15 FF specific or Table 1 0.80 1 0.80	56.87 3.00 -124.98 76.92 902.40 data 6c = [3.00 -124.98 80.62 957.48 Gains W 20.38 87.88 9.01	(69) (70) (71) (72) (73) (75) (77) (81)
Pump and fan g Losses e.g. eva Water heating Total internal g 6. Solar gains NorthEast SouthEast	(calculated in 56.87) gains (Table 93.00) sporation (Tal -124.98) gains (Table 83.12) gains (66)m -1986.94	3.00 ble 5) -124.98 50.61 + (67)m + (6	75.41 8)m + (69) 939.55 Access f Table	1.15 or L15 56.87 3.00 -124.98 68.34 m + (70)m 876.47 6d 7 x 7 x 7 x	a), also see 56.87 3.00 -124.98 63.75 + (71)m + (71	Table 5 56.87 3.00 -124.98 57.29 752.05 Sol W x 1 x 3 x 1	56.87 3.00 -124.98 51.80 719.59 ar flux y/m² 1.28 x 6.79 x 1.28 x	56.87 3.00 -124.98 58.83 731.28 spec or T 0.9 x 0.9 x 0.9 x	56.87 3.00 -124.98 61.34 768.81 g ific data able 6b 0.60	56.87 3.00 -124.98 68.65 832.15 FF specific or Table 0.80 0.80 0.80	56.87 3.00 -124.98 76.92 902.40 data e 6c = [= [3.00 -124.98 80.62 957.48 Gains W 20.38 87.88 9.01 190.07	(69) (70) (71) (72) (73) (75) (77) (81) (79)
Pump and fan g Losses e.g. eva Water heating Total internal g 6. Solar gains NorthEast SouthEast NorthWest	(calculated in 56.87) gains (Table 93.00) sporation (Tal -124.98) gains (Table 83.12) gains (66)m -1986.94	3.00 ble 5) -124.98 50.61 + (67)m + (6	75.41 8)m + (69) 939.55 Access f Table	1.15 or L15 56.87 3.00 -124.98 68.34 m + (70)m 876.47 actor 6d 7	a), also see 56.87 3.00 -124.98 63.75 + (71)m + (71	Table 5 56.87 3.00 -124.98 57.29 752.05 Sol W x	3.00 -124.98 51.80 719.59 ar flux //m² 1.28	56.87 3.00 -124.98 58.83 731.28 spec or T 0.9 x 0.9 x 0.9 x 0.9 x	56.87 3.00 -124.98 61.34 768.81 gific data rable 6b 0.60 x 0.60 x 0.60 x	56.87 3.00 -124.98 68.65 832.15 FF specific or Table 0.80 0.80 0.80 0.80	56.87 3.00 -124.98 76.92 902.40 data 6c = [= [= [3.00 -124.98 80.62 957.48 Gains W 20.38 87.88 9.01 190.07	(69) (70) (71) (72) (73) (75) (77) (81)
Pump and fan g Losses e.g. eva Water heating Total internal g 6. Solar gains NorthEast SouthEast NorthWest SouthWest	(calculated in 56.87) gains (Table 93.00) sporation (Tal -124.98) gains (Table 83.12) gains (66)m -1986.94	3.00 ble 5) -124.98 50.61 + (67)m + (6	75.41 8)m + (69) 939.55 Access f Table 0.7 0.7	1.15 or L15 56.87 3.00 -124.98 68.34 m + (70)m 876.47 6d 7	a), also see 56.87 3.00 -124.98 63.75 + (71)m + (71	Table 5 56.87 3.00 -124.98 57.29 752.05 Sol W x 1 x 3 x 1 x 3 x 1	56.87 3.00 -124.98 51.80 719.59 ar flux y/m² 1.28 x 6.79 x 1.28 x 6.79 x 9.64 x	56.87 3.00 -124.98 58.83 731.28 spec or T 0.9 x 0.9 x 0.9 x 0.9 x	56.87 3.00 -124.98 61.34 768.81 g ific data rable 6b 0.60 x 0.60 x 0.60 x 0.60 x	56.87 3.00 -124.98 68.65 832.15 FF specific or Table 0.80 0.80 0.80 0.80 0.80	56.87 3.00 -124.98 76.92 902.40 data e 6c = [= [= [3.00 -124.98 80.62 957.48 Gains W 20.38 87.88 9.01 190.07 23.52	(69) (70) (71) (72) (73) (75) (77) (81) (79)
Pump and fan g Losses e.g. eva Water heating Total internal g 6. Solar gains NorthEast SouthEast NorthWest SouthWest West	(calculated in 56.87) gains (Table 93.00) sporation (Tal -124.98) gains (Table 83.12) gains (66)m -1986.94	3.00 ble 5) -124.98 50.61 + (67)m + (6	75.41 8)m + (69) 939.55 Access f Table 0.7' 0.7' 0.7'	1.15 or L15 56.87 3.00 -124.98 68.34 m + (70)m 876.47 6d 7	a), also see 56.87 3.00 -124.98 63.75 + (71)m + (71	Table 5 56.87 3.00 -124.98 57.29 752.05 Sol W x	3.00 -124.98 51.80 719.59 ar flux //m² 1.28	56.87 3.00 -124.98 58.83 731.28 spec or T 0.9 x 0.9 x 0.9 x 0.9 x 0.9 x 0.9 x	56.87 3.00 -124.98 61.34 768.81 gific data rable 6b 0.60 x 0.60 x	56.87 3.00 -124.98 68.65 832.15 FF specific or Table 0.80 0.80 0.80 0.80 0.80 0.80 0.80	56.87 3.00 -124.98 76.92 902.40 data 6c = [= [= [= [3.00 -124.98 80.62 957.48 Gains W 20.38 87.88 9.01 190.07 23.52 36.39	(69) (70) (71) (72) (73) (75) (77) (81) (79) (80)
Pump and fan g Losses e.g. eva Water heating Total internal g 6. Solar gains NorthEast SouthEast NorthWest SouthWest West East	(calculated in 56.87 gains (Table 9.00 gains (Table 9.00 gains (Table 9.00 gains (66)m 9.00	3.00 ble 5) -124.98 5) 80.61 + (67)m + (6	3.00 -124.98 75.41 8)m + (69) 939.55 Access f Table 0.7' 0.7' 0.7' 0.7' 0.7'	1.15 or L15 56.87 3.00 -124.98 68.34 m + (70)m 876.47 6d 7	a), also see 56.87 3.00 -124.98 63.75 + (71)m + (71	Table 5 56.87 3.00 -124.98 57.29 752.05 Sol W x	3.00 -124.98 51.80 719.59 ar flux //m² 1.28	56.87 3.00 -124.98 58.83 731.28 spec or T 0.9 x 0.9 x 0.9 x 0.9 x 0.9 x 0.9 x	56.87 3.00 -124.98 61.34 768.81 g ific data rable 6b 0.60 x 0.60 x	56.87 3.00 -124.98 68.65 832.15 FF specific or Table 0.80 0.80 0.80 0.80 0.80 0.80 0.80	56.87 3.00 -124.98 76.92 902.40 data 6c = [= [= [= [3.00 -124.98 80.62 957.48 Gains W 20.38 87.88 9.01 190.07 23.52 36.39	(69) (70) (71) (72) (73) (75) (77) (81) (79) (80) (76)
Pump and fan g Losses e.g. eva Water heating Total internal g 6. Solar gains NorthEast SouthEast NorthWest West East North	(calculated in 56.87 gains (Table 9.00 gains (Table 9.00 gains (Table 9.00 gains (66)m 9.00	3.00 ble 5) -124.98 5) 80.61 + (67)m + (6	3.00 -124.98 75.41 8)m + (69) 939.55 Access f Table 0.7' 0.7' 0.7' 0.7' 0.7'	1.15 or L15 56.87 3.00 -124.98 68.34 m + (70)m 876.47 6d 7	a), also see 56.87 3.00 -124.98 63.75 + (71)m + (71	Table 5 56.87 3.00 -124.98 57.29 752.05 Sol W x	3.00 -124.98 51.80 719.59 ar flux //m² 1.28	56.87 3.00 -124.98 58.83 731.28 spec or T 0.9 x 0.9 x 0.9 x 0.9 x 0.9 x 0.9 x	56.87 3.00 -124.98 61.34 768.81 g ific data rable 6b 0.60 x 0.60 x	56.87 3.00 -124.98 68.65 832.15 FF specific or Table 0.80 0.80 0.80 0.80 0.80 0.80 0.80	56.87 3.00 -124.98 76.92 902.40 data 6c = [= [= [= [3.00 -124.98 80.62 957.48 Gains W 20.38 87.88 9.01 190.07 23.52 36.39 12.91	(69) (70) (71) (72) (73) (75) (77) (81) (79) (80) (76)

1367.10	1654.92	1930.05	2204.94	2382.52	2348.48	2244.24	2069.76	1876.44	1596.94	1362.93	1279.37	(84
al tempera	ture (heatii	ng season)										
ring heating	g periods in	the living a	area from T	able 9, Th1	(°C)						21.00	(85
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
r for gains f	or living are	ea n1,m (se	e Table 9a)									
1.00	1.00	0.99	0.98	0.92	0.78	0.61	0.67	0.90	0.99	1.00	1.00	(86
emp of livin	g area T1 (s	teps 3 to 7	in Table 9c)								
19.90	20.02	20.22	20.50	20.74	20.90	20.94	20.93	20.82	20.50	20.16	19.90	(87
ring heating	g periods in	the rest of	dwelling fr	om Table 9), Th2(°C)							
19.94	19.95	19.95	19.98	19.99	20.01	20.01	20.01	20.00	19.99	19.97	19.96	(88
r for gains f	or rest of d	welling n2,										1
1.00	1.00	0.99	0.97	0.89	0.69	0.48	0.55	0.85	0.98	1.00	1.00	(89
emperature	in the rest	of dwelling				1						1
18.45	18.64	18.94	19.36	19.69	19.90	19.93	19.93				18.47	(90
ion			6 . <i>6</i>	/a = 0: -:				Liv	∕ing area ÷	(4) =	0.16	(91
		1	_				4				T	1 .
							20.09	19.98	19.56	19.08	18.70	(92
							40.0	40.0=	40.11	1055	T 40 == '	
18.54	18.72	19.00	19.40	19.71	19.91	19.95	19.94	19.83	19.41	18.93	18.55	(93
g requirem	ent											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
r for gains,	ηm											
1.00	1.00	0.99	0.96	0.88	0.68	0.47	0.54	0.83	0.98	1.00	1.00	(94
Gm, W (94	l)m x (84)m											
1365.34	1649.15	1909.69	2121.26	2088.64	1599.14	1057.89	1109.42	1563.98	1562.60	1358.91	1278.22	(95
e external t	emperature	from Tabl	e 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
r mean inte	ernal tempe	rature, Lm	, W [(39)m	x [(93)m -	(96)m]							
4913.89	4740.22	4263.27	3477.84	2638.79	1697.01	1069.29	1131.19	1851.91	2900.18	3941.48	4839.24	(97
quirement,	, kWh/mon	th 0.024 x	[(97)m - (9!	5)m] x (41)ı	m							
2640.12	2077.20	C										
	2077.20	1751.07	976.74	409.32	0.00	0.00	0.00	0.00	995.16	1859.45	2649.40	l
	2077.20	1751.07	976.74	409.32	0.00	0.00	0.00		995.16 3)15, 10	·	2649.40 3358.45	(98
equirement			976.74	409.32	0.00	0.00	0.00		3)15, 10	.12 = 13		, . 1
	kWh/m²/ye		976.74	409.32	0.00	0.00	0.00		3)15, 10	.12 = 13	3358.45] (98 (99
ng requiren	kWh/m²/ye	ear						∑(98	(98)	.12 = 13 ÷ (4)	3358.45 45.40	, . 1
ng requiren Jan	kWh/m²/ye		976.74 Apr	409.32 May	0.00 Jun	0.00	0.00 Aug		3)15, 10	.12 = 13	3358.45	, . 1
ng requiren Jan	kWh/m²/ye nent Feb	ear Mar	Apr	May	Jun	Jul	Aug	∑(98 Sep	(98) Oct	.12 = 13 ÷ (4)	3358.45 45.40 Dec	(99
ng requiren Jan n 0.00	kWh/m²/ye	ear						∑(98	(98)	.12 = 13 ÷ (4)	3358.45 45.40	(99
Jan n 0.00 r for loss nn	kWh/m²/ye	ear Mar	Apr 0.00	May 0.00	Jun 3002.38	Jul 2363.58	Aug 2426.10	∑(98 Sep	(98) Oct	.12 = 13 ÷ (4) Nov	3358.45 45.40 Dec	(10
ng requiren Jan n 0.00	kWh/m²/ye	Mar 0.00	Apr	May	Jun	Jul	Aug	∑(98 Sep	(98) Oct	.12 = 13 ÷ (4)	3358.45 45.40 Dec	(10
Jan 0.00 r for loss nn 0.00 m (watts) (:	kWh/m²/ye	Mar 0.00 0.00 0.1)m	Apr 0.00 0.00	May 0.00	Jun 3002.38	Jul 2363.58	Aug 2426.10 0.82	∑(98 Sep	(98) Oct	.12 = 13 ÷ (4) Nov 0.00	3358.45 45.40 Dec 0.00	(100)
Jan n 0.00 r for loss nn 0.00	kWh/m²/ye nent Feb 0.00 n 0.00 100)m x (10	Mar 0.00	Apr 0.00	May 0.00	Jun 3002.38	Jul 2363.58	Aug 2426.10	∑(98 Sep 0.00	(98) Oct 0.00	.12 = 13 ÷ (4) Nov	3358.45 45.40 Dec	(100)
Jan 0.00 r for loss nn 0.00 m (watts) (:	kWh/m²/ye nent Feb 0.00 n 0.00 100)m x (10	Mar 0.00 0.00 0.1)m	Apr 0.00 0.00	May 0.00	Jun 3002.38 0.78 2333.51	Jul 2363.58	Aug 2426.10 0.82	∑(98 Sep 0.00	(98) Oct 0.00	.12 = 13 ÷ (4) Nov 0.00	3358.45 45.40 Dec 0.00	(100)
Jan n 0.00 r for loss nn 0.00 m (watts) (:	kWh/m²/ye nent Feb 0.00 n 0.00 100)m x (10 0.00	Mar 0.00 0.00 0.00 0.00 0.00	Apr 0.00 0.00 0.00	0.00 0.00 0.00	Jun 3002.38 0.78 2333.51 2615.01	Jul 2363.58 0.86 2039.27	Aug 2426.10 0.82 1979.14	∑(98 Sep 0.00 0.00	Oct 0.00 0.00	.12 = 13 ÷ (4) Nov 0.00 0.00	3358.45 45.40 Dec 0.00] (99] (10
Jan n 0.00 r for loss nn 0.00 m (watts) (3 0.00 0.00 quirement,	kWh/m²/ye nent Feb 0.00 n 0.00 100)m x (10 0.00 0.00 whole dwe	Mar 0.00 0.00 0.00 0.00 0.00 elling, conti	0.00 0.00 0.00 0.00 nuous (kW	0.00 0.00 0.00 0.00 0.00	Jun 3002.38 0.78 2333.51 2615.01 (103)m - (1	Jul 2363.58 0.86 2039.27 2498.65 02)m] x (41	Aug 2426.10 0.82 1979.14 2292.74	∑(98 Sep 0.00 0.00 0.00	Oct 0.00 0.00 0.00	.12 = 1: ÷ (4)	3358.45 45.40 Dec 0.00 0.00 0.00	(100)
Jan n 0.00 for loss nn 0.00 m (watts) (3	kWh/m²/ye nent Feb 0.00 n 0.00 100)m x (10 0.00	Mar 0.00 0.00 0.00 0.00 0.00	Apr 0.00 0.00 0.00	0.00 0.00 0.00	Jun 3002.38 0.78 2333.51 2615.01	Jul 2363.58 0.86 2039.27	Aug 2426.10 0.82 1979.14	∑(98 Sep 0.00 0.00	Oct 0.00 0.00	.12 = 1: ÷ (4)	3358.45 45.40 Dec 0.00	, . 1
	ring heating Jan for gains for 1.00 emp of living 19.90 ring heating 19.94 for gains for 1.00 emperature 18.45 on emperature 18.69 ent to the me 18.54 grequirem Jan for gains,	ring heating periods in Jan Feb for gains for living area 1.00 1.00 emp of living area T1 (s 19.90 20.02 ring heating periods in 19.94 19.95 for gains for rest of do 1.00 1.00 emperature in the rest 18.45 18.64 on emperature for the who 18.69 18.87 ot to the mean internal 18.54 18.72 grequirement Jan Feb for gains, ηm 1.00 1.00 Gm, W (94)m x (84)m 1365.34 1649.15 e external temperature 4.30 4.90 r mean internal tempe 4913.89 4740.22 quirement, kWh/mon	Jan Feb Mar for gains for living area n1,m (sec.) 1.00 0.99 emp of living area T1 (steps 3 to 7 19.90 20.02 20.22 ring heating periods in the rest of 19.94 19.95 19.95 for gains for rest of dwelling n2,0 1.00 1.00 0.99 emperature in the rest of dwelling n2,0 18.45 18.64 18.94 on 18.45 18.64 18.94 on 18.69 18.87 19.15 at to the mean internal temperature for the whole dwelling n2,0 18.69 18.87 19.15 at to the mean internal temperature for the whole dwelling n2,0 18.69 18.87 19.15 at to the mean internal temperature for the whole dwelling n2,0 18.69 18.87 19.15 at to the mean internal temperature for for gains, ηm 1.00 0.99 19.00 are grequirement Jan Feb Mar 19.00 are with the rest of dwelling n2,0 19.00 19.00 19.00 19.00 are gains, nm 1.00 0.99 19.00 19.00	Jan Feb Mar Apr Feb Mar Apr Feb Mar Apr For gains for living area n1,m (see Table 9a) 1.00 1.00 0.99 0.98 mp of living area T1 (steps 3 to 7 in Table 9c 19.90 20.02 20.22 20.50 20.94 20.95 20	ring heating periods in the living area from Table 9, Th1 Jan Feb Mar Apr May for gains for living area n1,m (see Table 9a) 1.00 1.00 0.99 0.98 0.92 rmp of living area T1 (steps 3 to 7 in Table 9c) 19.90 20.02 20.22 20.50 20.74 ring heating periods in the rest of dwelling from Table 9c 19.94 19.95 19.95 19.98 19.99 for gains for rest of dwelling n2,m 1.00 1.00 0.99 0.97 0.89 rmperature in the rest of dwelling T2 (follow steps 3 to 18.45 18.64 18.94 19.36 19.69 on remperature for the whole dwelling fLA x T1 +(1 - fLA) x T1 18.69 18.87 19.15 19.55 19.86 at to the mean internal temperature from Table 4e where 18.54 18.72 19.00 19.40 19.71 requirement Jan Feb Mar Apr May for gains, nm 1.00 1.00 0.99 0.96 0.88 Gm, W (94)m x (84)m 1365.34 1649.15 1909.69 2121.26 2088.64 e external temperature from Table U1 4.30 4.90 6.50 8.90 11.70 r mean internal temperature, Lm, W [(39)m x [(93)m - 4913.89 4740.22 4263.27 3477.84 2638.79 requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m	ring heating periods in the living area from Table 9, Th1(°C) Jan Feb Mar Apr May Jun for gains for living area n1,m (see Table 9a) 1.00 1.00 0.99 0.98 0.92 0.78 rmp of living area T1 (steps 3 to 7 in Table 9c) 19.90 20.02 20.22 20.50 20.74 20.90 ring heating periods in the rest of dwelling from Table 9, Th2(°C) 19.94 19.95 19.95 19.98 19.99 20.01 r for gains for rest of dwelling n2,m 1.00 1.00 0.99 0.97 0.89 0.69 rmperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9) 18.45 18.64 18.94 19.36 19.69 19.90 on remperature for the whole dwelling fLA x T1 +(1 - fLA) x T2 18.69 18.87 19.15 19.55 19.86 20.06 at to the mean internal temperature from Table 4e where appropring the tothe mean internal temperature from Table 4e where appropring 18.54 18.72 19.00 19.40 19.71 19.91 r for gains, nm 1.00 1.00 0.99 0.96 0.88 0.68 Gm, W (94)m x (84)m 1365.34 1649.15 1909.69 2121.26 2088.64 1599.14 e external temperature from Table U1 4.30 4.90 6.50 8.90 11.70 14.60 r mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]	Fring heating periods in the living area from Table 9, Th1(°C) Jan Feb Mar Apr May Jun Jul For gains for living area n1,m (see Table 9a) 1.00 1.00 0.99 0.98 0.92 0.78 0.61 Import for gains for living area n1,m (see Table 9a) 1.00 1.00 0.99 0.98 0.92 0.78 0.61 Import for gains for living area T1 (steps 3 to 7 in Table 9c) 19.90 20.02 20.22 20.50 20.74 20.90 20.94 Indicate the set of dwelling from Table 9, Th2(°C) 19.94 19.95 19.95 19.98 19.99 20.01 20.01 Infor gains for rest of dwelling n2,m 1.00 1.00 0.99 0.97 0.89 0.69 0.48 Imperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) 18.45 18.64 18.94 19.36 19.69 19.90 19.93 Into the mean internal temperature from Table 4e where appropriate 18.54 18.72 19.00 19.40 19.71 19.91 19.95 Into the mean internal temperature from Table 4e where appropriate 18.54 18.72 19.00 19.40 19.71 19.91 19.95 Into a feb Mar Apr May Jun Jul Into a for gains, nm 1.00 1.00 0.99 0.96 0.88 0.68 0.47 Into a feb Mar Apr May Jun Jul Into a feb Mar Apr	ring heating periods in the living area from Table 9, Th1(*C) Jan Feb Mar Apr May Jun Jul Aug for gains for living area n1,m (see Table 9a) 1.00 1.00 0.99 0.98 0.92 0.78 0.61 0.67 Imp of living area T1 (steps 3 to 7 in Table 9c) 19.90 20.02 20.22 20.50 20.74 20.90 20.94 20.93 ring heating periods in the rest of dwelling from Table 9, Th2(*C) 19.94 19.95 19.95 19.98 19.99 20.01 20.01 20.01 for gains for rest of dwelling n2,m 1.00 1.00 0.99 0.97 0.89 0.69 0.48 0.55 Imperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) 18.45 18.64 18.94 19.36 19.69 19.90 19.93 19.93 on Imperature for the whole dwelling fLA x T1 +(1 - fLA) x T2 18.69 18.87 19.15 19.55 19.86 20.06 20.10 20.09 It to the mean internal temperature from Table 4e where appropriate 18.54 18.72 19.00 19.40 19.71 19.91 19.95 19.94 In grequirement Jan Feb Mar Apr May Jun Jul Aug for gains, nm 1.00 1.00 0.99 0.96 0.88 0.68 0.47 0.54 Gm, W (94)m x (84)m 1365.34 1649.15 1909.69 2121.26 2088.64 1599.14 1057.89 1109.42 exeternal temperature from Table U1 4.30 4.90 6.50 8.90 11.70 14.60 16.60 16.40 r mean internal temperature, Lm, W [(39)m x [(93)m - (96)m] 4913.89 4740.22 4263.27 3477.84 2638.79 1697.01 1069.29 1131.19	ring heating periods in the living area from Table 9, Th1("C) Jan Feb Mar Apr May Jun Jul Aug Sep for gains for living area n1,m (see Table 9a) 1.00 1.00 0.99 0.98 0.92 0.78 0.61 0.67 0.90 mp of living area T1 (steps 3 to 7 in Table 9c) 19.90 20.02 20.22 20.50 20.74 20.90 20.94 20.93 20.82 ring heating periods in the rest of dwelling from Table 9, Th2("C) 19.94 19.95 19.95 19.98 19.99 20.01 20.01 20.01 20.01 20.00 for gains for rest of dwelling n2,m 1.00 1.00 0.99 0.97 0.89 0.69 0.48 0.55 0.85 memberature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) 18.45 18.64 18.94 19.36 19.69 19.90 19.93 19.93 19.81 on time material temperature from Table 4e where appropriate 18.69 18.87 19.15 19.55 19.86 20.06 20.10 20.09 19.98 to to the mean internal temperature from Table 4e where appropriate 18.54 18.72 19.00 19.40 19.71 19.91 19.95 19.94 19.83 grequirement Jan Feb Mar Apr May Jun Jul Aug Sep for gains, nm 1.00 1.00 0.99 0.96 0.88 0.68 0.47 0.54 0.83 Gm, W (94)m x (84)m 1365.34 1649.15 1909.69 2121.26 2088.64 1599.14 1057.89 1109.42 1563.98 external temperature from Table U1 4.30 4.90 6.50 8.90 11.70 14.60 16.60 16.40 14.10 r mean internal temperature, Lm, W [(39)m x [(93)m - (96)m] 4913.89 4740.22 4263.27 3477.84 2638.79 1697.01 1069.29 1131.19 1851.91	ring heating periods in the living area from Table 9, Th1(°C) Jan Feb Mar Apr May Jun Jul Aug Sep Oct	ring heating periods in the living area from Table 9, Th1("C) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov for gains for living area n1,m (see Table 9a) 1.00 1.00 0.99 0.98 0.92 0.78 0.61 0.67 0.90 0.99 1.00 ring of living area T1 (steps 3 to 7 in Table 9c) 19.90 20.02 20.22 20.50 20.74 20.90 20.94 20.93 20.82 20.50 20.16 ring heating periods in the rest of dwelling from Table 9, Th2("C) 19.94 19.95 19.95 19.98 19.99 20.01 20.01 20.01 20.00 19.99 19.97 rfor gains for rest of dwelling n2,m 1.00 1.00 0.99 0.97 0.89 0.69 0.48 0.55 0.85 0.98 1.00 remperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) 18.45 18.64 18.94 19.36 19.69 19.90 19.93 19.93 19.81 19.37 18.87 on Living area ÷ (4) = remperature for the whole dwelling fLA x T1 +(1 - fLA) x T2 18.69 18.87 19.15 19.55 19.86 20.06 20.10 20.09 19.98 19.56 19.08 It to the mean internal temperature from Table 4e where appropriate 18.54 18.72 19.00 19.40 19.71 19.91 19.95 19.94 19.83 19.41 18.93 grequire met Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov rfor gains, nm 1.00 1.00 0.99 0.96 0.88 0.68 0.47 0.54 0.83 0.98 1.00 Gm, W (94)m x (84)m 1365.34 1649.15 1909.69 2121.26 2088.64 1599.14 1057.89 1109.42 1563.98 1562.60 1358.91 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 r mean internal temperature, Lm, W [(39)m x [(93)m - (96)m] 4913.89 4740.22 4263.27 3477.84 2638.79 1697.01 1069.29 1131.19 1851.91 2900.18 3941.48	21.00 1.00

Cooled fraction		>							со	oled area ÷ (4	4) =	0.85	(105)
Intermittency fa		1	1 1				Г	1		1 -		1	7
	0.00	0.00	0.00	0.00	0.00	0.25	0.25	0.25	0.00	0.00	0.00	0.00	
										∑(106)6	.8 =	0.75	(106)
Space cooling re		1					I	1		1		1	7
	0.00	0.00	0.00	0.00	0.00	43.05	72.59	49.56	0.00	0.00	0.00	0.00]
										∑(107)6		165.20	(107)
Space cooling re	equirement	kWh/m²/ye	ear							(107) ÷ (4	4) = [0.56	(108)
9a. Energy req	uirements -	- individual	heating sys	tems inclu	ding micro	-СНР							
Space heating													
Fraction of space	e heat from	n secondary	/supplemer	ntary syster	m (table 11	L)						0.00	(201)
Fraction of space	e heat from	n main syste	em(s)							1 - (20:	1) =	1.00	(202)
Fraction of space	e heat from	n main syste	em 2									0.00	(202)
Fraction of tota	I space heat	t from main	system 1						(2	02) x [1- (203)] =	1.00	(204)
Fraction of tota	l space heat	t from main	system 2							(202) x (203	3) =	0.00	(205)
Efficiency of ma	in system 1	(%)										91.10	(206)
Cooling system	energy effic	ciency ratio	(Table 10c)									3.38	(209)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating f	uel (main sy	vstem 1), kV	Vh/month										
	2898.05	2280.13	1922.14	1072.17	449.31	0.00	0.00	0.00	0.00	1092.38	2041.11	2908.23	
									∑(21	1)15, 101	.2 =	14663.50	(211)
Water heating													
Efficiency of wa	ter heater												
	90.33	90.25	90.08	89.58	88.15	80.40	80.40	80.40	80.40	89.55	90.14	90.35	(217)
Water heating f	uel, kWh/m	nonth											
	199.98	175.18	181.40	159.43	155.76	147.87	137.51	157.10	158.77	165.57	179.03	193.75	
										∑(219a)11	.2 =	2011.34	(219)
Space cooling for	uel, kWh/m	onth											
	0.00	0.00	0.00	0.00	0.00	12.76	21.51	14.68	0.00	0.00	0.00	0.00	
										∑(221)6	.8 =	48.95	(221)
Annual totals													
Space heating f	uel - main s	ystem 1										14663.50	
Water heating f	uel											2011.34	
Space cooling for	uel											48.95	
Electricity for po	umps, fans a	and electric	keep-hot (Table 4f)									
mechanical	ventilation f	fans - balan	ced, extract	or positive	input fron	n outside			258.74				(230a)
central heat	ing pump o	r water pun	np within w	arm air hea	iting unit				30.00				(230c)
boiler flue fa	an								45.00				(230e)
Total electricity	for the abo	ve, kWh/ye	ar									333.74	(231)
Electricity for lig	ghting (Appe	endix L)										737.83	(232)
Energy saving/g	generation t	echnologies	s										
electricity ge	enerated by	PV (Append	dix M)									-1646.70	(233)
Total delivered	energy for a	all uses						(211)(222	1) + (231) +	· (232)(237l	o) = [16148.66	(238)
10a. Fuel costs	s - individua	ıl heating sy	ystems inclu	uding micro	o-CHP								
						Fuel		Fu	uel price			Fuel	
					k۱	Nh/year					C	ost £/year	
Space heating -	main syster	m 1			1	4663.50	x		3.48	x 0.01 =	:	510.29	(240)
												URN: 41	version 1

Water heating	2011.34	х	3.48	x 0.01 =	69.99	(247)
Space cooling	48.95	x	13.19	x 0.01 =	6.46	(248)
Pumps and fans	333.74	x	13.19	x 0.01 =	44.02	(249)
Electricity for lighting	737.83	x	13.19	x 0.01 =	97.32	(250)
Additional standing charges					120.00	(251)
Energy saving/generation technologies						
pv savings	-1646.70	х	13.19	x 0.01 =	-217.20	(252)
Total energy cost			(240)(242) +	- (245)(254) =	630.88	(255)
11a. SAP rating - individual heating systems including micro-CH	Р					7
Energy cost deflator (Table 12)					0.42	(256)
Energy cost factor (ECF)					0.78	∫ (257) ¬
SAP value					89.10	
SAP rating (section 13)					89	(258)
SAP band					В	
12a. CO₂ emissions - individual heating systems including micro	-СНР					
	Energy		Emission factor		Emissions	
	kWh/year		kg CO₂/kWh		kg CO₂/year	
Space heating - main system 1	14663.50	x	0.22	=	3167.32	(261)
Water heating	2011.34	x	0.22	=	434.45	(264)
Space and water heating			(261) + (262) +	(263) + (264) =	3601.77	(265)
Space cooling	48.95	x	0.52	=	25.40	(266)
Pumps and fans	333.74	х	0.52	=	173.21	(267)
Electricity for lighting	737.83	х	0.52	=	382.93	(268)
Energy saving/generation technologies						_
pv savings	-1646.70	x	0.52	=	-854.64	(269)
Total CO ₂ , kg/year				(265)(271) =	3328.68	(272)
Dwelling CO₂ emission rate				(272) ÷ (4) =	11.31	(273)
El value					86.85]
El rating (section 14)					87	(274)
El band					В]
13a. Primary energy - individual heating systems including micr						
	Energy kWh/year		Primary factor		Primary Energy kWh/year	•
Space heating - main system 1	14663.50	х	1.22	=	17889.48	(261)
Water heating	2011.34	x	1.22	=	2453.84	(264)
Space and water heating	2011.54	^		(263) + (264) =	20343.31	(265)
Space cooling	48.95	v	3.07	=	150.27	(266)
Pumps and fans	333.74	X	3.07	=	1024.57	(267)
		X				_
Electricity for lighting Energy saving/generation technologies	737.83	Х	3.07	=	2265.14	(268)
Energy saving/generation technologies	1040 70		2.07		F0FF 37	1,200
Electricity generated - PVs	-1646.70	Х	3.07	=	-5055.37	(269)
Primary energy kWh/year					18727.92	(272)
Dwelling primary energy rate kWh/m2/year					63.64	(273)

Dfee 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	Ms Rachell wootliff	Assessor number	8847
Client		Last modified	25/02/2017
Address	1, London		

1. Overall dwelling dimen	nsions						
		Area (m²)		Average storey height (m)		Volume (m³)	
Lowest occupied		120.21	(1a) x	3.00	2a) =	360.63	(3a)
+1		94.70	(1b) x	3.50	2b) =	331.45	(3b)
+2		79.35	(1c) x	2.70	2c) =	214.25	(3c)
Total floor area	(1a) + (1b) + (1c) + (1d)(1n) =	294.26	(4)				
Dwelling volume				(3a) + (3b) + (3c)	+ (3d)(3n) =	906.33	(5)

2. Ventilation rate				
			m³ per hour	
Number of chimneys	1	x 40 =	40	(6a)
Number of open flues	1	x 20 =	20	(6b)
Number of intermittent fans	4	x 10 =	40	(7a)
Number of passive vents	0	x 10 =	0	(7b)
Number of flueless gas fires	1	x 40 =	40	(7c)
			Air changes pe	r

Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) =	140	÷ (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

If based on air permeability value, then (18) = $[(17) \div 20] + (8)$, otherwise (18) = (16)	0.35
Number of sides on which the dwelling is sheltered	2

Shelter factor	1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(18) x (20) =	0.30	(21)
Infiltration rate modified for monthly wind speed:			

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average	e wind spee	ed from Tab	le 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 infiltra	tion rate (a	llowing for	shelter and	l wind facto	or) (21) x (2	2a)m							
	0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.30	0.32	0.34	0.35	(22b)
Calculate effection	ve air chang	ge rate for t	the annlica	hle case.									

0.38 0.38 0.37 0.33 0.32 0.29	29 0.29	0.28	0.30	0.32	0.34	0.35	(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 fro	om Table 4h					N/A	(23c)						
d) natural ventilation or whole house positive input ventilation from loft													
0.57 0.57 0.57 0.55 0.55 0.55	54 0.54	0.54	0.55	0.55	0.56	0.56	(24d)						



hour

4.00

(17)

(18)

3.68

3.80

3.80

3.68

3.80

3.68

3.80

3.43

3.80

3.68

3.80

(56)

Sab 3.43 3.80 3.68 3.80 3
Combi loss for each month Front Francis Say
Combi loss for each month From Table 3a, 3b or 3c 2a 2a 2a 2a 2a 2a 2a 2
Combi loss for each month Form Table 3a, 3b or 3c 2a, 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 (50)m (61)m (50)m
180.64 158.10 163.40 142.82 137.31 118.89 110.56 126.31 127.65 148.28 161.38 175.06 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 0.0
Output from water heater for each month (kWh/month) (62)m + (63)m 176.84 154.66 159.60 139.14 133.51 115.21 106.76 122.51 123.97 144.48 157.71 171.26 2(64)112 = 1705.65 64) Heat gains from water heating (kWh/month) 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m] 37.58 32.87 33.92 29.57 28.37 24.48 22.69 26.03 26.34 30.70 33.51 36.39 (55) Sinternal gains Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Metabolic gains (Table 5) Lighting gains (calculated in →ppendix → equation → U - U - U - U - U - U - U - U - U - U
Trins
Heat gains from water heating (kWh/morth) 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]
Heat gains from water heating (kWh/month) 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m] 37.58 32.87 33.92 29.57 28.37 24.48 22.69 26.03 26.34 30.70 33.51 36.39 (65) Sinternal gains S
S. Internal gains S. I
S. Internal gains S. Internal gains S. Internal gains Table 5
Metabolic gains (Table 5) Mary May Jun Jul Aug Sep Oct Nov Dec Metabolic gains (Table 5) 156.22 1
Metabolic gains (Table 5) Mary May Jun Jul Aug Sep Oct Nov Dec Metabolic gains (Table 5) 156.22 1
156.22 1
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 41.78
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 41.78
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 453.60 458.31 446.45 421.19 389.32 359.36 339.35 334.64 346.50 371.75 403.63 433.59 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 (69) Pump and fan gains (Table 5a) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 453.60 458.31 446.45 421.19 389.32 359.36 339.35 334.64 346.50 371.75 403.63 433.59 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 (69) Pump and fan gains (Table 5a) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.
453.60 458.31 446.45 421.19 389.32 359.36 339.35 334.64 346.50 371.75 403.63 433.59 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 (69) Pump and fan gains (Table 5a) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 (69) Pump and fan gains (Table 5a) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.
38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 38.62 (69) Pump and fan gains (Table 5a) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.
Pump and fan gains (Table 5a) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0
Losses e.g. evaporation (Table 5) -124.98 -124.98 -124.98 -124.98 -124.98 -124.98 -124.98 -124.98 -124.98 -124.98 -124.98 -124.98 -124.98 -124.98 -124.98 -124.98 -124.98 -124.98 (71) Water heating gains (Table 5) 50.51 48.91 45.58 41.07 38.13 34.00 30.49 34.99 36.59 41.27 46.55 48.91 (72) Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m
-124.98 -124.9
Water heating gains (Table 5) 50.51 48.91 45.58 41.07 38.13 34.00 30.49 34.99 36.59 41.27 46.55 48.91 (72) Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m
50.51 48.91 45.58 41.07 38.13 34.00 30.49 34.99 36.59 41.27 46.55 48.91 (72) Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m
Total internal gains (66)m + (67)m + (68)m + (70)m + (71)m + (72)m
615.75 614.19 592.08 554.97 514.40 477.65 455.28 459.75 480.14 517.40 560.32 595.31 (73)
6. Solar gains
Access factor Area Solar flux g FF Gains
Table 6d m² W/m² specific data specific data W
or Table 6b or Table 6c
NorthEast 0.77 x 5.43 x 11.28 x 0.9 x 0.60 x 0.80 = 20.38 (75)
SouthEast $0.77 x 7.18 x 36.79 x 0.9 x 0.60 x 0.80 = 87.88 (77)$
NorthWest $0.77 x 2.40 x 11.28 x 0.9 x 0.60 x 0.80 = 9.01 (81)$
SouthWest 0.77 x 15.53 x 36.79 x 0.9 x 0.60 x 0.80 = 190.07 (79)
West 0.77 x 3.60 x 19.64 x 0.9 x 0.60 x 0.80 = 23.52 (80)
East 0.77 x 5.57 x 19.64 x 0.9 x 0.60 x 0.80 = 36.39 (76)
North 0.77 x 3.65 x 10.63 x 0.9 x 0.60 x 0.80 = 12.91 (74)
Solar gains in watts ∑(74)m(82)m
380.16 675.14 990.50 1328.47 1572.64 1596.43 1524.65 1338.48 1107.63 764.80 460.52 321.90 (83)
Total gains - internal and solar (73)m + (83)m

	995.91	1289.33	1582.57	1883.45	2087.03	2074.08	1979.93	1798.23	1587.76	1282.19	1020.84	917.20 (84)
7. Mean inter	nal tempera	iture (heati	ng season)									
Temperature di	uring heatin	g periods in	the living	area from T	Γable 9, Th1	.(°C)						21.00 (85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation facto	or for gains t	for living are	ea n1,m (se	ee Table 9a))							
	1.00	1.00	1.00	0.99	0.95	0.85	0.69	0.76	0.95	1.00	1.00	1.00 (86)
Mean internal t	emp of livin	ng area T1 (s	steps 3 to 7	in Table 9	c)							
	19.50	19.66	19.93	20.30	20.64	20.88	20.97	20.95	20.75	20.29	19.83	19.48 (87)
Temperature di	_		1	_	_	1	T	T			T	
Utilization facts	19.95	19.95	19.96	19.97	19.97	19.98	19.98	19.98	19.98	19.97	19.97	19.96 (88)
Utilisation facto	_		_	1	0.03	0.77	0.55	0.63	0.01	0.00	1.00	1.00 (80)
Mean internal t	1.00	1.00	of dwelling	0.98	0.93	0.77	0.55	0.63	0.91	0.99	1.00	1.00 (89)
ivicali iliterilai t	18.57	18.73	19.00	19.37	19.70	19.92	19.97	19.96	19.81	19.37	18.91	18.55 (90)
Living area fract		10.73	15.00	13.37	15.70	13.32	13.57	13.30	!	ving area ÷		0.16 (91)
Mean internal t		e for the wh	ole dwellir	ng fLA x T1 -	+(1 - fLA) x 1	Г2						
	18.72	18.88	19.16	19.52	19.86	20.08	20.13	20.13	19.97	19.52	19.06	18.71 (92)
Apply adjustme	nt to the m	ean interna	l temperat	ure from Ta	able 4e whe	re appropr	riate			•	•	
	18.72	18.88	19.16	19.52	19.86	20.08	20.13	20.13	19.97	19.52	19.06	18.71 (93)
9 Enace heati	na roquiron	nont.										
8. Space heati	ng requiren Jan	Feb	Mar	Apr	May	Jun	Jul	Διισ	Sep	Oct	Nov	Dec
Utilisation facto			iviai	Арі	iviay	Juli	Jui	Aug	Зер	Ott	NOV	Dec
054	1.00	1.00	1.00	0.98	0.93	0.78	0.57	0.65	0.91	0.99	1.00	1.00 (94)
Useful gains, ηr		1										, ,
	995.64	1287.96	1575.87	1847.52	1930.66	1609.49	1137.52	1170.50	1443.23	1272.09	1020.09	917.04 (95)
Monthly averag	ge external t	temperature	e from Tab	le 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 fo	or mean int	ernal tempe	erature, Lm	n, W [(39)m	n x [(93)m -	(96)m]						
	4921.82	4760.94	4297.77	3566.12	2732.05	1815.28	1171.68	1232.86	1952.02	2989.08	4023.56	4902.52 (97)
Space heating r									ı			
	2921.08	2333.84	2025.10	1237.39	596.24	0.00	0.00	0.00	0.00	1277.44	2162.49	2965.20
		1341 / 3/							∑(98	3)15, 10		5518.78 (98)
Space heating r	equirement	: kWn/m²/yo	ear							(98)	÷ (4)	52.74 (99)
8c. Space cool	ing require	ment										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat loss rate L	m											
	0.00	0.00	0.00	0.00	0.00	3115.88	2452.92	2514.38	0.00	0.00	0.00	0.00 (100
Utilisation facto							1			1		
	0.00	0.00	0.00	0.00	0.00	0.75	0.84	0.79	0.00	0.00	0.00	0.00 (101
Useful loss ηmL		_				2005	200:	4005 5	•			
Cains	0.00	0.00	0.00	0.00	0.00	2339.89	2061.54	1988.27	0.00	0.00	0.00	0.00 (102
Gains	0.00	0.00	0.00	0.00	0.00	2501 72	2477 24	2260 00	0.00	0.00	0.00	0.00 (100
Space cooling re	0.00	0.00	0.00	0.00	0.00 h) 0.024 x [2591.72 (103)m - (1	2477.34 02)ml x (41	2268.89 1)m	0.00	0.00	0.00	0.00 (103
Space cooming it	0.00	0.00	0.00	0.00	0.00	181.32	309.35	208.78	0.00	0.00	0.00	0.00
	0.00	1 0.00	0.00	1 0.00	1 0.00	101.32	303.33	200.70	1 0.00	∑(104)6		699.46 (104
										۷,±0+,0	0 =	(104

cooled area ÷ (4) =

1.00

(105)

Intermittency factor (Table 10)

 $\Sigma(106)6...8 = 0.75$ (106)

Space cooling requirement (104)m x (105) x (106)m

 0.00
 0.00
 0.00
 0.00
 45.33
 77.34
 52.20
 0.00
 0.00
 0.00
 0.00

 $\Sigma(107)6...8 = 174.86$ (107)

Space cooling requirement kWh/m²/year

 $(107) \div (4) = 0.59$ (108)

8f. Fabric energy efficiency

Dwelling Fabric Energy Efficiency (DFEE)

(99) + (108) = 53.33 (109)

Tfee 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	Ms Rachell wootliff	Assessor number	8847
Client		Last modified	25/02/2017
Address	1, London		

Address		1, Londo	n										
1. Overall dwellin	ng dimens	sions											
					А	rea (m²)			rage storey eight (m)		Vo	lume (m³)	
Lowest occupied						120.21	(1a) x		3.00] (2a) =		360.63	(3a)
+1						94.70] (1b) x		3.50	(2b) =		331.45	(3b)
+2						79.35] (1c) x		2.70	(2c) =		214.25	(3c)
Total floor area		(1a)	+ (1b) + (1	c) + (1d)(1	Ln) =	294.26	(4)						
Dwelling volume								(3a)) + (3b) + (3	c) + (3d)(3n) =	906.33	(5)
2. Ventilation rat	е												
											m ⁱ	³ per hour	
Number of chimne	eys								0	x 40 =	=	0	(6a)
Number of open fl	ues								0	x 20 =	=	0	(6b)
Number of intermi	ittent fan:	s							4	x 10 =	=	40	(7a)
Number of passive	vents								0	x 10 =	=	0	(7b)
Number of flueless	gas fires								0	x 40 =	=	0	(7c)
											Air	changes pe hour	r
Infiltration due to	chimneys	, flues, fan	s, PSVs		(6a)	+ (6b) + (7a	a) + (7b) + (7c) =	40	÷ (5) :	=	0.04	(8)
If a pressurisation	test has b	een carrie	d out or is i	ntended, pr	roceed to (17), otherw	ise continu	e from (9) t	to (16)				
Air permeability va	alue, q50,	expressed	in cubic m	etres per ho	our per squ	are metre	of envelope	e area				5.00	(17)
If based on air peri	meability	value, the	n (18) = [(1	7) ÷ 20] + (8	s), otherwi	se (18) = (1	6)					0.29	(18)
Number of sides or	n which t	he dwellin	g is sheltere	ed								2	(19)
Shelter factor									1 -	[0.075 x (1	.9)] = [0.85	(20)
Infiltration rate inc	orporatin	ng shelter f	actor							(18) x (20) =	0.25	(21)
Infiltration rate mo	odified for	r monthly v	wind speed	:									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average v	vind spee	d from Tab	ole 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)



0.32

0.55

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

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

0.31

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

0.55

0.28

0.54

0.27

0.54

0.31

If mechanical ventilation: air change rate through system

0.55

Calculate effective air change rate for the applicable case:

0.54

0.29

N/A

N/A

(22b)

(23a)

(23c)

(24d)

0.24

0.53

0.24

0.53

0.23

0.53

0.25

0.53

0.27

0.54

0.28

0.54

0.54

0.75

0.75

23.33

(49)

(50)

(55)

(56)

22.58

23.33

23.33

22.58

23.33

Temperature factor from Table 2b

23.33

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

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

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

21.07

23.33

22.58

23.33

	ntains dedic	ated solar st	orage or d	edicated W	/WHRS (56))m x [(47) -	Vs] ÷ (47),	else (56)				
	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33 (57)
Primary circuit I		n month from	m Table 3		!		1	!			!	, ,
	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 e												, ,
	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 requ								!				(00)
	223.43	196.75	206.20	184.24	180.11	160.30	153.35	169.10	169.06	191.07	202.80	217.85 (62)
Solar DHW inpu		1			100:11			1 203.20	200.00			127.00
	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 wa		1					0.00	0.00	0.00	0.00	0.00	0.00 (00)
output from we	176.84	154.66	159.60	139.14	133.51	115.21	106.76	122.51	123.97	144.48	157.71	171.26
	170.84	154.00	133.00	159.14	133.31	113.21	100.70	122.51	123.97	Σ(64)1		
Heat gains from	water heat	ting (k\Mh/m	onth) 0.21	E ~ [U 0E ~	(15)m ± (61	\m1 + 0 0 v	· [(16)m ± (57)m + (50)	ıml	2(64)1	.12 –	1705.65 (64)
neat gains iron		1		1		1			-	20.70	22.54	26.20 (65)
	37.58	32.87	33.92	29.57	28.37	24.48	22.69	26.03	26.34	30.70	33.51	36.39 (65)
5. Internal gai	ns											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabolic gains	(Table 5)			-								
· ·	156.22	156.22	156.22	156.22	156.22	156.22	156.22	156.22	156.22	156.22	156.22	156.22 (66)
Lighting gains (o		1		1								(00)
8	42.91	38.11	30.99	23.46	17.54	14.81	16.00	20.80	27.92	35.44	41.37	44.10 (67)
Appliance gains		1	·				10.00	20.00	27.32	33.44	41.57	1 44.10 (07)
Appliance gains	453.60	458.31	446.45	421.19	389.32	359.36	339.35	334.64	346.50	371.75	403.63	433.59 (68)
Cooking gains (339.33	334.04	340.30	3/1./3	403.03	455.59 (08)
Cooking gains (1			20.62	20.62	20.62	20.62	20.62	20.62 (60)
5	38.62	38.62	38.62	38.62	38.62	38.62	38.62	38.62	38.62	38.62	38.62	38.62 (69)
Pump and fan g												(-0)
	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. evap	,	, ,						1	1		ı	
	-124.98	-124.98	-124.98	-124.98	-124.98	-124.98	-124.98	-124.98	-124.98	-124.98	-124.98	-124.98 (71)
Water heating g	gains (Table	5)										
	l											
	50.51	48.91	45.58	41.07	38.13	34.00	30.49	34.99	36.59	41.27	46.55	48.91 (72)
Total internal ga								34.99	36.59	41.27	46.55	48.91 (72)
Total internal ga								34.99	36.59	41.27 518.33	46.55	48.91 (72) 596.47 (73)
ŭ	ains (66)m	+ (67)m + (6	8)m + (69)ı	m + (70)m -	+ (71)m + (7	72)m	30.49					
Total internal ga	ains (66)m	+ (67)m + (6	8)m + (69)ı 592.89	m + (70)m - 555.59	+ (71)m + (7 514.86	72)m 478.04	30.49		480.87	518.33		596.47 (73)
	ains (66)m	+ (67)m + (6	8)m + (69)ı	m + (70)m - 555.59	+ (71)m + (7	72)m 478.04 Sol	30.49	460.29			561.41	
	ains (66)m	+ (67)m + (6	8)m + (69)i 592.89 Access f	m + (70)m - 555.59	+ (71)m + (7 514.86	72)m 478.04 Sol	30.49 455.71 ar flux	460.29	480.87	518.33 FF	561.41	596.47 (73) Gains
	ains (66)m	+ (67)m + (6	8)m + (69)i 592.89 Access f	m + (70)m - 555.59 factor 6d	+ (71)m + (7 514.86	72)m 478.04 Sol:	30.49 455.71 ar flux V/m²	460.29 spec or T	480.87 g ific data	518.33 FF specific cor Table	561.41	596.47 (73) Gains
6. Solar gains	ains (66)m	+ (67)m + (6	8)m + (69)ı 592.89 Access f Table	m + (70)m - 555.59 factor 6d	+ (71)m + (7 514.86 Area m ²	72)m 478.04 Sola V	30.49 455.71 ar flux V/m²	\$pec or T	g ific data able 6b	518.33 FF specific cor Table 0.70	561.41	596.47 (73) Gains W
6. Solar gains NorthEast	ains (66)m	+ (67)m + (6	8)m + (69)r 592.89 Access f Table	m + (70)m - 555.59 factor 6d 7 x 7 x	+ (71)m + (7 514.86 Area m ² 5.43	72)m 478.04 Sol: W x 1 x 3	30.49 455.71 ar flux V/m² 1.28 x 6.79 x	spec or T 0.9 x	g ific data able 6b 0.63 x	FF specific c or Table 0.70 0.70	561.41	Gains W (75)
6. Solar gains NorthEast SouthEast	ains (66)m	+ (67)m + (6	8)m + (69)i 592.89 Access f Table 0.77	factor 6d x 7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x	+ (71)m + (7 514.86 Area m ² 5.43 7.18	72)m 478.04 Soli X 1 X 3 X 1	30.49 455.71 ar flux V/m² 1.28 x 1.28 x	spec or T 0.9 x (0.9 x	g ific data able 6b 0.63 x 0.63 x	518.33 FF specific c or Table 0.70 0.70 0.70	561.41 data 6c =	Gains W (75) 80.74 (77)
6. Solar gains NorthEast SouthEast NorthWest	ains (66)m	+ (67)m + (6	8)m + (69)r 592.89 Access f Table 0.77 0.77	factor 6d x 7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x	+ (71)m + (7 514.86 Area m² 5.43 7.18 2.40	72)m 478.04 Sola X 1 X 3 X 1 X 3	30.49 455.71 ar flux y/m² 1.28	spec or T 0.9 x (0.9 x (0.9 x (0.9 x (g ific data able 6b 0.63 x 0.63 x	518.33 FF specific c or Table 0.70 0.70 0.70 0.70	561.41 data 66c = [Gains W 18.72 (75) 80.74 (77) 8.28 (81)
6. Solar gains NorthEast SouthEast NorthWest SouthWest	ains (66)m	+ (67)m + (6	8)m + (69)r 592.89 Access f Table 0.77 0.77	factor 6d	+ (71)m + (7 514.86 Area m ² 5.43 7.18 2.40 15.53	72)m 478.04 Sol: X	30.49 455.71 ar flux V/m² 1.28	spec or T 0.9 x (0.9 x	g ific data able 6b 0.63	518.33 FF specific or Table 0.70 0.70 0.70 0.70	561.41 data 66c = [Gains W 18.72 (75) 80.74 (77) 8.28 (81) 174.63 (79) 21.61 (80)
6. Solar gains NorthEast SouthEast NorthWest SouthWest West East	ains (66)m	+ (67)m + (6	8)m + (69)r 592.89 Access f Table 0.77 0.77 0.77 0.77	7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x	+ (71)m + (7 514.86 Area m² 5.43 7.18 2.40 15.53 3.60 5.57	Sola X 1 X 3 X 1 X 1 X 1 X 1 X 1 X 1 X 1 X 1	30.49 455.71 ar flux y/m² 1.28	spec or T 0.9 x (0.9 x	g ific data able 6b 0.63	518.33 FF specific c or Table 0.70 0.70 0.70 0.70 0.70 0.70	561.41	Gains W 18.72 (75) 80.74 (77) 8.28 (81) 174.63 (79) 21.61 (80) 33.43 (76)
6. Solar gains NorthEast SouthEast NorthWest SouthWest West East North	616.88	+ (67)m + (6 615.19	8)m + (69)r 592.89 Access f Table 0.77 0.77 0.77 0.77	7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x	+ (71)m + (7 514.86 Area m ² 5.43 7.18 2.40 15.53 3.60	Sola X 1 X 3 X 1 X 1 X 1 X 1 X 1 X 1 X 1 X 1	30.49 455.71 ar flux y/m² 1.28	spec or T 0.9 x (0.9 x	g ific data able 6b 0.63	518.33 FF specific c or Table 0.70 0.70 0.70 0.70 0.70 0.70	561.41 data 66c = [Gains W 18.72 (75) 80.74 (77) 8.28 (81) 174.63 (79) 21.61 (80)
6. Solar gains NorthEast SouthEast NorthWest SouthWest West East	ains (66)m 616.88	+ (67)m + (6 615.19	8)m + (69)r 592.89 Access f Table 0.77 0.77 0.77 0.77 0.77	7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x	+ (71)m + (7 514.86 Area m² 5.43 7.18 2.40 15.53 3.60 5.57 3.65	72)m 478.04 Solic X 1 X 3 X 1 X 1 X 1 X 1 X 1	30.49 455.71 ar flux y/m² 1.28	spec or T 0.9 x (0.9 x	g ific data able 6b 0.63	518.33 FF specific c or Table 0.70 0.70 0.70 0.70 0.70 0.70 0.70	561.41 data 66c = [Gains W 18.72 (75) 80.74 (77) 8.28 (81) 174.63 (79) 21.61 (80) 33.43 (76) 11.86 (74)
6. Solar gains NorthEast SouthEast NorthWest SouthWest West East North	ains (66)m 616.88 atts Σ(74)m 349.27	n(82)m	8)m + (69)r 592.89 Access f Table 0.77 0.77 0.77 0.77 0.77	7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x	+ (71)m + (7 514.86 Area m² 5.43 7.18 2.40 15.53 3.60 5.57	Sola X 1 X 3 X 1 X 1 X 1 X 1 X 1 X 1 X 1 X 1	30.49 455.71 ar flux y/m² 1.28	spec or T 0.9 x (0.9 x	g ific data able 6b 0.63	518.33 FF specific c or Table 0.70 0.70 0.70 0.70 0.70 0.70	561.41 data 66c = [Gains W 18.72 (75) 80.74 (77) 8.28 (81) 174.63 (79) 21.61 (80) 33.43 (76)

	966.15	1235.47	1502.91	1776.13	1959.72	1944.76	1856.48	1690.02	1498.50	1220.99	984.51	892.21
7. Mean intern	nal tempera	ture (heatii	ng season)									
Temperature du	ring heatin	g periods in	the living	area from T	able 9, Th1	.(°C)						21.00
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jtilisation facto	r for gains f	or living are	a n1,m (se	e Table 9a)								
	1.00	1.00	1.00	0.99	0.97	0.89	0.75	0.82	0.96	1.00	1.00	1.00
lean internal to	emp of livin	g area T1 (s	teps 3 to 7	1								
	19.39	19.54	19.81	20.18	20.54	20.82	20.94	20.92	20.67	20.20	19.72	19.36
emperature du	_		1	_		1	T				T	T
	19.89	19.89	19.89	19.90	19.90	19.90	19.90	19.90	19.90	19.90	19.89	19.89
Jtilisation facto	_			1	0.05	0.02	0.61	0.60	0.02	0.00	1.00	1.00
Mean internal to	1.00	1.00	1.00	0.99	0.95	0.82	0.61	0.69	0.93	0.99	1.00	1.00
nean internar te	18.40	18.56	18.83	19.20	19.55	19.80	19.89	19.87	19.68	19.22	18.75	18.38
iving area fract		18.30	18.83	19.20	19.55	19.80	19.89	19.67		ing area ÷		0.16
Nean internal to		for the wh	ole dwellin	g fLA x T1 +	·(1 - fLA) x 7	Γ2			LIV	mg area r	(7) -	5.10
	18.56	18.72	18.99	19.36	19.71	19.97	20.06	20.05	19.85	19.38	18.91	18.54
Apply adjustme												
-	18.56	18.72	18.99	19.36	19.71	19.97	20.06	20.05	19.85	19.38	18.91	18.54
											•	
8. Space heatir	ng requirem											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jtilisation facto											1	
landal antonio	1.00	1.00	1.00	0.99	0.94	0.82	0.63	0.71	0.93	0.99	1.00	1.00
Jseful gains, ηπ	965.88		1	1750.15	1849.81	1602.66	1176.30	1196.15	1394.02	1213.07	983.82	892.04
Monthly averag		1234.27 emperature	1497.62		1849.81	1002.00	1176.30	1196.15	1394.02	1213.07	983.82	892.04
violitilly average	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 fo							10.00	10.40	14.10	10.00	7.10	4.20
	5218.59	5048.22	4555.01		2896.62	1929.46	1242.84	1307.91	2068.98	3175.26	4280.57	5214.72
Space heating re					E)ml v //11)			l I				
,	equirement	, kWh/mon	th 0.024 x	[(97)m - (95	フ/ハリ X (4エ)ハ	m						
,	3164.02	, kWh/mon 2562.97	th 0.024 x 2274.70	[(97)m - (95 1465.72	778.83	0.00	0.00	0.00	0.00	1459.87	2373.66	3216.07
,			1	-			0.00	0.00		1459.87 3)15, 10	'	3216.07 7295.85
	3164.02	2562.97	2274.70	-			0.00	0.00		3)15, 10	.12 = 1	
Space heating re	3164.02	2562.97 kWh/m²/ye	2274.70	-			0.00	0.00		3)15, 10	.12 = 1	7295.85
Space heating re	3164.02 equirement	2562.97 kWh/m²/ye	2274.70 ear	1465.72	778.83	0.00			∑(98	(98)	.12 = 1 ÷ (4)	7295.85 58.78
Space heating re	3164.02 equirementing requirer	2562.97 kWh/m²/ye	2274.70	-			0.00 Jul	0.00 Aug		3)15, 10	.12 = 1	7295.85
Space heating re	3164.02 equirement ing requirer Jan	2562.97 kWh/m²/ye	2274.70 ear Mar	1465.72 Apr	778.83	0.00 Jun	Jul	Aug	∑(98 Sep	(98) Oct	.12 = 1 ÷ (4)	7295.85 58.78 Dec
Space heating re 8c. Space cooli	a164.02 equirement ing requirer Jan m	2562.97 kWh/m²/ye ment Feb 0.00	2274.70 ear	1465.72	778.83	0.00			∑(98	(98)	.12 = 1 ÷ (4)	7295.85 58.78
space heating re 8c. Space cooli Heat loss rate Lr	3164.02 equirement ing requirer Jan m 0.00 r for loss nr	2562.97 kWh/m²/ye ment Feb 0.00	2274.70 ear Mar 0.00	1465.72 Apr	May 0.00	Jun 3376.27	Jul 2657.92	Aug 2726.42	∑(98 Sep	(98) Oct	.12 = 1 ÷ (4) Nov	7295.85 58.78 Dec
Space heating re 8c. Space cooli Heat loss rate Lr Jtilisation facto	alfa.02 equirement ing requirer Jan m 0.00 r for loss nr	2562.97 kWh/m²/ye ment Feb 0.00 m 0.00	2274.70 ear Mar 0.00	1465.72 Apr	778.83	0.00 Jun	Jul	Aug	∑(98 Sep	(98) Oct	.12 = 1 ÷ (4)	7295.85 58.78 Dec
Space heating re 8c. Space cooli Heat loss rate Lr Jtilisation facto	alfa.02 equirement ing requirer Jan m 0.00 r for loss nr	2562.97 kWh/m²/ye ment Feb 0.00 m 0.00	2274.70 ear Mar 0.00	1465.72 Apr	May 0.00	Jun 3376.27	Jul 2657.92	Aug 2726.42	∑(98 Sep	(98) Oct	.12 = 1 ÷ (4) Nov	7295.85 58.78 Dec
Space heating re 8c. Space cooli Heat loss rate Lr Utilisation facto Useful loss ηmLi	as a sequirement of the sequirem	2562.97 kWh/m²/ye ment Feb 0.00 m 0.00 100)m x (10	2274.70 ear Mar 0.00 0.00 0.00	Apr 0.00	May 0.00 0.00	Jun 3376.27	Jul 2657.92	Aug 2726.42 0.72	∑(98 Sep 0.00	(98) Oct 0.00	Nov 0.00	7295.85 58.78 Dec 0.00
Space heating re	as a sequirement of the sequirem	2562.97 kWh/m²/ye ment Feb 0.00 m 0.00 100)m x (10	2274.70 ear Mar 0.00 0.00 0.00	Apr 0.00	May 0.00 0.00	Jun 3376.27	Jul 2657.92	Aug 2726.42 0.72	∑(98 Sep 0.00	(98) Oct 0.00	Nov 0.00	7295.85 58.78 Dec 0.00
Space heating re 8c. Space cooli Heat loss rate Lr Utilisation facto Jseful loss ηmLi	alfat.02 equirement ing requirer Jan m 0.00 r for loss nr 0.00 m (watts) (0.00	2562.97 kWh/m²/ye nent Feb 0.00 100)m x (10 0.00 0.00	2274.70 ear Mar 0.00 0.00 0.00 0.00 0.00	Apr 0.00 0.00 0.00	May 0.00 0.00 0.00	Jun 3376.27 0.67 2272.45	Jul 2657.92 0.77 2045.35 2333.60	Aug 2726.42 0.72 1951.10	∑(98 Sep 0.00 0.00	Oct 0.00 0.00	Nov 0.00 0.00	7295.85 58.78 Dec 0.00 0.00
Space heating re 8c. Space cooli Heat loss rate Lr Utilisation facto Jseful loss nmLi Gains	alfat.02 equirement ing requirer Jan m 0.00 r for loss nr 0.00 m (watts) (0.00	2562.97 kWh/m²/ye nent Feb 0.00 100)m x (10 0.00 0.00	2274.70 ear Mar 0.00 0.00 0.00 0.00 0.00	Apr 0.00 0.00 0.00	May 0.00 0.00 0.00	Jun 3376.27 0.67 2272.45	Jul 2657.92 0.77 2045.35 2333.60	Aug 2726.42 0.72 1951.10	∑(98 Sep 0.00 0.00	Oct 0.00 0.00	Nov 0.00 0.00	7295.85 58.78 Dec 0.00 0.00
Space heating reactions are Lindal loss rate Lindal loss factors. Justine Lindal loss factors are Lindal loss factors.	alfat.02 equirement ing requirer Jan m 0.00 r for loss nr 0.00 m (watts) (0.00 0.00 equirement,	2562.97 kWh/m²/ye ment Feb 0.00 m 0.00 100)m x (10 0.00 0.00 whole dwe	2274.70 ear Mar 0.00 0.00 0.00 0.00 elling, conti	Apr 0.00 0.00 0.00 nuous (kWI	May 0.00 0.00 0.00 0.00 0.00 0.00 0.004 x [0]	Jun 3376.27 0.67 2272.45 2441.09 (103)m - (1	Jul 2657.92 0.77 2045.35 2333.60 02)m] x (41	Aug 2726.42 0.72 1951.10 2143.15	∑(98 Sep 0.00 0.00 0.00	Oct 0.00 0.00 0.00	Nov 0.00 0.00 0.00	7295.85 58.78 Dec 0.00 0.00 0.00

cooled area \div (4) = 1.00

Intermittency factor (Table 10)

0.00	0.00	0.00	0.00	0.00	0.25	0.25	0.25	0.00	0.00	0.00	0.00

 $\Sigma(106)6...8 = 0.75$ (106)

Space cooling requirement (104)m x (105) x (106)m

 $\Sigma(107)6...8 = 119.69$ (107)

Space cooling requirement kWh/m²/year

 $(107) \div (4) = 0.41$ (108)

8f. Fabric energy efficiency

Target Fabric Energy Efficiency (TFEE)

[(99) + (108)] * 1.15 = 68.06 (109)