

ENERGY STATEMENT

(To Accompany Detailed Planning Application)

Site
6 STREATLEY PLACE, LONDON, NW3 1HP

Proposal

ERECTION OF FOUR RESIDENTIAL UNITS

6th JUNE 2018 Ref. E789-ES-00



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1.0 SUMMARY OF RECOMMENDATIONS

- a) This development is for the erection of four residential units at 6 Streatley Place, London NW3 1HP.
- b) It is proposed that in order to meet the requirements of policy this development will adopt a high standard of design with regard to energy efficiency principles.
- c) This report highlights a reduction in excess of 35% in carbon dioxide emissions by the incorporation of a combination of fabric and energy efficiency measures, together with the provision of on-site renewable energy production equipment.
- d) This development is at the planning stage and the detailed construction drawings have not been prepared, therefore initial stage SAP calculations and procedures provided in the Renewables Toolkit, which form the basis of the London Plan's "Energy Hierarchy", have been used to estimate that the baseline carbon dioxide emissions of this development.
- e) This report has demonstrated, by using initial SAP Assessments, to calculate carbon dioxide emissions for the development and that it is possible to achieve a 27.7% reduction in carbon dioxide emissions by making fabric and energy efficiency measures, with a further 29.8% reduction in carbon dioxide emissions by incorporating photovoltaic systems, resulting in a total reduction of 49.3% in carbon dioxide emissions. It is envisaged during detailed construction design, these figures can be improved.
- f) This Energy Statement demonstrates that the proposed development complies with the requirements of planning policy with regard to carbon dioxide reduction and incorporation of low and zero carbon technologies. It is for these reasons it is considered that this application should be viewed favorably by London Borough of Camden.



2.0 INTRODUCTION

- a) Doherty Energy Limited have been instructed to prepare an Energy Statement to support the submission of the planning application for the development at 6 Streatley Place, London, NW3 1HP. This report must be read in conjunction with the application forms, certificates, detailed plans and other supporting documents submitted to the Local Authority as part of the application.
- b) The Application is for the erection of four dwelling in a single block on an infill site. The dwellings shall be a mixture of two and three bedroom dwellings, made up of flats.
- c) The objectives of this Energy Statement are to make an appraisal of the carbon dioxide emissions of the proposed development, assess the potential fabric and building services efficiencies to reduce the carbon dioxide emission, review the various methods of generating and using renewable energy at source, and to suggest the most appropriate means by which the development can contribute towards the aspiration of policy relating to renewable energy provision.
- d) The Assessment shall be carried out following the principles set out in the Mayor's "Energy Hierarchy" which is implemented through the London Plan. These principles can be summarised as follows:
 - Be Lean –use less energy
 - Be Clean supply energy efficiently
 - Be Green use renewable energy
- e) At this stage in the design of the development, the detailed Building Regulations construction information has not been prepared and therefore following detailed construction design, the energy calculations will be revisited to ensure the energy requirements and carbon dioxide emissions are up to date.



f) In order to demonstrate the carbon dioxide emissions, it is proposed to use the Standard Assessment Procedure (SAP) for the calculations to obtain initial baseline carbon dioxide emissions figures for the dwellings. Further calculations will be used to demonstrate the potential carbon dioxide emission savings from the initial calculations by enhancements to the building fabric, plant and controls – BE LEAN. The suitability of supplying energy, both heat and power, through the use of a combined heat and power system shall be assessed – BE CLEAN. Finally, the carbon dioxide emission saving by the use of renewable energy shall be assessed through the outputs from the SAP calculation – BE GREEN.



3.0 POLICY CONTEXT

- a) The London Borough of Camden require all developments to ensure compliance with the applicable energy and sustainability standards stipulated in the London Plan, London Borough of Camden Local Plan and associated documented issued by the Mayor of London.
- b) The London Plan, March 2016, Policy 5.2 expects development proposals to make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:
 - Be Lean –use less energy
 - Be Clean supply energy efficiently
 - Be Green use renewable energy
- c) The Policy also states that the Mayor will work with boroughs and developers to ensure that major developments meet the following targets for carbon dioxide emissions reduction in buildings. These targets are expressed as minimum improvements over the Target Emission Rate (TER) outlined in the national Building Regulations leading to zero carbon residential buildings from 2016 and zero carbon non-domestic buildings from 2019.

Residential buildings:

Year	Improvement on 2010 building Regulations 2010
2010-2013	25 per cent (Code for Sustainable Homes Level 4)
2013-2016	40 per cent
2016-2031	Zero Carbon

Non-domestic buildings:

Year	Improvement on 2010 building Regulations 2010
2010-2013	25 per cent
2013-2016	40 per cent
2016-2019	As per Building Regulations
2019-2031	Zero Carbon



- d) The Energy Statement follows the principles set out in the Energy Hierarchy and is broken down to provide the following details:
 - Estimated site-wide regulated carbon dioxide emissions and reductions (broken down for the domestic and non-domestic elements of the development), expressed in tonnes per annum, after each stage of the energy hierarchy
 - ii) A clear commitment to regulated carbon dioxide emissions savings compared to a Part L 2013 of the Building Regulations compliant development through energy demand reduction measures alone
 - iii) Clear evidence that the risk of overheating has been mitigated through passive design
 - iv) Evidence of investigation into existing or planned district heating networks that the development could be connected to, including relevant correspondence with local heat network operators
 - v) Commitment to a site heat network served by a single energy centre linking all apartments and non-domestic building uses, if appropriate for the development
 - vi) Where applicable, investigations of the feasibility of installing CHP in the proposed development (if connection can't be made to an area wide network) before considering renewables
 - vii) An initial feasibility test for renewable energy technologies and, where appropriate, commitment to further reduce carbon dioxide emissions through the use of onsite renewable energy generation
- g) As can be seen above, the London Plan policy 5.2 sets a zero carbon target for residential developments over the Building Regulations 2010.
- h) However, as the Building Regulations were revised in 2013, the Greater London Authority issued their "Sustainable Design and Construction SPG" in April 2014, which clarifies the current target. This document states:



"To avoid complexity and extra costs for developers, the Mayor will adopt a flat carbon dioxide improvement target beyond Part L 2013 of 35% to both residential and non-residential development."

- e) Under The London Plan Policy 5.5, the Mayor expects 25 per cent of the heat and power used in London to be generated through the use if localised decentralised energy system by 2025. The London Heat Map has been used to assess the district heat systems, both current and proposed, with the view to connecting the building to them.
- f) Policy 5.7 seeks to increase the proportion of energy generated from renewable energy sources and expects that projects that developments will provide on-site renewable energy generation in order to meet the requirements of Policy 5.2.
- g) The aim of the Energy Statement is to meet the carbon dioxide reduction targets on-site. Where it is clearly demonstrated that the specific targets cannot be fully achieved on-site, as per the requirements of The London Plan, any shortfall may be provided off-site or through a "cash in lieu" contribution to the relevant borough to be ring fenced to secure delivery of carbon dioxide savings elsewhere.



4.0 LOW CARBON AND RENEWABLE ENERGY SYSTEMS

4.1 Introduction

- a) This section of the Energy Statement shall make an appraisal of the carbon dioxide emissions of the proposed development, the various methods of generating and using renewable energy at source, and to suggest the most appropriate means by which the development can contribute towards the aspiration of policy relating to renewable energy provision.
- b) The London Renewables Toolkit (LRT) is the system developed by the Greater London Authority to assist Planners, Developers and Consultants with the assessment of the appropriateness of renewable energy resources and technologies. It offers advice on which renewable technologies are suitable including aesthetic issues, risks, reliability and gives an insight into the cost benefit analysis of installing renewable.
- c) It also provides guidance on how to comply with the requirements of the London Plan and relevant borough development documents. Typical detailed calculations are provided to help determine the most appropriate renewable technology for each scheme.
- d) Within Section 4 of the LRT 'Including Renewables in the Development Proposals', a route map is provided to help consider the feasibility of renewable technologies and how to include them into the development.
- e) The dwellings emissions have been estimated using the Standard Assessment Procedure. A second set of SAP calculations have been undertaken to demonstrate an improvement in the carbon dioxide emissions by incorporating better fabric constructions, better windows and doors, improved ventilation systems and enhanced air tightness.



4.2 Baseline Carbon Dioxide Emissions

- a) In order to assess the carbon dioxide emissions of the development, the delivered energy demand needs to be estimated. At this stage in the design of the dwellings, the detailed construction drawings have not been prepared and therefore detailed carbon emission calculations cannot be undertaken to produce the carbon dioxide emissions.
- b) However, the dwellings carbon dioxide emission estimates can be based on initial stage SAP calculations. In this case, SAP calculations have been prepared for all of the proposed dwellings.
- c) Table 1 below summarises the results from the TER Worksheets that can be found in Appendix A.

Dwelling	Floor Area (m²)	Heating (kg/yr)	Water Heating (kg/yr)	Pumps & Fans (kg/yr)	Electricity for Lighting (kg/yr)	Total Emissions (kg/yr)	Dwelling CO ₂ Emission Rate
1	145.6	1521.28	561.13	38.93	258.02	2379.36	16.34
2	142.5	1416.8	561.23	38.93	255.78	2272.74	15.95
3	78.1	723.84	508.88	38.93	176.03	1447.68	18.54
4	87.9	1065.19	526.01	38.93	192.16	1822.29	20.73
Flat		TER (k	(g/m²/yr)	Ar	ea (m²)	Emission	ıs (kg/yr)
1	L	16	5.34	-	145.6	2,3	79
2	2	15	5.95	142.5		2,2	73
3	3	18	3.54	78.1		1,4	48
4		20	20.73 87.9 1,		87.9		22
То	tal			4	154.1	7,9	22
Ва	Baseline Carbon Dioxide Emissions (kg/yr)					7,9	22

Table 1 - Baseline Carbon Dioxide Emissions



4.3 Improved Baseline Carbon Dioxide Emissions – BE LEAN

- a) Following the principles set out in the Mayor's "Energy Hierarchy" which is implemented in the London Plan and the Local Policy, the design has been improved to use less energy - BE LEAN.
- b) This has been achieved by improving the thermal performance of the various constructions, like the walls, roof, floors, windows, doors etc and incorporating mechanical ventilation heat recovery and improving the air tightness of the dwelling.
- c) The floor U Values can be improved by incorporating insulation under the screed, or by using insulation blocks instead of concrete blocks between the beams. For the purposes of these calculations, the U Values of the current floor constructions have been calculated as 0.12 W/m²K.
- d) The wall U Values can be improved by improving the thermal performance of the insulation, either by increased thickness or lower thermal conductivity. For the purposes of these calculations, the U Values of the current wall constructions have been calculated as 0.13 W/m²K.
- e) The roof areas offer excellent opportunity to enhance the insulation levels and for the purposes of these calculations, the U Value of 0.089 W/m²K has been used.
- f) The party walls between the dwellings shall be fully filled with insulation and shall have sealed edges, which effective results on a U Value of 0.0 W/m²K. There are also Robust Details to lower the noise transmissions through fully filled party walls.
- g) The thermal performance of the windows can be improved by adding coatings to the panes or adding an inert gas to the cavities. For the purposes of these calculations, the U Values of the windows has been taken as 1.2 W/m²K, which uses double glazed planitherm glass, argon gas and warm edge spacer bars.



- h) A composite front door can be used instead of a timber door. Modern composite doors have good thermal, fire, acoustic and security properties. These types of door can have U Values as low as 0.55 W/m²K.
- i) The air leakage rate for the dwellings can be improved. The maximum allowed under the current Building Regulations Approved Document L1A:2013 is 10 m³/hr/m² at 50 Pascal's. With carful detailing, this can be easily improved to 3 m³/hr/m² at 50 Pascal's.
- j) The use of Accredited Construction Details in the development means that the thermal bridging coefficient can be greatly improved, thus lowering the γ can be lowered.
- k) With regard to the heating, a combi boiler shall be provided in each dwelling to provide the heating and hot water.
- More efficient controls can be installed to control the heating, which can include weather compensation on the boiler control and the use of programmers, thermostats and thermostatic radiator valves all improve the efficiency of the heating system.
- m) Instead of simply installing 75% of the light fittings as low energy efficient light fittings, as required by the current Building Regulations, 100% of the light fitting could be low energy fittings.
- n) The use of natural lighting has been considered and although its use is not measured in the SAP calculations, it can help lower the energy use and therefore carbon dioxide emissions of the development. This has to be carefully assessed against any unwanted solar overheating. Whilst a degree of solar gain can be beneficial for the occupants and helps lower the carbon dioxide emissions, it must be controlled to minimise the risk of solar overheating. The calculations show only slight to medium risk of overheating.
- o) Mechanical ventilation heat recovery systems work by removing the warm moist air from kitchens and bathrooms and passing it through a heat exchanger to recover waste heat. This waste heat can then be used to



27.7 %

warm the fresh air that is brought into the living areas of the dwelling, therefore reducing the heating load.

- p) The development shall be designed to ensure that the Dwelling Emission Rates are better than the Target Emission Rates and the Fabric Energy Efficiency is better than the Target Fabric Energy Efficiency. These are the requirements from Criterion 1 of the current Building Regulations Approved Document L (2013).
- q) By incorporating items like those stated above, the SAP calculations have been updated to demonstrate the effect of these improvements and the results are listed in Table 2 below.
- r) Full details of the SAP calculations can be found in the SAP Worksheets in Appendix B.

Dwelling	Floor Area (m²)	Heating (kg/yr)	Water Heating (kg/yr)	Pumps & Fans (kg/yr)	Electricity for Lighting (kg/yr)	Total Emissions (kg/yr)	DER
1	145.6	853.7	490.32	208.63	257.96	1810.61	13.37
2	142.5	677.67	490.38	205.15	255.14	1628.34	12.39
3	78.1	246.27	447.19	120.83	176.03	990.32	13.83
4	87.9	500.71	460.97	145.31	192.16	1299.15	16.02
Flot			ing CO ₂	Avoc (m	2,	Emissions	(learly m)

Flat	Dwelling CO ₂ Emission Rate (kg/m²/yr)	Area (m²)	Emissions (kg/yr)
1	12.44	145.6	1,811
2	11.43	142.5	1,628
3	12.68	78.1	990
4	14.78	87.9	1,299
Total		454.1	5,728
Total Res	idential Emissions ((kg/yr)	5,728

Table 2 - Actual Carbon Dioxide Emissions

s) As demonstrated in Table 2 above, it can be seen that the improvements in the thermal performance and fixed building services, a reduction of 27.7%.

Percentage Improvement over current Building Regulations



4.4 Supplying Energy Efficiently – BE CLEAN

a) Following the principles set out in the Energy Hierarchy, which is implemented in the London Plan and Local Policy, the next step is to reduce the carbon dioxide emissions by supplying energy efficiently - BE CLEAN.

4.5 District Heat Network

- a) The London Heat Map is an online tool that can help identify opportunities for the use of decentralised energy networks and systems for use in projects.
- b) Using the Heat Map, there appears to be no district heating systems available or even proposed in the area within the next five years, so it would not be feasible to install plant for future connection to such a network at this time.
- c) Due to the small size of the development, a communal heating system would be relatively expensive to install and to operate and therefore is not be considered at this time. This is in line with the Greater London Authority's "Sustainable Design and Construction SPG" in published in April 2014.
- d) In line with the Greater London Authority's "Sustainable Design and Construction SPG" in published in April 2014, it is considered that no potential heat networks available in the foreseeable future.



4.6 Combined Heat and Power

- a) Combined Heat and Power typically generates electricity on site as a byproduct of generating heat. It uses fuel efficient energy technology that,
 unlike traditional forms of power generation, uses the by-product of the heat
 generation required for the development. Normally during power generation,
 the heat is discharged or wasted to atmosphere. A typical CHP plant can
 increase the overall efficiency of the fuel use to more than 75%, compared to
 the traditional power supplies of 40%, which uses inefficient power stations
 and takes into account transmission and distribution losses.
- b) The use of this development is primarily residential and it will be built to exceed the current Building Regulations. The aim of these regulations is to minimise the base heating load and electrical loads. The site base heating and electrical loads is key to the sizing and operation of any CHP system.
- c) Due to the high levels of insulation and energy efficiency measures that will be incorporated into this development, there is no year round heat load for the CHP plant and therefore, a CHP system would be considered not viable on this development. As such, if a CHP system were to be incorporated, it would not operate efficiently and therefore NOT BE CLEAN.



4.7 Renewable Technologies Considered – BE GREEN

- a) Taking into account the requirements of planning policy set out by London Borough of Camden and the London Plan, the developments annual carbon dioxide emission reduction target of 35%, based on the Building Regulations 2013, from energy efficiencies and renewable technology has been calculated as 7,922 kgCO₂/year.
- b) The final step in the Mayor's "Energy Hierarchy" is to reduce the carbon dioxide emissions by the use of renewable technologies BE GREEN.
- c) In accordance with the toolkit the following renewable energy resources have been assessed for availability and appropriateness in relation to the site location, building occupancy and design.
 - Combined Heat and Power
 - Biomass Heating
 - Biomass CHP
 - Heat Pumps
 - Solar Photovoltaics
 - Domestic Solar Hot Water Systems
 - Wind Power
- d) A preliminary assessment has been carried out for each renewable energy technology and for those appearing viable a further detailed appraisal has been undertaken.
- e) The preliminary study considered the site location and the type of building in the development and surroundings and produced a shortlist of renewable energy technologies that will be the subject of a further feasibility study.
- f) Table 3 below provides a summary of the assessment.



4.8 Renewables Toolkit Assessment

Energy System	Description	Comment
Combined Heat and Power (CHP)	Combined Heat and Power systems use the waste heat from an engine to provide heating and hot water, while the engine drives an electricity generator. These systems uses gas or oil as the main fuel and therefore can not truly be considered as renewable technology however, it is recognised that they have a significant reduced impact on the environment compared to conventional fossil fueled systems.	As CHP systems produce roughly twice as much heat as they generate electricity, they are usually sized according to the base load heat demand of a building, to minimise heat that is wasted during part-load operations. Therefore, to be viable economically they require a large and constant demand for heat, which make their use in new energy efficient housing, with high insulation, not really suitable. The efficiency of small scale CHP is relatively low and is unlikely to result in CO ₂ emission savings. Economic viability relies on 4000 hours running time, which is unlikely to be achieved in this scheme. As policy requires a reduction in carbon dioxide emissions via true renewable sources this would not assist in achieving the policy objectives.
Combined H	leat and Power	Feasible – NO
Biomass Heating	Solid, liquid or gaseous fuels derived from plant material can provide boiler heat for space and water heating. Biomass can be burnt	Wood pellet or wood chip fired or dual biodiesel/gas-fired boilers could be considered. As this development consists of a new building, it offers the opportunity to accommodate such a system. The flues would have to be discharged to
	directly to provide heat in buildings. Wood from forests, urban tree pruning, farmed coppices or farm and factory waste, is the most common fuel and is used commercially	atmosphere above roof level and concerns raised by Environmental Health regarding the pollutants and particles, which would have to be addressed. Care need to be taken with the design of the flue to ensure particle discharge is not a concern to residents.
	in the form of wood chips or pellets, although traditional logs are also used. Other forms of Biomass can be used, e.g. bio-diesel.	The fuel storage silo/tank would have to be located external to the building, which is not available on this site. A suitable local fuel supplier is required to supply the site.
Biomass He	ating	Feasible - NO



Energy System	Description	Comment
Biomass CHP	CHP as above, but with biomass as the fuel.	Biomass CHP overcomes the issue of the reduction in carbon dioxide emissions via true renewable sources, however, the lack of a year round base load is still a problem and therefore Biomass CHP is not feasible for this development.
Biomass CHP		Feasible - NO
Ground/Air Source Heat Pumps (GSHP / ASHP) - heating	The ground collector can be installed, either as a loop of pipe, in the piles or using a borehole and a compressor offer efficient heating of a space in winter, as the temperature of the ground (below approx 2m) remains almost constant all year. For air source, the external condensing unit can be located adjacent to the dwelling in a	Ground and air source heat pumps are most efficient when supplying heat continuously and in areas where a mains gas supply is not available. In dwellings, GSHP and ASHP are capable of supplying the majority of the total space heating and pre heat for the hot water demand. This site does not have external areas of sufficient size for the installation of ground loops for the collection of heat. Due to the size of the dwellings and their location, it is considered that the use of ASHP to offset the heat losses of these dwellings is not feasible.
Ground/Air Se	discreet location. ource Heat Pumps	Feasible – NO
Glound/All St	ource rieat rumps	i easible – NO
Solar Photovoltaics (PV)	Building Integrated Photovoltaics (BIPV) or Roof mounted collectors provide noiseless, low maintenance, carbon free electricity.	There appears to be a reasonable amount of roof area that can be utilitised to install PV panels onto the scheme. These could be integrated into the roof finishes or mounted on frames on the roof and orientated south for optimal performance. Careful consideration must be given to the chosen roof finish to ensure compatibility.
Solar PhotoV	oltaics	Feasible - YES
Solar Thermal Hot Water	Solar collectors for low temperature hot water systems require direct isolation, so the chosen location, orientation and tilt are critical.	This solution could be utilised to generate hot water using the energy from the sun. The area of roof could be used for the installation of solar thermal collectors. These could be mounted on frames and orientated south for optimal performance. These would have to be installed at a pitch of 30-40 degrees and ideally as close to the dwelling served as possible.
Solar Therma	l Hot Water	Feasible - YES



Energy System	Description	Comment
Wind Power	Most small (1-25kW) wind turbines can be mounted on buildings, but larger machines require foundations at ground level and suitable site location	It could be viable to install some form of wind turbines on this site, however due to surrounding buildings and the visual impact it is not considered to be the most sensitive system of providing energy via renewable resources in this built up location. There are also concerns that the wind across the site would be turbulent because of the surrounding buildings.
Wind Power	•	Feasible - NO

Table 3 - Renewable Technology Feasibility Assessment

- a) From the above it has been established that there are two potential ways of providing energy via renewable sources appropriate for inclusion in this scheme, these being the use of solar photovoltaics and domestic solar hot water or a combination thereof.
- b) CHP and Micro CHP are considered not feasible as the economic viability relies on at least 4,000 hours runtime which is unlikely to be achieved in this development.
- c) Biomass systems have been considered unfeasible for this site due to particle discharge in a built up area, fuel handling and storage on a site with limited open space, required plant areas and the on going maintenance of the system.
- d) Heat pumps have been considered not feasible for this development as there is insufficient ground area for the installation of ground loops. Air source have been considered unfeasible due to the size of the dwellings and their close proximity of the neighboring dwellings.
- e) Wind has been considered not viable for this site as there are a lot of the buildings and trees in the surrounding area which are likely to cause disruption to air flows.



4.9 Solar Photovoltaics

- a) Photovoltaics (PV) is a technology that allows the production of electricity directly from sunlight. The term originates from "Photo" referring to light and "voltaic" referring to voltage. This type of technology has been developed for incorporation within building design to produce electricity for either direct consumption or re-sale to the National Grid.
- b) PV panels come in modular panels which can be fitted on the top of roofs or incorporated in the finishes like slates or shingles to form integral part of the roof covering. PV cells can be incorporated into glass for atria walls and roofs or used in the cladding or rain screen on a building wall.
- c) When planning to install PV panels, it is important to consider the inherent cost of installation in comparison to possible alternatives. The aesthetic impact of the PV panels also requires careful consideration.
- d) Roof mounted PV panels should ideally face south-east to south-west at an elevation of about 30-40°. However, in the UK even if installed flat on a roof, they receive 90% of the energy of an optimum system.
- e) PV installations are expressed in terms of the electrical output of the system, i.e. kilowatt peak (kWp). The Department of Trade and Industry estimate that an installation of 1kWp, could produce approximately 700-850 kWh/yr, which would require an area of between 8-20m², depending on the efficiencies and type of PV panel used.
- f) It is also estimated that a gas heated, well insulated typical dwelling would use approximately 1,500kWh/year electricity for the lights and appliances, therefore the 1kWp system could save approximately 45% of a single dwellings electrical energy requirements.
- g) Although often not unattractive, and possible to integrate into the building or roof cladding system PV systems are still considered likely to have visual implications, therefore careful sighting of the panels is required. As this installation will be contained on the roof of the proposed dwellings, it involves no additional land use.



- h) With regard to noise and vibration, a PV system is completely silent in operation.
- i) Care must be taken with the design and installation of PV systems as they need to meet standards for electrical safety.
- Space has been identified on the proposed roof for photovoltaic system with a total output of 4.0 kWp.

Development incorporating Energy Efficiency Measures	Total Carbon Dioxide Emissions (kgCO₂/yr)	Percentage Reduction (%)
No Renewables	5,728	-
Reduction by including 4.0 kWp PV system	1,709	29.8%

Table 4 – Photovoltaic Carbon Dioxide Emissions

- k) As can be seen from Table 4 above, the incorporation of 4.0 kWp photovoltaic systems on the roof of the development could reduce the carbon dioxide emissions by a further 29.8% and when combined with the fabric energy efficiency measures from in Table 2 above, a total reduction of 49.3% is achieved, which complies with the requirements of Planning Policy.
- I) From the above calculations, based on 250 watt panels, orientated towards the south and mounted on the roof finishes at a 30 degree pitch, it is calculated that 16-No. panels are required on the proposed developments roof. It is believed that these panels will not be visible from the street level due to the parapet wall around the roof.
- m) It is estimated that this size of system could generate 3,293 kWh of electricity in a year.
- n) Further detailed calculations for the carbon dioxide emissions and the final system size and layout shall be carried out during detailed design.



4.10 Domestic Solar Hot Water System

- a) This system uses the energy from the sun to heat water, most commonly to provide the hot water demands of the development. The system uses heat collectors, generally mounted on the roof, in which a fluid is heated by the sun. This fluid is used to heat up water that is stored in either a separate cylinder or a twin coil hot water cylinder inside the dwelling. The system works very successfully in the UK, as it can operate in diffused light conditions.
- b) As with PV panels, the collectors should be mounted facing in a southerly direction, from south-east through to south-west and at an elevation of 10 to 60°. The panels can be installed on the roof, either on the slope of the roof, on a frame, or they can be integrated into the roof finishes.
- c) This system would be best suited on sites where the solar thermal collectors can be located close to the hot water storage vessel within the dwelling and therefore any losses can be minimised.
- d) Approximately 2-4m² of solar thermal collectors could provide the hot water requirements of a typical dwelling. These could be used to feed twin coil hot water cylinders positioned within the dwellings, allowing the water to be heated by the sun when possible whilst retaining the back up of the main heating system when required.
- e) This system would be relatively easy to install. However, the visual impact needs to be given consideration.
- f) Although often not unattractive, and possible to integrate into the building or roof cladding system domestic solar thermal collectors are still considered likely to have visual implications, therefore careful sighting of the panels is required.
- g) As this installation will be contained on the roof of the proposed development, it involves no additional land use.



- h) With regard to noise and vibration, a domestic solar hot water system is completely silent in operation.
- i) The current proposal for the heating and hot water utilitises combi boilers so therefore there is no hot water storage cylinders being installed in the flats.
- j) Therefore, at this stage, the use of domestic solar hot water will not be considered further.



4.11 Annual Carbon Dioxide Emission Reduction

- a) From the above, it can be seen that a Photovoltaic system, together with the fabric and energy efficiency measures, could be used to achieve the 35% reduction in carbon dioxide emissions as required by Planning Policy.
- b) Based on the initial SAP calculations for the dwellings, it has been calculated that the baseline carbon dioxide emissions figure for the development is 2,773 kgCO₂/year.
- c) In accordance with the Planning Policies set out by London Borough of Camden and the London Plan, this report has demonstrated a 27.7% improvement in carbon dioxide emissions by fabric and energy efficiencies. In addition, a further reduction of 29.8% in carbon dioxide emissions is possible by the use of renewable technologies, resulting in a total reduction of 49.3%.
- d) A number of options have been considered and the potential carbon dioxide reductions calculated using the SAP calculations and a summary of the results is provided in Table 5 below.

	Total Carbon Dioxide Emissions	Reduction in Carbon Dioxide Emissions		
	(kgCO ₂ /yr)	(%)		
Building Regulations Compliant Development	7,922	-		
Development incorporating Energy Efficiency Measures	5,728	27.7%		
Further Reduction in Carbon Dioxide Emissions by incorporating a Renewable Technology				
PV (4.0 kWp)	1,709	29.8%		
Percentage Improvement incorp	49.3 %			

Table 5 - Summary of Reduction in Carbon Dioxide Emissions

e) It has been demonstrated that it is possible to achieve a 49.3% reduction in carbon dioxide emissions over and above the 2013 Building Regulations by



improving the energy efficiency of the development and its building services efficiencies and by the incorporation of renewable technologies.

- f) CHP and Biomass CHP have been analysed but are considered not feasible for this development as the heating and electrical load profiles would not provide a good clean efficient system for the development.
- g) Biomass heating has been analysed but is considered not feasible for this development due to particle discharge in the built up area, space requirements and the cost and the reliability of a biomass fuel source.
- h) Wind power is considered not feasible for this development due to the turbulence caused by the surrounding buildings and trees etc.
- Solar hot water has been considered but as the type of boiler being install is not best suited for solar hot water, it is not being considered further at this stage.
- j) The initial calculations show that in order to achieve in excess of the 35% reduction via fabric and energy efficiency measure and incorporating PV panels, a system with an output of 4.0 kWp with a southerly aspect would be required.
- k) Detailed calculations of the total carbon dioxide emissions compared to the estimated carbon dioxide reduction for the development can be undertaken once the detailed design has progressed to construction drawing stage.
- For the purpose of planning and based on the figures provided by initial SAP calculations, this report has demonstrated that it is feasible, with the improvement of the building fabric, the introduction of energy efficient controls and systems and the incorporation of photovoltaic systems, a reduction in excess of 35% of the developments carbon dioxide emissions could be achieved. This complies with the requirements of the planning policies set out by London Borough of Camden and in the London Plan.



4.12 Energy Hierarchy Carbon Dioxide Emissions Summary

- a) The concept of applying the energy hierarchy in relation to Approved Document L of the Building Regulations 2013, the Energy Planning, Greater London Authority Guidance on Preparing Energy Assessments (March 2016) document provides further guidance on how the carbon dioxide emission figures can be presented.
- b) The regulated carbon dioxide emissions reduction target for the development would be to achieve zero carbon as assessed under the Approved Document L 2013 of the Building Regulations.
- c) These figures are based on the current design information and are subject to change when the detailed construction information is produced.
- Table 6 provides Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings.

		Tonnes CO ₂ /yr
Baseline: Part L 2013 of the Building Regulations Compliant Development	а	7.9
After energy demand reduction	b	5.7
After heat network / CHP	С	5.7
After renewable energy	d	4.0

Table 6 – Carbon Dioxide Emissions after each stage of the Energy Hierarchy



e) Table 7 provides Regulated carbon dioxide savings from each stage of the Energy Hierarchy for domestic buildings

		Tonnes CO ₂ /yr		%
Savings from energy demand reduction	a-b	2.2	(a-b)/a*100	27.7%
Savings from heat network / CHP	b-c	0.0	(b-c)/a*100	0.0%
Savings from renewable energy	c-d	1.7	(c-d)/a*100	21.6%
Cumulative on site savings	a-d=e	3.9	(a-d)/a*100	49.3%
Annual Savings from off-set payment	a-e=f	4.0		
Cumulative savings for off-set payment	f*30=g	120.6		

Table 7 – Regulated carbon dioxide savings from each stage of the Energy Hierarchy

f) The calculations contained within this Energy Statement are based on the current design information and are subject to change when the detailed design is undertaken and the construction information is produced.



5.0 OVERHEATING

- a) It is important to consider the internal comfort conditions for the occupants of the dwellings. At design stage, this can be met through the cooling hierarchy set out in the London Plan.
- b) The cooling hierarchy in Policy 5.9 seeks to reduce any potential overheating and also the need to cool a building through active cooling measures. Air conditioning systems are a very resource intensive form of active cooling, increasing carbon dioxide emissions, and also emitting large amounts of heat into the surrounding area. By incorporating the cooling hierarchy into the design process buildings will be better equipped to manage their cooling needs and to adapt to the changing climate they will experience over their lifetime.
- c) The development shall reduce the potential for overheating and reliance on air conditioning systems and demonstrate this in accordance with the following cooling hierarchy:
 - i) minimise internal heat generation through energy efficient design
 - ii) reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls
 - iii) manage the heat within the building through exposed internal thermal mass and high ceilings
 - iv) passive ventilation
 - v) mechanical ventilation
 - vi) active cooling systems (ensuring they are the lowest carbon options).
- d) During the initial design, the initial SAP Assessments were carried out for each flat to help assess the energy demand and carbon emissions of the development. The SAP Assessments included an overheating assessment in line with the requirements of the Building Regulations.



- e) Based on these SAP Assessments, some of the dwellings have a slight to medium risk of solar overheating, but none have a high risk of overheating. This is acceptable under the requirements of the Building Regulations.
- f) The internal heat generation has been minimised through energy efficient design. The heat generating equipment shall be located in a central plant room which is naturally ventilated. No heat generating plant will be installed in any of the dwellings. All of the luminaires shall be low energy which will also remove an internal heat generating load.
- g) The heat entering the building in summer is reduced through the optimisation of glazing area, the use of shading via balconies and other protruding edges, together with the inclusion of very high performance façade materials and improved air tightness. The use of a solar control glazing, which has a coating applied to lower the G Value of the glass, can be applied. This acts in the same way that the low e coating lowers the U Value which helps reduce heat losses through the windows.
- h) The dwellings will have a mechanical ventilation system installed, which provides filtered fresh air to the dwellings. This is tempered by the crossover heat exchanger, which recovers waste heat from the extract air from the dwellings. These ventilation systems shall be individual systems installed in each dwelling so they are controlled locally by the occupants, therefore avoiding the distribution losses of a central system with large fans and ducts.
- Low energy lamps shall be used in the luminaires to reduce heat gain. These lamps do not emit heat like traditional GLS lamps.



6.0 CONCLUSION

- a) The London Borough of Camden and the London Plan 2016 Policy 5.2 requires new residential developments to minimise and exhibit the highest standards of sustainable design and construction. The reduction in carbon dioxide emissions target has been set as zero carbon. The development should achieve a minimum of 35% over the Target Emission Rate, as defined by the Building Regulations 2013.
- b) This development is for the erection of four residential units on the site at 6 Streatley Place, London NW3 1HP.
- c) It is proposed that in order to meet the requirements of policy this development will adopt a high standard of design with regard to energy efficiency principles and will achieve a reduction of at least 35% in the carbon dioxide emissions.
- d) At planning stage it is not possible to produce final reports on the energy demand, carbon dioxide emissions or financial appraisals of the appropriate systems, based on the initial construction information.
- e) However, for the development as a whole, this Energy Statement has demonstrated using initial SAP calculations that it is possible to achieve a 27.7% reduction in carbon dioxide emissions by making improvements in fabric and energy efficiency measures, with a further 29.8% reduction in carbon dioxide emissions by incorporating a photovoltaic system, resulting in a total carbon dioxide emissions reduction of more than 49.3%. It is envisaged during detailed construction design, these figures can be improved.
- f) This Energy Statement demonstrates that the proposed development complies with the requirements of planning policy with regard to carbon dioxide reduction and incorporation of low and zero carbon technologies. It is for these reasons it is considered that this application should be viewed favorably by London Borough of Camden.



Appendix A - TER Worksheets



Air changes per hour

5.00

0.35

3

0.78

0.27

1 - [0.075 x (19)] =

 $(18) \times (20) =$

(17)

(18)

(19)

(20)

(23a)

(23c)

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

Assessor name	Mr Jason Doherty	Assessor number	2634
Client		Last modified	07/06/2018
Address	1 6 Streatley Place, London, NW3 1HP		

1. Overall dwelling dimension	S					
		Area (m²)	Average storey height (m)	1	Volume (m³)	
Lowest occupied		80.60 (1a) x	2.60	(2a) =	209.56	(3a)
+1		65.00 (1b) x	3.00	(2b) =	195.00	(3b)
Total floor area	(1a) + (1b) + (1c) + (1d)(1n) =	145.60 (4)				
Dwelling volume			(3a) + (3b) + (3	3c) + (3d)(3n) =	404.56	(5)
2. Ventilation rate						
					m³ per hour	
Number of chimneys			0	x 40 =	0	(6a)
Number of open flues			0	x 20 =	0	(6b)
				_		
Number of intermittent fans			4	x 10 =	40	(7a)
Number of intermittent fans Number of passive vents				」 ¬	40	(7a) (7b)

Infiltration due to chimneys, flues, fans, PSVs (6a) + (6b) + (7a) + (7b) + (7c) =0.10 (8) \div (5) =

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)

Number of sides on which the dwelling is sheltered

Shelter factor

Infiltration rate incorporating shelter factor

Infiltration rate n	nodified fo	r monthly v	vind 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)

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

Aujusteu IIIIItrat	ion rate (al	iowing for	sileitei ailu	i willu lacto)) (ZI) X (Z	20,111							
	0.34	0.34	0.33	0.30	0.29	0.26	0.26	0.25	0.27	0.29	0.30	0.32	(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

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

0.56 0.54 0.54 0.53 0.53 0.56 0.55 0.53 0.54 0.54 0.55 0.55 (24d)

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



N/A

N/A

-lamant	oss parameter		0	Blat	11	A 1134	/v	•	
Element		Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	AxUW	/K κ-valu kJ/m²	•	•
Vindow				33.74	x 1.33	= 44.73			(2
Door				1.95	x 1.00	= 1.95			(2
Roof window				0.68	x 1.59	= 1.08			(:
Basement floor				80.60	x 0.13	= 10.48			(2
xternal wall				100.77	x 0.18	= 18.14			(2
Party wall				80.74	x 0.00	= 0.00			(3
oof				28.32	x 0.13	= 3.68			(3
otal area of external elem	nents ∑A, m²			246.06					(3
abric heat loss, $W/K = \sum (A$	4 × U)					(26	5)(30) + (32)	= 80.06	(3
leat capacity Cm = ∑(A x κ	()				(28).	(30) + (32) +	+ (32a)(32e) =	= N/A	(3
hermal mass parameter ((TMP) in kJ/m²l	<						250.00) (3
hermal bridges: ∑(L x Ψ) α	calculated usin	g Appendix K						15.77	(3
otal fabric heat loss							(33) + (36)	= 95.83	(3
Jan	Feb	Mar Apr	May	Jun J	ul Aug	Sep	Oct	Nov De	ес
entilation heat loss calcu	lated monthly	0.33 x (25)m x (5)							
74.69	74.38	74.08 72.66	72.39	71.16 71	.16 70.93	71.63	72.39	72.93 73.	49 (3
leat transfer coefficient, \	W/K (37)m + (3	38)m							
170.52	170.21	169.91 168.49	168.23	166.99 166	5.99 166.76	167.47	168.23 1	68.76 169	.32
						Average = ∑	(39)112/12	= 168.49) (3
Heat loss parameter (HLP)	, W/m²K (39)m	n ÷ (4)							
1.17	1.17	1.17 1.16	1.16	1.15 1.	15 1.15	1.15	1.16	1.16 1.1	16
1.17	1.17	1.17 1.16	1.16	1.15 1.	15 1.15		1.16		
	1	1.17 1.16	1.16	1.15 1.	15 1.15				16 (4
	1	1.17 1.16 31.00 30.00	31.00		15 1.15		(40)112/12		(4
Number of days in month 31.00	(Table 1a)					Average = ∑	(40)112/12	= 1.16	(4
Sumber of days in month 31.00 4. Water heating energy	(Table 1a)					Average = ∑	(40)112/12	= 1.16 30.00 31.	00 (4
Jumber of days in month 31.00 4. Water heating energy assumed occupancy, N	(Table 1a) 28.00 requirement	31.00 30.00	31.00	30.00 31		Average = ∑	(40)112/12	= 1.16 30.00 31.	00 (2
Jumber of days in month 31.00 4. Water heating energy assumed occupancy, N	(Table 1a) 28.00 requirement usage in litres	31.00 30.00 per day Vd,averag	31.00 e = (25 x N) + 3	30.00 31	.00 31.00	Average = \$\sqrt{30.00}	31.00	= 1.16 30.00 31. 2.93 103.72	(4000) (40
4. Water heating energy Assumed occupancy, N Annual average hot water Jan	(Table 1a) 28.00 requirement usage in litres Feb	31.00 30.00 per day Vd,averag Mar Apr	31.00 e = (25 x N) + 3	30.00 31 36 Jun J		Average = ∑	31.00	= 1.16 30.00 31.	(4000) (40
4. Water heating energy assumed occupancy, Nannual average hot water	(Table 1a) 28.00 requirement usage in litres Feb	31.00 30.00 per day Vd,averag Mar Apr	31.00 e = (25 x N) + 3	30.00 31 36 Jun J	.00 31.00	Average = \$\sqrt{30.00}	31.00	= 1.16 30.00 31. 2.93 103.72	(4000) (40
Assumed occupancy, N Annual average hot water Jan	(Table 1a) 28.00 requirement usage in litres Feb per day for each	31.00 30.00 per day Vd,averag Mar Apr	31.00 e = (25 x N) + 3 May ctor from Tabl	30.00 31 36 Jun Jun e 1c x (43)	.00 31.00	Average = \$\sqrt{30.00}	31.00 3	= 1.16 30.00 31. 2.93 103.72	(4 000 (4 000 (2 000 (4 000 (4 000 (4
Assumed occupancy, N Annual average hot water Jan Hot water usage in litres p	(Table 1a) 28.00 requirement usage in litres Feb per day for each	31.00 30.00 per day Vd,average Mar Apr month Vd,m = fac	31.00 e = (25 x N) + 3 May ctor from Tabl	30.00 31 36 Jun Jun e 1c x (43)	.00 31.00 ul Aug	Average = ∑ 30.00 Sep	31.00 3	2.93 103.72 Nov De	(4 00 (4 2 (4 2 (4
Assumed occupancy, N Annual average hot water Jan Hot water usage in litres p	(Table 1a) 28.00 requirement usage in litres Feb per day for each 109.94	31.00 30.00 per day Vd,average Mar Apr month Vd,m = fact 105.79 101.64	31.00 e = (25 x N) + 3 May ctor from Tabl	30.00 31 36 Jun Jun 93.35 93	.00 31.00 ul Aug	Average = ∑ 30.00 Sep	Oct 105.79 1	2.93 103.72 Nov De	(4 00 (4 2 (4 2 (4
Assumed occupancy, N Annual average hot water Jan Hot water usage in litres p	(Table 1a) 28.00 requirement usage in litres Feb er day for each 109.94 er used = 4.18	31.00 30.00 per day Vd,average Mar Apr month Vd,m = fact 105.79 101.64	8 = (25 x N) + 3 May ctor from Tabl 97.49 /3600 kWh/mc	30.00 31 36 Jun 93.35 93 onth (see Table	.00 31.00 ul Aug	Average = ∑ 30.00 Sep	Oct 105.79 1 Σ(44)112	2.93 103.72 Nov De	(4 00 (4 2 (4 2 (4 2 (4 2 (4
Assumed occupancy, N Annual average hot water Jan Hot water usage in litres p 114.09	(Table 1a) 28.00 requirement usage in litres Feb er day for each 109.94 er used = 4.18	31.00 30.00 per day Vd,average Mar Apr n month Vd,m = face 105.79 101.64 x Vd,m x nm x Tm/	8 = (25 x N) + 3 May ctor from Tabl 97.49 /3600 kWh/mc	30.00 31 36 Jun 93.35 93 onth (see Table	.00 31.00 ul Aug .35 97.49 es 1b, 1c 1d)	Average = ∑ 30.00 Sep 101.64	Oct 105.79 1 Σ(44)112	= 1.16 30.00 31. 2.93 103.72 Nov De 09.94 114 = 1244.6	(4 00 (4 2 (4 2 (4 2 (4 3.09 (4
Assumed occupancy, N Annual average hot water Jan Hot water usage in litres p 114.09 Energy content of hot wat	requirement usage in litres Feb er day for each 109.94 er used = 4.18 147.98	31.00 30.00 per day Vd,average Mar Apr n month Vd,m = face 105.79 101.64 x Vd,m x nm x Tm/	8 = (25 x N) + 3 May ctor from Tabl 97.49 /3600 kWh/mc	30.00 31 36 Jun 93.35 93 onth (see Table	.00 31.00 ul Aug .35 97.49 es 1b, 1c 1d)	Average = ∑ 30.00 Sep 101.64	Oct 105.79 1 Σ(44)112 138.23 1	= 1.16 30.00 31. 2.93 103.72 Nov De 09.94 114 = 1244.6	(4 00 (4 2 (4 2 (4 2 (4 3 (4)
4. Water heating energy Assumed occupancy, N Annual average hot water Jan Hot water usage in litres p 114.09 Energy content of hot wat	requirement usage in litres Feb er day for each 109.94 er used = 4.18 147.98	31.00 30.00 per day Vd,average Mar Apr n month Vd,m = face 105.79 101.64 x Vd,m x nm x Tm/	8 = (25 x N) + 3 May ctor from Tabl 97.49 /3600 kWh/mc	30.00 31 36 Jun 93.35 93 onth (see Table 110.23 102	.00 31.00 ul Aug .35 97.49 es 1b, 1c 1d)	Average = ∑ 30.00 Sep 101.64	Oct 105.79 1 Σ(44)112 138.23 1 Σ(45)112	= 1.16 30.00 31. 2.93 103.72 Nov De 09.94 114 = 1244.6	00 (4 00 (4 2 (4 2 (4 2 (4 2 (4 3 (4)
4. Water heating energy assumed occupancy, Notational average hot water and but water usage in litres process of the second seco	(Table 1a) 28.00 requirement usage in litres	31.00 30.00 per day Vd,average Mar Apr n month Vd,m = fact 105.79 101.64 x Vd,m x nm x Tm/ 152.70 133.13	31.00 e = (25 x N) + 3 May ctor from Tabl 97.49 /3600 kWh/mc 127.74	30.00 31 36 Jun 93.35 93 onth (see Table 110.23 102	.00 31.00 ul Aug .35 97.49 es 1b, 1c 1d) 2.14 117.21	Sep 101.64 118.61	Oct 105.79 1 Σ(44)112 138.23 1 Σ(45)112	1.16 30.00 31. 2.93 103.72 Nov De 09.94 114 1244.6 50.89 163 1631.8	00 (4 00 (4 2 (4 ec .09 2 (4
4. Water heating energy assumed occupancy, Notational average hot water and but water usage in litres process of the second seco	(Table 1a) 28.00 requirement usage in litres	31.00 30.00 per day Vd,average Mar Apr n month Vd,m = fact 105.79 101.64 x Vd,m x nm x Tm/ 152.70 133.13	31.00 e = (25 x N) + 3 May ctor from Tabl 97.49 /3600 kWh/mc 127.74	30.00 31 36 Jun 93.35 93 onth (see Table 110.23 102	.00 31.00 ul Aug .35 97.49 es 1b, 1c 1d) 2.14 117.21	Sep 101.64 118.61	Oct 105.79 1 Σ(44)112 138.23 1 Σ(45)112	1.16 30.00 31. 2.93 103.72 Nov De 09.94 114 1244.6 50.89 163 1631.8	00 (4 00 (4 2 (4 2 (4 2 (4 2 (4 3 (4) 3 (4
A. Water heating energy Assumed occupancy, N Annual average hot water Jan Hot water usage in litres p 114.09 Annual average in litres p 25.38 Vater storage loss calculation	(Table 1a) 28.00 requirement usage in litres	31.00 30.00 per day Vd,average Mar Apr 1 month Vd,m = fact 105.79 101.64 x Vd,m x nm x Tm/ 152.70 133.13 22.90 19.97 onth (55) x (41)m 0.00 0.00	31.00 e = (25 x N) + 3 May ctor from Tabl 97.49 /3600 kWh/mc 127.74 19.16	30.00 31 36 Jun 93.35 93 onth (see Table 110.23 102 16.53 15 0.00 0.	.00 31.00 ul Aug .35 97.49 es 1b, 1c 1d) 2.14 117.21 .32 17.58	Average = ∑ 30.00 Sep 101.64 118.61	Oct 105.79 1 Σ(44)112 138.23 1 Σ(45)112	= 1.16 30.00 31. 2.93 103.72 Nov De 09.94 114 = 1244.6 50.89 163 = 1631.8	00 (4 00 (4 2 (4 ec .09 2 (4 .85 9 (4
A. Water heating energy Assumed occupancy, N Annual average hot water Jan Hot water usage in litres p 114.09 Annual average in litres p 25.38 Vater storage loss calculation	(Table 1a) 28.00 requirement usage in litres	31.00 30.00 per day Vd,average Mar Apr 1 month Vd,m = fact 105.79 101.64 x Vd,m x nm x Tm/ 152.70 133.13 22.90 19.97 onth (55) x (41)m 0.00 0.00	31.00 e = (25 x N) + 3 May ctor from Tabl 97.49 /3600 kWh/mc 127.74 19.16	30.00 31 36 Jun 93.35 93 onth (see Table 110.23 102 16.53 15 0.00 0.00 1 x [(47) - Vs] ÷	.00 31.00 ul Aug .35 97.49 es 1b, 1c 1d) 2.14 117.21 .32 17.58	Average = ∑ 30.00 Sep 101.64 118.61	Oct 105.79 1 Σ(44)112 138.23 1 Σ(45)112 20.73 2 0.00	= 1.16 30.00 31. 2.93 103.72 Nov De 09.94 114 = 1244.6 50.89 163 = 1631.8	.09 (4 .85 9 (4 .58 (4
Assumed occupancy, N Annual average hot water Jan Hot water usage in litres p 114.09 Energy content of hot water 169.19 Distribution loss 0.15 x (4) 25.38 Water storage loss calcular 0.00 If the vessel contains dedict	(Table 1a) 28.00 requirement usage in litres	31.00 30.00 per day Vd,average Mar Apr month Vd,m = fact 105.79 101.64 x Vd,m x nm x Tm/ 152.70 133.13 22.90 19.97 onth (55) x (41)m 0.00 0.00 rage or dedicated value of the control of the co	31.00 e = (25 x N) + 3 May ctor from Tabl 97.49 /3600 kWh/me 127.74 19.16 0.00 WWHRS (56)m	30.00 31 36 Jun 93.35 93 onth (see Table 110.23 102 16.53 15 0.00 0. n x [(47) - Vs] ÷	.00 31.00 ul Aug .35 97.49 es 1b, 1c 1d) 2.14 117.21 .32 17.58 00 0.00 (47), else (56)	Sep 101.64 118.61 17.79 0.00	Oct 105.79 1 Σ(44)112 138.23 1 Σ(45)112 20.73 2 0.00	= 1.16 30.00 31. 2.93 103.72 Nov De 09.94 114 = 1244.6 50.89 163 = 1631.8	.09 (4.2.2.3.2.3.2.3.2.3.3.3.3.3.3.3.3.3.3.3.
Assumed occupancy, N Annual average hot water Jan Hot water usage in litres p 114.09 Energy content of hot wat 169.19 Distribution loss 0.15 x (49) 25.38 Water storage loss calcular 0.00 If the vessel contains dedic	(Table 1a) 28.00 requirement usage in litres	31.00 30.00 per day Vd,average Mar Apr month Vd,m = fact 105.79 101.64 x Vd,m x nm x Tm/ 152.70 133.13 22.90 19.97 onth (55) x (41)m 0.00 0.00 rage or dedicated value of the control of the co	31.00 e = (25 x N) + 3 May ctor from Tabl 97.49 /3600 kWh/me 127.74 19.16 0.00 WWHRS (56)m	30.00 31 36 Jun Jun 20 e 1c x (43) 93.35 93 onth (see Table 110.23 102 16.53 15 0.00 0. n x [(47) - Vs] ÷ 0.00 0.	.00 31.00 ul Aug .35 97.49 es 1b, 1c 1d) 2.14 117.21 .32 17.58 00 0.00 (47), else (56)	Sep 101.64 118.61 17.79 0.00	Oct 105.79 1 Σ(44)112 138.23 1 Σ(45)112 20.73 2	= 1.16 30.00 31. 2.93 103.72 Nov De 09.94 114 = 1244.6 50.89 163 = 1631.8	.85 9 (42) (42) (42) (42) (42) (43)

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					1		I	1					٦,,,
T-4-1 b 4	50.96	46.03	50.96	49.32	49.68	46.03	47.57	49.68	49.32	50.96	49.32	50.96	(61)
Total heat requir			1				1	1		100.10	222.22		7 (60)
C.I. Dinari	220.15	194.00	203.66	182.44	177.42	156.26	149.71	166.89	167.92	189.19	200.20	214.81	(62)
Solar DHW input			1		_						0.00		٦ ، د د ۱
	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 wat							ī		1 1			1	7
	220.15	194.00	203.66	182.44	177.42	156.26	149.71	166.89	167.92	189.19	200.20	214.81	_
										∑(64)1	12 = 2	222.66	(64)
Heat gains from		ing (kWh/m	nonth) 0.25	5 × [0.85 ×	(45)m + (61	l)m] + 0.8 ×	[(46)m + (57)m + (59) -	m]				_
	69.00	60.71	63.51	56.59	54.89	48.16	45.85	51.39	51.77	58.70	62.50	67.22	(65)
5. Internal gain	ıs												
9	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains					,	•		718					
victabolic gailis	146.35	146.35	146.35	146.35	146.35	146.35	146.35	146.35	146.35	146.35	146.35	146.35	(66)
ighting gains (ca					1	1	140.55	140.55	140.55	140.55	140.55	140.55	(00)
b.i.ciiig guilis (Co	28.15	25.00	20.33	15.39	11.51	9.71	10.50	13.64	18.31	23.25	27.14	28.93	(67)
Appliance gains (1		10.30	13.04	10.31	23.23	27.14	20.33	_ (07)
Abununce Rains (315.69	318.97	310.71	293.14	270.96	250.11	236.18	232.90	241.16	258.73	280.91	301.76	(68)
Cooking goins (o							236.18	232.90	241.16	258.73	280.91	301.76] (68)
Cooking gains (ca		1				_	27.64	27.64	27.64	27.64	27.64	27.64	7 (60)
uma and fan as	37.64	37.64	37.64	37.64	37.64	37.64	37.64	37.64	37.64	37.64	37.64	37.64	(69)
Pump and fan ga			2.00	2.00	2.00	2.00	2.00	1 2 00	2.00	2.00	2.00	2.00	7 (70)
	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
osses e.g. evapo			447.00	447.00	117.00	117.00	117.00	147.00	147.00	447.00	447.00	117.00	7 (74)
	-117.08	-117.08	-117.08	-117.08	-117.08	-117.08	-117.08	-117.08	-117.08	-117.08	-117.08	-117.08	(71)
Nater heating ga			0- 0-				54.50				00.00		٦ (=٥)
	92.74	90.34	85.37	78.60	73.78	66.89	61.63	69.08	71.90	78.90	86.80	90.35	<u>(72)</u>
Total internal gai			, , , <i>,</i>	<u> </u>	·			T					٦ ,,
	506.49	504.22	486.32	457.04	426.15	396.61	378.21	385.53	401.27	430.79	464.76	490.95	<u>(73)</u>
6. Solar gains													
			Access f	actor	Area	Sol	ar flux		g	FF		Gains	
			Table	6d	m²	W	//m²	•	ific data	specific d		W	
									able 6b	or Table	6c		_
lorthEast			0.54	1 x	8.06	x 1	1.28 x	0.9 x	0.63 x	0.70	=	19.49	(75)
outhEast			0.54	1 ×	3.24	x3	6.79 x	0.9 x	0.63 x	0.70	=	25.55	(77)
lorthWest			0.54	1 x	1.08	x 1	1.28 x	0.9 x	0.63 x	0.70	=	2.61	(81)
lorizontal			1.00) x	0.68	x 2	6.00 x	0.9 x	0.63 x	0.70	=	7.02	
			0.77	7 x	12.04	_ x _ 1	1.28 x	0.9 x	0.63 x	0.70	=	41.52	(75)
NorthEast				7 x	8.35	x 3	6.79 x	0.9 x	D.63 x	0.70	=	93.89	(77)
			0.7			_							-
SouthEast			0.7		0.97	x 1	1.28 x	0.9 x	0.63 x	0.70	=	3.34	(81)
SouthEast NorthWest	itts ∑(74)m	ı(82)m			0.97	x 1	1.28 x	0.9 x (0.63 x	0.70	=	3.34	(81)
SouthEast NorthWest	ntts ∑(74)m 193.42	n(82)m 354.34			0.97	x 1	1.28 x 961.47	0.9 x (0.63 x 631.71	409.25	236.23	3.34 162.57	7
SouthEast NorthWest Solar gains in wa	193.42	354.34	549.87	7 x									7
SouthEast NorthWest Solar gains in wa	193.42	354.34	549.87	7 x									[83]
SouthEast NorthWest Solar gains in wa Fotal gains - inte	193.42 ernal and so 699.91	354.34 blar (73)m + 858.56	0.77 549.87 (83)m 1036.19	7 x 788.72	980.30	1015.50	961.47	812.29	631.71	409.25	236.23	162.57	(81) (83) (84)
SouthEast NorthWest Solar gains in wa Total gains - inte 7. Mean interna	193.42 ernal and so 699.91	354.34 blar (73)m + 858.56 ture (heatin	0.77 549.87 (83)m 1036.19	7 x 788.72	980.30	1015.50	961.47	812.29	631.71	409.25	700.99	162.57 653.53	(83)
NorthEast SouthEast NorthWest Solar gains in wa Total gains - inte 7. Mean interna	193.42 ernal and so 699.91 al tempera	354.34 blar (73)m + 858.56 ture (heating periods in	0.77 549.87 (83)m 1036.19 ng season)	7 x 788.72 1245.76 area from 1	980.30 1406.45 Table 9, Th1	1015.50 1412.12	961.47	812.29	631.71	409.25 840.04	700.99	162.57 653.53 21.00	(83)
SouthEast NorthWest Solar gains in wa Total gains - inte 7. Mean interna	193.42 ernal and so 699.91	354.34 blar (73)m + 858.56 ture (heatin	0.77 549.87 (83)m 1036.19	7 x 788.72	980.30	1015.50	961.47	812.29	631.71	409.25	700.99	162.57 653.53	(83)

Utilisation factor	for gains f	or living are	ea n1,m (se	e Table 9a)	1							
	1.00	1.00	0.99	0.97	0.87	0.70	0.54	0.61	0.88	0.99	1.00	1.00
Mean internal te	mp of livin	g area T1 (s	steps 3 to 7	in Table 9	:)							
	19.62	19.79	20.08	20.46	20.78	20.95	20.99	20.98	20.84	20.41	19.94	19.59
Temperature dur	ring heating	g periods in	the rest of	dwelling f	rom Table 9							
	19.94	19.94	19.95	19.95	19.96	19.96	19.96	19.96	19.96	19.96	19.95	19.95
Utilisation factor	for gains f	or rest of d	welling n2,	m								
	1.00	1.00	0.99	0.95	0.83	0.61	0.42	0.49	0.81	0.98	1.00	1.00
Mean internal te	mperature	in the rest	of dwelling	T2 (follow	steps 3 to	7 in Table !	9c)					
	18.09	18.34	18.76	19.32	19.74	19.93	19.96	19.96	19.83	19.25	18.57	18.05
Living area fraction	on								Liv	ving area ÷	(4) =	0.33
Mean internal te		for the wh	ole dwellin	g fLA x T1 +	+(1 - fLA) x ٦	Г2						
	18.59	18.82	19.19	19.69	20.09	20.26	20.30	20.29	20.16	19.63	19.02	18.56
Apply adjustmen	it to the me		l temperati	ure from Ta	ble 4e whe		riate					
[18.59	18.82	19.19	19.69	20.09	20.26	20.30	20.29	20.16	19.63	19.02	18.56
L												
8. Space heating	g requirem	ent										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor	for gains,	ηm										
	1.00	1.00	0.99	0.95	0.83	0.64	0.46	0.53	0.83	0.98	1.00	1.00
Useful gains, ηm(Gm, W (94	i)m x (84)m	1									
	698.88	854.98	1021.89	1179.73	1174.09	900.32	610.60	635.14	853.68	820.12	698.63	652.84
Monthly average	external t	emperature	e 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
Heat loss rate for	r mean inte	ernal tempe	erature, Lm	, W [(39)m	x [(93)m -	(96)m]						
	2437.19	2368.60	2156.55	1818.26	1410.72	945.87	617.39	649.01	1014.53	1518.69	2011.23	2430.93
Space heating red	quirement,	, kWh/mon	th 0.024 x	[(97)m - (9	5)m] x (41)ı	m		•			•	
	1293.30	1017.15	844.19	459.74	176.06	0.00	0.00	0.00	0.00	519.74	945.07	1322.90
-									Σ(98	8)15 <i>,</i> 10	.12 = (5578.15
Space heating red	quirement	kWh/m²/yı	ear							(98)	÷ (4)	45.18
9a. Energy requ	irements -	individual	heating sys	stems inclu	iding micro	-СНР						
Space heating												
Fraction of space	heat from	secondary	/suppleme	ntary syste	m (table 11	.)						0.00
Fraction of space	heat from	main syste	em(s)							1 - (2	01) =	1.00
Fraction of space	heat from	main syste	em 2									0.00
Eraction of tatal	space heat	from main	system 1						(20	02) x [1- (20	3)] =	1.00
Fraction of total S	snace heat	from main	system 2							(202) x (2	03) =	0.00
	space near											93.40
Fraction of total s		(%)							C			
Fraction of total s		(%)	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fraction of total s Fraction of total s Efficiency of mair Space heating fue	n system 1 Jan	Feb		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fraction of total s	n system 1 Jan	Feb		Apr 492.23	May 188.50	Jun 0.00	Jul 0.00	Aug 0.00	0.00	Oct 556.46	1011.86	Dec
Fraction of total s	n system 1 Jan el (main sy	Feb stem 1), kW	Vh/month					_	0.00		1011.86	
Fraction of total s Efficiency of mair Space heating fue	n system 1 Jan el (main sy	Feb stem 1), kW	Vh/month					_	0.00	556.46	1011.86	1416.38
Fraction of total s Efficiency of main Space heating fue	Jan el (main sy 1384.69	Feb stem 1), kW	Vh/month					_	0.00	556.46	1011.86	1416.38
Fraction of total s	Jan el (main sy 1384.69	Feb stem 1), kW 1089.03	Vh/month 903.84	492.23	188.50	0.00	0.00	0.00	0.00 Σ(212	556.46 1)15, 10	1011.86	1416.38 7042.98
Fraction of total s Efficiency of main Space heating fue Water heating Efficiency of wate	n system 1 Jan el (main sy 1384.69 er heater 88.78	Feb stem 1), kW 1089.03	Vh/month					_	0.00	556.46	1011.86	1416.38
Fraction of total s Efficiency of main Space heating fue	n system 1 Jan el (main sy 1384.69 er heater 88.78	Feb stem 1), kW 1089.03	Vh/month 903.84	492.23	188.50	0.00	0.00	0.00	0.00 Σ(212	556.46 1)15, 10	1011.86	1416.38 7042.98

	∑(219a)112 =	2597.81	(219)
Annual totals			
Space heating fuel - main system 1		7042.98	
Water heating fuel		2597.81	
Electricity for pumps, fans and electric keep-hot (Table 4f)			
central heating pump or water pump within warm air heating unit	30.00		(230c)
boiler flue fan	45.00		(230e)
Total electricity for the above, kWh/year		75.00	(231)
Electricity for lighting (Appendix L)		497.14	(232)
Total delivered energy for all uses	(211)(221) + (231) + (232)(237b) =	10212.94	(238)

Space heating - main system 1	7042.98	x	3.48	x 0.01 =	245.10	7 (240)
Makanhaattaa				X 0.01 -	243.10	(240)
Water heating	2597.81	x	3.48	x 0.01 =	90.40	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	497.14	x	13.19	x 0.01 =	65.57	(250)
Additional standing charges					120.00	(251)
Total energy cost			(240)(242) +	- (245)(254) =	530.97	(255)

11a. SAP rating - individual heating systems including micro-CHP		
Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.17	(257)
SAP value	83.68	
SAP rating (section 13)	84	(258)
SAP band	В	

	Energy kWh/year		Emission factor kg CO₂/kWh	Emissions kg CO₂/year	
Space heating - main system 1	7042.98	x	0.216 =	1521.28	(261)
Water heating	2597.81	x	0.216 =	561.13	(264)
Space and water heating			(261) + (262) + (263) + (264) = 2082.41	(265)
Pumps and fans	75.00	X	0.519 =	38.93	(267)
Electricity for lighting	497.14	x	0.519 =	258.02	(268)
Total CO₂, kg/year			(265)(271) = 2379.35	(272)
Dwelling CO₂ emission rate			(272) ÷ (4	.) = 16.34	(273)
El value				83.27	
El rating (section 14)				83	(274)
EI band				В	

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	7042.98	x	1.22	=	8592.44	(261
Water heating	2597.81	x	1.22	=	3169.33	(264
Space and water heating			(261) + (262) + (26	3) + (264) =	11761.77	(265
Pumps and fans	75.00	x	3.07	=	230.25	(267
Electricity for lighting	497.14	х	3.07	=	1526.23	(268

92.85

(273)



Assessor name	Mr Jason Doherty	Assessor number	2634
Client		Last modified	07/06/2018
Address	2 6 Streatley Place, London, NW3 1HP		

		Area (m²)	Average storey height (m)	Volume (m³)
Lowest occupied		78.10 (1a) x	2.60 (2a) =	203.06 (3a)
+1		64.40 (1b) x	3.00 (2b) =	193.20 (3b)
Total floor area	(1a) + (1b) + (1c) + (1d)(1n) =	142.50 (4)		
Dwelling volume			(3a) + (3b) + (3c) + (3d)(3r	n) = 396.26 (5)

2. Ventilation rate		
		m³ per hour
Number of chimneys	0 x	40 = 0 (6a)
Number of open flues	0 x	20 = 0 (6b)
Number of intermittent fans	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 per hour

Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) =	40	÷ (5) =	0.10	(8)
If a pressurisation test has been carried out or is intended, pro-	ceed 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)

Number of sides on which the dwelling is sheltered

Shelter factor

Shelter factor	1 - [0.075 x (19)] = [0.78	(20)
nfiltration rate incorporating shelter factor	(18) x (20) = [0.27	(21)
nfiltration 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	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 (allowing for shelter and wind factor) (21) x (22a)m													
	0.35	0.34	0.33	0.30	0.29	0.26	0.26	0.25	0.27	0.29	0.31	0.32	(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

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

0.56 0.56 0.56 0.54 0.54 0.53 0.53 0.53 0.54 0.54 0.55 0.55 (24d)

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



N/A

N/A

5.00

0.35

3

(17)

(19)

(23a)

(23c)

Flomont	eat loss paramet		2000	Opania ==	Nete		Hualisa		u W/K		aluc	Λ	
Element			oss a, m²	Openings m ²	Net are A, m²		U-value W/m²K	A	O W/K		alue, 'm².K	Ахк kJ/k	•
Window					31.88	x [1.33] =	42.27]			(2
Door					1.95	x [1.00] = [1.95				(2
Roof window					1.81	x [1.59] = [2.88				(2
Basement floor					78.10	х [0.13] =	10.15				(2
external wall					112.7	8 x [0.18] = [20.30				(2
Party wall					72.42	x [0.00] = [0.00				(3
Roof					28.48	x [0.13] = [3.70				(3
Total area of external	elements ∑A, m²	:			255.0	0							(3
abric heat loss, W/K	= ∑(A × U)								(26)	.(30) + (3	32) =	81.25	(3
leat capacity Cm = ∑(A x к)						(28).	(30) +	(32) + (3	32a)(32	!e) =	N/A	(3
hermal mass parame	ter (TMP) in kJ/n	n²K										250.00	(3
Thermal bridges: ∑(L >	Ψ) calculated us	sing Appendix	K									14.20	(3
Total fabric heat loss										(33) + (3	(6) =	95.45	(3
Ja	n Feb	Mar	Apr	May	Jun	Jul	Aug	Se	p	Oct	Nov	Dec	:
entilation heat loss o	alculated month	ly 0.33 x (25)	m x (5)										
73	.25 72.94	72.64	71.24	70.97	69.75	69.75	69.52	70.	22	70.97	71.50	72.0	6 (3
leat transfer coefficie	ent, W/K (37)m +	+ (38)m											
168	3.69 168.39	168.09	166.68	166.42	165.20	165.20	164.97	165	.67	166.42	166.95	167.5	51
								Avera	ge = ∑(3	9)112/	12 =	166.68	(3
Heat loss parameter (HLP), W/m²K (39	9)m ÷ (4)											
1.	18 1.18	1.18	1.17	1.17	1.16	1.16	1.16	1.	16	1.17	1.17	1.18	3
1.	18 1.18	1.18	1.17	1.17	1.16	1.16	1.16			1.17 0)112/		1.17	_
	1	1.18	1.17	1.17	1.16	1.16	1.16						_
Number of days in mo	1		30.00	31.00		1.16 31.00	31.00		ge = ∑(4				(4
Number of days in mo	nth (Table 1a) .00 28.00	31.00						Avera	ge = ∑(4	0)112/	12 =	1.17	(4
Number of days in mo	nth (Table 1a) .00 28.00 ergy requiremen	31.00						Avera	ge = ∑(4	0)112/	12 =	31.0	0 (4
Number of days in mo 31 4. Water heating end	onth (Table 1a) .00 28.00 ergy requirement	31.00	30.00	31.00	30.00			Avera	ge = ∑(4	0)112/	12 =	1.17 31.0	0 (4
A. Water heating end	onth (Table 1a) 28.00 28.00 28.00 28.00 29.00 20.00	31.00 t es per day Vd,	30.00	31.00 = (25 x N) +	30.00	31.00		Avera	ge = ∑(4	31.00	30.00	1.17 31.0 2.92 103.59	(4 0 (4
Assumed occupancy, Annual average hot w	ergy requirement Nater usage in litre	31.00 t es per day Vd, Mar	30.00 average	31.00 = (25 x N) + May	30.00 36 Jun			Avera	ge = ∑(4	0)112/	12 =	1.17 31.0	(4
4. Water heating endassumed occupancy, Annual average hot water usage in lite	ergy requirement ater usage in litre an Feb res per day for ea	31.00 t es per day Vd, Mar ach month Vd	30.00 average Apr	31.00 = (25 x N) + May or from Tabl	30.00 36 Jun e 1c x (43)	31.00 Jul	31.00 Aug	Avera 30.	ge = Σ(4 00	0)112/: 31.00	30.00 Nov	1.17 31.0 2.92 103.59 Dec	(4
4. Water heating end Assumed occupancy, Annual average hot well.	ergy requirement Nater usage in litre	31.00 t es per day Vd, Mar ach month Vd	30.00 average	31.00 = (25 x N) + May	30.00 36 Jun e 1c x (43)	31.00	31.00	Avera 30.	ge = Σ(4 00	0)112/: 31.00 Oct	30.00 Nov	1.17 31.0 2.92 103.59 Dec	(4
A. Water heating end Assumed occupancy, Annual average hot w Ji Hot water usage in lite	ergy requirements ater usage in litre an Feb es per day for ea	31.00 t es per day Vd, Mar ech month Vd 105.66	30.00 average a Apr and a factor of the fa	31.00 = (25 x N) + May or from Tabl	30.00 36 Jun e 1c x (43) 93.23	31.00 Jul 93.23	31.00 Aug	Avera 30.	ge = Σ(4 00	0)112/: 31.00	30.00 Nov	1.17 31.0 2.92 103.59 Dec	(4
A. Water heating end Assumed occupancy, I Annual average hot w Ji Hot water usage in lite	ergy requirements ater usage in litre an Feb es per day for ea	31.00 t es per day Vd, Mar ech month Vd 105.66	30.00 average a Apr and a factor of the fa	31.00 = (25 x N) + May or from Tabl	30.00 36 Jun e 1c x (43) 93.23	31.00 Jul 93.23	31.00 Aug	Avera 30.	ge = Σ(4 00	0)112/: 31.00 Oct	30.00 Nov	1.17 31.0 2.92 103.59 Dec	(4
Assumed occupancy, Annual average hot w Hot water usage in lite Energy content of hot	ergy requirements ater usage in litre an Feb es per day for ea	ach month Vd	30.00 average a Apr and a factor of the fa	31.00 = (25 x N) + May or from Tabl	30.00 36 Jun e 1c x (43) 93.23 onth (see Ta	31.00 Jul 93.23	31.00 Aug	Avera 30.	ge = Σ(4 00 .52 .52 .62	Oct 105.66 Σ(44)1	30.00 Nov 109.81 12 =	1.17 31.0 2.92 103.59 Dec 113.9 1243.08	(4
Assumed occupancy, Annual average hot w Hot water usage in lite Energy content of hot	ergy requirement ater usage in litre es per day for ea 3.95 109.81	ach month Vd	30.00 average Apr ,m = factor 101.52 m x Tm/3	31.00 = (25 x N) + May or from Tabl 97.37	30.00 36 Jun e 1c x (43) 93.23 onth (see Ta	31.00 Jul 93.23 bles 1b,	Aug 97.37	Avera 30. Se	ge = Σ(4 00 .52 .52 .62	Oct 105.66 Σ(44)1	30.00 Nov 109.81 12 =	1.17 31.0 2.92 103.59 Dec 113.9 1243.08	(4 0 (4 1 (4 1 (4 1 (4 1 (4 1 (4 1 (4 1 (4)
A. Water heating end Assumed occupancy, Annual average hot w Janual average in lite Energy content of hot	ergy requirement 28.00 28.00 ergy requirement an Feb es per day for ea 3.95 109.81 water used = 4.1 3.98 147.79	ach month Vd	30.00 average Apr ,m = factor 101.52 m x Tm/3	31.00 = (25 x N) + May or from Tabl 97.37	30.00 36 Jun e 1c x (43) 93.23 onth (see Ta	31.00 Jul 93.23 bles 1b,	Aug 97.37	Avera 30. Se	ge = Σ(4 00 .52 .52 .62	Oct 105.66 Σ(44)1	30.00 Nov 109.81 12 =	1.17 31.00 2.92 103.59 Dec 113.9 1243.08	(4
4. Water heating end Assumed occupancy, Annual average hot water usage in liting 11: Energy content of hot 168 Distribution loss 0.15	ergy requirement 28.00 28.00 ergy requirement an Feb es per day for ea 3.95 109.81 water used = 4.1 3.98 147.79	31.00 t es per day Vd, Mar ach month Vd 105.66	30.00 average Apr ,m = factor 101.52 m x Tm/3	31.00 = (25 x N) + May or from Tabl 97.37	30.00 36 Jun 93.23 onth (see Ta	31.00 Jul 93.23 bles 1b,	Aug 97.37	Avera 30. Se	ge = Σ(4 00 .52 .52 .46 .2	Oct 105.66 Σ(44)1	30.00 Nov 109.81 12 =	1.17 31.00 2.92 103.59 Dec 113.9 1243.08	(4 0 (4 (4 (4 (4 (4 (4
A. Water heating end Assumed occupancy, Annual average hot water usage in little finergy content of hot loss O.15	ergy requirements 28.00 28.00 28.00 28.00 28.00 29.00 20.0	31.00 tes per day Vd, Mar ach month Vd 105.66	30.00 ,average : Apr ,m = factor 101.52 m x Tm/3 132.96	31.00 = (25 x N) + May or from Tabl 97.37 600 kWh/m 127.58	30.00 36 Jun 93.23 onth (see Ta	31.00 Jul 93.23 bles 1b,	Aug 97.37, 1c 1d) 117.07	Se 101	ge = Σ(4 00 .52 .52 .46 .2	Oct 105.66 Σ(44)1 138.06 Σ(45)1	30.00 Nov 109.81 12 = 150.70 12 =	1.17 31.0 2.92 103.59 Dec 113.9 1243.08 163.6 1629.88	(4 0 (4 1 (4 1 (4 1 (4 1 (4 1 (4 1 (4 1 (4) 1 (4
4. Water heating end Assumed occupancy, Annual average hot water usage in lities. Energy content of hot 168 Distribution loss 0.15 Vater storage loss cal	ergy requirements 28.00 28.00 28.00 28.00 28.00 29.00 20.0	31.00 tes per day Vd, Mar ach month Vd 105.66	30.00 ,average : Apr ,m = factor 101.52 m x Tm/3 132.96	31.00 = (25 x N) + May or from Tabl 97.37 600 kWh/m 127.58	30.00 36 Jun 93.23 onth (see Ta	31.00 Jul 93.23 bles 1b,	Aug 97.37, 1c 1d) 117.07	Se 101	ge = Σ(4 00 .52 .2	Oct 105.66 Σ(44)1 138.06 Σ(45)1	30.00 Nov 109.81 12 = 150.70 12 =	1.17 31.0 2.92 103.59 Dec 113.9 1243.08 163.6 1629.88	(4 0 (4 1 (4 1 (4 1 (4 1 (4 1 (4 1 (4 1 (4 1
Assumed occupancy, Annual average hot w Hot water usage in liti Energy content of hot 168 Distribution loss 0.15 Water storage loss cal 0.	ergy requirement 28.00 28.00 28.00 28.00 28.00 28.00 28.00 29.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00	31.00 tes per day Vd, Mar ach month Vd 105.66 18 x Vd,m x nr 152.51 22.88 month (55) x	30.00 average: Apr ,m = factor 101.52 average: 132.96 average: 19.94 average: (41)m 0.00	31.00 = (25 x N) + May or from Table 97.37 = 600 kWh/m 127.58 = 19.14 = 0.00	30.00 36 Jun e 1c x (43) 93.23 onth (see Ta 110.09	Jul 93.23 bles 1b, 102.02 15.30 0.00	Aug 97.37 , 1c 1d) 117.07	Se 101	ge = Σ(4 00 .52 .2	Oct 105.66 Σ(44)1 Σ(45)1	30.00 Nov 109.81 12 = 150.70 12 = 22.61	1.17 31.0 2.92 103.59 Dec 113.9 1243.08 163.6 1629.88	0 (4 0 (4 1 (4 1 : 2 95 (4 5 (4
Assumed occupancy, Annual average hot w Hot water usage in liti Energy content of hot Oistribution loss 0.15 Water storage loss ca O. f the vessel contains	ergy requirement 28.00 28.00 28.00 28.00 28.00 28.00 28.00 29.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00	31.00 tes per day Vd, Mar ach month Vd 105.66 18 x Vd,m x nr 152.51 22.88 month (55) x	30.00 average: Apr ,m = factor 101.52 average: 132.96 average: 19.94 average: (41)m 0.00	31.00 = (25 x N) + May or from Table 97.37 = 600 kWh/m 127.58 = 19.14 = 0.00	30.00 36 Jun e 1c x (43) 93.23 onth (see Ta 110.09	Jul 93.23 bles 1b, 102.02 15.30 0.00	Aug 97.37 , 1c 1d) 117.07	Se 101	ge = Σ(4 000 .52 .2 .46 .2	Oct 105.66 Σ(44)1 Σ(45)1	30.00 Nov 109.81 12 = 150.70 12 = 22.61	1.17 31.0 2.92 103.59 Dec 113.9 1243.08 163.6 1629.88	0 (4 0 (4 .:
Assumed occupancy, Annual average hot w Hot water usage in liti Energy content of hot Oistribution loss 0.15 Water storage loss ca O. f the vessel contains	anth (Table 1a) .00	31.00 t es per day Vd, Mar ech month Vd 105.66 18 x Vd,m x nr 152.51 22.88 month (55) x 0.00 torage or ded 0.00	30.00 average Apr averag	31.00 = (25 x N) + May or from Tabl 97.37 = 600 kWh/m 127.58 = 19.14 = 0.00	30.00 36 Jun e 1c x (43) 93.23 onth (see Ta 110.09 16.51 0.00 n x [(47) - Vs	31.00 Jul 93.23 bles 1b, 102.02 15.30 0.00 0.00] ÷ (47),	Aug 97.37 , 1c 1d) 117.07 17.56 0.00 , else (56)	Se 101	ge = Σ(4 000 .52 .2 .46 .2	Oct 105.66 Σ(44)1 20.71 0.00	30.00 Nov 109.81 12 = 150.70 12 = 22.61 0.00	1.17 31.00 2.92 103.59 Dec 113.9 1243.08 163.6 1629.88 24.5	0 (4 0 (4
Assumed occupancy, Annual average hot w Hot water usage in lite Energy content of hot 25 Water storage loss ca f the vessel contains of Crimary circuit loss fo	anth (Table 1a) .00	31.00 t es per day Vd, Mar ech month Vd 105.66 18 x Vd,m x nr 152.51 22.88 month (55) x 0.00 torage or ded 0.00	30.00 average Apr averag	31.00 = (25 x N) + May or from Tabl 97.37 = 600 kWh/m 127.58 = 19.14 = 0.00	30.00 36 Jun e 1c x (43) 93.23 onth (see Ta 110.09 16.51 0.00 n x [(47) - Vs	31.00 Jul 93.23 bles 1b, 102.02 15.30 0.00 0.00] ÷ (47),	Aug 97.37 , 1c 1d) 117.07 17.56 0.00 , else (56)	Se 101	ge = Σ(4 000	Oct 105.66 Σ(44)1 20.71 0.00	30.00 Nov 109.81 12 = 150.70 12 = 22.61 0.00	1.17 31.00 2.92 103.59 Dec 113.9 1243.08 163.6 1629.88 24.5	0 (4 0 (4

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					T		T	T	T T				7 ,
-	50.96	46.03	50.96	49.32	49.62	45.98	47.51	49.62	49.32	50.96	49.32	50.96	(61)
Total heat requi			1						1		222.22		7 (60)
c l Dinii:	219.94	193.82	203.47	182.28	177.20	156.07	149.53	166.69	167.78	189.02	200.02	214.61	(62)
Solar DHW inpu			т т					T			2.22		7 (60)
	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							т						7
	219.94	193.82	203.47	182.28	177.20	156.07	149.53	166.69	167.78	189.02	200.02	214.61	
				_						∑(64)1	12 = 2	2220.42	(64)
Heat gains from		ing (kWh/m		× [0.85 ×	(45)m + (61	.)m] + 0.8 ×	[(46)m + (!	57)m + (59))m]				7
	68.93	60.65	63.45	56.54	54.83	48.10	45.80	51.33	51.72	58.64	62.44	67.15	(65)
5. Internal gair	ns												
9	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains				7.10.	,	34		7108	ССР	5 0.		200	
victasone game	146.08	146.08	146.08	146.08	146.08	146.08	146.08	146.08	146.08	146.08	146.08	146.08	(66)
ighting gains (c							140.00	140.00	140.00	140.00	140.00	140.00] (00)
	27.91	24.79	20.16	15.26	11.41	9.63	10.41	13.53	18.16	23.05	26.91	28.68	(67)
Appliance gains					-	•	10.71	15.55	1 20.10	23.03	20.71		۱ (۵۱)
LE Paris	312.24	315.48	307.31	289.93	267.99	247.37	233.59	230.35	238.51	255.90	277.84	298.46	(68)
Cooking gains (c							233.33	230.33	250.51	233.30	277.04	230.40] (00)
cooking gains (c	37.61	37.61	37.61	37.61	37.61	37.61	37.61	37.61	37.61	37.61	37.61	37.61	(69)
Pump and fan g			37.01	37.01	37.01	37.01	37.01	37.01	37.01	37.01	37.01	37.01] (03)
amp and rang	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
₋osses e.g. evap			3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00] (70)
Losses e.g. evap	-116.87	-116.87	-116.87	-116.87	-116.87	-116.87	-116.87	-116.87	-116.87	-116.87	-116.87	-116.87	(71)
Water heating g			-110.67	-110.67	-110.67	-110.87	-110.67	-110.87	-110.67	-110.67	-110.67	-110.67] (/1)
water neating g	92.64	90.25	85.28	78.53	73.69	66.81	61.56	68.99	71.83	78.82	86.72	90.26	(72)
Гotal internal ga				7			01.50	1 66.99	/1.05	70.02	80.72	90.26] (/2)
i Otai iliterilai ge	502.61	500.34	482.58	453.54	422.91	,	275 20	382.69	398.33	427.60	461.29	197.22	7 (72)
	502.61	500.34	482.58	455.54	422.91	393.63	375.38	382.09	398.33	427.00	401.29	487.23	(73)
6. Solar gains													
			Access f	actor	Area	Sol	ar flux		g	FF		Gains	
			Table	6d	m²	W	V/m²	•	ific data able 6b	specific d or Table		W	
						- —							٦
NorthEast			0.54		4.36				0.63 x		=	10.54	∫ (75) ¬
SouthEast			0.54		7.43				0.63 x		=	58.59	∫ (77) □
SouthWest			0.54		7.16	-			0.63 x		=	56.46	<u> </u> (79)
NorthWest			0.54	4 x	2.02	-			0.63 x		=	4.88	∫ (81) ¬
				1		1	6.00 x	0.9 x	0.63 x	0.70	=	18.68	
			1.00		1.81	7 =							_
NorthWest			0.77	7 ×	1.88	x 1	1.28 x	0.9 x	0.63 x		=	6.48	_
NorthWest SouthEast				7 ×		x 1	1.28 x	0.9 x	0.63 x		= = =	6.48	
NorthWest SouthEast	ratts ∑(74)m	1(82)m	0.77	7 ×	1.88	x 1	1.28 x	0.9 x					
NorthWest SouthEast	ratts ∑(74)m 257.18	n(82)m 452.33	0.77	7 ×	1.88	x 1	1.28 x	0.9 x					(77)
NorthWest SouthEast Solar gains in w	257.18	452.33	0.77 0.77	7 x [1.88 9.03	x 1 x 3	1.28 x 6.79 x	0.9 x 0	0.63 x	0.70	= [101.54	(77)
NorthWest SouthEast Solar gains in w	257.18	452.33	0.77 0.77	7 x [1.88 9.03 1015.90	x 1 x 3	1.28 x 6.79 x	0.9 x 0	0.63 x	0.70	= [101.54	(77)
NorthWest SouthEast Solar gains in wa Total gains - into	257.18 ernal and so 759.80	452.33 blar (73)m + 952.67	0.77 0.77 654.12 (83)m	7 x 7 x 865.20	1.88 9.03 1015.90	x 1 x 3	1.28 x 6.79 x	0.9 x	727.12	509.68	310.71	101.54	(77)
NorthWest SouthEast Solar gains in water Total gains - inte	257.18 ernal and so 759.80	452.33 blar (73)m + 952.67 ture (heatin	0.77 0.77 654.12 (83)m 1136.70	7 x 7 x 865.20	1.88 9.03 1015.90 1438.81	x 1 x 3 1028.31	1.28 x 6.79 x	0.9 x	727.12	509.68	310.71	101.54 218.34 705.57	(81) (77) (83) (84)
Horizontal NorthWest SouthEast Solar gains in water Total gains - into 7. Mean interr Temperature du	257.18 ernal and so 759.80 nal tempera	452.33 blar (73)m + 952.67 ture (heating periods in	0.77 0.77 654.12 (83)m 1136.70 ng season)	7 x 7 x 865.20 1318.74	1.88 9.03 1015.90 1438.81 Table 9, Th1	x 1 x 3 1028.31 1421.94	1.28 x 6.79 x 983.24 1358.62	0.9 x 0 0.9 x 0 868.34	727.12 1125.45	0.70 509.68 937.27	310.71 771.99	101.54 218.34 705.57 21.00	(77)
NorthWest SouthEast Solar gains in water Total gains - inte	257.18 ernal and so 759.80	452.33 blar (73)m + 952.67 ture (heatin	0.77 0.77 654.12 (83)m 1136.70	7 x 7 x 865.20	1.88 9.03 1015.90 1438.81	x 1 x 3 1028.31	1.28 x 6.79 x	0.9 x	727.12	509.68	310.71	101.54 218.34 705.57	(77) (83) (84)

Utilisation factor	for gains f	or living are	ea n1,m (se	e Table 9a)								
	1.00	1.00	0.99	0.95	0.86	0.69	0.52	0.59	0.84	0.98	1.00	1.00
Mean internal te	mp of livin	g area T1 (s	steps 3 to 7	in Table 9	c)							
	19.65	19.85	20.14	20.50	20.80	20.95	20.99	20.98	20.87	20.46	19.98	19.62
Temperature dui	ring heating	g periods ir	the rest of	f dwelling f	rom Table 9	, Th2(°C)						•
	19.93	19.93	19.94	19.94	19.95	19.95	19.95	19.95	19.95	19.95	19.94	19.94
Utilisation factor	for gains f	or rest of d	welling n2,	m								
	1.00	0.99	0.98	0.94	0.81	0.60	0.40	0.46	0.77	0.97	1.00	1.00
Mean internal te	mperature	in the rest	of dwelling	T2 (follow	steps 3 to	7 in Table	9c)	'		1	•	•
	18.13	18.41	18.84	19.36	19.75	19.92	19.95	19.95	19.85	19.32	18.62	18.08
Living area fracti	on			•			•		Li	ving area ÷	(4) =	0.32
Mean internal te		for the wh	ole dwellin	g fLA x T1 -	+(1 - fLA) x ∃	Г2				J		
	18.62	18.87	19.26	19.73	20.08	20.25	20.28	20.28	20.17	19.69	19.06	18.57
Apply adjustmen			1		1							
,,,,	18.62	18.87	19.26	19.73	20.08	20.25	20.28	20.28	20.17	19.69	19.06	18.57
8. Space heatin	g requirem	ent										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor	for gains,	ηm										
	1.00	0.99	0.98	0.93	0.82	0.63	0.44	0.50	0.78	0.96	0.99	1.00
Useful gains, ηm	Gm, W (94	↓)m x (84)m	1									
	758.02	946.00	1112.68	1230.10	1178.87	890.83	602.16	628.71	881.23	902.09	767.69	704.40
Monthly average	e external t	emperature	e 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
Heat loss rate for	r mean inte	ernal tempe	erature, Lm	, W [(39)m	ı x [(93)m -	(96)m]						
	2415.28	2352.81	2144.12	1804.69	1395.42	933.45	608.29	639.86	1006.18	1512.24	1996.11	2407.80
Space heating re	quirement	, kWh/mon	th 0.024 x	[(97)m - (9	5)m] x (41)ı	m		•	•		•	•
	1233.00	945.38	767.39	413.71	161.11	0.00	0.00	0.00	0.00	453.95	884.47	1267.33
									•	8)15 <i>,</i> 10		5126.34
Space heating re	auirement	kWh/m²/v	ear						2(-	•	÷ (4)	42.99
	4	,,,								(,	. (- /	
9a. Energy requ	uirements -	individual	heating sy	stems inclu	ıding micro	-СНР						
Space heating												
Fraction of space	e heat from	secondary	/suppleme	ntary syste	m (table 11)						0.00
Fraction of space	e heat from	main syste	em(s)							1 - (2	01) =	1.00
Fraction of space	e heat from	main syste	em 2									0.00
Fraction of total	space heat	from main	system 1						(20)2) x [1- (20	3)] =	1.00
Fraction of total	space heat	from main	system 2							(202) x (2	03) =	0.00
Efficiency of mai	n system 1	(%)										93.40
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating fu	el (main sv	stem 1), kV	Vh/month		-			-	,			
	1320.13	1012.18	821.62	442.94	172.50	0.00	0.00	0.00	0.00	486.03	946.97	1356.88
							<u>,</u>		1	1)15, 10		6559.25
									۷,۲۰۰	,, 10		
Water heating												
_	er heater											
Water heating Efficiency of wat		00 E1	90 00	97.05	0/1 01	8U 3U	90.20	90.20	90.20	07 10	00 25	00 70
Efficiency of wat	88.71	88.51	88.08	87.05	84.81	80.30	80.30	80.30	80.30	87.18	88.35	88.78
_	88.71	!	88.08	87.05 209.39	84.81	80.30	80.30	80.30	80.30	87.18	88.35	88.78

	∑(219a)112 =	2598.28	(219)
Annual totals			
Space heating fuel - main system 1		6559.25	
Water heating fuel		2598.28	
Electricity for pumps, fans and electric keep-hot (Table 4f)			
central heating pump or water pump within warm air heating unit	30.00		(230c)
boiler flue fan	45.00		(230e)
Total electricity for the above, kWh/year		75.00	(231)
Electricity for lighting (Appendix L)		492.84	(232)
Total delivered energy for all uses	(211)(221) + (231) + (232)(237b) =	9725.36	(238)

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	6559.25	x	3.48	x 0.01 =	228.26	(240)
Water heating	2598.28	x	3.48	x 0.01 =	90.42	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	492.84	x	13.19	x 0.01 =	65.01	(250)
Additional standing charges					120.00	(251)
Total energy cost			(240)(242) +	- (245)(254) =	513.58	(255)

11a. SAP rating - individual heating systems including micro-CHP		
Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.15	(257)
SAP value	83.95	
SAP rating (section 13)	84	(258)
SAP band	В	

	Energy kWh/year		Emission factor kg CO₂/kWh	Emissions kg CO₂/year	
Space heating - main system 1	6559.25	x	0.216 =	1416.80	(261)
Water heating	2598.28	x	0.216 =	561.23	(264)
Space and water heating			(261) + (262) + (263) + (26	4) = 1978.03	(265)
Pumps and fans	75.00	x	0.519 =	38.93	(267)
Electricity for lighting	492.84	x	0.519 =	255.78	(268)
Total CO ₂ , kg/year			(265)(27	1) = 2272.73	(272)
Dwelling CO₂ emission rate			(272) ÷ (4) = 15.95	(273)
El value				83.76	
El rating (section 14)				84	(274)
EI band				В	

	Energy kWh/year		Primary factor	Primary Energy kWh/year		
Space heating - main system 1	6559.25	x	1.22	=	8002.28	(261
Water heating	2598.28	x	1.22	=	3169.90	(264
Space and water heating			(261) + (262) + ((263) + (264) =	11172.18	(265
Pumps and fans	75.00	x	3.07	=	230.25	(267
Electricity for lighting	492.84	х	3.07	=	1513.01	(268

90.63

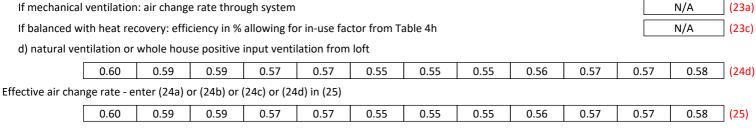
0.63 (2)



Assessor name	Mr Jason Doherty	Assessor number	2634
Client		Last modified	07/06/2018
Address	3 6 Streatley Place, London, NW3 1HP		

Client							La	ast modified	l	07/06	/2018	
Address	3 6 Strea	tley Place,	London, NV	W3 1HP								
1. Overall dwelling dimens	ions											
				Α	rea (m²)			rage storey eight (m)		Vo	olume (m³)	
Lowest occupied					78.10] (1a) x		2.50	(2a) =		195.25	(3a)
Total floor area	(1a)	+ (1b) + (1d	c) + (1d)(1	1n) =	78.10	(4)						
Dwelling volume							(3a) + (3b) + (3	c) + (3d)(3n) =	195.25	(5)
2. Ventilation rate												
										m	³ per hour	
Number of chimneys								0	x 40 :	=	0	(6a)
Number of open flues								0	x 20 :	=	0	(6b)
Number of intermittent fans								3	x 10 :	=	30	(7a)
Number of passive vents								0	x 10 :	=	0	(7b)
Number of flueless gas fires								0	x 40 :	=	0	(7c)
										Air	changes pe hour	r
Infiltration due to chimneys,	flues, fans	s, PSVs		(6a)	+ (6b) + (7a	a) + (7b) + (7c) =	30	÷ (5)	= [0.15	(8)
lf a pressurisation test has b	een carried	d out or is i	ntended, pr	roceed to (1	17), otherw	vise continu	e from (9)	to (16)	_			_
Air permeability value, q50,	expressed	in cubic me	etres per ho	our per squ	are metre	of envelop	e area				5.00	(17)
If based on air permeability	value, ther	n (18) = [(17	7) ÷ 20] + (8	3), otherwis	se (18) = (1	6)					0.40	(18)
Number of sides on which th	e dwelling	; is sheltere	ed								2	(19)
Shelter factor								1 -	· [0.075 x (1	L9)] =	0.85	(20)
Infiltration rate incorporatin	g shelter fa	actor							(18) x (20) =	0.34	(21)
Infiltration rate modified for	monthly v	vind speed										
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind speed	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 (all	owing for	shelter and	wind facto	or) (21) x (2	2a)m							
0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.40	(22b
Calculate effective air chang	e rate for t	he applical	ble case:									

	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.7
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	1.1
Adjusted infiltrat	ion rate (al	lowing for	shelter and	wind facto	or) (21) x (2	2a)m						
	0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.4
Calculate effective	ve air chang	ge rate for t	the applical	ole case:								
If mechanical	ventilation	: air change	e rate throu	ıgh system								N/A
If balanced w	ith heat red	covery: effic	ciency in %	allowing fo	r in-use fac	ctor from Ta	able 4h					N/A
d) natural ventilation or whole house positive input ventilation from loft												





3. Heat losses and heat loss parameter									
Element	Gross area, m²	Openings m ²	Net ar		U-value W/m²K	A x U W/F	К к-value, kJ/m².К	Ахк, kJ/K	
Window			16.13	1 x	1.33	= 21.36			(27)
Door			1.95	x	1.00	= 1.95			(26)
Roof window			1.44	x	1.59	= 2.29			(27a)
External wall			84.26	5 x	0.18	= 15.17			(29a)
Party wall			13.00) x	0.00	= 0.00			(32)
Roof			28.54	4 x	0.13	= 3.71			(30)
Total area of external elements ΣA , m^2			132.3	0					(31)
Fabric heat loss, W/K = $\sum (A \times U)$						(26).	(30) + (32) =	44.48	(33)
Heat capacity Cm = \sum (A x κ)					(28)	.(30) + (32) + (32a)(32e) =	N/A	(34)
Thermal mass parameter (TMP) in kJ/m²K								250.00	(35)
Thermal bridges: $\Sigma(L \times \Psi)$ calculated using App	oendix K							11.74	(36)
Total fabric heat loss							(33) + (36) =	56.22	(37)
Jan Feb Ma	Apr	May	Jun	Jul	Aug	Sep	Oct Nov	Dec	
Ventilation heat loss calculated monthly 0.33									_
38.38 38.14 37.9	1 36.81	36.60	35.64	35.64	35.46	36.01	36.60 37.0	2 37.45	(38)
Heat transfer coefficient, W/K (37)m + (38)m									7
94.60 94.36 94.1	2 93.02	92.81	91.85	91.85	91.68	92.22	92.81 93.2]
	`					Average = $\sum (3)$	39)112/12 = _	93.02	(39)
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4	·	1.10	1.10	1.10	1 4 4 7	1.10	110 110	1 20	٦
1.21 1.21 1.21	1.19	1.19	1.18	1.18	1.17	1.18	1.19 1.19		_ □ (40)
Number of days in month (Table 1a)						Average = $\sum_{i=1}^{n} (2^{n})^{n}$	10)112/12 =	1.19	(40)
31.00 28.00 31.0	0 30.00	31.00	30.00	31.00	31.00	30.00	31.00 30.0	0 31.00	(40)
32.00	00.00	02.00	00.00	02.00	7 02.00	7 30.00	02.00	02.00	
4. Water heating energy requirement							_		
Assumed occupancy, N								2.43	(42)
Annual average hot water usage in litres per o			36					91.81	(43)
Jan Feb Mai		May	Jun	Jul	Aug	Sep	Oct Nov	Dec	
Hot water usage in litres per day for each mor				02.62	06.00	00.00	02.65	100.00	٦
100.99 97.32 93.6	5 89.98	86.30	82.63	82.63	86.30	89.98	93.65 97.3	!]]
Energy content of hot water used = 4.18 x Vd,	m v nm v Tm/3	2600 WWh/m	onth (soo Ta	bloc 1b	1014)		∑(44)112 =	1101.76	(44)
149.77 130.99 135.3		113.08	97.58	90.42	103.76	105.00	122.36 133.5	7 145.05	٦
149.77 130.99 135	17 117.85	113.08	97.58	90.42	103.76	105.00	$\sum (45)112 = $	1444.58	」 │ (45)
Distribution loss 0.15 x (45)m							2(43)112 -	1444.36	(43)
22.47 19.65 20.2	8 17.68	16.96	14.64	13.56	15.56	15.75	18.35 20.0	4 21.76	(46)
Water storage loss calculated for each month		10.50	11.01	15.50	13.30	13.73	10.03 20.0	. 21.70	()
0.00 0.00 0.00		0.00	0.00	0.00	0.00	0.00	0.00 0.00	0.00	(56)
If the vessel contains dedicated solar storage			I		-1			1 2,00	
0.00 0.00 0.00		0.00	0.00	0.00	0.00	0.00	0.00 0.00	0.00	(57)
Primary circuit loss for each month from Table			I					l	_ · '
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	!	. !			!		!	· ·	_ *
50.96 44.79 47.7		43.98	40.75	42.11	43.98	44.37	47.72 47.9	9 50.96	(61)
Total heat required for water heating calculat	ed for each mo	onth 0.85 x (45)m + (46)ı	m + (57))m + (59)m	+ (61)m			

	200.73	175.79	182.89	162.22	157.06	138.33	132.53	147.74	149.37	170.09	181.56	196.01	(62)
Solar DHW inpu		1			l	138.33	132.33	147.74	143.37	170.03	101.50	130.01] (02)
r.	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] ()
	200.73	175.79	182.89	162.22	157.06	138.33	132.53	147.74	149.37	170.09	181.56	196.01]
		1		•	•	1	1		'	∑(64)1	.12 = 3	1994.29	(64)
Heat gains from	water heat	ting (kWh/m	nonth) 0.2!	5 × [0.85 × ((45)m + (61	L)m] + 0.8 ×	: [(46)m + (!	57)m + (59))m]				
	62.54	54.75	56.88	50.28	48.59	42.63	40.59	45.49	46.00	52.62	56.41	60.97	(65)
						•	•				•		
5. Internal gai	ns												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains							1						1
	121.29	121.29	121.29	121.29	121.29	121.29	121.29	121.29	121.29	121.29	121.29	121.29	(66)
Lighting gains (d			., equation	L9 or L9a),	also see Ta						1	1	1
	19.21	17.06	13.87	10.50	7.85	6.63	7.16	9.31	12.49	15.86	18.52	19.74	(67)
Appliance gains				on L13 or L1	L3a), also s	ee Table 5		.				_	1
	215.42	217.66	212.03	200.03	184.90	170.67	161.16	158.93	164.56	176.55	191.69	205.92	(68)
Cooking gains (1								1	7
	35.13	35.13	35.13	35.13	35.13	35.13	35.13	35.13	35.13	35.13	35.13	35.13	(69)
Pump and fan g	ains (Table			ı	r	<u> </u>			1		1	1	1
	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evap	oration (Ta			1									7
	-97.03	-97.03	-97.03	-97.03	-97.03	-97.03	-97.03	-97.03	-97.03	-97.03	-97.03	-97.03	(71)
Water heating §				ı	ı						1	1	7
	84.06	81.48	76.45	69.83	65.31	59.21	54.56	61.15	63.89	70.72	78.35	81.95	(72)
					l] (72)
Total internal g		+ (67)m + (6	8)m + (69)		+ (71)m + (72)m							1
Total internal g	381.07			m + (70)m - 342.75	l		285.27	291.77	303.34	325.53	350.94	369.99	(73)
Total internal ga		+ (67)m + (6	8)m + (69)		+ (71)m + (72)m		291.77		325.53	350.94	369.99	1
		+ (67)m + (6	8)m + (69)	342.75	+ (71)m + (72)m 298.89		291.77	303.34	325.53 FF	350.94	369.99 Gains	1
		+ (67)m + (6	8)m + (69) 364.73	342.75	+ (71)m + (320.45	72)m 298.89 Sol	285.27	spec	303.34 g ific data	FF specific c	data	1	1
6. Solar gains		+ (67)m + (6	8)m + (69) 364.73 Access 1 Table	342.75 Factor 6d	+ (71)m + (320.45 Area m ²	72)m 298.89 Sol	285.27 ar flux V/m²	spec or T	g ific data	FF specific c or Table	data : 6c	Gains W] (73)
6. Solar gains NorthWest		+ (67)m + (6	8)m + (69) 364.73 Access 1 Table	342.75 Factor 6d	+ (71)m + (320.45 Area m ²	72)m 298.89 Sol	285.27 ar flux //m²	spec or T	g ific data able 6b	FF specific c or Table	data e 6c	Gains W] (73)] (81)
6. Solar gains NorthWest SouthEast		+ (67)m + (6	8)m + (69) 364.73 Access 1 Table 0.7	342.75 factor 6d 7 x 7 x	+ (71)m + (320.45 Area m² 0.99 8.29	72)m 298.89 Sol V x 1 x 3	285.27 ar flux y/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	data : 6c = =	Gains W 3.41 93.22] (73)] (81)] (77)
6. Solar gains NorthWest SouthEast SouthWest		+ (67)m + (6	8)m + (69) 364.73 Access 1 Table 0.7 0.7	342.75 Factor 6d 7 x 7 x 7 x	Area m² 0.99 8.29 1.28	72)m 298.89 Sol W x 1 x 3 x 3	285.27 ar flux //m² 1.28 x 6.79 x 6.79 x	spec or T 0.9 x (0.9 x	g ific data able 6b 0.63 x 0.63 x	FF specific c or Table 0.70 0.70 0.70	data : 6c	Gains W 3.41 93.22 14.39] (73)] (81)] (77)] (79)
6. Solar gains NorthWest SouthEast SouthWest NorthEast		+ (67)m + (6	8)m + (69) 364.73 Access 1 Table 0.7 0.7 0.7	342.75 factor 6d 7	Area m² 0.99 8.29 1.28 5.55	72)m 298.89 Sol X 1 X 3 X 3 X 1	285.27 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	FF specific c or Table 0.70 0.70 0.70 0.70	data : 6c	Gains W 3.41 93.22 14.39 19.14] (73)] (81)] (77)
6. Solar gains NorthWest SouthEast SouthWest NorthEast Horizontal	381.07	+ (67)m + (6 378.58	8)m + (69) 364.73 Access 1 Table 0.7 0.7	342.75 factor 6d 7	Area m² 0.99 8.29 1.28	72)m 298.89 Sol X 1 X 3 X 3 X 1	285.27 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	FF specific c or Table 0.70 0.70 0.70 0.70	data : 6c	Gains W 3.41 93.22 14.39] (73)] (81)] (77)] (79)
6. Solar gains NorthWest SouthEast SouthWest NorthEast	381.07	+ (67)m + (6 378.58	8)m + (69) 364.73 Access f Table 0.7 0.7 0.7 1.0	342.75 factor 6d 7	Area m² 0.99 8.29 1.28 5.55 1.44	Sol W 3 x 3 x 3 x 1 x 2	285.27 ar flux J/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	FF specific c or Table 0.70 0.70 0.70 0.70 0.70	data e 6c = [= [= = [= = [Gains W 3.41 93.22 14.39 19.14 14.86] (73)] (81)] (77)] (79)] (75)
6. Solar gains NorthWest SouthEast SouthWest NorthEast Horizontal Solar gains in w	381.07 atts ∑(74)m 145.02	+ (67)m + (6 378.58 378.58	8)m + (69) 364.73 Access f Table 0.7 0.7 0.7 1.0	342.75 factor 6d 7	Area m² 0.99 8.29 1.28 5.55	72)m 298.89 Sol X 1 X 3 X 3 X 1	285.27 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	FF specific c or Table 0.70 0.70 0.70 0.70	data : 6c	Gains W 3.41 93.22 14.39 19.14] (73)] (81)] (77)] (79)
6. Solar gains NorthWest SouthEast SouthWest NorthEast Horizontal	381.07 atts ∑(74)n 145.02 ernal and so	n(82)m 260.07 plar (73)m +	8)m + (69) 364.73 Access f Table 0.7 0.7 0.7 1.0 388.37 (83)m	342.75 factor 6d 7	Area m² 0.99 8.29 1.28 5.55 1.44	Sol W 3 x 3 x 3 x 1 x 2 654.51	285.27 ar flux J/m² 1.28	spec or T 0.9 x (0.9 x	g ific data able 6b 0.63	FF specific c or Table 0.70 0.70 0.70 0.70 0.70 296.41	data e 6c = = = = = = = = = = = = = = = = = = =	Gains W 3.41 93.22 14.39 19.14 14.86] (73)] (81)] (77)] (79)] (75)] (83)
6. Solar gains NorthWest SouthEast SouthWest NorthEast Horizontal Solar gains in w	381.07 atts ∑(74)m 145.02	+ (67)m + (6 378.58 378.58	8)m + (69) 364.73 Access f Table 0.7 0.7 0.7 1.0	342.75 factor 6d 7	Area m² 0.99 8.29 1.28 5.55 1.44	Sol W 3 x 3 x 3 x 1 x 2	285.27 ar flux J/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	FF specific c or Table 0.70 0.70 0.70 0.70 0.70	data e 6c = [= [= = [= = [Gains W 3.41 93.22 14.39 19.14 14.86] (73)] (81)] (77)] (79)] (75)
6. Solar gains NorthWest SouthEast SouthWest NorthEast Horizontal Solar gains in w	381.07 atts ∑(74)m 145.02 ernal and so 526.10	n(82)m 260.07 blar (73)m +	8)m + (69) 364.73 Access f Table 0.7 0.7 0.7 1.0 388.37 (83)m 753.10	342.75 factor 6d 7	Area m² 0.99 8.29 1.28 5.55 1.44	Sol W 3 x 3 x 3 x 1 x 2 654.51	285.27 ar flux J/m² 1.28	spec or T 0.9 x (0.9 x	g ific data able 6b 0.63	FF specific c or Table 0.70 0.70 0.70 0.70 0.70 296.41	data e 6c = = = = = = = = = = = = = = = = = = =	Gains W 3.41 93.22 14.39 19.14 14.86] (73)] (81)] (77)] (79)] (75)] (83)
6. Solar gains NorthWest SouthEast SouthWest NorthEast Horizontal Solar gains in w	381.07 atts ∑(74)m 145.02 ernal and so 526.10 nal tempera	n(82)m 260.07 clar (73)m + 638.65	8)m + (69) 364.73 Access frable 0.7 0.7 0.7 1.0 388.37 (83)m 753.10	342.75 factor 6d 7	Area m² 0.99 8.29 1.28 5.55 1.44 640.38	298.89 Sol W	285.27 ar flux J/m² 1.28	spec or T 0.9 x (0.9 x	g ific data able 6b 0.63	FF specific c or Table 0.70 0.70 0.70 0.70 0.70 296.41	data e 6c = = = = = = = = = = = = = = = = = = =	Gains W 3.41 93.22 14.39 19.14 14.86] (73)] (81)] (77)] (79)] (75)] (83)
NorthWest SouthEast SouthWest NorthEast Horizontal Solar gains in w Total gains - int	381.07 atts ∑(74)m 145.02 ernal and so 526.10 nal tempera	n(82)m 260.07 clar (73)m + 638.65	8)m + (69) 364.73 Access frable 0.7 0.7 0.7 1.0 388.37 (83)m 753.10	342.75 factor 6d 7	Area m² 0.99 8.29 1.28 5.55 1.44 640.38	298.89 Sol W	285.27 ar flux J/m² 1.28	spec or T 0.9 x (0.9 x	g ific data able 6b 0.63	FF specific c or Table 0.70 0.70 0.70 0.70 0.70 296.41	data e 6c = = = = = = = = = = = = = = = = = = =	Gains W 3.41 93.22 14.39 19.14 14.86 122.51] (73)] (81)] (77)] (79)] (75)] (83)
6. Solar gains NorthWest SouthEast SouthWest NorthEast Horizontal Solar gains in w Total gains - int	atts ∑(74)n 145.02 ernal and so 526.10 nal temperating heating	n(82)m 260.07 blar (73)m + 638.65 sture (heating periods in Feb	8)m + (69) 364.73 Access f Table 0.7 0.7 0.7 1.0 388.37 (83)m 753.10 the living a Mar	342.75 factor 6d 7	Area m² 0.99 8.29 1.28 5.55 1.44 640.38 960.83	72)m 298.89 Sol V x 1 x 3 x 3 x 1 x 2 654.51 953.40	285.27 ar flux y/m² 1.28	spec or T 0.9 x (0.9 x (0.0	g ific data able 6b 0.63 x 0.63 x 0.63 x 0.63 x 0.63 x 741.41	FF specific c or Table 0.70 0.70 0.70 0.70 0.70 0.70 0.70	data : 6c = [Gains W 3.41 93.22 14.39 19.14 14.86 492.50 21.00] (73)] (81)] (77)] (79)] (75)] (83)
NorthWest SouthEast SouthWest NorthEast Horizontal Solar gains in w Total gains - int	atts ∑(74)n 145.02 ernal and so 526.10 nal temperating heating	n(82)m 260.07 blar (73)m + 638.65 sture (heating periods in Feb	8)m + (69) 364.73 Access f Table 0.7 0.7 0.7 1.0 388.37 (83)m 753.10 the living a Mar	342.75 factor 6d 7	Area m² 0.99 8.29 1.28 5.55 1.44 640.38 960.83	72)m 298.89 Sol V x 1 x 3 x 3 x 1 x 2 654.51 953.40	285.27 ar flux y/m² 1.28	spec or T 0.9 x (0.9 x (0.0	g ific data able 6b 0.63 x 0.63 x 0.63 x 0.63 x 0.63 x 741.41	FF specific c or Table 0.70 0.70 0.70 0.70 0.70 0.70 0.70	data : 6c = [Gains W 3.41 93.22 14.39 19.14 14.86 492.50 21.00] (73)] (81)] (77)] (79)] (75)] (83)] (84)
6. Solar gains NorthWest SouthEast SouthWest NorthEast Horizontal Solar gains in w Total gains - int	atts ∑(74)n 145.02 ernal and so 526.10 nal temperating heatin Jan or for gains for 1.00	n(82)m 260.07 blar (73)m + 638.65 sture (heating periods in Feb for living are	8)m + (69) 364.73 Access 1 Table 0.7 0.7 0.7 1.0 388.37 (83)m 753.10 the living a Mar an 1,m (se	342.75 factor 6d 7	Area m² 0.99 8.29 1.28 5.55 1.44 640.38 960.83 Table 9, Thi May 0.78	72)m 298.89 Sol V x 1 x 3 x 3 x 1 x 2 654.51 953.40 L(°C) Jun	285.27 ar flux y/m² 1.28	spec or T 0.9 x (0.9 x (0.0	g ific data able 6b 0.63	FF specific c or Table 0.70 0.70 0.70 0.70 0.70 0.70 0.70 0.7	data : 6c	Gains W 3.41 93.22 14.39 19.14 14.86 492.50 21.00 Dec] (73)] (81)] (77)] (79)] (75)] (83)
NorthWest SouthEast SouthWest NorthEast Horizontal Solar gains in w Total gains - int 7. Mean interr Temperature de Utilisation factor	atts ∑(74)n 145.02 ernal and so 526.10 nal temperating heatin Jan or for gains for 1.00	n(82)m 260.07 blar (73)m + 638.65 sture (heating periods in Feb for living are	8)m + (69) 364.73 Access 1 Table 0.7 0.7 0.7 1.0 388.37 (83)m 753.10 the living a Mar an 1,m (se	342.75 factor 6d 7	Area m² 0.99 8.29 1.28 5.55 1.44 640.38 960.83 Table 9, Thi May 0.78	72)m 298.89 Sol V x 1 x 3 x 3 x 1 x 2 654.51 953.40 L(°C) Jun	285.27 ar flux y/m² 1.28	spec or T 0.9 x (0.9 x (0.0	g ific data able 6b 0.63	FF specific c or Table 0.70 0.70 0.70 0.70 0.70 0.70 0.70 0.7	data : 6c	Gains W 3.41 93.22 14.39 19.14 14.86 492.50 21.00 Dec] (73)] (81)] (77)] (79)] (75)] (83)] (84)

Temperature during heat	ing periods in	n the rest o	f dwelling f	rom Table	9. Th2(°C)							
19.91	19.91	19.92	19.93	19.93	19.94	19.94	19.94	19.94	19.93	19.93	19.92	(88)
Utilisation factor for gain		1] (/
1.00	0.99	0.97	0.89	0.72	0.50	0.34	0.39	0.68	0.94	0.99	1.00	(89)
Mean internal temperatu	_		1	1				0.00] (/
18.25	18.54	18.98	19.49	19.81	19.92	19.94	19.94	19.87	19.43	18.75	18.21	(90)
Living area fraction									ving area ÷		0.57	(91)
Mean internal temperatu	re for the wh	nole dwellin	ng fLA x T1 +	+(1 - fLA) x	T2				g a. ca ·	()] (0-)
19.10	19.34	19.70	20.13	20.41	20.52	20.54	20.54	20.46	20.07	19.50	19.06	(92)
Apply adjustment to the		Į	!	1	Į.] (0 = /
19.10		19.70	20.13	20.41	20.52	20.54	20.54	20.46	20.07	19.50	19.06	(93)
] (00)
8. Space heating require	ement											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gain	s, ηm											
0.99	0.99	0.96	0.89	0.75	0.55	0.40	0.45	0.72	0.94	0.99	1.00	(94)
Useful gains, ηmGm, W (94)m x (84)n	n										
523.16	629.82	725.34	782.72	722.21	528.55	359.35	374.83	535.20	583.49	520.80	490.46	(95)
Monthly average externa	l temperatur	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 for mean in	nternal temp	erature, Lm	n, W [(39)m	x [(93)m -	(96)m]							
1399.8	8 1362.45	1242.44	1044.49	808.37	543.69	361.66	379.11	586.88	878.95	1156.27	1391.87	(97)
Space heating requireme	nt, kWh/mor	nth 0.024 x	[(97)m - (9	5)m] x (41)	m							
652.28	492.32	384.72	188.48	64.11	0.00	0.00	0.00	0.00	219.83	457.54	670.65	
												7
								∑(98	8)15, 10	.12 = 3	3129.93	(98)
Space heating requireme	nt kWh/m²/y	/ear						∑(98		.12 = 3 ÷ (4)	40.08	(98) (99)
	•		etams inclu	iding micro	CHD			∑(98] ' '
9a. Energy requirement	•		stems inclu	iding micro	o-CHP			∑(98] ' '
9a. Energy requirement	s - individual	l heating sy						∑(98			40.08	(99)
9a. Energy requirement Space heating Fraction of space heat from	s - individual	I heating sy y/suppleme						∑(98	(98)	÷ (4)	0.00	(99)
9a. Energy requirement Space heating Fraction of space heat fro Fraction of space heat fro	s - individual om secondary om main syste	I heating sy y/suppleme em(s)						∑(98		÷ (4)	0.00	(99) (201) (202)
9a. Energy requirement Space heating Fraction of space heat fro Fraction of space heat fro Fraction of space heat fro	s - individual om secondary om main syste	I heating sy y/suppleme em(s) em 2							1 - (2	÷ (4)	0.00 1.00 0.00	(99) (201) (202) (202)
9a. Energy requirement Space heating Fraction of space heat fro Fraction of space heat fro Fraction of space heat fro Fraction of total space heat	s - individual om secondary om main syste om main syste at from mair	I heating sy y/suppleme em(s) em 2							1 - (2 02) x [1- (20	÷ (4)	0.00 1.00 0.00] (99)] (201)] (202)] (202)] (204)
9a. Energy requirement Space heating Fraction of space heat fro Fraction of space heat fro Fraction of space heat fro Fraction of total space he Fraction of total space he	s - individual om secondary om main syste om main syste at from main	I heating sy y/suppleme em(s) em 2							1 - (2	÷ (4)	0.00 1.00 0.00 1.00 0.00	[(99) [(201) [(202) [(204) [(205) [
9a. Energy requirement Space heating Fraction of space heat fro Fraction of space heat fro Fraction of space heat fro Fraction of total space he Fraction of total space he Efficiency of main system	om secondary om main syste om main syste at from mair at from mair at from mair	I heating sy y/suppleme em(s) em 2 n system 1 n system 2	entary syste	m (table 11	1)	Ini	Διισ	(20	1 - (2 02) x [1- (20 (202) x (2	÷ (4)	0.00 1.00 0.00 1.00 0.00 93.40] (99)] (201)] (202)] (202)] (204)
9a. Energy requirement Space heating Fraction of space heat fro Fraction of space heat fro Fraction of space heat fro Fraction of total space he Fraction of total space he Efficiency of main system Jan	om secondary om main syste om main syste om main syste oat from main at from main 1 (%)	y/suppleme em(s) em 2 n system 1 n system 2				Jui	Aug		1 - (2 02) x [1- (20	÷ (4)	0.00 1.00 0.00 1.00 0.00	[(99) [(201) [(202) [(204) [(205) [
9a. Energy requirement Space heating Fraction of space heat fro Fraction of space heat fro Fraction of space heat fro Fraction of total space he Fraction of total space he Efficiency of main system Jan Space heating fuel (main	om secondary om main syste om main syste at from mair at from mair 1 (%) Feb system 1), k	y/suppleme em(s) em 2 n system 1 n system 2 Mar Wh/month	Apr	m (table 11	Jun			(20 Sep	1 - (2 02) x [1- (20 (202) x (2	÷ (4)	0.00 1.00 0.00 1.00 0.00 93.40 Dec	[(99) [(201) [(202) [(204) [(205) [
9a. Energy requirement Space heating Fraction of space heat fro Fraction of space heat fro Fraction of space heat fro Fraction of total space he Fraction of total space he Efficiency of main system Jan	om secondary om main syste om main syste at from mair at from mair 1 (%) Feb system 1), ky	y/suppleme em(s) em 2 n system 1 n system 2	entary syste	m (table 11	1)	Jul 0.00	Aug 0.00	(20 Sep	1 - (2 02) x [1- (20 (202) x (2 Oct	÷ (4)	0.00 1.00 0.00 1.00 0.00 93.40 Dec	[(99) [(201) [(202) [(204) [(205) [(206) [
9a. Energy requirement Space heating Fraction of space heat fro Fraction of space heat fro Fraction of space heat fro Fraction of total space he Fraction of total space he Efficiency of main system Jan Space heating fuel (main 698.33	om secondary om main syste om main syste at from mair at from mair 1 (%) Feb system 1), k	y/suppleme em(s) em 2 n system 1 n system 2 Mar Wh/month	Apr	m (table 11	Jun			(20 Sep	1 - (2 02) x [1- (20 (202) x (2	÷ (4)	0.00 1.00 0.00 1.00 0.00 93.40 Dec	[(99) [(201) [(202) [(204) [(205) [
9a. Energy requirement Space heating Fraction of space heat from Fraction of space heat from Fraction of total space heat Fraction o	om secondary om main syste om main syste om mair syste out from mair out from mair out from syste system 1), kv	y/suppleme em(s) em 2 n system 1 n system 2 Mar Wh/month	Apr	m (table 11	Jun			(20 Sep	1 - (2 02) x [1- (20 (202) x (2 Oct	÷ (4)	0.00 1.00 0.00 1.00 0.00 93.40 Dec	[(99) [(201) [(202) [(204) [(205) [(206) [
9a. Energy requirement Space heating Fraction of space heat fro Fraction of space heat fro Fraction of space heat fro Fraction of total space he Fraction of total space he Efficiency of main system Jan Space heating fuel (main 698.33	om secondary om main syste om main syste om main syste om mair at from mair at from mair 1 (%) Feb system 1), kv	y/suppleme em(s) em 2 n system 1 n system 2 Mar Wh/month 411.91	Apr 201.80	May 68.64	Jun 0.00	0.00	0.00	(20 Sep 0.00 Σ(21:	1 - (2 02) x [1- (20 (202) x (2 Oct 235.36 1)15, 10	÷ (4) 01) = 03)] = Nov 489.87 .12 = 5	0.00 1.00 0.00 1.00 0.00 93.40 Dec 718.04	[(99) [(201) [(202) [(204) [(205) [(206) [(211) [(211) [(211) [(211) [(205)
9a. Energy requirement Space heating Fraction of space heat from Fraction of space heat from Fraction of space heat from Fraction of total space heat Fraction of	om secondary om main syste om main syste om main syste om mair at from mair at from mair 1 (%) Feb system 1), kv	y/suppleme em(s) em 2 n system 1 n system 2 Mar Wh/month	Apr	m (table 11	Jun			(20 Sep	1 - (2 02) x [1- (20 (202) x (2 Oct	÷ (4)	0.00 1.00 0.00 1.00 0.00 93.40 Dec	[(99) [(201) [(202) [(204) [(205) [(206) [
9a. Energy requirement Space heating Fraction of space heat fro Fraction of space heat fro Fraction of space heat fro Fraction of total space he Fraction of total space he Efficiency of main system Jan Space heating fuel (main 698.37 Water heating Efficiency of water heate 87.80 Water heating fuel, kWh,	om secondary om main syste om main syste om main syste om mair at from mair at from mair 1 (%) Feb system 1), kv 7 527.11	y/suppleme em(s) em 2 n system 1 n system 2 Mar Wh/month 411.91	Apr 201.80	May 68.64	Jun 0.00	0.00	0.00	Sep 0.00 Σ(21:	1 - (2 02) x [1- (20 (202) x (2 Oct 235.36 1)15, 10	÷ (4) 01) = 03)] = Nov 489.87 .12 = 87.28	0.00 1.00 0.00 1.00 0.00 93.40 Dec 718.04 87.90	[(99) [(201) [(202) [(204) [(205) [(206) [(211) [(211) [(211) [(211) [(205)
9a. Energy requirement Space heating Fraction of space heat from Fraction of space heat from Fraction of space heat from Fraction of total space heat Fraction of	om secondary om main syste om main syste om main syste om mair at from mair at from mair 1 (%) Feb system 1), kv 7 527.11	y/suppleme em(s) em 2 n system 1 n system 2 Mar Wh/month 411.91	Apr 201.80	May 68.64	Jun 0.00	0.00	0.00	(20 Sep 0.00 Σ(21:	1 - (2 02) x [1- (20 (202) x (2 0ct 235.36 1)15, 10	÷ (4) 01) = 03)] = Nov 489.87 .12 = 87.28	0.00 1.00 0.00 1.00 0.00 93.40 Dec 718.04 87.90	[(99) [(201) [(202) [(204) [(205) [(206) [(211) [(217)
9a. Energy requirement Space heating Fraction of space heat from Fraction of space heat from Fraction of space heat from Fraction of total space heat Fraction of total space heat Fraction of total space heat Efficiency of main system Jan Space heating fuel (main) 698.33 Water heating Efficiency of water heate 87.80 Water heating fuel, kWhy 228.62	om secondary om main syste om main syste om main syste om mair at from mair at from mair 1 (%) Feb system 1), kv 7 527.11	y/suppleme em(s) em 2 n system 1 n system 2 Mar Wh/month 411.91	Apr 201.80	May 68.64	Jun 0.00	0.00	0.00	Sep 0.00 Σ(21:	1 - (2 02) x [1- (20 (202) x (2 Oct 235.36 1)15, 10	÷ (4) 01) = 03)] = Nov 489.87 .12 = 87.28	0.00 1.00 0.00 1.00 0.00 93.40 Dec 718.04 87.90	[(99) [(201) [(202) [(204) [(205) [(206) [(211) [(211) [(211) [(211) [(205)
9a. Energy requirement Space heating Fraction of space heat from Fraction of space heat from Fraction of space heat from Fraction of total space heat Fraction of total space heat Efficiency of main system Jan Space heating fuel (main 698.33 Water heating Efficiency of water heate 87.80 Water heating fuel, kWhy 228.63	s - individual om secondary om main syste om main syste om mair syste om mair at from mair at from mair 1 (%) Feb system 1), kV 7 527.11 r 87.50 month 2 200.89	y/suppleme em(s) em 2 n system 1 n system 2 Mar Wh/month 411.91	Apr 201.80	May 68.64	Jun 0.00	0.00	0.00	Sep 0.00 Σ(21:	1 - (2 02) x [1- (20 (202) x (2 0ct 235.36 1)15, 10	÷ (4) 01) = 03)] = Nov 489.87 .12 = 208.02 .12 = 2	0.00 1.00 0.00 1.00 0.00 93.40 Dec 718.04 8351.10 87.90 222.99	[(99) [(201) [(202) [(204) [(205) [(206) [(211) [(217)
9a. Energy requirement Space heating Fraction of space heat from Fraction of space heat from Fraction of space heat from Fraction of total space heat Fraction of total space heat Efficiency of main system Jan Space heating fuel (main) 698.37 Water heating Efficiency of water heate 87.80 Water heating fuel, kWh, 228.62 Annual totals Space heating fuel - main	s - individual om secondary om main syste om main syste om mair syste om mair at from mair at from mair 1 (%) Feb system 1), kV 7 527.11 r 87.50 month 2 200.89	y/suppleme em(s) em 2 n system 1 n system 2 Mar Wh/month 411.91	Apr 201.80	May 68.64	Jun 0.00	0.00	0.00	Sep 0.00 Σ(21:	1 - (2 02) x [1- (20 (202) x (2 0ct 235.36 1)15, 10	÷ (4) 01) = 03)] = Nov 489.87 .12 = 387.28 208.02 .12 = 2	0.00 1.00 0.00 1.00 0.00 93.40 Dec 718.04 87.90 222.99 2355.93	[(99) [(201) [(202) [(204) [(205) [(206) [(211) [(217)
9a. Energy requirement Space heating Fraction of space heat from Fraction of space heat from Fraction of space heat from Fraction of total space heat Fraction of total space heat Efficiency of main system Jan Space heating fuel (main 698.33 Water heating Efficiency of water heate 87.80 Water heating fuel, kWhy 228.63	s - individual om secondary om main syste om main syste om mair syste om mair at from mair at from mair 1 (%) Feb system 1), kV 7 527.11 r 87.50 month 2 200.89	y/suppleme em(s) em 2 n system 1 n system 2 Mar Wh/month 411.91	Apr 201.80	May 68.64	Jun 0.00	0.00	0.00	Sep 0.00 Σ(21:	1 - (2 02) x [1- (20 (202) x (2 0ct 235.36 1)15, 10	÷ (4) 01) = 03)] = Nov 489.87 .12 = 387.28 208.02 .12 = 2	0.00 1.00 0.00 1.00 0.00 93.40 Dec 718.04 8351.10 87.90 222.99	[(99) [(201) [(202) [(204) [(205) [(206) [(211) [(217)

Electricity for pumps, fans and electric keep-hot (Table 4f)			
central heating pump or water pump within warm air heating	unit	30.00	(230c)
boiler flue fan		45.00	(230e)
Total electricity for the above, kWh/year			75.00 (231)
Electricity for lighting (Appendix L)			339.17 (232)
Total delivered energy for all uses		(211)(221) + (231) + (232)(23	7b) = 6121.20 (238)
10a. Fuel costs - individual heating systems including micro-CH	P		
	Fuel kWh/year	Fuel price	Fuel cost £/year
Space heating - main system 1	3351.10	x 3.48 x 0.01	= 116.62 (240)
Water heating	2355.93	x 3.48 x 0.01	= 81.99 (247)
Pumps and fans	75.00	x 13.19 x 0.01	= 9.89 (249)
Electricity for lighting	339.17	x 13.19 x 0.01	= 44.74 (250)
Additional standing charges			120.00 (251)
Total energy cost		(240)(242) + (245)(25	54) = 373.23 (255)
11a. SAP rating - individual heating systems including micro-CF	IP		
Energy cost deflator (Table 12)			0.42 (256)
Energy cost factor (ECF)			1.27 (257)
SAP value			82.24
SAP rating (section 13)			82 (258)
SAP band			В
12a. CO₂ emissions - individual heating systems including micro			
12a. CO₂ emissions - individual heating systems including micro	D-CHP Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO₂/year
12a. CO₂ emissions - individual heating systems including micro Space heating - main system 1	Energy		
	Energy kWh/year	kg CO₂/kWh	kg CO₂/year
Space heating - main system 1	Energy kWh/year	kg CO ₂ /kWh x 0.216 =	kg CO ₂ /year 723.84 (261) 508.88 (264)
Space heating - main system 1 Water heating	Energy kWh/year	kg CO ₂ /kWh x	kg CO ₂ /year 723.84 (261) 508.88 (264)
Space heating - main system 1 Water heating Space and water heating	Energy kWh/year 3351.10 2355.93	kg CO ₂ /kWh x	kg CO ₂ /year 723.84 (261) 508.88 (264) 64) = 1232.72 (265)
Space heating - main system 1 Water heating Space and water heating Pumps and fans	Energy kWh/year 3351.10 2355.93	kg CO ₂ /kWh x 0.216 = x 0.216 = (261) + (262) + (263) + (263) x 0.519 =	kg CO ₂ /year 723.84 (261) 508.88 (264) 64) = 1232.72 (265) 38.93 (267) 176.03 (268)
Space heating - main system 1 Water heating Space and water heating Pumps and fans Electricity for lighting	Energy kWh/year 3351.10 2355.93	kg CO ₂ /kWh x	kg CO ₂ /year 723.84 (261) 508.88 (264) 64) = 1232.72 (265) 38.93 (267) 176.03 (268) 71) = 1447.67 (272)
Space heating - main system 1 Water heating Space and water heating Pumps and fans Electricity for lighting Total CO ₂ , kg/year	Energy kWh/year 3351.10 2355.93	kg CO ₂ /kWh x	kg CO ₂ /year 723.84 (261) 508.88 (264) 64) = 1232.72 (265) 38.93 (267) 176.03 (268) 71) = 1447.67 (272)
Space heating - main system 1 Water heating Space and water heating Pumps and fans Electricity for lighting Total CO ₂ , kg/year Dwelling CO ₂ emission rate	Energy kWh/year 3351.10 2355.93	kg CO ₂ /kWh x	kg CO ₂ /year 723.84 (261) 508.88 (264) 64) = 1232.72 (265) 38.93 (267) 176.03 (268) 71) = 1447.67 (272) (4) = 18.54 (273)
Space heating - main system 1 Water heating Space and water heating Pumps and fans Electricity for lighting Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value	Energy kWh/year 3351.10 2355.93	kg CO ₂ /kWh x	kg CO ₂ /year 723.84 (261) 508.88 (264) 64) = 1232.72 (265) 38.93 (267) 176.03 (268) 71) = 1447.67 (272) (4) = 18.54 (273)
Space heating - main system 1 Water heating Space and water heating Pumps and fans Electricity for lighting Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14)	Energy kWh/year 3351.10 2355.93 75.00 339.17	kg CO ₂ /kWh x	kg CO ₂ /year 723.84 (261) 508.88 (264) 64) = 1232.72 (265) 38.93 (267) 176.03 (268) 71) = 1447.67 (272) (4) = 18.54 (273) 84.24 84 (274)
Space heating - main system 1 Water heating Space and water heating Pumps and fans Electricity for lighting Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14) El band	Energy kWh/year 3351.10 2355.93 75.00 339.17	kg CO ₂ /kWh x	kg CO ₂ /year 723.84 (261) 508.88 (264) 64) = 1232.72 (265) 38.93 (267) 176.03 (268) 71) = 1447.67 (272) (4) = 18.54 (273) 84.24 84 (274)
Space heating - main system 1 Water heating Space and water heating Pumps and fans Electricity for lighting Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14) El band	Energy kWh/year 3351.10 2355.93 75.00 339.17	kg CO ₂ /kWh x	kg CO ₂ /year 723.84 (261) 508.88 (264) 64) = 1232.72 (265) 38.93 (267) 176.03 (268) 71) = 1447.67 (272) (4) = 18.54 (273) 84.24 84 (274) B Primary Energy
Space heating - main system 1 Water heating Space and water heating Pumps and fans Electricity for lighting Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14) El band 13a. Primary energy - individual heating systems including mic	Energy kWh/year 3351.10 2355.93 75.00 339.17 ro-CHP Energy kWh/year	kg CO ₂ /kWh x	kg CO ₂ /year 723.84 (261) 508.88 (264) 64) = 1232.72 (265) 38.93 (267) 176.03 (268) 71) = 1447.67 (272) (4) = 18.54 (273) 84.24 84 (274) B Primary Energy kWh/year
Space heating - main system 1 Water heating Space and water heating Pumps and fans Electricity for lighting Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14) El band 13a. Primary energy - individual heating systems including mic	Energy kWh/year 3351.10 2355.93 75.00 339.17 ro-CHP Energy kWh/year 3351.10	kg CO ₂ /kWh x	kg CO ₂ /year 723.84 (261) 508.88 (264) 64) = 1232.72 (265) 38.93 (267) 176.03 (268) 71) = 1447.67 (272) (4) = 18.54 (273) 84.24 84 (274) B Primary Energy kWh/year 4088.34 (261) 2874.24 (264)

8234.08 105.43 (268)

(273)

339.17

3.07

Electricity for lighting

Primary energy kWh/year

Dwelling primary energy rate kWh/m2/year



Assessor name	Mr Jason Doherty	Assessor number	2634
Client		Last modified	07/06/2018
Address	4 6 Streatley Place, London, NW3 1HP		

Address	4 6 Streatiey Place, London, NW3	5 THP			
1. Overall dwelling dime	ensions				
		Area (m²)	Average storey height (m)	Volume ((m³)
Lowest occupied		20.20 (1a) x	2.50 (2a	= 50.50	(3a)
+1		67.70 (1b) x	3.00 (2b	203.10	0 (3b)
Total floor area	(1a) + (1b) + (1c) + (1d)(1n)) = 87.90 (4)			
Dwelling volume			(3a) + (3b) + (3c) + (3d)(3n) = 253.60	0 (5)
2. Ventilation rate					
2. Ventuation fate				m³ per h	our
Number of chimneys			0	x 40 = 0	(6a)
Number of open flues			0	x 20 = 0	(6b)
Number of intermittent fa	ans		3	x 10 = 30	(7a)
Number of passive vents			0	x 10 = 0	(7b)
Number of flueless gas fir	es		0	x 40 = 0	(7c)
				Air change hour	•
Infiltration due to chimne	ys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) +	- (7c) = 30	÷ (5) = 0.12	(8)
If a pressurisation test has	s been carried out or is intended, proc	ceed to (17), otherwise contin	nue from (9) to (16)		
Air permeability value, q5	0, expressed in cubic metres per hou	r per square metre of envelo	pe area	5.00	(17)
If based on air permeabili	ty value, then $(18) = [(17) \div 20] + (8)$,	otherwise (18) = (16)		0.37	(18)
Number of sides on which	the dwelling is sheltered			2	(19)

Shelter factor

Infiltration rate incorporating shelter factor

0.40

 $In filtration \ rate \ modified \ for \ monthly \ wind \ speed:$

	7												
	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 infiltrat	ion rate (al	lowing for	shelter and	wind facto	or) (21) x (2	2a)m							

0.30

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system

0.39

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

0.38

0.34

0.34

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

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

0.30

0.29

0.31

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



0.85

0.31

0.37

N/A

N/A

(22b)

(23a)

(23c)

1 - [0.075 x (19)] =

0.34

0.35

 $(18) \times (20) =$

				Gross	Openings	Net ar		U-value	A x U W		ılue,	Α x к,	
			а	rea, m²	m²	A, m	2 	W/m²K		kJ/ı 	m².K	kJ/K	
/indow						19.48	3 x	1.33	= 25.83				(
oor						1.95	x	1.00	= 1.95				(
oof window						0.54	x _	1.59	= 0.86				(
xternal wall						107.5	7 x	0.18	= 19.36				(
arty wall						13.00) x	0.00	= 0.00				(
toof						84.14	ı x	0.13	= 10.94				(
otal area of ex	xternal elem	ents ∑A, m²	!			213.6	8						(
abric heat los	s, W/K = ∑(A	× U)							(26	5)(30) + (3	2) =	58.94	(
leat capacity (Cm = ∑(A x κ))						(28)	.(30) + (32) -	+ (32a)(32	e) =	N/A	(
hermal mass	parameter (ΓMP) in kJ/n	n²K									250.00	(
hermal bridge	es: Σ(L x Ψ) c	alculated us	sing Appen	dix K								12.88	(
otal fabric hea	at loss									(33) + (3	6) =	71.82	(
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
entilation hea	at loss calcul	ated month	ly 0.33 x (2	25)m x (5)									
	48.51	48.25	48.00	46.81	46.58	45.54	45.54	45.35	45.94	46.58	47.03	47.51	(
leat transfer c	coefficient, V	V/K (37)m +	+ (38)m										
	120.33	120.07	119.81	118.62	118.40	117.36	117.36	117.17	117.76	118.40	118.85	119.32	
									Average = ∑	(39)112/1	.2 =	118.62	(
leat loss parar	meter (HLP),	W/m ² K (39	9)m ÷ (4)										
	1.37	1.37	1.36	1.35	1.35	1.34	1.34	1.33	1.34	1.35	1.35	1.36	
									Average = ∑	(40)112/1	.2 =	1.35	(
Number of day	/s in month (Table 1a)											
lumber of day	s in month (31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(
	31.00	28.00		30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(
4. Water heat	31.00	28.00		30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00		
4. Water heat	31.00 ting energy r	28.00 requiremen	t				31.00	31.00	30.00	31.00	30.00	2.60	
4. Water heat	31.00 ting energy r pancy, N e hot water t	28.00 requirement usage in litro	t es per day	Vd,average	e = (25 x N) +	36						2.60 95.85	
4. Water head ssumed occup	31.00 ting energy r pancy, N e hot water r Jan	28.00 requirementusage in litro	t es per day Mar	Vd,average Apr	e = (25 x N) + May	36 Jun	31.00 Jul	31.00	30.00 Sep	31.00 Oct	30.00 Nov	2.60	
4. Water head Assumed occup	an ge in litres pe	28.00 requiremen usage in litro Feb er day for ea	es per day Mar ach month	Vd,average Apr Vd,m = fac	e = (25 x N) + May ctor from Tabl	36 Jun le 1c x (43)	Jul	Aug	Sep	Oct	Nov	2.60 95.85 Dec	
4. Water head Assumed occup	31.00 ting energy r pancy, N e hot water r Jan	28.00 requirementusage in litro	t es per day Mar	Vd,average Apr	e = (25 x N) + May	36 Jun le 1c x (43)				Oct 97.77	Nov 101.60	2.60 95.85 Dec	
4. Water heat assumed occup annual average dot water usage	31.00 ting energy r pancy, N e hot water t Jan ge in litres pe	28.00 requirementusage in litro Feb er day for each	es per day Mar ach month 97.77	Vd,average Apr Vd,m = fac 93.93	e = (25 x N) + May ctor from Tabl	36 Jun le 1c x (43) 86.27	Jul 86.27	Aug 90.10	Sep	Oct	Nov 101.60	2.60 95.85 Dec	
4. Water heat assumed occup annual average dot water usage	31.00 ting energy r pancy, N e hot water r Jan ge in litres pe 105.44	zequiremen usage in litro Feb er day for ea 101.60	es per day Mar ach month 97.77	Vd,average Apr Vd,m = fac 93.93	e = (25 x N) + May ctor from Tabl 90.10 /3600 kWh/m	36 Jun le 1c x (43) 86.27 onth (see Ta	Jul 86.27 bles 1b,	Aug 90.10	Sep 93.93	Oct 97.77 Σ(44)11	Nov 101.60 2 =	2.60 95.85 Dec 105.44 1150.22	
4. Water heat Assumed occup Annual average Hot water usage	31.00 ting energy r pancy, N e hot water t Jan ge in litres pe	28.00 requirementusage in litro Feb er day for each	es per day Mar ach month 97.77	Vd,average Apr Vd,m = fac 93.93	e = (25 x N) + May ctor from Tabl	36 Jun le 1c x (43) 86.27 onth (see Ta	Jul 86.27	Aug 90.10	Sep	Oct 97.77 Σ(44)11	Nov 101.60 .2 = 139.44	2.60 95.85 Dec 105.44 1150.22	
4. Water heat Assumed occup Annual average Hot water usage	31.00 ting energy repancy, Nee hot water to Jan ge in litres per 105.44 t of hot water to 156.36	zequiremen usage in litro Feb er day for ea 101.60 er used = 4.1 136.75	es per day Mar ach month 97.77	Vd,average Apr Vd,m = fac 93.93	e = (25 x N) + May ctor from Tabl 90.10 /3600 kWh/m	36 Jun le 1c x (43) 86.27 onth (see Ta	Jul 86.27 bles 1b,	Aug 90.10	Sep 93.93	Oct 97.77 Σ(44)11	Nov 101.60 .2 = 139.44	2.60 95.85 Dec 105.44 1150.22	
4. Water heat Assumed occup Annual average Hot water usage	31.00 ting energy r pancy, N e hot water t Jan ge in litres pe 105.44 t of hot wate 156.36	28.00 requirement usage in litro Feb er day for each 101.60 er used = 4.1 136.75	es per day Mar ach month 97.77 18 x Vd,m x 141.12	Vd,average	e = (25 x N) + May ctor from Tabl 90.10 /3600 kWh/m 118.05	36 Jun le 1c x (43) 86.27 onth (see Ta	Jul 86.27 bles 1b, 94.40	Aug 90.10 1c 1d) 108.32	Sep 93.93	Oct 97.77 Σ(44)11 127.74 Σ(45)11	Nov 101.60 .2 = 139.44 .2 =	2.60 95.85 Dec 105.44 1150.22 151.43 1508.12	
4. Water heat Assumed occup Annual average Hot water usage Energy content	31.00 ting energy r pancy, N e hot water t Jan ge in litres pe 105.44 t of hot wate 156.36 ss 0.15 x (45	28.00 requirement usage in litro Feb er day for eact	es per day Mar ach month 97.77 18 x Vd,m x 141.12	Vd,average	e = (25 x N) + May ctor from Tabl 90.10 /3600 kWh/m	36 Jun le 1c x (43) 86.27 onth (see Ta	Jul 86.27 bles 1b,	Aug 90.10	Sep 93.93	Oct 97.77 Σ(44)11	Nov 101.60 .2 = 139.44	2.60 95.85 Dec 105.44 1150.22	
4. Water heat assumed occup annual average dot water usage anergy content	31.00 ting energy r pancy, N e hot water of Jan ge in litres per 105.44 t of hot water 156.36 ss 0.15 x (45) 23.45	28.00 requirement usage in litro Feb er day for each 101.60 er used = 4.1 136.75 i)m 20.51 ed for each	es per day Mar ach month 97.77 18 x Vd,m x 141.12 21.17 month (55)	Vd,average Apr Vd,m = face 93.93 cnm x Tm/ 123.03 18.45 5) x (41)m	e = (25 x N) + May ctor from Tabl 90.10 /3600 kWh/m 118.05	36 Jun le 1c x (43) 86.27 onth (see Ta 101.87	Jul 86.27 bles 1b, 94.40	Aug 90.10 1c 1d) 108.32	Sep 93.93 109.61 16.44	Oct 97.77 Σ(44)11 127.74 Σ(45)11 19.16	Nov 101.60 2 = 139.44 .2 = 20.92	2.60 95.85 Dec 105.44 1150.22 151.43 1508.12	
4. Water heat assumed occup annual average dot water usage anergy content distribution los	31.00 ting energy r pancy, N e hot water t Jan ge in litres pe 105.44 t of hot wate 156.36 ss 0.15 x (45 23.45 loss calculat 0.00	28.00 requirement usage in litro Feb er day for each 101.60 136.75 3)m 20.51 ed for each 0.00	t	Vd,average	e = (25 x N) + May ctor from Tabl 90.10 /3600 kWh/m 118.05 17.71	36 Jun le 1c x (43) 86.27 onth (see Ta 101.87	Jul 86.27 bles 1b, 94.40	Aug 90.10 1c 1d) 108.32 16.25	Sep 93.93	Oct 97.77 Σ(44)11 127.74 Σ(45)11	Nov 101.60 .2 = 139.44 .2 =	2.60 95.85 Dec 105.44 1150.22 151.43 1508.12	
4. Water heat Assumed occup Annual average Hot water usage Energy content Distribution los	31.00 ting energy repancy, Note that water to Jan ge in litres per 105.44 that of hot water to 156.36 ass 0.15 x (45 23.45 10ss calculate 0.00 centains dedice	28.00 requiremen usage in litro Feb er day for ea 101.60 er used = 4.1 136.75 i)m 20.51 ed for each 0.00 ated solar s	es per day Mar ach month 97.77 18 x Vd,m x 141.12 21.17 month (55) 0.00 torage or contracts	Vd,average Apr Vd,m = fac 93.93 s nm x Tm/ 123.03 18.45 5) x (41)m 0.00 dedicated V	e = (25 x N) + May Stor from Tabl 90.10 /3600 kWh/m 118.05 17.71 0.00 WWHRS (56)n	36 Jun le 1c x (43) 86.27 onth (see Ta 101.87 15.28 0.00 n x [(47) - Vs	Jul 86.27 bles 1b, 94.40 14.16 0.00] ÷ (47),	Aug 90.10 1c 1d) 108.32 16.25 0.00 else (56)	Sep 93.93 109.61 16.44 0.00	Oct 97.77 Σ(44)11 127.74 Σ(45)11 19.16 0.00	Nov 101.60 2 = 139.44 .2 = 20.92 0.00	2.60 95.85 Dec 105.44 1150.22 151.43 1508.12 22.71	
4. Water heat Assumed occup Annual average Hot water usage Energy content Distribution los Vater storage If the vessel co	31.00 ting energy r pancy, N e hot water t Jan ge in litres pe 105.44 t of hot wate 156.36 ss 0.15 x (45 23.45 loss calculat 0.00 ontains dedic	28.00 requiremen usage in litro Feb er day for ea 101.60 er used = 4.1 136.75 i)m 20.51 ed for each 0.00 ated solar s 0.00	tes per day Mar ach month 97.77 18 x Vd,m x 141.12 21.17 month (55) 0.00 torage or c	Vd,average	e = (25 x N) + May ctor from Tabl 90.10 /3600 kWh/m 118.05 17.71	36 Jun le 1c x (43) 86.27 onth (see Ta 101.87	Jul 86.27 bles 1b, 94.40	Aug 90.10 1c 1d) 108.32 16.25	Sep 93.93 109.61 16.44	Oct 97.77 Σ(44)11 127.74 Σ(45)11 19.16	Nov 101.60 2 = 139.44 .2 = 20.92	2.60 95.85 Dec 105.44 1150.22 151.43 1508.12	
4. Water heat Assumed occup Annual average Hot water usage Energy content Distribution los Water storage If the vessel co	31.00 ting energy repancy, Nee hot water of Jan ge in litres per 105.44 t of hot water of 156.36 ass 0.15 x (45 23.45 10ss calculated 0.00 ontains dediced 0.00 loss for each	28.00 requiremen usage in litro Feb er day for ea 101.60 er used = 4.1 136.75 i)m 20.51 ed for each 0.00 ated solar s 0.00 month fro	t Mar ach month 97.77 18 x Vd,m x 141.12 21.17 month (55) 0.00 torage or c 0.00 m Table 3	Vd,average Apr Vd,m = fac 93.93 s nm x Tm/ 123.03 18.45 5) x (41)m 0.00 dedicated V	e = (25 x N) + May Stor from Tabl 90.10 /3600 kWh/m 118.05 17.71 0.00 WWHRS (56)n 0.00	36 Jun le 1c x (43) 86.27 onth (see Ta 101.87 15.28 0.00 n x [(47) - Vs 0.00	Jul 86.27 bles 1b, 94.40 14.16 0.00] ÷ (47), 0.00	Aug 90.10 1c 1d) 108.32 16.25 0.00 else (56) 0.00	Sep 93.93 109.61 16.44 0.00 0.00	Oct 97.77 Σ(44)11 127.74 Σ(45)11 19.16 0.00 0.00	Nov 101.60 2 = 139.44 2 = 20.92 0.00 0.00	2.60 95.85 Dec 105.44 1150.22 151.43 1508.12 22.71 0.00	
4. Water heat Assumed occup Annual average Hot water usage Energy content Distribution los Water storage If the vessel co	31.00 ting energy r pancy, N e hot water t Jan ge in litres pe 105.44 t of hot wate 156.36 ss 0.15 x (45 23.45 loss calculat 0.00 ontains dedic 0.00 loss for each	28.00 requiremen usage in litro Feb er day for ea 101.60 er used = 4.1 136.75 a)m 20.51 ed for each 0.00 ated solar s 0.00 month fro	es per day Mar ach month 97.77 18 x Vd,m x 141.12 21.17 month (59 0.00 torage or c 0.00 m Table 3 0.00	Vd,average Apr Vd,m = fac 93.93 x nm x Tm/ 123.03 18.45 5) x (41)m 0.00 dedicated V 0.00	e = (25 x N) + May Stor from Tabl 90.10 /3600 kWh/m 118.05 17.71 0.00 WWHRS (56)n	36 Jun le 1c x (43) 86.27 onth (see Ta 101.87 15.28 0.00 n x [(47) - Vs	Jul 86.27 bles 1b, 94.40 14.16 0.00] ÷ (47),	Aug 90.10 1c 1d) 108.32 16.25 0.00 else (56)	Sep 93.93 109.61 16.44 0.00	Oct 97.77 Σ(44)11 127.74 Σ(45)11 19.16 0.00	Nov 101.60 2 = 139.44 .2 = 20.92 0.00	2.60 95.85 Dec 105.44 1150.22 151.43 1508.12 22.71	
4. Water heat Assumed occup Annual average Hot water usage Energy content Distribution los Water storage If the vessel co	31.00 ting energy r pancy, N e hot water t Jan ge in litres pe 105.44 t of hot wate 156.36 ss 0.15 x (45 23.45 loss calculat 0.00 ontains dedic 0.00 loss for each	28.00 requiremen usage in litro Feb er day for ea 101.60 er used = 4.1 136.75 a)m 20.51 ed for each 0.00 ated solar s 0.00 month fro	es per day Mar ach month 97.77 18 x Vd,m x 141.12 21.17 month (59 0.00 torage or c 0.00 m Table 3 0.00	Vd,average Apr Vd,m = fac 93.93 x nm x Tm/ 123.03 18.45 5) x (41)m 0.00 dedicated V 0.00	e = (25 x N) + May Stor from Tabl 90.10 /3600 kWh/m 118.05 17.71 0.00 WWHRS (56)n 0.00	36 Jun le 1c x (43) 86.27 onth (see Ta 101.87 15.28 0.00 n x [(47) - Vs 0.00	Jul 86.27 bles 1b, 94.40 14.16 0.00] ÷ (47), 0.00	Aug 90.10 1c 1d) 108.32 16.25 0.00 else (56) 0.00	Sep 93.93 109.61 16.44 0.00 0.00	Oct 97.77 Σ(44)11 127.74 Σ(45)11 19.16 0.00 0.00	Nov 101.60 2 = 139.44 2 = 20.92 0.00 0.00	2.60 95.85 Dec 105.44 1150.22 151.43 1508.12 22.71 0.00	

0.58

0.57

0.56

0.56

0.54

0.54

0.54

0.55

0.56

0.56

0.57

Total heat required for water heating calculated for e	each month 0.85 x (45	5)m + (46)m + (57)m +	+ (59)m + (61)m		
207.32 182.78 190.94 1	69.35 163.96 1	44.41 138.36	154.23 155.94	177.57 188	3.76 202.39 (62)
Solar DHW input calculated using Appendix G or App	endix H			·	
0.00 0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.	00 0.00 (63)
Output from water heater for each month (kWh/mo	nth) (62)m + (63)m		,		
207.32 182.78 190.94 1	69.35 163.96 1	44.41 138.36	154.23 155.94	177.57 188	3.76 202.39
		•		∑(64)112 =	2076.01 (64)
Heat gains from water heating (kWh/month) $0.25 \times$	[0.85 × (45)m + (61)m]] + 0.8 × [(46)m + (57))m + (59)m]		
64.73 56.98 59.38	52.49 50.73 4	44.51 42.38	47.50 48.03	54.93 58	.69 63.09 (65)
		'		<u>'</u>	
5. Internal gains					
Jan Feb Mar	Apr May	Jun Jul	Aug Sep	Oct N	ov Dec
Metabolic gains (Table 5)					
129.79 129.79 129.79 1	29.79 129.79 1	29.79 129.79	129.79 129.79	129.79 129	9.79 129.79 <mark>(66)</mark>
ighting gains (calculated in Appendix L, equation L9	or L9a), also see Table	: 5			
20.96 18.62 15.14	11.46 8.57	7.24 7.82	10.16 13.64	17.32 20	.21 21.55 (67)
Appliance gains (calculated in Appendix L, equation L	13 or L13a), also see T	Table 5			
235.16 237.60 231.45 2	18.36 201.84 1	86.30 175.93	173.49 179.64	192.73 209	9.25 224.78 (68)
Cooking gains (calculated in Appendix L, equation L1	5 or L15a), also see Tal	ble 5		•	
35.98 35.98 35.98	35.98 35.98 3	35.98 35.98	35.98 35.98	35.98 35	.98 35.98 (69)
Pump and fan gains (Table 5a)				'	
	3.00 3.00	3.00 3.00	3.00 3.00	3.00 3.	00 3.00 (70)
osses e.g. evaporation (Table 5)	3.55		5.55		20 0.00 (1.0)
	.03.83 -103.83 -1	103.83 -103.83 -	-103.83 -103.83	-103.83 -10	3.83 -103.83 (71)
Water heating gains (Table 5)	103.03	103.03	103.03	103.03	2.03 103.03 (71)
	72.90 68.19 6	51.81 56.96	63.84 66.71	73.83 81	.52 84.80 (72)
Fotal internal gains (66)m + (67)m + (68)m + (69)m +			03.84 00.71	73.63 61	.32 84.80 (72)
			312.43 324.92	348.82 375	5.92 396.07 (73)
406.07 405.95 591.54 5	07.00 343.33 3	20.29 303.64 .	312.43 324.92	340.02 373	<u>1.92 390.07 (73)</u>
6. Solar gains					
Access fact	or Area	Solar flux	g	FF	Gains
Table 6d	m²	W/m²	specific data or Table 6b	specific data or Table 6c	W
NorthWest 0.77	x 2.73	x 11.28 x 0.9		0.70	= 9.41 (81)
NorthEast 0.77	x 10.03	x 11.28 x 0.9	9 x 0.63 x	0.70	= 34.59 (75)
outhEast 0.77	x 6.72	x 36.79 x 0.9	9 x 0.63 x	0.70	= 75.56 (77)
Horizontal 1.00	x 0.54	x 26.00 x 0.9	9 x 0.63 x	0.70	= 5.57
olar gains in watts ∑(74)m(82)m					
425.44 220.05 250.05 5	15.36 641.78 6	65.28 629.71	531.26 411.96	265.85 152	2.94 105.10 (83)
125.14 229.85 358.05 5					
otal gains - internal and solar (73)m + (83)m	83.03 985.31 9	85.57 935.35	843.68 736.88	614.67 528	3.87 501.17 (84)
otal gains - internal and solar (73)m + (83)m 533.20 635.80 749.39 8	83.03 985.31 9	85.57 935.35	843.68 736.88	614.67 528	3.87 501.17 (84)
Total gains - internal and solar (73)m + (83)m 533.20 635.80 749.39 8 7. Mean internal temperature (heating season)			843.68 736.88	614.67 528	
Total gains - internal and solar (73)m + (83)m 533.20	a from Table 9, Th1(°C))			21.00 (85)
Total gains - internal and solar (73)m + (83)m 533.20 635.80 749.39 8 7. Mean internal temperature (heating season) Temperature during heating periods in the living area Jan Feb Mar	a from Table 9, Th1(°C) Apr May		843.68 736.88 Aug Sep		
Total gains - internal and solar (73)m + (83)m 533.20 635.80 749.39 8 7. Mean internal temperature (heating season) Temperature during heating periods in the living area Jan Feb Mar	a from Table 9, Th1(°C) Apr May)			21.00 (85)
Total gains - internal and solar (73)m + (83)m 533.20 635.80 749.39 8 7. Mean internal temperature (heating season) Temperature during heating periods in the living area Jan Feb Mar Utilisation factor for gains for living area n1,m (see Table 1)	a from Table 9, Th1(°C) Apr May able 9a))		Oct N	21.00 (85)
Total gains - internal and solar (73)m + (83)m 533.20 635.80 749.39 8 7. Mean internal temperature (heating season) Temperature during heating periods in the living area Jan Feb Mar Utilisation factor for gains for living area n1,m (see Table 1)	a from Table 9, Th1(°C) Apr May able 9a) 0.95 0.86) Jun Jul	Aug Sep	Oct N	21.00 (85) ov Dec
Total gains - internal and solar (73)m + (83)m 533.20 635.80 749.39 8 7. Mean internal temperature (heating season) Temperature during heating periods in the living area Jan Feb Mar Utilisation factor for gains for living area n1,m (see Time 1.00 0.99 0.99) Mean internal temp of living area T1 (steps 3 to 7 in 1.00)	a from Table 9, Th1(°C) Apr May able 9a) 0.95 0.86) Jun Jul 0.69 0.53	Aug Sep	Oct N 0.98 1.	21.00 (85) ov Dec

Temperature during heating periods in the rest of dwelling from Table 9, Th2/C C
Utilisation factor for gains for rest of dwelling n2, 1.00 0.99 0.98 0.98 0.93 0.81 0.59 0.40 0.47 0.78 0.96 0.99 1.00 (89) Mean internal temperature in the rest of dwelling r12 (follow steps 3 to 7 in Table 9c): 17.78 18.05 18.50 19.09 19.55 19.77 19.81 19.80 19.66 19.05 18.32 17.74 (90) Utiling area r4(4) = 0.54 191 Mean internal temperature for the whole dwelling (LA x T1 + (1 - fLA) x T2 18.70 18.92 19.29 19.79 20.19 20.39 20.44 20.43 20.28 19.75 19.13 18.66 (93) Apply adjustment to the mean internal temperature from Table 4e where appropriate 18.70 18.92 19.29 19.79 20.19 20.39 20.44 20.43 20.28 19.75 19.13 18.66 (93) 8. Space heating requirement 18.70 18.92 19.29 19.79 20.19 20.39 20.44 20.43 20.28 19.75 19.13 18.66 (93) 8. Space heating requirement 18.70 18.92 19.29 19.79 20.19 20.39 20.44 20.43 20.28 19.75 19.13 18.66 (93) 8. Space heating requirement 18.70 18.92 19.29 19.79 20.19 20.39 20.44 20.43 20.28 19.75 19.13 18.66 (93) 8. Space heating requirement 18.70 18.92 19.29 19.79 20.99 20.39 20.44 20.43 20.28 19.75 19.13 18.66 (93) 8. Space heating requirement 19. Space heating requirement 20. Space heating requirement 10.00 0.99 0.98 0.93 0.82 0.64 0.47 0.54 0.81 0.96 0.99 1.00 (94) 10.00 19.99 0.98 0.99 0.98 0.93 18.17 0.86 0.66 0.66 0.66 0.66 0.86 0.96 0.99 1.00 (94) 10.00 19.99 0.99 0.99 0.99 0.99 0.99 0.9
Mean intermal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table ey. 1.778 18.05 18.05 18.05 19.09 19.05 19.77 19.81 19.80 19.06 19.05 18.32 17.74 90) Living area fraction Living area fraction Living
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) 17.78 18.05 18.50 19.09 19.55 19.77 19.81 19.80 19.66 19.05 18.32 17.74 90) When internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2 18.70 18.92 19.29 19.79 20.19 20.39 20.44 20.43 20.28 19.75 19.13 18.66 92) Apply adjustment to the mean internal temperature from Table 4e where appropriate 18.70 18.92 19.29 19.79 20.19 20.39 20.44 20.43 20.28 19.75 19.13 18.66 92) Apply adjustment to the mean internal temperature from Table 4e where appropriate 18.70 18.92 19.29 19.79 20.19 20.39 20.44 20.43 20.28 19.75 19.13 18.66 93) **Space heating requirement** **Space heating requirement** **Outside a sign of the
17.78 18.05 18.50 19.09 19.55 19.77 19.81 19.80 19.65 19.05 18.32 17.74 19.10 19.10 19.05 19.32 17.74 19.10 19.1
Living area fraction Mean internal temperature for the whole dwelling (LA x T1 +(1 - fLA) x T2 18.70 18.92 19.29 19.79 20.19 20.39 20.44 20.43 20.28 19.75 19.13 18.66 92
Mean internal temperature for the whole dwelling ft.A x T1 +(1-1 fLA) x T2 18.70 18.92 19.29 19.79 20.19 20.39 20.44 20.43 20.28 19.75 19.13 18.66 (92)
18.70 18.92 19.29 19.79 20.19 20.39 20.44 20.43 20.28 19.75 19.13 18.66 92
Apply adjustment to the mean internal temperature from Table 4e where appropriate 18.70 18.92 19.29 19.79 20.19 20.39 20.44 20.43 20.28 19.75 19.13 18.66 (93) 8. Space heating requirement Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains, m 1.00 0.99 0.98 0.93 0.82 0.64 0.47 0.54 0.81 0.96 0.99 1.00 (94) Useful gains, n,mGm, W (94)mx (84)m 531.08 630.25 732.55 823.69 811.97 633.54 441.39 456.02 597.93 592.11 524.76 499.64 (95) Monthly average external temperature from Table U1 4.30 4.90 6.50 8.90 11.70 14.60 16.60 16.40 14.10 10.60 7.10 4.20 (96) Heat loss rate for mean internal temperature, Lm, W (139)mx (193)m (195)m) 1732.14 1628.28 1532.53 1291.55 1050.50 679.71 450.48 472.20 727.50 1083.24 1430.26 1725.49 (97) Space heating requirement, kWh/month 0.024 x (197)m - (95)m) x (41)m 893.58 707.32 595.17 336.86 143.65 0.00 0.00 0.00 0.00 365.39 651.96 912.03 \$\$\text{Space heating requirement twh/m} = \text{Vh/month beating systems including micro-CHP}\$\$ Space heating requirement individual heating systems including micro-CHP Fraction of space heat from main system 2 (202) x [1- (203)] = \text{0.00} (202) x [7600 for for for for for for for for for main system 1 (8)
8. Space heating requirements 1
8. Space heating requirement Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains, nm 1.00 0.99 0.98 0.93 0.82 0.64 0.47 0.54 0.81 0.96 0.99 1.00 (94) Useful gains, nmGm, W (94)m x (84)m S31.08 630.25 732.55 823.69 811.97 633.54 441.39 456.02 597.93 592.11 524.76 499.64 (95) Monthly average external temperature from Table U1 4.30 4.90 6.50 8.90 11.70 14.60 16.60 16.40 14.10 10.60 7.10 4.20 (96) Heat loss rate for mean internal temperature, Lm, W ([39]m x ([39]m - (96]m)] 1732.14 1682.81 1532.51 1291.56 1005.04 679.71 450.48 472.20 727.50 1083.24 1430.26 1725.49 (97) Space heating requirement, kWh/month 0.024 x ([97]m - (95)m] x (41)m 893.58 707.32 595.17 336.86 143.65 0.00 0.00 0.00 0.00 365.39 651.96 912.03 Space heating requirement kWh/m²/year (98) + (4) 52.40 (99) 9a. Energy requirements - individual heating systems including micro-CHP Space heat from secondary/supplementary system (table 11) Fraction of space heat from main system (5) Fraction of total space heat from main system 2 (202) x (203) = 0.000 (202) Fraction of total space heat from main system 2 Efficiency of main system 1, kWh/month 956.73 757.30 637.23 360.67 153.80 0.00 0.00 0.00 0.00 391.21 698.03 976.48 Efficiency of water heater Efficiency of water heater
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Useful gains, ηmGm, W (94)m x (84)m 531.08 630.25 732.55 823.69 811.97 633.54 441.39 456.02 597.93 592.11 524.76 499.64 (95) Monthly average external temperature from Table U1 4.30 4.90 6.50 8.90 11.70 14.60 16.60 16.40 14.10 10.60 7.10 4.20 (96) Heat loss rate for mean internal temperature, Lm, W (139)m x [193)m x [193)m x [193)m x [193)m x [193)m x [193]m x [19
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1732.14 1682.81 1532.51 1291.56 1005.04 679.71 450.48 472.20 727.50 1083.24 1430.26 1725.49 97) Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m 893.58 707.32 595.17 336.86 143.65 0.00 0.00 0.00 0.00 365.39 651.96 912.03 Σ(98)15, 1012 = 4605.97 98) Space heating requirement kWh/m²/year (98) ± (4) 52.40 (99) 9a. Energy requirements - individual heating systems including micro-CHP Space heating Fraction of space heat from secondary/supplementary system (table 11) 0.00 (201) Fraction of space heat from main system(s) 1 - (201) = 1.00 (202) Fraction of space heat from main system 1 (202) x [1 - (203)] = 1.00 (204) Fraction of total space heat from main system 2 (202) x (203) = 0.00 (205) Efficiency of main system 1 % 93.40 (206) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Space heating fuel (main system 1), kWh/month 956.73 757.30 637.23 360.67 153.80 0.00 0.00 0.00 0.00 391.21 698.03 976.48 Σ(211)15, 1012 = 4931.44 (211) Water heating Efficiency of water heater (202) x (202) (203) (203) (203) Total space heat from main system 1 (203) (203) (203) (203) Space heating fuel (main system 1), kWh/month (203)
Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m 893.58 707.32 595.17 336.86 143.65 0.00 0.00 0.00 0.00 365.39 651.96 912.03 \$\sum_{\text{(98)}15}\$, 1012 = \frac{4605.97}{4605.97}\$ (98) \$\text{Space heating requirement kWh/m²/year}\$ (98) \div (4) \frac{52.40}{52.40}\$ (99) 9a. Energy requirements - individual heating systems including micro-CHP Space heating Fraction of space heat from secondary/supplementary system (table 11) Fraction of space heat from main system(s) Fraction of space heat from main system 2 Fraction of total space heat from main system 1 \$\text{(202)} \times \text{[1-(203)]} = \frac{1.00}{1.00}\$ (202) Fraction of total space heat from main system 2 \$\text{(202)} \times \text{[1-(203)]} = \frac{1.00}{1.00}\$ (204) Fraction of total space heat from main system 2 \$\text{(202)} \times \text{[1-(203)]} = \frac{1.00}{1.00}\$ (204) Fraction of total space heat from main system 2 \$\text{(202)} \times \text{[3-(203)]} = \frac{0.00}{0.00}\$ (205) Efficiency of main system 1 (%) \$[3-(3-(3-(3-(3-(3-(3-(3-(3-(3-(3-(3-(3-(3
893.58 707.32 595.17 336.86 143.65 0.00 0.00 0.00 0.00 365.39 651.96 912.03 \[\frac{1}{2}\left{(98)}\frac{1}{1}\left{5}\tau{12} = \frac{4605.97}{4605.97} \] \[\frac{1}{98}\right{)} = \frac{1}{2}\left{5}\tau{12} = \frac{4605.97}{4605.97} \] \[\frac{1}{99}\right{)} = \frac{1}{2}\left{00} \] \[\frac{1}{99}\right{)} = \frac{1}{2}\left{00} \] \[\frac{1}{99}\right{)} = \frac{1}{2}\left{00} \] \[\frac{1}{2}\left{01} = \frac{1}{2}\left{00} \] \[\frac{1}{2}\left{00} \] \[\frac{1}{2}\left{01} = \frac{1}{2}\left{00} \] \[\frac{1}\left{00} \] \[\frac{1}{2}\left{00} \] \[\frac{1}\left{00} \] \[\frac{1}\left{00} \] \[\frac{1}\left{00} \] \[
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Space heating requirement kWh/m²/year (98) ÷ (4) 52.40 (99) 9a. Energy requirements - individual heating systems including micro-CHP Space heating Fraction of space heat from secondary/supplementary system (table 11)
9a. Energy requirements - individual heating systems including micro-CHP Space heating Fraction of space heat from secondary/supplementary system (table 11) Fraction of space heat from main system(s) Fraction of space heat from main system 2 Fraction of total space heat from main system 1 Fraction of total space heat from main system 1 Fraction of total space heat from main system 2 Efficiency of main system 1 (%) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Space heating fuel (main system 1), kWh/month 956.73 757.30 637.23 360.67 153.80 0.00 0.00 0.00 0.00 391.21 698.03 976.48 ∑(211)15, 1012 = 4931.44 (211) Water heating Efficiency of water heater
Space heating Fraction of space heat from secondary/supplementary system (table 11) 0.00 (201) Fraction of space heat from main system(s) 1 - (201) = 1.00 (202) Fraction of space heat from main system 2 0.00 (202) Fraction of total space heat from main system 1 (202) x [1- (203)] = 1.00 (204) Fraction of total space heat from main system 2 (202) x (203) = 0.00 (205) Efficiency of main system 1 (%) 93.40 (206) Space heating fuel (main system 1), kWh/month Apr May Jun Jun Aug Sep Oct Nov Dec Space heating fuel (main system 1), kWh/month 956.73 757.30 637.23 360.67 153.80 0.00 0.00 0.00 0.00 391.21 698.03 976.48 Σ(211)15, 1012 = 4931.44 (211) Water heating Efficiency of water heater
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Fraction of space heat from secondary/supplementary system (table 11) Fraction of space heat from main system(s) Fraction of space heat from main system 2 Fraction of space heat from main system 2 Fraction of total space heat from main system 1 Fraction of total space heat from main system 2 Fraction of total space heat from main system 2 Fraction of total space heat from main system 2 Efficiency of main system 1 (%) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Space heating fuel (main system 1), kWh/month 956.73 757.30 637.23 360.67 153.80 0.00 0.00 0.00 391.21 698.03 976.48 \[\sum{\sum{\sum{\sum{\sum{\sum{\sum{
Fraction of space heat from main system(s) Fraction of space heat from main system 2 Fraction of total space heat from main system 1 Fraction of total space heat from main system 1 Fraction of total space heat from main system 2 Fraction of total space heat from main system 2 Fraction of total space heat from main system 2 Fraction of total space heat from main system 2 Fraction of total space heat from main system 2 Fraction of total space heat from main system 2 (202) x (203) = 0.00 (205) 93.40 (206) Space heating fuel (main system 1), kWh/month 956.73 757.30 637.23 360.67 153.80 0.00 0.00 0.00 391.21 698.03 976.48 Σ(211)15, 1012 = 4931.44 (211) Water heating Efficiency of water heater
Fraction of space heat from main system 2 Fraction of total space heat from main system 1 Fraction of total space heat from main system 2 Efficiency of main system 1 (%) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Space heating fuel (main system 1), kWh/month 956.73 757.30 637.23 360.67 153.80 0.00 0.00 0.00 391.21 698.03 976.48 \[\begin{array}{ c c c c c c c c c c c c c c c c c c c
Fraction of total space heat from main system 1 Fraction of total space heat from main system 2 Efficiency of main system 1 (%) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Space heating fuel (main system 1), kWh/month 956.73 757.30 637.23 360.67 153.80 0.00 0.00 0.00 391.21 698.03 976.48 Σ(211)15, 1012 = 4931.44 (211) Water heating Efficiency of water heater
Fraction of total space heat from main system 2 Efficiency of main system 1 (%) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Space heating fuel (main system 1), kWh/month 956.73 757.30 637.23 360.67 153.80 0.00 0.00 0.00 391.21 698.03 976.48 Σ(211)15, 1012 = 4931.44 (211) Water heating Efficiency of water heater
Efficiency of main system 1 (%) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Space heating fuel (main system 1), kWh/month $956.73 757.30 637.23 360.67 153.80 0.00 0.00 0.00 391.21 698.03 976.48$ $\Sigma(211)15, 1012 = 4931.44$ Water heating Efficiency of water heater
Space heating fuel (main system 1), kWh/month
Space heating fuel (main system 1), kWh/month
956.73 757.30 637.23 360.67 153.80 0.00 0.00 0.00 391.21 698.03 976.48 $\Sigma(211)15, 1012 = 4931.44 \qquad (211)$ Water heating Efficiency of water heater
$\Sigma(211)15, 1012 = 4931.44 $ (211) Water heating Efficiency of water heater
Water heating Efficiency of water heater
Efficiency of water heater
88.31 88.12 87.72 86.75 84.72 80.30 80.30 80.30 80.30 86.83 87.92 88.38 (217)
Water heating fuel, kWh/month
234.77 207.41 217.67 195.22 193.54 179.84 172.30 192.07 194.19 204.50 214.70 228.99
$\Sigma(219a)112 = 2435.21 $ (219)
Annual totals
Secretarity field and a material and a
Space heating fuel - main system 1 4931.44
Space heating fuel - main system 1 Water heating fuel 2435.21

Electricity for pumps, fans and electric keep-hot (Table 4f)					
central heating pump or water pump within warm air heating	unit		30.00		(230c)
boiler flue fan			45.00		(230e)
Total electricity for the above, kWh/year				75.00	(231)
Electricity for lighting (Appendix L)				370.24	(232)
Total delivered energy for all uses		(211)	(221) + (231) + (232)((237b) = 7811.89	(238)
10a. Fuel costs - individual heating systems including micro-CH	P				
	Fuel kWh/year		Fuel price	Fuel cost £/year	
Space heating - main system 1	4931.44	x	3.48 x 0	.01 = 171.61	(240)
Water heating	2435.21	x	3.48 x 0	.01 = 84.75	(247)
Pumps and fans	75.00	x	13.19 x 0	.01 = 9.89	(249)
Electricity for lighting	370.24	x	13.19 x 0	.01 = 48.84	(250)
Additional standing charges				120.00	(251)
Total energy cost			(240)(242) + (245)	(254) = 435.09	(255)
11a. SAP rating - individual heating systems including micro-CF	IP .				
Energy cost deflator (Table 12)				0.42	(256)
Energy cost factor (ECF)				1.37	(257)
SAP value				80.82	
SAP rating (section 13)				81	(258)
SAP band				В	
					I
12a. CO₂ emissions - individual heating systems including micro					
12a. CO₂ emissions - individual heating systems including micro	Energy kWh/year		Emission factor kg CO ₂ /kWh	Emissions kg CO₂/year	
12a. CO₂ emissions - individual heating systems including micro Space heating - main system 1	Energy	x	kg CO₂/kWh	Emissions	(261)
	Energy kWh/year	x x	kg CO ₂ /kWh 0.216	Emissions kg CO ₂ /year	_
Space heating - main system 1	Energy kWh/year 4931.44		kg CO ₂ /kWh	Emissions kg CO ₂ /year = 1065.19 = 526.01	(261)
Space heating - main system 1 Water heating	Energy kWh/year 4931.44		kg CO ₂ /kWh 0.216 0.216 (261) + (262) + (263) +	Emissions kg CO ₂ /year = 1065.19 = 526.01	(261)
Space heating - main system 1 Water heating Space and water heating	Energy kWh/year 4931.44 2435.21	x	kg CO ₂ /kWh 0.216 0.216 (261) + (262) + (263) + 0.519	Emissions kg CO ₂ /year = 1065.19 = 526.01 + (264) = 1591.20	(261) (264) (265)
Space heating - main system 1 Water heating Space and water heating Pumps and fans	Energy kWh/year 4931.44 2435.21	x x	kg CO ₂ /kWh 0.216 0.216 (261) + (262) + (263) + 0.519 0.519	Emissions kg CO ₂ /year = 1065.19 = 526.01 + (264) = 1591.20 = 38.93	(261) (264) (265) (267)
Space heating - main system 1 Water heating Space and water heating Pumps and fans Electricity for lighting	Energy kWh/year 4931.44 2435.21	x x	kg CO ₂ /kWh 0.216 0.216 (261) + (262) + (263) + 0.519 0.519 (265)	Emissions kg CO ₂ /year = 1065.19 = 526.01 + (264) = 1591.20 = 38.93 = 192.16	(261) (264) (265) (267) (268)
Space heating - main system 1 Water heating Space and water heating Pumps and fans Electricity for lighting Total CO ₂ , kg/year	Energy kWh/year 4931.44 2435.21	x x	kg CO ₂ /kWh 0.216 0.216 (261) + (262) + (263) + 0.519 0.519 (265)	Emissions kg CO ₂ /year = 1065.19 = 526.01 + (264) = 1591.20 = 38.93 = 192.16 (271) = 1822.28	(261) (264) (265) (267) (268) (272)
Space heating - main system 1 Water heating Space and water heating Pumps and fans Electricity for lighting Total CO ₂ , kg/year Dwelling CO ₂ emission rate	Energy kWh/year 4931.44 2435.21	x x	kg CO ₂ /kWh 0.216 0.216 (261) + (262) + (263) + 0.519 0.519 (265)	Emissions kg CO ₂ /year $= 1065.19$ $= 526.01$ $+ (264) = 1591.20$ $= 38.93$ $= 192.16$ (271) = 1822.28 2) ÷ (4) = 20.73	(261) (264) (265) (267) (268) (272)
Space heating - main system 1 Water heating Space and water heating Pumps and fans Electricity for lighting Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value	Energy kWh/year 4931.44 2435.21	x x	kg CO ₂ /kWh 0.216 0.216 (261) + (262) + (263) + 0.519 0.519 (265)	Emissions kg CO_2 /year $= 1065.19$ $= 526.01$ $+ (264) = 1591.20$ $= 38.93$ $= 192.16$ $(271) = 1822.28$ $2) \div (4) = 20.73$ 81.63	(261) (264) (265) (267) (268) (272) (273)
Space heating - main system 1 Water heating Space and water heating Pumps and fans Electricity for lighting Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14)	Energy kWh/year 4931.44 2435.21 75.00 370.24	x x	kg CO ₂ /kWh 0.216 0.216 (261) + (262) + (263) + 0.519 0.519 (265)	Emissions kg CO ₂ /year = 1065.19 = 526.01 + (264) = 1591.20 = 38.93 = 192.16(271) = 1822.28 2) ÷ (4) = 20.73 81.63 82	(261) (264) (265) (267) (268) (272) (273)
Space heating - main system 1 Water heating Space and water heating Pumps and fans Electricity for lighting Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14) El band	Energy kWh/year 4931.44 2435.21 75.00 370.24	x x	kg CO ₂ /kWh 0.216 0.216 (261) + (262) + (263) + 0.519 0.519 (265)	Emissions kg CO ₂ /year = 1065.19 = 526.01 + (264) = 1591.20 = 38.93 = 192.16(271) = 1822.28 2) ÷ (4) = 20.73 81.63 82	(261) (264) (265) (267) (268) (272) (273) (274)
Space heating - main system 1 Water heating Space and water heating Pumps and fans Electricity for lighting Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14) El band	Energy kWh/year 4931.44 2435.21 75.00 370.24	x x	kg CO ₂ /kWh 0.216 0.216 (261) + (262) + (263) + 0.519 0.519 (265) (272	Emissions kg CO ₂ /year = 1065.19 = 526.01 + (264) = 1591.20 = 38.93 = 192.16(271) = 1822.28 2) ÷ (4) = 20.73 81.63 82 B Primary Energ	(261) (264) (265) (267) (268) (272) (273) (274)
Space heating - main system 1 Water heating Space and water heating Pumps and fans Electricity for lighting Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14) El band 13a. Primary energy - individual heating systems including mic	Energy kWh/year 4931.44 2435.21 75.00 370.24	x x x	kg CO ₂ /kWh 0.216 0.216 (261) + (262) + (263) + 0.519 0.519 (265) (272	Emissions kg CO ₂ /year = 1065.19 = 526.01 + (264) = 1591.20 = 38.93 = 192.16(271) = 1822.28 2) ÷ (4) = 20.73 81.63 82 B Primary Energy KWh/year	(261) (264) (265) (267) (268) (272) (273) (274)
Space heating - main system 1 Water heating Space and water heating Pumps and fans Electricity for lighting Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14) El band 13a. Primary energy - individual heating systems including mic	Energy kWh/year 4931.44 2435.21 75.00 370.24 ro-CHP Energy kWh/year 4931.44	x x x	kg CO ₂ /kWh 0.216 0.216 (261) + (262) + (263) + 0.519 0.519 (265) (272	Emissions kg CO ₂ /year = 1065.19 = 526.01 - (264) = 1591.20 = 38.93 = 192.16(271) = 1822.28 2) ÷ (4) = 20.73 81.63 82 B Primary Energy KWh/year = 6016.36 = 2970.95	(261) (264) (265) (267) (268) (272) (273) (274)

10354.21

(268)

(273)

370.24

3.07

Electricity for lighting

Primary energy kWh/year

Dwelling primary energy rate kWh/m2/year



Appendix B - SAP Worksheets



Assessor name	Mr Jason Doherty	Assessor number	2634
Client		Last modified	07/06/2018
Address	1 6 Streatley Place, London, NW3 1HP		

		Area (m²)	Average sto height (m	•	Volume (m³)	
Lowest occupied		80.60 (1a) x	2.60	(2a) =	209.56	(3a)
+1		65.00 (1b) x	3.00	(2b) =	195.00	(3b)
Total floor area	(1a) + (1b) + (1c) + (1d)(1n) =	145.60 (4)				
Dwelling volume			(3a) + (3b)	+ (3c) + (3d)(3n) =	404.56	(5)

2. Ventilation rate					
				m³ per hou	r
Number of chimneys		0	x 40 =	0	(6a)
Number of open flues		0	x 20 =	0	(6b)
Number of intermittent fans		0	x 10 =	0	(7a)
Number of passive vents		0	x 10 =	0	(7b)
Number of flueless gas fires		0	x 40 =	0	(7c)
				Air changes phour	er
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 0	÷ (5) =	0.00	(8)

Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) =	0	÷ (5) =	0.00	(8)
If a pressurisation test has been carried out or is intended,	proceed to (17), otherwise continue from (9) to (16)			
Air permeability value, q50, expressed in cubic metres per	hour per square metre of envelope area			3.00	(17)

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

Number of sides on which the dwelling is sheltered

Shelter factor

Infiltration rate incorporating shelter factor

Infiltration rate modified for monthly wind speed:

			····a speca										
	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 (al	llowing for	shelter and	wind facto	or) (21) x (2	2a)m							

	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 infiltrat	ion rate (al	llowing for	shelter and	wind facto	or) (21) x (2	2a)m							
	0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14	(22b)
Calculate effective	e air chang	ge rate for t	he applical	ble case:									

If mechanical ventilation: air change rate through system If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h

a) If balanced mechanical ventilation with heat recovery (MVHR) (22b)m + (23b) x [1 - (23c) ÷ 100]

a) ii balanceu	mechanica	ai veritilatio	iii wittii iiea	t recovery ((10101111) (22	D)111 1 (23L) X [1 - (230	., . 100]					
	0.25	0.25	0.24	0.23	0.23	0.21	0.21	0.21	0.22	0.23	0.23	0.24	(24a)

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



0.50

79.90

0.15

3

0.78

0.12

1 - [0.075 x (19)] =

 $(18) \times (20) =$

(18)

(19)

(20)

(23a)

lement		ss paramet		Gross	Openings	Net ar	rea	U-value	AxUW	//К к-v	alue,	Ахк,	
				rea, m²	m²	A, m		W/m²K		-	/m².K	kJ/K	
Vindow						72.9	6 x	1.15	= 83.54				(2
)oor						1.95	5 x	0.55	= 1.07				(2
loof window						1.48	3 x	0.96	= 1.42				(2
Basement floor						80.6	0 x	0.12	= 9.67				(2
external wall						100.7	77 x	0.13	= 13.10)			(2
Party wall						80.7	4 x	0.00	= 0.00				(3
Roof						28.3	2 x	0.09	= 2.52				(3
otal area of exter	rnal eleme	ents ∑A, m²				286.0	08						(3
abric heat loss, W	V/K = ∑(A :	× U)							(20	5)(30) + (3	32) =	111.33	(3
leat capacity Cm	= Σ(A x κ)							(28)	(30) + (32)	+ (32a)(32	2e) =	N/A	(3
hermal mass par	ameter (T	MP) in kJ/n	1²K									150.00	(3
hermal bridges: 2	∑(L x Ѱ) ca	lculated us	ing Appen	dix K								17.68	(3
otal fabric heat lo	oss									(33) + (3	36) =	129.01	(3
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
entilation heat lo	oss calcula	ted month	ly 0.33 x (2	25)m x (5)									
	33.21	32.82	32.43	30.49	30.10	28.16	28.16	27.77	28.94	30.10	30.88	31.65	(3
leat transfer coef	fficient, W	/K (37)m +	(38)m										
	162.21	161.82	161.43	159.49	159.11	157.17	157.17	156.78	157.94	159.11	159.88	3 160.60	6
									Average = 2	(39)112/	/12 =	159.40	(3
leat loss paramet	ter (HLP), \	W/m ² K (39)m ÷ (4)										
leat loss paramet	1.11	W/m²K (39 1.11	1.11	1.10	1.09	1.08	1.08	1.08	1.08	1.09	1.10	1.10	
Heat loss paramet				1.10	1.09	1.08	1.08		1.08 Average = 2			1.10	(4
	1.11	1.11		1.10	1.09	1.08	1.08					I	(4
	1.11	1.11		30.00	31.00	30.00	1.08					1.09	
Number of days ir	1.11 n month (T 31.00	1.11 Table 1a)	31.00						Average = 2	(40)112/	/12 =	1.09	(4
Jumber of days in	1.11 n month (T 31.00	1.11 Table 1a)	31.00						Average = 2	(40)112/	/12 =	1.09	(4
Number of days in 4. Water heating	1.11 n month (T 31.00 g energy re	1.11 Table 1a) 28.00 equirement	31.00	30.00	31.00	30.00			Average = 2	(40)112/	/12 =	1.09	(4
Jumber of days in 4. Water heating	1.11 n month (T 31.00 g energy re	1.11 Table 1a) 28.00 equirement	1.11 31.00	30.00 Vd,average	31.00 = (25 x N) +	30.00	31.00	31.00	Average = 2	31.00	30.00	1.09 31.00 2.93 103.72	(4
Jumber of days in 4. Water heating ssumed occupan	1.11 n month (T 31.00 genergy re	1.11 Table 1a) 28.00 equirement sage in litre	1.11 31.00	30.00 Vd,average Apr	31.00 = (25 x N) + May	30.00 36 Jun			Average = 2	(40)112/	/12 =	1.09	(4
A. Water heating	1.11 a month (T 31.00 g energy re acy, N bt water u Jan n litres pe	1.11 Table 1a) 28.00 equirement sage in litre Feb r day for ea	31.00 ses per day war ch month was	30.00 Vd,average Apr Vd,m = fact	31.00 = (25 x N) + May tor from Tab	30.00 36 Jun le 1c x (43)	31.00 Jul	31.00	Average = 2 30.00	(40)112/ 31.00 Oct	/12 =	1.09 31.00 2.93 103.72 Dec	(4
A. Water heating	1.11 n month (T 31.00 genergy re	1.11 Table 1a) 28.00 equirement sage in litre	1.11 31.00	30.00 Vd,average Apr	31.00 = (25 x N) + May	30.00 36 Jun	31.00	31.00	Average = 2	(40)112/ 31.00 Oct	/12 =	1.09 31.00 2.93 103.72 Dec	(4)
A. Water heating Assumed occupan Annual average ho	1.11 n month (T 31.00 g energy re ncy, N ot water u Jan n litres per	1.11 Table 1a) 28.00 equirement sage in litre Feb r day for ea 109.94	31.00 as per day Mar ch month 105.79	30.00 Vd,average Apr Vd,m = fact 101.64	31.00 = (25 x N) + May tor from Tab 97.49	30.00 36 Jun le 1c x (43) 93.35	31.00 Jul 93.35	31.00 Aug	Average = 2 30.00	(40)112/ 31.00 Oct	/12 =	1.09 31.00 2.93 103.72 Dec	(4
A. Water heating Assumed occupan Annual average ho	1.11 n month (T 31.00 genergy reacy, N ot water u Jan n litres per 114.09	1.11 Table 1a) 28.00 equirement sage in litre Feb r day for ea 109.94 r used = 4.1	31.00 as per day v Mar ch month v 105.79	30.00 Vd,average Apr Vd,m = fact 101.64	31.00 = (25 x N) + May for from Tab 97.49	30.00 36 Jun le 1c x (43) 93.35	31.00 Jul 93.35 ables 1b,	31.00 Aug 97.49 1c 1d)	Average = 2 30.00 Sep	Oct 105.79 Σ(44)1	Nov 109.94 .12 =	1.09 31.00 2.93 103.72 Dec 1 114.09	(4
A. Water heating Assumed occupan Annual average ho	1.11 n month (T 31.00 g energy re ncy, N ot water u Jan n litres per	1.11 Table 1a) 28.00 equirement sage in litre Feb r day for ea 109.94	31.00 as per day Mar ch month 105.79	30.00 Vd,average Apr Vd,m = fact 101.64	31.00 = (25 x N) + May tor from Tab 97.49	30.00 36 Jun le 1c x (43) 93.35	31.00 Jul 93.35	31.00 Aug	Average = 2 30.00	Oct 105.79 Σ(44)1 138.23	Nov 109.94 .12 =	1.09 31.00 2.93 103.72 Dec 1 114.09 1244.62	(44 (44 (44 (44 (44 (44 (44 (44 (44 (44
A. Water heating Assumed occupan Annual average ho	1.11 n month (T 31.00 genergy reactor, N ot water u Jan n litres per 114.09	1.11 Table 1a) 28.00 equirement sage in litre Feb r day for ea 109.94 r used = 4.1 147.98	31.00 as per day v Mar ch month v 105.79	30.00 Vd,average Apr Vd,m = fact 101.64	31.00 = (25 x N) + May for from Tab 97.49	30.00 36 Jun le 1c x (43) 93.35	31.00 Jul 93.35 ables 1b,	31.00 Aug 97.49 1c 1d)	Average = 2 30.00 Sep	Oct 105.79 Σ(44)1	Nov 109.94 .12 =	1.09 31.00 2.93 103.72 Dec 1 114.09	(4) (4) (4) (4) (4) (4) (5)
4. Water heating Assumed occupan Annual average he Hot water usage in	1.11 n month (T 31.00 genergy red ncy, N ot water u Jan n litres per 114.09 hot water 169.19	1.11 Table 1a) 28.00 equirement sage in litre Feb r day for ea 109.94 r used = 4.1 147.98	1.11 31.00 Ses per day V Mar ch month V 105.79 8 x Vd,m x 152.70	30.00 Vd,average Apr Vd,m = fact 101.64 nm x Tm/3 133.13	31.00 = (25 x N) + May tor from Tab 97.49 3600 kWh/m 127.74	30.00 36 Jun le 1c x (43) 93.35 onth (see Ta	31.00 Jul 93.35 ables 1b,	31.00 Aug 97.49 1c 1d) 117.21	Average = 2 30.00 Sep 101.64	Oct 105.79 Σ(44)1 138.23 Σ(45)1	Nov 109.94 .12 =	1.09 31.00 2.93 103.72 Dec 1 114.09 1244.62 9 163.89	(4) (4) (4) (4) (4
4. Water heating assumed occupant annual average heating the state of	1.11 n month (T 31.00 g energy re icy, N ot water u Jan n litres per 114.09 hot water 169.19 0.15 x (45) 25.38	1.11 Table 1a) 28.00 equirement sage in litre Feb r day for ea 109.94 r used = 4.1 147.98	1.11 31.00 es per day v Mar ch month v 105.79 8 x Vd,m x 152.70	30.00 Vd,average Apr Vd,m = fact 101.64 nm x Tm/3 133.13	31.00 = (25 x N) + May for from Tab 97.49	30.00 36 Jun le 1c x (43) 93.35	31.00 Jul 93.35 ables 1b,	31.00 Aug 97.49 1c 1d)	Average = 2 30.00 Sep	Oct 105.79 Σ(44)1 138.23	Nov 109.94 .12 =	1.09 31.00 2.93 103.72 Dec 1 114.09 1244.62 9 163.89	(4) (4) (4) (4) (4
4. Water heating assumed occupant annual average heating the state of	1.11 n month (T 31.00 genergy re acy, N by water u Jan n litres per 114.09 chot water 169.19 chot water 25.38 s calculate	1.11 Table 1a) 28.00 equirement sage in litre Feb r day for ea 109.94 r used = 4.1 147.98 m 22.20 ed for each	1.11 31.00 tes per day very month of the set of the s	30.00 Vd,average Apr Vd,m = fact 101.64 nm x Tm/3 133.13	31.00 = (25 x N) + May for from Tab 97.49 3600 kWh/m 127.74	30.00 36 Jun le 1c x (43) 93.35 onth (see Ta 110.23	31.00 Jul 93.35 ables 1b, 102.14	31.00 Aug 97.49 1c 1d) 117.21	Average = 2 30.00 Sep 101.64 118.61	Oct 105.79 Σ(44)1 138.23 Σ(45)1	Nov 109.94 .12 = 150.89 .12 =	1.09 31.00 2.93 103.72 Dec 1 114.09 1244.62 0 163.89 24.58	(4)
4. Water heating assumed occupant annual average heating the latest the lates	1.11 n month (T 31.00 g energy re acy, N ot water u Jan n litres per 114.09 c hot water 169.19 0.15 x (45) 25.38 s calculate 0.00	1.11 Table 1a) 28.00 equirement sage in litre Feb r day for ea 109.94 r used = 4.1 147.98 m 22.20 ed for each 0.00	1.11 31.00 Ses per day V Mar ch month V 105.79 8 x Vd,m x 152.70 22.90 month (55) 0.00	30.00 Vd,average Apr Vd,m = fact 101.64 nm x Tm/3 133.13 19.97 5) x (41)m 0.00	31.00 = (25 x N) + May for from Tab 97.49 3600 kWh/m 127.74 19.16	30.00 36 Jun le 1c x (43) 93.35 onth (see Ta 110.23	31.00 Jul 93.35 ables 1b, 102.14 15.32	Aug 97.49 1c 1d) 117.21 17.58	Average = 2 30.00 Sep 101.64	Oct 105.79 Σ(44)1 138.23 Σ(45)1	Nov 109.94 .12 =	1.09 31.00 2.93 103.72 Dec 1 114.09 1244.62 9 163.89	(4) (4) (4) (4) (4) (4) (4) (4) (4) (4)
4. Water heating Assumed occupan Annual average ho Hot water usage in Energy content of Distribution loss (1.11 n month (T 31.00 genergy reactions, N but water u Jan n litres per 114.09 chot water 169.19 chot water 25.38 s calculate 0.00 sins dedica	1.11 Table 1a) 28.00 equirement sage in litre Feb r day for ea 109.94 r used = 4.1 147.98 m 22.20 ed for each 0.00 ated solar st	1.11 31.00 Ses per day V Mar ch month V 105.79 8 x Vd,m x 152.70 22.90 month (55) 0.00	30.00 Vd,average Apr Vd,m = fact 101.64 nm x Tm/3 133.13 19.97 5) x (41)m 0.00	31.00 = (25 x N) + May for from Tab 97.49 3600 kWh/m 127.74 19.16	30.00 36 Jun le 1c x (43) 93.35 onth (see Ta 110.23	31.00 Jul 93.35 ables 1b, 102.14 15.32	Aug 97.49 1c 1d) 117.21 17.58	Average = 2 30.00 Sep 101.64 118.61	Oct 105.79 Σ(44)1 138.23 Σ(45)1	Nov 109.94 .12 = 150.89 .12 =	1.09 31.00 2.93 103.72 Dec 1 114.09 1244.62 0 163.89 24.58	(4) (4) (4) (4) (4) (4) (4) (4) (4) (4)
4. Water heating assumed occupant annual average heating that water usage in the content of the	1.11 n month (T 31.00 g energy re acy, N ot water u Jan n litres per 114.09 c hot water 169.19 0.15 x (45) 25.38 s calculate 0.00	1.11 Table 1a) 28.00 equirement sage in litre Feb r day for ea 109.94 r used = 4.1 147.98 m 22.20 ed for each 0.00	1.11 31.00 Ses per day V Mar ch month V 105.79 8 x Vd,m x 152.70 22.90 month (55) 0.00	30.00 Vd,average Apr Vd,m = fact 101.64 nm x Tm/3 133.13 19.97 5) x (41)m 0.00	31.00 = (25 x N) + May for from Tab 97.49 3600 kWh/m 127.74 19.16	30.00 36 Jun le 1c x (43) 93.35 onth (see Ta 110.23	31.00 Jul 93.35 ables 1b, 102.14 15.32	Aug 97.49 1c 1d) 117.21 17.58	Average = 2 30.00 Sep 101.64 118.61	Oct 105.79 Σ(44)1 138.23 Σ(45)1	Nov 109.94 .12 = 150.89 .12 =	1.09 31.00 2.93 103.72 Dec 1 114.09 1244.62 0 163.89 24.58	(44 (44 (44 (44 (44 (44 (44 (44 (44 (44
A. Water heating Assumed occupan Annual average ho Hot water usage in Energy content of Distribution loss (Water storage lose If the vessel conta	1.11 n month (T 31.00 genergy re acy, N ot water u Jan n litres per 114.09 chot water 169.19 chot water 25.38 s calculate 0.00 cins dedica 0.00	1.11 Table 1a) 28.00 equirement sage in litre Feb r day for ea 109.94 r used = 4.1 147.98 m 22.20 ed for each 0.00 eted solar st	1.11 31.00 Ses per day V Mar ch month V 105.79 8 x Vd,m x 152.70 22.90 month (55) 0.00 torage or d 0.00	30.00 /d,average	31.00 = (25 x N) + May tor from Tab 97.49 = 3600 kWh/m 127.74 = 19.16 = 0.00	30.00 36 Jun le 1c x (43) 93.35 onth (see Ta 110.23 16.53 0.00 m x [(47) - Vs	31.00 Jul 93.35 ables 1b, 102.14 15.32 0.00 s] ÷ (47),	31.00 Aug 97.49 1c 1d) 117.21 17.58 0.00 else (56)	30.00 Sep 101.64 118.61 17.79 0.00	Oct 105.79 Σ(44)1 138.23 Σ(45)1 20.73	Nov 109.94 .12 = 150.89 .12 = 22.63	1.09 31.00 2.93 103.72 Dec 1244.62 1631.89 24.58	(4) (4) (4) (4) (4) (4) (4) (4) (4) (4)
A. Water heating Assumed occupan Annual average ho Energy content of Water storage loss of the vessel conta	1.11 n month (T 31.00 genergy reading and second se	1.11 Table 1a) 28.00 equirement sage in litre Feb r day for ea 109.94 r used = 4.1 147.98 m 22.20 ed for each 0.00 eted solar st	1.11 31.00 Ses per day V Mar ch month V 105.79 8 x Vd,m x 152.70 22.90 month (55) 0.00 torage or d 0.00	30.00 /d,average	31.00 = (25 x N) + May tor from Tab 97.49 = 3600 kWh/m 127.74 = 19.16 = 0.00	30.00 36 Jun le 1c x (43) 93.35 onth (see Ta 110.23 16.53 0.00 m x [(47) - Vs	31.00 Jul 93.35 ables 1b, 102.14 15.32 0.00 s] ÷ (47),	31.00 Aug 97.49 1c 1d) 117.21 17.58 0.00 else (56)	30.00 Sep 101.64 118.61 17.79 0.00	Oct 105.79 Σ(44)1 138.23 Σ(45)1 20.73	Nov 109.94 .12 = 150.89 .12 = 22.63	1.09 31.00 2.93 103.72 Dec 1244.62 1631.89 24.58	(44 (44 (44 (44 (44 (44 (44 (44 (44 (44

0.25

0.24

0.23

0.23

0.21

0.21

0.21

0.22

0.23

0.23

0.24

													_
	32.00	28.89	31.95	30.87	31.86	30.78	31.78	31.83	30.83	31.91	30.93	31.98	(61
Total heat requi	ired for wate	er heating o	calculated f	or each mo	onth 0.85 x	(45)m + (4	6)m + (57)ı	n + (59)m +	- (61)m				
	201.19	176.86	184.65	164.00	159.60	141.01	133.92	149.04	149.44	170.13	181.81	195.84	(62
olar DHW inpu	it calculated	using Appe	endix G or A	Appendix H	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	(63
Output from wa		1		!	1	!					0.00		_ (
output mom we		1		1		1	122.02	140.04	140.44	170.12	101.01	105.04	1
	201.19	176.86	184.65	164.00	159.60	141.01	133.92	149.04	149.44	170.13	181.81	195.84]]
										∑(64)1	.12 =2	.007.50	(64
leat gains from		ing (kWh/m	nonth) 0.25	5 × [0.85 ×	(45)m + (61	.)m] + 0.8 ×	[(46)m + (57)m + (59)	mJ				7
	64.26	56.42	58.76	51.98	50.44	44.35	41.91	46.93	47.15	53.94	57.90	62.48	(65
5. Internal gair	20												
o. Iliterilai gali		Fala	D.C.	A	0.4	1	11	0	Com	Oct	Non	Dan	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1etabolic gains	(Table 5)												_
	175.62	175.62	175.62	175.62	175.62	175.62	175.62	175.62	175.62	175.62	175.62	175.62	(66
ghting gains (c	calculated in	Appendix I	L, equation	L9 or L9a),	, also see Ta	ble 5							
	70.36	62.49	50.82	38.48	28.76	24.28	26.24	34.10	45.77	58.12	67.84	72.32	(67
ppliance gains	(calculated	in Appendi	x L, equatio	on L13 or L	.13a), also se	ee Table 5							
	471.19	476.07	463.75	437.52	404.41	373.29	352.50	347.61	359.93	386.16	419.28	450.40	(68
ooking gains (d	calculated in	Appendix	L, equation	L15 or L15	5a), also see	Table 5							_
	55.49	55.49	55.49	55.49	55.49	55.49	55.49	55.49	55.49	55.49	55.49	55.49	(69
ump and fan g			331.3		33.13	30.13	333	33.13	, 331.13		333	1 331.13] (00
amp and ram g	3.00	3.00	3.00	3.00	3.00	3.00	2.00	3.00	2.00	3.00	2.00	3.00	7 /70
			3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70
osses e.g. evap			·	l	1						·		٦,
	-117.08	-117.08	-117.08	-117.08	-117.08	-117.08	-117.08	-117.08	-117.08	-117.08	-117.08	-117.08	[71
/ater heating g	gains (Table	5)	r										7
	86.37	83.96	78.98	72.20	67.79	61.59	56.33	63.08	65.48	72.50	80.42	83.97	(72
otal internal ga	ains (66)m -	+ (67)m + (6	58)m + (69)	m + (70)m	+ (71)m + (7	72)m							_
		. , .						FC4 00	588.22	633.81			
	744.94	739.56	710.59	665.23	618.00	576.20	552.10	561.83	300.22	033.81	684.56	723.72	[73
6 Solar gains		739.56	710.59	665.23	618.00	576.20	552.10	561.83	300.22	033.81	684.56	723.72	<u> </u>
6. Solar gains		739.56						561.83			684.56		<u></u> (73
6. Solar gains		739.56	Access f	factor	Area	Sol	ar flux		g	FF		Gains	<u> </u>
6. Solar gains		739.56		factor		Sol		spec			lata		J (73
		739.56	Access f Table	factor 6d	Area m²	Sol	ar flux //m²	spec or T	g ific data able 6b	FF specific c or Table	lata 6c	Gains W	, ·
orthEast		739.56	Access f Table	factor 6d	Area m² 17.42	Sol W	ar flux //m²	spec or T	g ific data able 6b	FF specific c or Table	lata 6c	Gains W] (75
orth East outh East		739.56	Access f Table	factor 6d x 4 x 4 x 1	Area m² 17.42 7.02	Sol W	ar flux //m² 1.28 x 6.79 x	spec or T 0.9 x (g ific data able 6b 0.70 x 0.70 x	FF specific c or Table 0.70 0.70	lata 6c = =	Gains W 46.81 61.51] (75] (77
orthEast outhEast orthWest		739.56	0.5-0.5-0.5-0.5-0.5-0.5-0.5-0.5-0.5-0.5-	factor 6d	Area m² 17.42 7.02 2.34	X	ar flux //m² 1.28 x 6.79 x 1.28 x	spec or T 0.9 x (0.9 x	g ific data able 6b 0.70	FF specific c or Table 0.70 0.70	lata 6c = = = =	Gains W 46.81 61.51 6.29] (7 <u>5</u>
orthEast outhEast orthWest orizontal		739.56	0.5- 0.5- 0.5- 1.00	factor 6d	Area m² 17.42 7.02 2.34 1.48	Sol W x 1 x 3 x 1 x 2	ar flux //m² 1.28 x 6.79 x 1.28 x 6.00 x	spec or T 0.9 x (0.9 x (0.9 x (0.9 x (g ific data able 6b 0.70	FF specific c or Table 0.70 0.70 0.70 0.70	lata	Gains W 46.81 61.51 6.29 15.27] (75] (77] (81
orthEast outhEast orthWest orizontal		739.56	0.5-0.5-0.5-0.5-0.5-0.5-0.5-0.5-0.5-0.5-	factor 6d	Area m² 17.42 7.02 2.34	Sol W x 1 x 3 x 1 x 2	ar flux //m² 1.28 x 6.79 x 1.28 x 6.00 x	spec or T 0.9 x (0.9 x (0.9 x (0.9 x (g ific data able 6b 0.70	FF specific c or Table 0.70 0.70 0.70 0.70	lata 6c = = = =	Gains W 46.81 61.51 6.29] (75] (77] (81
orthEast outhEast orthWest orizontal orthEast		739.56	0.5- 0.5- 0.5- 1.00	factor 6d	Area m² 17.42 7.02 2.34 1.48	X	ar flux //m² 1.28	spec or T 0.9 x (0.9 x (0.9 x (0.9 x (g ific data able 6b 0.70	FF specific c or Table 0.70 0.70 0.70 0.70 0.70	lata	Gains W 46.81 61.51 6.29 15.27] (75] (77] (81] (75
orthEast outhEast orthWest orizontal orthEast outhEast		739.56	0.5/ 0.5/ 0.5/ 0.5/ 0.7/	factor 6d	Area m² 17.42 7.02 2.34 1.48 26.02	Sol W x 1 x 3 x 1 x 2 x 1 x 2	ar flux //m² 1.28	spec or T 0.9 x (0.9 x	g ific data able 6b 0.70	FF specific c or Table 0.70 0.70 0.70 0.70 0.70 0.70	lata 6c =	Gains W 46.81 61.51 6.29 15.27 99.69	(75) (75) (81) (75) (75)
orthEast outhEast orthWest orizontal orthEast outhEast orthWest	744.94		0.5- 0.5- 0.5- 0.7- 0.7-	factor 6d	Area m² 17.42 7.02 2.34 1.48 26.02 18.06	Sol W x 1 x 3 x 1 x 2 x 1 x 2	ar flux //m² 1.28	spec or T 0.9 x (0.9 x	g ific data able 6b 0.70	FF specific c or Table 0.70 0.70 0.70 0.70 0.70 0.70	lata 6c =	Gains W 46.81 61.51 6.29 15.27 99.69 225.64	75] (75] (77] (81] (75] (75] (75]
orthEast outhEast orthWest orizontal orthEast outhEast orthWest	744.94		0.5- 0.5- 0.5- 0.7- 0.7-	factor 6d	Area m² 17.42 7.02 2.34 1.48 26.02 18.06	Sol W x 1 x 3 x 1 x 2 x 1 x 2	ar flux //m² 1.28	spec or T 0.9 x (0.9 x	g ific data able 6b 0.70	FF specific c or Table 0.70 0.70 0.70 0.70 0.70 0.70	lata 6c =	Gains W 46.81 61.51 6.29 15.27 99.69 225.64] (75] (77] (81] (75] (75] (75] (81]
lorthEast outhEast lorthWest lorizontal lorthEast outhEast lorthWest olar gains in wa	744.94 atts ∑(74)m 463.26	(82)m 848.22	0.5- 0.5- 0.5- 1.00 0.7- 0.7- 1315.47	factor 6d	Area m² 17.42 7.02 2.34 1.48 26.02 18.06 2.10	X	ar flux //m² 1.28	spec or T 0.9 x () 0.9 x () 0.9 x () 0.9 x () 0.9 x ()	g ific data able 6b 0.70	5F specific co or Table 0.70 0.70 0.70 0.70 0.70 0.70 0.70 0.7	lata 6c =	Gains W 46.81 61.51 6.29 15.27 99.69 225.64 8.05] (75] (77] (81] (75] (77
JorthEast outhEast JorthWest JorthEast outhEast JorthWest JorthWest	744.94 atts ∑(74)m 463.26 ernal and so	(82)m 848.22 olar (73)m +	0.5- 0.5- 0.5- 0.7- 0.7- 0.7- 1315.47 (83)m	factor 6d	Area m² 17.42 7.02 2.34 1.48 26.02 18.06 2.10	Sol W x 1 x 3 x 1 x 2 x 1 x 2 x 1 x 2 x 1 x 3	ar flux //m² 1.28	spec or T 0.9 x (0.9 x	g ific data able 6b 0.70	FF specific coor Table 0.70 0.70 0.70 0.70 0.70 0.70 979.44	lata 6c =	Gains W 46.81 61.51 6.29 15.27 99.69 225.64 8.05	75] (75] (75] (81] (75] (75] (75] (81] (83]
lorthEast outhEast lorthWest lorizontal lorthEast outhEast lorthWest olar gains in wa	744.94 atts ∑(74)m 463.26	(82)m 848.22	0.5- 0.5- 0.5- 1.00 0.7- 0.7- 1315.47	factor 6d	Area m² 17.42 7.02 2.34 1.48 26.02 18.06 2.10	X	ar flux //m² 1.28	spec or T 0.9 x () 0.9 x () 0.9 x () 0.9 x () 0.9 x ()	g ific data able 6b 0.70	5F specific co or Table 0.70 0.70 0.70 0.70 0.70 0.70 0.70 0.7	lata 6c =	Gains W 46.81 61.51 6.29 15.27 99.69 225.64 8.05	75] (75] (75] (81] (75] (75] (75] (81] (83]
lorthEast outhEast lorthWest lorizontal lorthEast outhEast lorthWest olar gains in wa	744.94 744.94 atts ∑(74)m 463.26 ernal and so 1208.20	(82)m 848.22 llar (73)m +	Access f Table 0.5- 0.5- 1.00 0.7- 0.7- 1315.47 (83)m 2026.05	factor 6d	Area m² 17.42 7.02 2.34 1.48 26.02 18.06 2.10	Sol W x 1 x 3 x 1 x 2 x 1 x 2 x 1 x 2 x 1 x 3	ar flux //m² 1.28	spec or T 0.9 x (0.9 x	g ific data able 6b 0.70	FF specific coor Table 0.70 0.70 0.70 0.70 0.70 0.70 979.44	lata 6c =	Gains W 46.81 61.51 6.29 15.27 99.69 225.64 8.05] (75] (77] (81] (75] (75] (75] (81] (83]
JorthEast outhEast JorthWest JorthEast outhEast JorthWest olar gains in ward otal gains - inter	744.94 744.94 atts ∑(74)m 463.26 ernal and so 1208.20 nal tempera	3(82)m 848.22 slar (73)m + 1587.79 ture (heati	Access f Table 0.5- 0.5- 0.5- 1.00 0.7' 0.7' 1315.47 (83)m 2026.05	factor 6d	Area m² 17.42 7.02 2.34 1.48 26.02 18.06 2.10 2343.67	Sol W x 1 x 3 x 1 x 2 x 1 x 1 x 2 x 1 x 3 x 1 x 3 x 1 x 3	ar flux //m² 1.28	spec or T 0.9 x (0.9 x	g ific data able 6b 0.70	FF specific coor Table 0.70 0.70 0.70 0.70 0.70 0.70 979.44	section sect	Gains W 46.81 61.51 6.29 15.27 99.69 225.64 8.05] (75] (77] (81] (75] (77] (81] (83] (84
6. Solar gains NorthEast SouthEast NorthWest Horizontal NorthEast SouthEast Solar gains in water Total gains - inter Total gains - inter Temperature du	744.94 744.94 atts ∑(74)m 463.26 ernal and so 1208.20 nal tempera	3(82)m 848.22 slar (73)m + 1587.79 ture (heati	Access f Table 0.5- 0.5- 0.5- 1.00 0.7' 0.7' 1315.47 (83)m 2026.05	factor 6d	Area m² 17.42 7.02 2.34 1.48 26.02 18.06 2.10 2343.67	Sol W x 1 x 3 x 1 x 2 x 1 x 1 x 2 x 1 x 3 x 1 x 3 x 1 x 3	ar flux //m² 1.28	spec or T 0.9 x (0.9 x	g ific data able 6b 0.70	FF specific coor Table 0.70 0.70 0.70 0.70 0.70 0.70 979.44	section sect	Gains W 46.81 61.51 6.29 15.27 99.69 225.64 8.05 389.42] (73] (75] (77] (81] (77] (81] (83] (84

Utilisation factor	r for gains f	or living are	ea n1,m (se	e Table 9a))							
	0.97	0.92	0.83	0.66	0.48	0.33	0.24	0.29	0.49	0.79	0.94	0.97
Mean internal te	emp of livin	g area T1 (s	steps 3 to 7	in Table 9c	:)				•		•	•
	19.53	19.91	20.37	20.77	20.94	20.99	21.00	20.99	20.95	20.64	20.00	19.46
Temperature du	ring heatin	g periods in	the rest of	dwelling fi	rom Table 9), Th2(°C)						
	19.99	19.99	19.99	20.00	20.01	20.02	20.02	20.02	20.01	20.01	20.00	20.00
Utilisation factor	r for gains f	or rest of d	welling n2,r	m								
	0.96	0.91	0.81	0.62	0.43	0.28	0.19	0.23	0.43	0.75	0.92	0.97
Mean internal te	emperature	in the rest	of dwelling	T2 (follow	steps 3 to	7 in Table 9	Эc)	•		•		•
	18.06	18.60	19.23	19.75	19.95	20.01	20.02	20.02	19.97	19.60	18.73	17.96
Living area fracti	ion	-								ving area ÷		0.33
Mean internal te		for the wh	ole dwellin	g fLA x T1 +	+(1 - fLA) x 7	Г2				Ü	` ,	
	18.54	19.03	19.60	20.08	20.27	20.33	20.34	20.34	20.29	19.94	19.15	18.45
Apply adjustmer		l .	1									
1. 1. 7 · · · 3 · · · ·	18.54	19.03	19.60	20.08	20.27	20.33	20.34	20.34	20.29	19.94	19.15	18.45
	10.5	13.03	13.00	20.00			20.31	20.51	20.23	13.31	13.13	10.13
8. Space heatin	ng requirem	nent										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor	r for gains,	ηm										
	0.95	0.89	0.79	0.63	0.44	0.30	0.21	0.25	0.45	0.75	0.91	0.96
Useful gains, ηm	nGm, W (94	1)m x (84)m	1									
	1144.87	1419.80	1609.80	1594.88	1315.14	891.94	585.85	614.25	942.51	1204.89	1139.13	1066.04
Monthly average	e external t	emperature	e 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
Heat loss rate fo	or mean inte	ernal tempe	erature, Lm,	, W [(39)m	x [(93)m -	(96)m]						
	2310.02	2286.51	2115.60	1783.35	1363.76	900.49	587.50	617.35	978.03	1486.44	1926.15	2289.10
Space heating re	equirement	, kWh/mon	th 0.024 x	[(97)m - (9!	5)m] x (41)ı	m						
	866.87	582.43	376.31	135.70	36.18	0.00	0.00	0.00	0.00	209.47	566.66	909.96
									Σ(98	3)15, 10	.12 = 3	3683.57
Space heating re	equirement	kWh/m²/y	ear							(98)	÷ (4)	25.30
9a. Energy requ	uirements -	individual	heating sys	tems inclu	ding micro	-СНР						
Space heating												
Fraction of space	e heat from	secondary	/supplemer	ntary system	m (table 11)						0.00
Fraction of space	e heat from	ı main syste	em(s)							1 - (20	01) =	1.00
	e heat from	main systs	_									0.00
Fraction of space		i illalli syste	em 2									
·		·							(20)2) x [1- (20	3)] =	1.00
Fraction of total	space heat	from main	system 1						(20)2) x [1- (20 (202) x (20		1.00 0.00
Fraction of total	space heat	from main	system 1						(20			
Fraction of space Fraction of total Fraction of total Efficiency of mai	space heat	from main	system 1	Apr	May	Jun	Jul	Aug	(20 Sep			0.00
Fraction of total Fraction of total Efficiency of mai	space heat space heat in system 1 Jan	from main from main (%) Feb	system 1 system 2 Mar	Apr	May	Jun	Jul	Aug		(202) x (20	03) =	0.00 93.20
Fraction of total Fraction of total Efficiency of mai	space heat space heat in system 1 Jan	from main from main (%) Feb	system 1 system 2 Mar	Apr 145.60	May 38.82	Jun	Jul 0.00	Aug		(202) x (20	03) =	0.00 93.20
Fraction of total Fraction of total Efficiency of mai	space heat space heat in system 1 Jan uel (main sy	from main from main (%) Feb estem 1), kW	system 1 system 2 Mar Vh/month						Sep	(202) x (20 Oct	Nov 608.00	0.00 93.20 Dec
Fraction of total Fraction of total Efficiency of mai Space heating fu	space heat space heat in system 1 Jan uel (main sy	from main from main (%) Feb estem 1), kW	system 1 system 2 Mar Vh/month						Sep	(202) x (20 Oct	Nov 608.00	0.00 93.20 Dec 976.35
Fraction of total Fraction of total Efficiency of mai Space heating fu Water heating	space heat space heat in system 1 Jan uel (main sy 930.12	from main from main (%) Feb estem 1), kW	system 1 system 2 Mar Vh/month						Sep	(202) x (20 Oct	Nov 608.00	0.00 93.20 Dec 976.35
Fraction of total Fraction of total Efficiency of mai Space heating fu Water heating	space heat space heat in system 1 Jan uel (main sy 930.12	from main from main (%) Feb estem 1), kW	system 1 system 2 Mar Wh/month 403.77	145.60	38.82	0.00	0.00	0.00	Sep 0.00 Σ(213	Oct 224.76 1)15, 10	Nov 608.00 .12 = 3	0.00 93.20 Dec 976.35
Fraction of total Fraction of total Efficiency of mai Space heating fu Water heating Efficiency of wat	space heat space heat in system 1 Jan uel (main sy 930.12 ter heater 89.58	from main from main (%) Feb rstem 1), kW 624.92	system 1 system 2 Mar Vh/month						Sep	(202) x (20 Oct	Nov 608.00	0.00 93.20 Dec 976.35
Fraction of total Fraction of total Efficiency of mai Space heating fu Water heating	space heat space heat in system 1 Jan uel (main sy 930.12 ter heater 89.58	from main from main (%) Feb rstem 1), kW 624.92	system 1 system 2 Mar Wh/month 403.77	145.60	38.82	0.00	0.00	0.00	Sep 0.00 Σ(213	Oct 224.76 1)15, 10	Nov 608.00 .12 = 3	0.00 93.20 Dec 976.35

			_
	∑(219a)112 = [2269.99	(219)
Annual totals			
Space heating fuel - main system 1		3952.33	
Water heating fuel		2269.99	
Electricity for pumps, fans and electric keep-hot (Table 4f)			
mechanical ventilation fans - balanced, extract or positive input from out	tside 326.99		(230a)
central heating pump or water pump within warm air heating unit	30.00		(230c)
boiler flue fan	45.00		(230e)
Total electricity for the above, kWh/year		401.99	(231)
Electricity for lighting (Appendix L)		497.04	(232)
Total delivered energy for all uses	(211)(221) + (231) + (232)(237b) =	7121.34	(238)
10a. Fuel costs - individual heating systems including micro-CHP			
Fue	l Fuel price	Fuel	

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	3952.33	x	3.48	x 0.01 =	137.54	(240)
Water heating	2269.99	x	3.48	x 0.01 =	79.00	(247)
Pumps and fans	401.99	x	13.19	x 0.01 =	53.02	(249)
Electricity for lighting	497.04	x	13.19	x 0.01 =	65.56	(250)
Additional standing charges					120.00	(251)
Total energy cost			(240)(242)	- (245)(254) =	455.12	(255)
11a. SAP rating - individual heating systems including micro-Ch	НР					
Energy cost deflator (Table 12)					0.42	(256)

11a. SAP rating - individual heating systems including micro-CHP		
Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.00	(257)
SAP value	86.01	
SAP rating (section 13)	86	(258)
SAP band	В	

12a. CO ₂ emissions - individual heating systems including m	nicro-CHP					
	Energy kWh/year		Emission factor kg CO₂/kWh		Emissions kg CO₂/year	
Space heating - main system 1	3952.33	x	0.216	=	853.70	(261)
Water heating	2269.99	x	0.216	=	490.32	(264)
Space and water heating			(261) + (262) +	(263) + (264) =	1344.02	(265)
Pumps and fans	401.99	x	0.519	=	208.63	(267)
Electricity for lighting	497.04	x	0.519	=	257.96	(268)
Total CO₂, kg/year				(265)(271) =	1810.61	(272)
Dwelling CO ₂ emission rate				(272) ÷ (4) =	12.44	(273)
El value					87.27	
El rating (section 14)					87	(274)
EI band					В]

	Energy kWh/year		Primary factor	Primary Energy kWh/year		
Space heating - main system 1	3952.33	x	1.22	=	4821.84	(261)
Water heating	2269.99	x	1.22	=	2769.38	(264
Space and water heating			(261) + (262) +	(263) + (264) =	7591.23	(265
Pumps and fans	401.99	х	3.07	=	1234.10	(267

Electricity for lighting Primary energy kWh/year Dwelling primary energy rate kWh/m2/year 497.04

1525.91

10351.23

(268)

71.09 (273)



Assessor name	Mr Jason Doherty	Assessor number	2634
Client		Last modified	07/06/2018
Address	2 6 Streatley Place, London, NW3 1HP		

		Area (m²)	Average stor height (m)	•	Volume (m³)	
Lowest occupied		78.10 (1a) x	2.60	(2a) =	203.06	(3a)
+1		64.40 (1b) x	3.00	(2b) =	193.20	(3b)
Total floor area	(1a) + (1b) + (1c) + (1d)(1n) =	142.50 (4)				
Dwelling volume			(3a) + (3b) +	(3c) + (3d)(3n) =	396.26	(5)
2. Ventilation rate						
					m³ per hour	
Number of chimneys			0	× 40 =	0	(62)

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

Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) =	0	÷ (5) =	0.00	(8)
If a pressurisation test has been carried out or is intended,	proceed to (17), otherwise continue from	(9) to (16)			
Air permeability value, q50, expressed in cubic metres per	hour per square metre of envelope area			3.00	(17)

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)

Number of sides on which the dwelling is sheltered

Shelter factor

Infiltration rate incorporat						(18) x (2	20) =	0.12	(21)					
Infiltration rate modified f	or m	onthly w	ind speed:											
Jan		Feb	Mar	Apr	May	Jun	J	lul	Aug	Sep	Oct	Nov	Dec	

	• • • • • • • • • • • • • • • • • • • •				,	• • • • • • • • • • • • • • • • • • • •							
Monthly averag	e wind spee	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 (allowing for shelter and wind factor) (21) x (22a)m													
	0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14	(22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system

0.50 (23a)

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

a) If balanced mechanical ventilation with heat recovery (MVHR) (22b)m + (23b) x [1 - (23c) ÷ 100] 0.25 0.25 0.24 0.23 0.23 0.21 0.21 0.21 0.22 0.23 0.23 0.24 (24a)

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



79.90

(23c)

0.15

3

0.78

1 - [0.075 x (19)] =

(19)

3. Heat losses and hea	t ioss paramet	er	Gross	Openings	Net	area	U-value	A x U W	'/К к- \	alue,	Αхκ,
		а	rea, m²	m²	Α,		W/m²K	_	-	/m².K	kJ/K
Vindow					53.	25 x	1.15	= 60.97			
Door					1.9	95 x	0.55	= 1.07			
Roof window					3.0)2 x	0.96	= 2.90			
Basement floor					78.	10 x	0.12	= 9.37			
external wall					112	.78 x	0.13	= 14.66			
arty wall					72.	42 x	0.00	= 0.00			
toof					28.	48 x	0.09	= 2.53			
otal area of external el	ements ∑A, m²	2			277	.58					
abric heat loss, W/K = 1	∑(A × U)								5)(30) + (3		91.52
leat capacity Cm = ∑(A	х к)						(28)	.(30) + (32) -	+ (32a)(3	2e) =	N/A
hermal mass paramete	er (TMP) in kJ/r	m²K									150.00
Thermal bridges: ∑(L x Ч	י) calculated u	sing Appen	dix K								15.71
otal fabric heat loss									(33) + (3		107.23
Jan		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
entilation heat loss cal				T T				1			1
32.5		31.76	29.86	29.48	27.58	27.58	27.20	28.34	29.48	30.24	31.00
leat transfer coefficien							T	T		l	T
139.7	75 139.37	138.99	137.09	136.71	134.81	134.81	134.43	135.57	136.71	137.47	138.23
loot loss norometer /III	D) W/m²/ /2/	n) (4)						Average = \(\)	(39)112/	/12 =	137.00
Heat loss parameter (HI 0.98		0.98	0.96	0.96	0.95	0.95	0.94	0.95	0.96	0.96	0.07
0.90	0.96	0.98	0.96	0.96	0.95	0.95	0.94	Average = 2			0.97
Number of days in mon	th (Table 1a)							Average - 2	<u>(</u> 40)112)	12 -	0.90
31.0		31.00	30.00	31.00							
31.0		31.00	30.00		30.00	31 00	31.00	30.00	31.00	30.00	31.00
	20.00			31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00
4. Water heating ener	<u> </u>	nt		31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00
-	<u> </u>	t		31.00	30.00	31.00	31.00	30.00	31.00	30.00	2.92
ssumed occupancy, N	gy requiremen		Vd,average			31.00	31.00	30.00	31.00	30.00	
Assumed occupancy, N	gy requiremen er usage in litr		Vd,average Apr			31.00 Jul	31.00 Aug	30.00 Sep	31.00 Oct	30.00	2.92
Assumed occupancy, N Annual average hot wat Jan	gy requiremen er usage in litr Feb	es per day ' Mar	Apr	= (25 x N) + May	36 Jun	Jul					2.92 103.59
Assumed occupancy, N Annual average hot wat Jan	gy requiremen er usage in litr Feb s per day for ea	es per day ' Mar	Apr	= (25 x N) + May	36 Jun	Jul			Oct	Nov 109.81	2.92 103.59 Dec
Assumed occupancy, N Annual average hot wat Jan Hot water usage in litre 113.9	er usage in litre Feb s per day for ea	es per day Mar Mar ach month	Apr Vd,m = fact 101.52	= (25 x N) +	36 Jun le 1c x (43 93.23	Jul 93.23	Aug 97.37	Sep	Oct	Nov 109.81	2.92 103.59 Dec
Assumed occupancy, N Annual average hot wat Jan Hot water usage in litre 113.9	gy requirementer usage in litres Feb so per day for each so 109.81 water used = 4.3	es per day Mar Mar ach month	Apr Vd,m = fact 101.52 anm x Tm/3	= (25 x N) +	36 Jun le 1c x (43 93.23	Jul 93.23	Aug 97.37	Sep	Oct 105.66 Σ(44)1	Nov 109.81	2.92 103.59 Dec
Assumed occupancy, N Annual average hot wat Jan Hot water usage in litre 113.9	gy requirementer usage in litres Feb so per day for each so 109.81 water used = 4.3	es per day Mar Mar ach month	Apr Vd,m = fact 101.52	= (25 x N) +	36 Jun le 1c x (43 93.23	Jul 93.23	Aug 97.37	Sep	Oct 105.66 Σ(44)1	Nov 109.81 .12 =	2.92 103.59 Dec 113.95 1243.08
Annual average hot wat Jan Hot water usage in litre 113.5	gy requirementer usage in litre Feb s per day for each of the second of	es per day Mar Mar ach month 105.66	Apr Vd,m = fact 101.52 anm x Tm/3	= (25 x N) + May cor from Tab 97.37	36 Jun le 1c x (43 93.23	Jul 93.23 Tables 1b,	Aug 97.37	Sep	Oct 105.66 Σ(44)1	Nov 109.81 .12 =	2.92 103.59 Dec 113.95 1243.08
Assumed occupancy, N Annual average hot wat Jan Hot water usage in litre 113.9 Energy content of hot w 168.9 Distribution loss 0.15 x	gy requirementer usage in litre Feb s per day for each of the second of	es per day Mar ach month 105.66 18 x Vd,m x 152.51	Apr Vd,m = fact 101.52 x nm x Tm/3 132.96	= (25 x N) + May for from Tab 97.37 8600 kWh/m 127.58	36 Jun le 1c x (43 93.23 onth (see 110.09	Jul 93.23 Tables 1b, 102.02	Aug 97.37 1c 1d) 117.07	Sep 101.52 118.46	Oct 105.66 Σ(44)1 138.06 Σ(45)1	Nov 109.81 12 = 150.70 .12 =	2.92 103.59 Dec 113.95 1243.08 163.65 1629.88
Assumed occupancy, Nonnual average hot water usage in litreed and the state of the	gy requirement er usage in litrifeb s per day for each 25 109.81 vater used = 4.3 28 147.79 (45)m 5 22.17	es per day Mar ach month 105.66 18 x Vd,m x 152.51	Apr Vd,m = fact 101.52 s nm x Tm/3 132.96	= (25 x N) + May cor from Tab 97.37	36 Jun le 1c x (43 93.23	Jul 93.23 Tables 1b,	Aug 97.37	Sep	Oct 105.66 Σ(44)1	Nov 109.81 .12 =	2.92 103.59 Dec 113.95 1243.08
Assumed occupancy, Nonnual average hot water usage in litreed to the second sec	gy requirement er usage in litr Feb s per day for each 25 109.81 vater used = 4.2 28 147.79 (45)m 5 22.17 ulated for each	es per day Mar ach month 105.66 18 x Vd,m x 152.51 22.88 month (55	Apr Vd,m = fact 101.52 x nm x Tm/3 132.96 19.94 5) x (41)m	= (25 x N) + May for from Tab 97.37 8600 kWh/m 127.58	36 Jun le 1c x (43 93.23 onth (see 110.09	Jul 93.23 Tables 1b, 102.02	Aug 97.37 1c 1d) 117.07	Sep 101.52 118.46	Oct 105.66 Σ(44)1 138.06 Σ(45)1	Nov 109.81 12 = 150.70 .12 = 22.61	2.92 103.59 Dec 113.95 1243.08 163.65 1629.88
Assumed occupancy, N Annual average hot wat Jan Hot water usage in litre 113.9 Energy content of hot w 168.9 Distribution loss 0.15 x 25.3 Vater storage loss calcumostics	gy requirement er usage in litr	es per day Mar ach month 105.66 18 x Vd,m x 152.51 22.88 month (55)	Apr Vd,m = fact 101.52 s nm x Tm/3 132.96 19.94 5) x (41)m 0.00	= (25 x N) + May for from Tab 97.37 3600 kWh/m 127.58 19.14	36 Jun le 1c x (43 93.23 onth (see 110.09	Jul 93.23 Tables 1b, 102.02	Aug 97.37 1c 1d) 117.07 17.56	Sep 101.52 118.46	Oct 105.66 Σ(44)1 138.06 Σ(45)1	Nov 109.81 12 = 150.70 .12 =	2.92 103.59 Dec 113.95 1243.08 163.65 1629.88
Annual average hot wat Jan Hot water usage in litre 113.5 Energy content of hot w 168.5 Distribution loss 0.15 x 25.3 Vater storage loss calculus of the vessel contains de	er usage in litre Feb s per day for each 25 109.81 vater used = 4.2 28 147.79 (45)m 5 22.17 ulated for each 0 0.00 edicated solar s	es per day Mar ach month 105.66 18 x Vd,m x 152.51 22.88 month (59) 0.00 storage or co	Apr Vd,m = fact 101.52 x nm x Tm/3 132.96 19.94 5) x (41)m 0.00 dedicated W	= (25 x N) + May for from Tab 97.37 8600 kWh/m 127.58 19.14 0.00 WWHRS (56)r	36 Jun le 1c x (43 93.23 onth (see 110.09 16.51 0.00 m x [(47) -	Jul 93.23 Tables 1b, 102.02 15.30 0.00 Vs] ÷ (47),	Aug 97.37 1c 1d) 117.07 17.56 0.00 else (56)	Sep 101.52 118.46 17.77 0.00	Oct 105.66 Σ(44)1 138.06 Σ(45)1 20.71	Nov 109.81 12 = 150.70 12 = 22.61 0.00	2.92 103.59 Dec 113.95 1243.08 163.65 1629.88 24.55
Energy content of hot w 168.9 Distribution loss 0.15 x 25.3 Water storage loss calculus of the vessel contains de 0.00	gy requirement er usage in litrifeb s per day for each 25 109.81 rater used = 4.3 28 147.79 (45)m 5 22.17 ulated for each 20 0.00 dicated solar sola	es per day Mar ach month 105.66 18 x Vd,m x 152.51 22.88 month (55) 0.00 storage or c	Apr Vd,m = fact 101.52 s nm x Tm/3 132.96 19.94 5) x (41)m 0.00	= (25 x N) + May for from Tab 97.37 3600 kWh/m 127.58 19.14	36 Jun le 1c x (43 93.23 onth (see 110.09	Jul 93.23 Tables 1b, 102.02	Aug 97.37 1c 1d) 117.07	Sep 101.52 118.46	Oct 105.66 Σ(44)1 138.06 Σ(45)1	Nov 109.81 12 = 150.70 .12 = 22.61	2.92 103.59 Dec 113.95 1243.08 163.65 1629.88
Annual average hot wat Jan Hot water usage in litre 113.5 Energy content of hot w 168.5 Distribution loss 0.15 x 25.3 Water storage loss calculot 0.00 If the vessel contains de 0.00 Crimary circuit loss for e	gy requirement er usage in litr Feb s per day for each 25	es per day Mar ach month 105.66 18 x Vd,m x 152.51 22.88 month (58) 0.00 ctorage or c 0.00 m Table 3	Apr Vd,m = fact 101.52 s nm x Tm/3 132.96 19.94 5) x (41)m 0.00 dedicated W 0.00	= (25 x N) + May for from Tab 97.37 8600 kWh/m 127.58 19.14 0.00 WHRS (56)r 0.00	36 Jun le 1c x (43 93.23 onth (see 110.09 16.51 0.00 m x [(47) -	Jul 93.23 Tables 1b, 102.02 15.30 0.00 Vs] ÷ (47), 0.00	Aug 97.37 1c 1d) 117.07 17.56 0.00 else (56) 0.00	Sep 101.52 118.46 17.77 0.00 0.00	Oct 105.66 Σ(44)1 138.06 Σ(45)1 20.71 0.00	Nov 109.81 .12 = 150.70 .12 = 22.61 0.00 0.00	2.92 103.59 Dec 113.95 1243.08 163.65 1629.88 24.55 0.00
Assumed occupancy, Nonnual average hot water dot water usage in litre. 113.9 Inergy content of hot water usage in litre. 25.3 Vater storage loss calculus of the vessel contains de o.00	gy requirement er usage in litring Feb s per day for each 25	es per day Mar ach month 105.66 18 x Vd,m x 152.51 22.88 month (59 0.00 storage or color of the	Apr Vd,m = fact 101.52 a nm x Tm/3 132.96 19.94 5) x (41)m 0.00 dedicated W 0.00 0.00	= (25 x N) + May for from Tab 97.37 8600 kWh/m 127.58 19.14 0.00 WWHRS (56)r	36 Jun le 1c x (43 93.23 onth (see 110.09 16.51 0.00 m x [(47) -	Jul 93.23 Tables 1b, 102.02 15.30 0.00 Vs] ÷ (47),	Aug 97.37 1c 1d) 117.07 17.56 0.00 else (56)	Sep 101.52 118.46 17.77 0.00	Oct 105.66 Σ(44)1 138.06 Σ(45)1 20.71	Nov 109.81 12 = 150.70 12 = 22.61 0.00	2.92 103.59 Dec 113.95 1243.08 163.65 1629.88 24.55

0.25

0.24

0.23

0.23

0.21

0.21

0.21

0.22

0.23

0.23

0.24

													-
	32.00	28.89	31.95	30.87	31.86	30.78	31.78	31.83	30.83	31.90	30.93	31.98	(61
Total heat requi	red for wate	er heating o	calculated f	or each mo	onth 0.85 x	(45)m + (4	6)m + (57)ı	m + (59)m +	- (61)m				
	200.98	176.68	184.46	163.84	159.44	140.88	133.79	148.90	149.29	169.96	181.63	195.63	(62
olar DHW input	t calculated	using Appe	endix G or A	Appendix H	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	(63
Output from wa		1	nth (kWh/ı		1								_
	200.98	176.68	184.46	163.84	159.44	140.88	133.79	148.90	149.29	169.96	181.63	195.63	1
	200.38	170.08	104.40	103.84	133.44	140.00	133.73	148.90	143.23			-]]
		: (LAA/I- /		F [O OF	(45) (64	\1 · 0 0 · ·	[/46]/	F7) (F0)	1	∑(64)1	12 =2	2005.48	(64)
leat gains from		1		1								1	7
	64.19	56.36	58.70	51.93	50.39	44.30	41.86	46.88	47.10	53.88	57.84	62.41	(65
5. Internal gain	ns												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
lotabolic gains		100	IVIGI	Aþi	iviay	Juli	Jui	Aug	Зер	Oct	1404	Dec	
letabolic gains		.== 00		1 00	1 00		.== 00	1 00		1== 00	.== 00	1== 00	٦,,,
	175.30	175.30	175.30	175.30	175.30	175.30	175.30	175.30	175.30	175.30	175.30	175.30	(66
ghting gains (c			-										,
	69.59	61.81	50.27	38.06	28.45	24.02	25.95	33.73	45.27	57.49	67.09	71.52	(67
ppliance gains	(calculated	in Appendi	x L, equatio	on L13 or L	13a), also se	ee Table 5							_
	466.03	470.86	458.67	432.73	399.98	369.20	348.64	343.81	355.99	381.94	414.68	445.46	(68
ooking gains (c	alculated in	Appendix	L, equation	L15 or L15	āa), also see	Table 5							
	55.45	55.45	55.45	55.45	55.45	55.45	55.45	55.45	55.45	55.45	55.45	55.45	(69
ump and fan ga	ains (Table s	5a)											
	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70
osses e.g. evap	oration (Tal	ble 5)		•	•							•	-
	-116.87	-116.87	-116.87	-116.87	-116.87	-116.87	-116.87	-116.87	-116.87	-116.87	-116.87	-116.87	(71
/ater heating g] (
00	86.27	83.87	78.89	72.12	67.72	61.53	56.27	63.01	65.41	72.42	80.33	83.88	(72
	00.27	03.07	70.03	, , , , ,	07.72		30.27	03.01	05.11	, 2	00.55	03.00] (/-
otal internal ga	ins (66)m =	+ (67)m + (6	(8)m + (69)	m + (70)m	+ (71)m + (7)	72\m							
otal internal ga		. , .			, , ,	,	F 4 7 7 F	T 557.44	F02.56	620.72	670.00	747.76] (73
otal internal ga	738.77	733.43	704.72	m + (70)m 659.80	+ (71)m + (7 613.04	72)m 571.64	547.75	557.44	583.56	628.73	679.00	717.76	[73
		. , .			, , ,	,	547.75	557.44	583.56	628.73	679.00	717.76	(73
		. , .		659.80	, , ,	571.64		557.44		628.73 FF	679.00	717.76 Gains	[73
		. , .	704.72	659.80	613.04	571.64 Sol	547.75 ar flux //m²		583.56 g ific data				(73
		. , .	704.72 Access f	659.80	613.04 Area	571.64 Sol	ar flux	spec	g	FF	lata	Gains	(73
5. Solar gains		. , .	704.72 Access f	659.80 Factor	613.04 Area	571.64 Sol	ar flux //m²	spec or T	g ific data	FF specific d or Table	lata	Gains	1
5. Solar gains orthEast		. , .	704.72 Access f Table	659.80 factor 6d	Area m²	571.64 Sol W	ar flux //m²	spec or T	g ific data able 6b	FF specific d or Table	lata 6c	Gains W] (75
5. Solar gains orthEast outhEast		. , .	Access f Table	659.80 factor 6d 4 x [4 x [Area m² 7.28 12.40	\$571.64 \$01 W	ar flux //m² 1.28 x 6.79 x	spec or T 0.9 x (g ific data able 6b 0.63 x 0.63 x	FF specific d or Table 0.70 0.70	lata 6c	Gains W] (75] (77
orthEast buthEast		. , .	704.72 Access f Table 0.56 0.56	659.80 Factor 6d 4 x 4 x 4 x	Area m² 7.28 12.40 11.96	\$571.64 \$01 W X 1 X 3 X 3	ar flux //m² 1.28 x 6.79 x	spec or T 0.9 x (0.9 x (g ific data able 6b 0.63 x 0.63 x	FF specific d or Table 0.70 0.70 0.70	lata 6c = = = =	Gains W 17.60 97.78 94.32] (75] (77] (79
6. Solar gains forthEast outhEast outhWest		. , .	704.72 Access f Table 0.5- 0.5- 0.5- 0.5-	factor 6d x [4 x [Area m² 7.28 12.40 11.96 3.38	\$571.64 \$501 W x 1 x 3 x 3 x 1	ar flux //m² 1.28 x 6.79 x 6.79 x 1.28 x	spec or T 0.9 x (0.9 x (0.9 x (0.9 x (g ific data able 6b 0.63	FF specific d or Table 0.70 0.70 0.70 0.70	lata 6c = [= [= = [Gains W 17.60 97.78 94.32 8.17] (75] (77] (79
6. Solar gains lorthEast outhEast outhWest lorthWest		. , .	704.72 Access f Table 0.5- 0.5- 0.5- 1.00	659.80 factor 6d 4	Area m² 7.28 12.40 11.96 3.38 3.02	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	ar flux //m² 1.28 x 6.79 x 6.79 x 1.28 x 6.00 x	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 0.63 x	FF specific d or Table 0.70 0.70 0.70 0.70 0.70	lata 6c =	Gains W 17.60 97.78 94.32 8.17 31.16] (75] (75] (77] (79] (81]
6. Solar gains forthEast outhEast outhWest forthWest orizontal orthWest		. , .	704.72 Access f Table 0.5- 0.5- 0.5- 0.5- 0.5- 0.7	factor 66d	7.28 12.40 11.96 3.38 3.02 3.15	Sol W 3 x 3 x 3 x 1 x 2 x 1	ar flux //m² 1.28	spec or T 0.9 x (0.9 x (0.9 x (0.9 x (0.9 x (0.9 x (g ific data able 6b 0.63 x 0.63 x 0.63 x 0.63 x 0.63 x	FF specific d or Table 0.70 0.70 0.70 0.70 0.70 0.70	lata 6c =	Gains W 17.60 97.78 94.32 8.17 31.16 10.86] (75] (75] (75] (75] (81] (81]
6. Solar gains ForthEast outhEast outhWest forthWest orizontal orthWest outhEast	738.77	733.43	704.72 Access f Table 0.5- 0.5- 0.5- 1.00	factor 66d	Area m² 7.28 12.40 11.96 3.38 3.02	Sol W 3 x 3 x 3 x 1 x 2 x 1	ar flux //m² 1.28	spec or T 0.9 x (0.9 x (0.9 x (0.9 x (0.9 x (0.9 x (g ific data able 6b 0.63 x 0.63 x 0.63 x	FF specific d or Table 0.70 0.70 0.70 0.70 0.70 0.70	lata 6c =	Gains W 17.60 97.78 94.32 8.17 31.16] (75] (75] (75] (75] (81] (81]
6. Solar gains forthEast outhEast outhWest forthWest fortizontal forthWest outhEast	738.77 atts ∑(74)m	733.43 (82)m	704.72 Access f Table 0.5- 0.5- 0.5- 0.5- 0.7-	factor 6d	7.28 12.40 11.96 3.38 3.02 3.15 15.08	Sol W 3 x 3 x 3 x 1 x 2 x 1 x 3 x 3	ar flux //m² 1.28 x 6.79 x 6.79 x 1.28 x 6.00 x 1.28 x 6.79 x	spec or T 0.9 x (0.9 x	g ific data able 6b 0.63	FF specific d or Table 0.70 0.70 0.70 0.70 0.70 0.70 0.70	lata 6c = [Gains W 17.60 97.78 94.32 8.17 31.16 10.86 169.57] (75] (77] (79] (81] (81] (81] (77
6. Solar gains lorthEast outhEast outhWest lorizontal lorthWest outhEast outhEast	738.77 738.77 atts ∑(74)m 429.47	733.43 (82)m 755.37	704.72 Access f Table 0.5- 0.5- 0.5- 0.7- 1.00 0.7- 1092.36	factor 66d	7.28 12.40 11.96 3.38 3.02 3.15	Sol W 3 x 3 x 3 x 1 x 2 x 1	ar flux //m² 1.28	spec or T 0.9 x (0.9 x (0.9 x (0.9 x (0.9 x (0.9 x (g ific data able 6b 0.63 x 0.63 x 0.63 x 0.63 x 0.63 x	FF specific d or Table 0.70 0.70 0.70 0.70 0.70 0.70	lata 6c =	Gains W 17.60 97.78 94.32 8.17 31.16 10.86] (75] (77] (79] (81] (81] (81] (77
6. Solar gains lorthEast outhEast outhWest lorthWest lorizontal lorthWest outhEast outhEast	738.77 738.77 atts ∑(74)m 429.47	733.43 (82)m 755.37	704.72 Access f Table 0.5- 0.5- 0.5- 0.7- 1.00 0.7- 1092.36	factor 6d x [4 x [4 x [4 x [7 x [7 x [7] x	Area m² 7.28 12.40 11.96 3.38 3.02 3.15 15.08	Sol W 3 x 3 x 3 x 1 x 2 x 1 x 3 x 3 x 1 x 1 x 3 x 3 x 1 x 1 x 3 x 1 x 1	ar flux //m² 1.28	spec or T 0.9 x (0.9 x (0.15	g ific data able 6b 0.63	FF specific d or Table 0.70 0.70 0.70 0.70 0.70 0.70 0.70 851.13	lata 6c	Gains W 17.60 97.78 94.32 8.17 31.16 10.86 169.57] (75] (75] (77] (79] (81] (81] (81] (77]
6. Solar gains lorthEast outhEast outhWest lorthWest lorizontal lorthWest outhEast outhEast	738.77 738.77 atts ∑(74)m 429.47	733.43 (82)m 755.37	704.72 Access f Table 0.5- 0.5- 0.5- 0.7- 1.00 0.7- 1092.36	factor 6d	7.28 12.40 11.96 3.38 3.02 3.15 15.08	Sol W 3 x 3 x 3 x 1 x 2 x 1 x 3 x 3	ar flux //m² 1.28 x 6.79 x 6.79 x 1.28 x 6.00 x 1.28 x 6.79 x	spec or T 0.9 x (0.9 x	g ific data able 6b 0.63	FF specific d or Table 0.70 0.70 0.70 0.70 0.70 0.70 0.70	lata 6c = [Gains W 17.60 97.78 94.32 8.17 31.16 10.86 169.57] (75] (75] (75] (75] (81] (81] (81] (83]
6. Solar gains lorthEast outhEast outhWest lorizontal lorthWest outhEast outhEast outhEast	738.77 738.77 atts ∑(74)m 429.47 ernal and so 1168.25	733.43 733.43 (82)m 755.37 olar (73)m +	704.72 Access f Table 0.5 0.5 0.5 0.7 1.00 0.7 1092.36 (83)m 1797.08	factor 6d x [4 x [4 x [4 x [7 x [7 x [7] x	Area m² 7.28 12.40 11.96 3.38 3.02 3.15 15.08	Sol W 3 x 3 x 3 x 1 x 2 x 1 x 3 x 3 x 1 x 1 x 3 x 3 x 1 x 1 x 3 x 1 x 1	ar flux //m² 1.28	spec or T 0.9 x (0.9 x (0.15	g ific data able 6b 0.63	FF specific d or Table 0.70 0.70 0.70 0.70 0.70 0.70 0.70 851.13	lata 6c	Gains W 17.60 97.78 94.32 8.17 31.16 10.86 169.57] (75] (75] (75] (75] (81] (81] (81] (83]
6. Solar gains lorthEast outhEast outhWest lorthWest lorizontal lorthWest outhEast olar gains in wa otal gains - inte	738.77 738.77 738.77 429.47 ernal and so 1168.25 all tempera	733.43 (82)m 755.37 plar (73)m + 1488.80 ture (heati	704.72 Access f Table 0.5- 0.5- 0.5- 1.00 0.7 1092.36 (83)m 1797.08	factor 66d 4	Area m² 7.28 12.40 11.96 3.38 3.02 3.15 15.08 1696.61	Sol W 3 x 3 x 3 x 1 x 2 x 1 x 3 x 3 x 1 1717.34	ar flux //m² 1.28	spec or T 0.9 x (0.9 x (0.15	g ific data able 6b 0.63	FF specific d or Table 0.70 0.70 0.70 0.70 0.70 0.70 0.70 851.13	lata 6c	Gains W 17.60 97.78 94.32 8.17 31.16 10.86 169.57 364.61] (75] (77] (79] (81] (81] (83] (844]
6. Solar gains NorthEast SouthEast SouthWest NorthWest Horizontal NorthWest Solar gains in wa Total gains - inter 7. Mean intern Temperature du	738.77 738.77 738.77 429.47 ernal and so 1168.25 all tempera	733.43 (82)m 755.37 plar (73)m + 1488.80 ture (heati	704.72 Access f Table 0.5- 0.5- 0.5- 1.00 0.7 1092.36 (83)m 1797.08	factor 66d 4	Area m² 7.28 12.40 11.96 3.38 3.02 3.15 15.08 1696.61	Sol W 3 x 3 x 3 x 1 x 2 x 1 x 3 x 3 x 1 1717.34	ar flux //m² 1.28	spec or T 0.9 x (0.9 x (0.15	g ific data able 6b 0.63	FF specific d or Table 0.70 0.70 0.70 0.70 0.70 0.70 0.70 851.13	lata 6c	Gains W 17.60 97.78 94.32 8.17 31.16 10.86 169.57	[(73] (75] (77] (79] (81] (81] (83] (84

for gains fo	or living are	ea n1,m (se	e Table 9a)								
0.96	0.92	0.84	0.69	0.52	0.37	0.27	0.31	0.50	0.78	0.93	0.97
mp of living	g area T1 (s	steps 3 to 7	in Table 9	:)				•			•
19.78	20.12	20.48	20.79	20.94	20.99	21.00	21.00	20.96	20.73	20.19	19.71
ing heating	g periods in	the rest of	dwelling f	rom Table 9), Th2(°C)	•	•				•
20.10	20.10	20.10	20.12	20.12	20.13	20.13	20.13	20.12	20.12	20.11	20.11
for gains for	or rest of d	welling n2,	m			-		!	•	•	1
0.96	0.91	0.81	0.66	0.48	0.32	0.22	0.25	0.44	0.74	0.92	0.97
mperature	in the rest	of dwelling	T2 (follow	steps 3 to	7 in Table !	9c)	•		•	1	•
18.49	18.96	19.47	19.88	20.06	20.12	20.13	20.13	20.09	19.81	19.09	18.40
on						•		Liv	ving area ÷	(4) =	0.32
	for the wh	ole dwellin	g fLA x T1 +	+(1 - fLA) x ٦	Г2				J		
18.90			_	20.34		20.41	20.41	20.37	20.11	19.44	18.82
t to the me				ble 4e whe							
			1				20.41	20.37	20.11	19.44	18.82
g requirem	ent										
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
for gains, r	μm										
0.95	0.89	0.80	0.66	0.49	0.34	0.23	0.27	0.46	0.74	0.91	0.96
3m, W (94)m x (84)m	ı									
1105.07	1329.94	1445.90	1386.94	1137.26	774.03	511.75	536.33	825.84	1096.79	1086.23	1035.05
external to	emperature	e 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
mean inte	rnal tempe	erature, Lm	, W [(39)m	x [(93)m -	(96)m]						
2040.60	2011.45	1847.63	1545.71	1181.27	781.56	513.05	538.53	850.26	1299.68	1696.95	2020.82
quirement,	kWh/mon	th 0.024 x	[(97)m - (9	5)m] x (41)ı	m						
696.03	457.97	298.88	114.32	32.74	0.00	0.00	0.00	0.00	150.95	439.72	733.41
								∑(98	8)15, 10	.12 = 2	2924.03
quirement	kWh/m²/ye	ear							(98)	÷ (4)	20.52
irements -	individual	heating sys	stems inclu	iding micro	-СНР						
			ntary syste	m (table 11)						0.00
									1 - (2	01) =	1.00
											0.00
pace heat	from main	system 1						(20	02) x [1- (20)3)] = [1.00
pace heat	from main	system 2							(202) x (2	03) =	0.00
n system 1											93.20
lan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan											
	stem 1), kW	Vh/month									
	stem 1), kW 491.39	74 320.69	122.66	35.13	0.00	0.00	0.00	0.00	161.96	471.80	786.92
el (main sys			122.66	35.13	0.00	0.00	0.00	l.	161.96 1)15, 10		786.92 3137.37
el (main sys			122.66	35.13	0.00	0.00	0.00	l.	1		1
el (main sys			122.66	35.13	0.00	0.00	0.00	l.	1		1
el (main sys 746.81			122.66 88.29	35.13 87.53	0.00 87.00	87.00	0.00 87.00	l.	1		1
el (main sys 746.81	491.39 89.29	320.69						∑(211	1)15, 10	.12 = 3	3137.37
	19.78 ing heating 20.10 for gains for 0.96 mperature 18.49 on mperature 18.90 t to the me 18.90 t to the me 18.90 grequirem Jan for gains, r 0.95 Gm, W (94 1105.07 external te 4.30 mean inte 2040.60 quirement, 696.03 quirements heat from	19.78 20.12 ing heating periods in 20.10 20.10 for gains for rest of di 0.96 0.91 mperature in the rest 18.49 18.96 on mperature for the wh 18.90 19.33 t to the mean internal 18.90 19.33 grequirement Jan Feb for gains, ηm 0.95 0.89 Gm, W (94)m x (84)m 1105.07 1329.94 external temperature 4.30 4.90 mean internal tempe 2040.60 2011.45 quirement, kWh/mon 696.03 457.97 quirement kWh/m²/ya irements - individual heat from main system of the secondary, the secondary, the secondary the seco	19.78 20.12 20.48 ing heating periods in the rest of 20.10 20.10 for gains for rest of dwelling n2,	19.78 20.12 20.48 20.79 ing heating periods in the rest of dwelling for 20.10 20.10 20.12 for gains for rest of dwelling n2,m 0.96 0.91 0.81 0.66 mperature in the rest of dwelling T2 (follow 18.49 18.96 19.47 19.88 on mperature for the whole dwelling fLA x T1 + 18.90 19.33 19.79 20.18 it to the mean internal temperature from Ta 18.90 19.33 19.79 20.18 it to the mean internal temperature from Ta 18.90 19.33 19.79 20.18 grequirement Jan Feb Mar Apr for gains, ηm 0.95 0.89 0.80 0.66 Gm, W (94)m x (84)m 1105.07 1329.94 1445.90 1386.94 external temperature from Table U1 4.30 4.90 6.50 8.90 mean internal temperature, Lm, W [(39)m 2040.60 2011.45 1847.63 1545.71 quirement, kWh/month 0.024 x [(97)m - (9 696.03 457.97 298.88 114.32 quirements - individual heating systems included the from main system (s) heat from main system 2 space heat from main system 1	ing heating periods in the rest of dwelling from Table 9 20.10 20.10 20.10 20.12 20.12 for gains for rest of dwelling n2,m 0.96 0.91 0.81 0.66 0.48 mperature in the rest of dwelling T2 (follow steps 3 to 18.49 18.96 19.47 19.88 20.06 on mperature for the whole dwelling fLA x T1 +(1 - fLA) x T1 18.90 19.33 19.79 20.18 20.34 at to the mean internal temperature from Table 4e whe 18.90 19.33 19.79 20.18 20.34 grequirement Jan Feb Mar Apr May for gains, ηm 0.95 0.89 0.80 0.66 0.49 Gm, W (94)m x (84)m 1105.07 1329.94 1445.90 1386.94 1137.26 external temperature from Table U1 4.30 4.90 6.50 8.90 11.70 mean internal temperature, Lm, W [(39)m x [(93)m - 2040.60 2011.45 1847.63 1545.71 1181.27 quirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m (105.03 457.97 298.88 114.32 32.74 quirements - individual heating systems including micro heat from main system 2 space heat from main system 1	19.78 20.12 20.48 20.79 20.94 20.99 ing heating periods in the rest of dwelling from Table 9, Th2(°C) 20.10 20.10 20.10 20.12 20.12 20.13 for gains for rest of dwelling n2,m 0.96 0.91 0.81 0.66 0.48 0.32 mperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 18.49 18.96 19.47 19.88 20.06 20.12 20.13 20.34 20.40 20.12 20.13 20.34 20.40 20.12 20.13 20.34 20.40 20.14 20.40 20.15 20.18 20.34 20.40 20.40 20.18 20.34 20.40 20.40 20.18 20.34 20.40 20.40 20.18 20.34 20.40 20.40 20.18 20.34 20.40 20.40 20.18 20.34 20.40	19.78 20.12 20.48 20.79 20.94 20.99 21.00 ing heating periods in the rest of dwelling from Table 9, Th2(°C) 20.10 20.10 20.10 20.12 20.12 20.13 20.13 for gains for rest of dwelling n2,m 0.96 0.91 0.81 0.66 0.48 0.32 0.22 imperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) 18.49 18.96 19.47 19.88 20.06 20.12 20.13 in imperature for the whole dwelling fLA x T1 +(1 - fLA) x T2 18.90 19.33 19.79 20.18 20.34 20.40 20.41 it to the mean internal temperature from Table 4e where appropriate 18.90 19.33 19.79 20.18 20.34 20.40 20.41 it to the mean internal temperature from Table 4e where appropriate 18.90 19.33 19.79 20.18 20.34 20.40 20.41 it to the mean internal temperature from Table 4e where appropriate 18.90 19.33 19.79 20.18 20.34 20.40 20.41 it to the mean internal temperature from Table 4e where appropriate 18.90 19.33 19.79 20.18 20.34 20.40 20.41 it to the mean internal temperature from Table 4e where appropriate 18.90 19.33 19.79 20.18 20.34 20.40 20.41 it to the mean internal temperature from Table 4e where appropriate 18.90 19.33 19.79 20.18 20.34 20.40 20.41 it to the mean internal temperature from Table U1 4.30 4.90 6.50 8.90 11.70 14.60 16.60 mean internal temperature, Lm, W [(39)m × ([93)m - (96)m] 2040.60 2011.45 1847.63 1545.71 1181.27 781.56 513.05 quirement kWh/month 0.024 × [(97)m - (95)m] × (41)m 696.03 457.97 298.88 114.32 32.74 0.00 0.00 quirement kWh/m²/year irements - individual heating systems including micro-CHP heat from main system 2 ispace heat from main system 1	19.78 20.12 20.48 20.79 20.94 20.99 21.00 21.00 21.00 21.00 21.00 21.00 20.10 20.10 20.10 20.12 20.12 20.13 20.99 20.99 20.99 20.10 20.10 20.10 20.12 20.12 20.13 20.13 20.13 20.13 20.99 20.99 20.99 20.25 20.99 20.99 20.25 20.99 20.25 20.99 20.25 20.99 20.25	19.78 20.12 20.48 20.79 20.94 20.99 21.00 21.00 20.96 ing heating periods in the rest of dwelling from Table 9, Th2("C) 20.10 20.10 20.10 20.12 20.12 20.13 20.13 20.13 20.12 for gains for rest of dwelling n2,m 0.96 0.91 0.81 0.66 0.48 0.32 0.22 0.25 0.44 mperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) 18.49 18.96 19.47 19.88 20.06 20.12 20.13 20.13 20.09 mperature for the whole dwelling fLA x T1 + (1 - fLA) x T2 18.90 19.33 19.79 20.18 20.34 20.40 20.41 20.41 20.37 tto the mean internal temperature from Table 4e where appropriate 18.90 19.33 19.79 20.18 20.34 20.40 20.41 20.41 20.37 tto the mean internal temperature from Table 4e where appropriate 18.90 19.33 19.79 20.18 20.34 20.40 20.41 20.41 20.37 trought mean internal temperature from Table 4e where appropriate 18.90 19.33 19.79 20.18 20.34 20.40 20.41 20.41 20.37 trought mean internal temperature from Table 4e where appropriate 18.90 19.33 19.79 20.18 20.34 20.40 20.41 20.41 20.37 trought mean internal temperature from Table 4e where appropriate 18.90 19.33 19.79 20.18 20.34 20.40 20.41 20.41 20.37 trought mean internal temperature from Table 4e where appropriate 18.90 19.33 19.79 20.18 20.34 20.40 20.41 20.41 20.37 trought mean internal temperature from Table 4e where appropriate 18.90 19.33 19.79 20.18 20.34 20.40 20.41 20.41 20.37 trought mean internal temperature from Table 4e where appropriate 18.90 19.33 19.79 20.18 20.34 20.40 20.41 20.41 20.37 to the mean internal temperature from Table 4e where appropriate 18.90 19.33 19.79 20.18 20.34 20.40 20.41 20.41 20.37 to the mean internal temperature from Table 4e where appropriate 18.90 19.33 19.79 20.18 20.34 20.40 20.41 20.41 20.41 19.30 19.30 19.79 20.18 20.34 20.40 20.41 20.41 20.41	19.78 20.12 20.48 20.79 20.94 20.99 21.00 21.00 20.96 20.73 ing heating periods in the rest of dwelling from Table 9, Th2(°C) 20.10 20.10 20.10 20.12 20.12 20.13 20.13 20.13 20.12 20.12 for gains for rest of dwelling n2,m 0.96 0.91 0.81 0.66 0.48 0.32 0.22 0.25 0.44 0.74 mperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) 18.49 18.96 19.47 19.88 20.06 20.12 20.13 20.13 20.09 19.81 Eliving area ÷ mperature for the whole dwelling fLA x T1 + (1 - fLA) x T2 18.90 19.33 19.79 20.18 20.34 20.40 20.41 20.41 20.37 20.11 to the mean internal temperature from Table 4e where appropriate 18.90 19.33 19.79 20.18 20.34 20.40 20.41 20.41 20.37 20.11 st of the mean internal temperature from Table 4e where appropriate 18.90 19.33 19.79 20.18 20.34 20.40 20.41 20.41 20.37 20.11 st of the mean internal temperature from Table 4e where appropriate 18.90 19.33 19.79 20.18 20.34 20.40 20.41 20.41 20.37 20.11 st of the mean internal temperature from Table 4e where appropriate 18.90 19.33 19.79 20.18 20.34 20.40 20.41 20.41 20.37 20.11 st of the mean internal temperature from Table 4e where appropriate 18.90 19.33 19.79 20.18 20.34 20.40 20.41 20.41 20.37 20.11 st of the mean internal temperature from Table 4e where appropriate 18.90 19.33 19.79 20.18 20.34 20.40 20.41 20.41 20.41 20.37 20.11 st of the mean internal temperature from Table 4e where appropriate 18.90 19.33 19.79 20.18 20.34 20.30 20.00 20.01 20.41 20.41 20.37 20.11 st of the mean internal temperature from Table 4e where appropriate 18.90 19.33 19.79 20.18 20.34 20.34 20.40 20.41 20.41 20.41 20.37 20.11 st of the mean internal temperature from Table 4e where appropriate 18.90 19.33 19.79 20.18 20.34 20.30 20.40 20.41 20.41 20.41 20.41 st of the mean inte	19.78 20.12 20.48 20.79 20.94 20.99 21.00 21.00 20.96 20.73 20.19 ing heating periods in the rest of dwelling from Table 9, Th2("C) 20.10 20.10 20.10 20.10 20.12 20.12 20.13 20.13 20.13 20.12 20.12 20.11 for gains for rest of dwelling nz,m 0.96 0.91 0.81 0.66 0.48 0.32 0.22 0.25 0.44 0.74 0.92 megrature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) 18.49 18.96 19.47 19.88 20.06 20.12 20.13 20.13 20.09 19.81 19.09 18.90 19.33 19.79 20.18 20.34 20.40 20.41 20.41 20.37 20.11 19.44 18.90 19.33 19.79 20.18 20.34 20.40 20.41 20.41 20.37 20.11 19.44 18.90 19.33 19.79 20.18 20.34 20.40 20.41 20.41 20.37 20.11 19.44 18.90 19.33 19.79 20.18 20.34 20.40 20.41 20.41 20.37 20.11 19.44 18.90 19.33 19.79 20.18 20.34 20.40 20.41 20.41 20.37 20.11 19.44 18.90 19.33 19.79 20.18 20.34 20.40 20.41 20.41 20.37 20.11 19.44 18.90 19.33 19.79 20.18 20.34 20.40 20.41 20.41 20.37 20.11 19.44 18.90 19.33 19.79 20.18 20.34 20.40 20.41 20.41 20.37 20.11 19.44 18.90 19.33 19.79 20.18 20.34 20.40 20.41 20.41 20.37 20.11 19.44 18.90 19.33 19.79 20.18 20.34 20.40 20.41 20.41 20.37 20.11 19.44 18.90 19.33 19.79 20.18 20.34 20.40 20.41 20.41 20.37 20.11 19.44 18.90 19.33 19.79 20.18 20.34 20.40 20.41 20.41 20.37 20.11 19.44 18.90 19.33 19.79 20.18 20.34 20.40 20.41 20.41 20.41 20.37 20.11 19.44 18.90 19.33 19.79 20.18 20.34 20.40 20.41 20.41 20.41 20.37 20.11 19.44 18.90 19.33 19.79 20.18 20.34 20.40 20.41 20.41 20.41 20.37 20.11 19.44 18.90 19.33 19.79 20.18 20.34 20.40 20.40 20.41 20.41 20.37 20.11 19.44 18.90 19.33 19.79 20.18 20.34 20.40 20.40 20.41 20.41 20.37 20.11 19.44 18.90 19.33 19.79 20.18 20.34 20.40 20.40 20.41 20.41 20.37 20.11 19.44 18.90 19.33 19.79 20.18 20.34 20.40 20.40 20.41 20.41 20.37 20.11 19.44 18.90 19.33 19.79 20.18 20.34 20.40 20.40 20.41 20.41 20.41 20.37 20.11 19.44 18.90 19.33 19.79 20.18 20.34 20.40 20.40 20.41 20.41 20.41 20.37 20.11 19.40 18.90 19.33 19.79 20.18 20.18 20.34 20.40 20.41 20.41 20.41 20.41 20.41 20.41 20.41 20.41 20.41 20.41 20.41 20.

	Σ(219a)112 =	2270.29	(219)
Annual totals	Σ(213α)112 - [2270.23	_ (213)
Space heating fuel - main system 1		3137.37	
Water heating fuel		2270.29	
Electricity for pumps, fans and electric keep-hot (Table 4f)			
mechanical ventilation fans - balanced, extract or positive input from outside	320.28		(230a)
central heating pump or water pump within warm air heating unit	30.00		(230c)
boiler flue fan	45.00		(230e)
Total electricity for the above, kWh/year		395.28	(231)
Electricity for lighting (Appendix L)		491.60	(232)
Total delivered energy for all uses	(211)(221) + (231) + (232)(237b) = [6294.53	(238)
10a. Fuel costs - individual heating systems including micro-CHP			
Fuel	Fuel price	Fuel	

Tod. I del costs - maividual neating systems meldanig	, IIIICIO-CIII					
	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	3137.37	x	3.48	x 0.01 =	109.18	(240)
Water heating	2270.29	x	3.48	x 0.01 =	79.01	(247)
Pumps and fans	395.28	x	13.19	x 0.01 =	52.14	(249)
Electricity for lighting	491.60	x	13.19	x 0.01 =	64.84	(250)
Additional standing charges					120.00	(251)
Total energy cost			(240)(242)	+ (245)(254) =	425.17	(255)
11a. SAP rating - individual heating systems including	g micro-CHP					
Energy cost deflator (Table 12)					0.42	(256)

11a. SAP rating - individual heating systems including micro-CHP		
Energy cost deflator (Table 12)	0.42 (256))
Energy cost factor (ECF)	0.95 (257))
SAP value	86.71	
SAP rating (section 13)	87 (258))
SAP band	В	

12a. CO ₂ emissions - individual heating systems including m	nicro-CHP					
	Energy kWh/year		Emission factor kg CO₂/kWh		Emissions kg CO₂/year	
Space heating - main system 1	3137.37	x	0.216	=	677.67	(261)
Water heating	2270.29	x	0.216	=	490.38	(264)
Space and water heating			(261) + (262) +	(263) + (264) =	1168.05	(265)
Pumps and fans	395.28	x	0.519	=	205.15	(267)
Electricity for lighting	491.60	x	0.519	=	255.14	(268)
Total CO₂, kg/year				(265)(271) =	1628.34	(272)
Dwelling CO₂ emission rate				(272) ÷ (4) =	11.43	(273)
El value					88.36]
El rating (section 14)					88	(274)
El band					В]

	Energy kWh/year		Primary factor		Primary Energ kWh/year	′
Space heating - main system 1	3137.37	x	1.22	=	3827.59	(261
Water heating	2270.29	x	1.22	=	2769.76	(264
Space and water heating			(261) + (262) +	(263) + (264) =	6597.34	(265
Pumps and fans	395.28	х	3.07	=	1213.50	(267

Electricity for lighting Primary energy kWh/year Dwelling primary energy rate kWh/m2/year 491.60

1509.20

9320.04

(268)

65.40 (273)



Assessor name	Mr Jason Doherty	Assessor number	2634
Client		Last modified	07/06/2018
Address	3 6 Streatley Place, London, NW3 1HP		

Client								Last modified	I	07/0	6/2018	
Address	3 6 Strea	tley Place, I	London, N	W3 1HP								
1. Overall dwelling dimens	ions											
				Aı	rea (m²)			erage storey height (m)	,	V	olume (m³)	
Lowest occupied					78.10] (1a) x		2.50	(2a) =		195.25	(3a)
Total floor area	(1a)	+ (1b) + (1d	c) + (1d)(1n) =	78.10	(4)						
Dwelling volume							(3	a) + (3b) + (3	c) + (3d)(3n) =	195.25	(5)
2. Ventilation rate												
										n	n³ per hour	
Number of chimneys								0	x 40 =	=	0	(6a)
Number of open flues								0	x 20 =	=	0	(6b)
Number of intermittent fans	5							0	x 10 =	=	0	(7a)
Number of passive vents								0	x 10 =	=	0	(7b)
Number of flueless gas fires								0	x 40 =	=	0	(7c)
										Air	changes pe	r
Infiltration due to chimneys,	. flues. fans	s. PSVs		(6a)	+ (6b) + (7a	a) + (7b) + (7c) =	0	÷ (5) :		0.00	(8)
If a pressurisation test has b			ntended, p) to (16)	_ (-,			(-/
Air permeability value, q50,	expressed	in cubic me	etres per h	our per squ	are metre	of envelop	e area				3.00	(17)
If based on air permeability	value, ther	n (18) = [(17	7) ÷ 20] + (8	8), otherwis	se (18) = (10	6)					0.15	(18)
Number of sides on which th	ne dwelling	g is sheltere	d								2	(19)
Shelter factor								1 -	· [0.075 x (1	.9)] =	0.85	(20)
Infiltration rate incorporating	g shelter fa	actor							(18) x (20) =	0.13	(21)
Infiltration rate modified for	monthly v	vind 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 (al	lowing for	shelter and	wind fact	or) (21) x (2	2a)m							
0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15	(22b)
Calculate effective air chang	e rate for t	the applical	ole case:									
if an a character language and land											0.50	7 (22-)

If mechanical ventilation: air change rate through system													(23a)
If balanced w	ith heat re	covery: effi	ciency in %	allowing fo	r in-use fac	ctor from Ta	able 4h					79.90	(23c)
a) If balanced mechanical ventilation with heat recovery (MVHR) (22b)m + (23b) x [1 - (23c) \div 100]													
	0.26	0.26	0.26	0.24	0.24	0.22	0.22	0.22	0.23	0.24	0.24	0.25	(24a)
Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)													
	0.26	0.26	0.26	0.24	0.24	0.22	0.22	0.22	0.23	0.24	0.24	0.25	(25)



3. Heat losses and heat loss parameter									
Element	Gross area, m²	Openings m ²	Net a		U-value W/m²K	A x U W/F	К к-value, kJ/m².К	Ахк, kJ/K	
Window			20.	79 x	1.15	= 23.81			(27)
Door			1.9	5 x	0.55	= 1.07			(26)
Roof window			1.8	6 x	0.96	= 1.79]		(27a)
External wall			84.2	26 x	0.13	= 10.95			(29a)
Party wall			13.0	00 x	0.00	= 0.00			(32)
Roof			28.	54 x	0.09	= 2.54			(30)
Total area of external elements $\sum A$, m^2			137.	40					(31)
Fabric heat loss, $W/K = \sum (A \times U)$						(26).	(30) + (32) =	40.16	(33)
Heat capacity Cm = \sum (A x κ)					(28).	(30) + (32) + (32a)(32e) =	N/A	(34)
Thermal mass parameter (TMP) in kJ/m²K								150.00	(35)
Thermal bridges: $\Sigma(L \times \Psi)$ calculated using Apple	oendix K							9.92	(36)
Total fabric heat loss							(33) + (36) =	50.08	(37)
Jan Feb Ma	Apr	May	Jun	Jul	Aug	Sep	Oct Nov	Dec	
Ventilation heat loss calculated monthly 0.33	x (25)m x (5)								
16.95 16.74 16.5	4 15.51	15.31	14.28	14.28	14.07	14.69	15.31 15.7	2 16.13	(38)
Heat transfer coefficient, W/K (37)m + (38)m									_
67.03 66.82 66.6	2 65.59	65.39	64.36	64.36	64.15	64.77	65.39 65.8	0 66.21	
						Average = ∑(3	39)112/12 = _	65.54	(39)
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4	.)								_
0.86 0.86 0.85	0.84	0.84	0.82	0.82	0.82	0.83	0.84 0.84	0.85	
						Average = ∑(4	10)112/12 =	0.84	(40)
Number of days in month (Table 1a)									7
31.00 28.00 31.0	0 30.00	31.00	30.00	31.00	31.00	30.00	31.00 30.0	0 31.00	(40)
4. Water heating energy requirement									
Assumed occupancy, N								2.43	(42)
Annual average hot water usage in litres per c	ay Vd,average	= (25 x N) +	36				Ī	91.81	(43)
Jan Feb M a	Apr	May	Jun	Jul	Aug	Sep	Oct Nov	Dec	_
Hot water usage in litres per day for each mor	nth Vd,m = fac	tor from Tab	le 1c x (43)						
100.99 97.32 93.6	5 89.98	86.30	82.63	82.63	86.30	89.98	93.65 97.3	2 100.99	
							∑(44)112 =	1101.76	(44)
Energy content of hot water used = 4.18 x Vd,	m x nm x Tm/3	3600 kWh/m	onth (see	Γables 1b	, 1c 1d)				
149.77 130.99 135.3	.7 117.85	113.08	97.58	90.42	103.76	105.00	122.36 133.5	7 145.05	
							∑(45)112 =	1444.58	(45)
Distribution loss 0.15 x (45)m									
22.47 19.65 20.2	8 17.68	16.96	14.64	13.56	15.56	15.75	18.35 20.0	4 21.76	(46)
Water storage loss calculated for each month	(55) x (41)m								
0.00 0.00 0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 0.00	0.00	(56)
If the vessel contains dedicated solar storage	or dedicated V	VWHRS (56)r	n x [(47) - \	/s] ÷ (47)	, else (56)				
0.00 0.00 0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 0.00	0.00	(57)
Primary circuit loss for each month from Table	2 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)
Combi loss for each month from Table 3a, 3b	or 3c								
31.94 28.83 31.8	7 30.79	31.78	30.72	31.71	31.76	30.76	31.83 30.8	6 31.93	(61)
Total heat required for water heating calculat	ed for each mo	onth 0.85 x (45)m + (46	5)m + (57))m + (59)m	+ (61)m			

101	150.93	167.04	149.64	144.96	120 20	122.12	125 52	125.75	154.20	164.42	176.07	(62)
Solar DHW input calcula	I	167.04 endix G or A	148.64 Annendix H	144.86	128.29	122.13	135.52	135.75	154.20	164.43	176.97	J (62)
0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
Output from water hea	I	1				1 0.00	1 0.00	0.00	0.00	0.00	1 0.00] (00)
181.	71 159.82	167.04	148.64	144.86	128.29	122.13	135.52	135.75	154.20	164.43	176.97]
		_							∑(64)1	12 = 1	819.37	(64)
Heat gains from water h	eating (kWh/r	month) 0.2	5 × [0.85 × ((45)m + (61	.)m] + 0.8 ×	: [(46)m + (57)m + (59)	m]				-
57.7	8 50.76	52.91	46.88	45.54	40.12	37.99	42.44	42.60	48.64	52.13	56.21	(65)
E totamed solve												
5. Internal gains	Foh	Max	A	May	1	11	Aug	Com	Oct	Nov	Das	
Jan Metabolic gains (Table !		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
145.	'	145.55	145.55	145.55	145.55	145.55	145.55	145.55	145.55	145.55	145.55	(66)
Lighting gains (calculate						143.33	143.33	145.55	143.33	143.33	143.33	[(00)
48.0		34.68	26.26	19.63	16.57	17.90	23.27	31.24	39.66	46.29	49.35	(67)
Appliance gains (calcula	!		!	!		17.30	25.27	31.24	33.00	40.25	1 43.33] (07)
321.		316.46	298.56	275.96	254.73	240.54	237.20	245.61	263.51	286.11	307.34	(68)
Cooking gains (calculate		1	l		•)] (30)
51.9		51.98	51.98	51.98	51.98	51.98	51.98	51.98	51.98	51.98	51.98	(69)
Pump and fan gains (Ta	ole 5a)		l .									, ,
3.00		3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evaporation	(Table 5)	1	•									
-97.0	3 -97.03	-97.03	-97.03	-97.03	-97.03	-97.03	-97.03	-97.03	-97.03	-97.03	-97.03	(71)
Water heating gains (Ta	ble 5)											
77.6	7 75.54	71.12	65.11	61.21	55.73	51.07	57.04	59.17	65.38	72.40	75.55	(72)
Total internal gains (66	m + (67)m + (6	68)m + (69)	m + (70)m -	+ (71)m + (7	72)m						•	-
550.	71 546.54	525.75	493.42	460.30	430.52	413.01	421.02	439.51	472.05	508.29	535.74	(73)
6. Solar gains		Access		0.44	Cal	ar flux		_	FF		Gains	
		Table		Area m²		V/m²	•	g ific data able 6b	specific d or Table		W	
NorthWest		0.7	7 x	1.28	x 1	1.28 x	0.9 x	0.63 x	0.70		4.41	(81)
SouthEast		0.7		10.69	7 =			0.63 x		=	120.21	(77)
SouthWest		0.7	7 x	1.65	x 3			0.63 x	0.70	= =	18.55	(79)
NorthEast		0.7	7 x	7.17	x 1	.1.28 x	0.9 x	0.63 x	0.70	<u> </u>	24.72	(75)
Horizontal		1.0	0 x	1.86	x 2	6.00 x	0.9 x	0.63 x	0.70	_ = _	19.19]
Solar gains in watts ∑(7	4)m(82)m				_							•
		F04.43	686.93	826.46	844.71	804.37	697.14	565.27	382.43	227.23	158.05	(83)
187.0	9 335.53	501.12	000.55	020.10	044.71	004.57	037.14					
Total gains - internal an	· ·		080.55	020.10	044.71	804.37	037.14					
	d solar (73)m +		1180.35	1286.76	1275.23	1217.38	1118.16	1004.79	854.48	735.52	693.78	(84)
Total gains - internal an	d solar (73)m + 80 882.08	+ (83)m 1026.88							854.48	735.52	693.78	[(84)
Total gains - internal an 737.	d solar (73)m + 80 882.08 erature (heati	1026.88 ing season)	1180.35	1286.76	1275.23				854.48	735.52		1 , ,
737.	d solar (73)m + 80 882.08 erature (heati	1026.88 ing season)	1180.35	1286.76 Table 9, Th1	1275.23 .(°C)	1217.38	1118.16	1004.79			21.00] (84)] (85)
737.3 7. Mean internal temp Temperature during he	d solar (73)m + 80 882.08 erature (heati	1026.88 ing season) the living	1180.35 area from T	1286.76 Table 9, Th1 May	1275.23				854.48 Oct	735.52 Nov		1 , ,
7. Mean internal temp Temperature during he Jan Utilisation factor for gain	d solar (73)m + 80 882.08 erature (heating periods in Feb ens for living are	1026.88 ing season) the living Mar ea n1,m (se	1180.35 area from T Apr e Table 9a)	1286.76 Table 9, Th1 May	1275.23 .(°C) Jun	1217.38	1118.16	1004.79 Sep	Oct	Nov	21.00 Dec] (85)
737.3 7. Mean internal temp Temperature during he	d solar (73)m + 80 882.08 erature (heating periods in Feb ns for living are 8 0.88	1026.88 1026.88 Ing season) In the living Mar ea n1,m (se	1180.35 area from T Apr e Table 9a) 0.63	1286.76 Table 9, Th1 May 0.46	1275.23 .(°C)	1217.38	1118.16	1004.79			21.00	1 , ,
737.3 7. Mean internal temporature during help the Jan Utilisation factor for gain 0.95	d solar (73)m + 80 882.08 erature (heating periods in Feb ns for living area 0.88 iving area T1 (1026.88 1026.88 Ing season) In the living Mar ea n1,m (se	1180.35 area from T Apr e Table 9a) 0.63	1286.76 Table 9, Th1 May 0.46	1275.23 .(°C) Jun	1217.38	1118.16	1004.79 Sep	Oct	Nov	21.00 Dec] (85)

Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)										
20.20 20.21 20.21 20.22 20.22 20.23	20.23 20.23	20.23 20.22	20.22 20.21 (88)							
Utilisation factor for gains for rest of dwelling n2,m										
0.92 0.86 0.76 0.59 0.43 0.28	0.19 0.22	0.39 0.67	0.87 0.94 (89)							
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c			(00)							
19.13	20.23 20.23	20.22 20.07	19.59 19.06 (90)							
Living area fraction	20.23	Living area								
Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2		Living area	(31)							
19.73 20.02 20.32 20.55 20.64 20.66	20.67 20.67	20.65 20.52	20.11 19.67 (92)							
Apply adjustment to the mean internal temperature from Table 4e where appropria		20.03 20.32	20.11 13.07 (32)							
19.73 20.02 20.32 20.55 20.64 20.66	20.67 20.67	20.65 20.52	20.11 19.67 (93)							
13.73 20.02 20.32 20.04 20.00	20.07	20.03 20.32	20.11 13.07 (53)							
8. Space heating requirement										
Jan Feb Mar Apr May Jun	Jul Aug	Sep Oct	Nov Dec							
Utilisation factor for gains, ηm										
0.92 0.86 0.76 0.61 0.45 0.30	0.21 0.24	0.42 0.69	0.87 0.93 (94)							
Useful gains, ηmGm, W (94)m x (84)m										
676.79 758.53 783.71 718.37 573.73 388.77	261.52 273.36	418.58 586.66	637.77 645.23 (95)							
Monthly average external temperature from Table U1										
4.30 4.90 6.50 8.90 11.70 14.60	16.60 16.40	14.10 10.60	7.10 4.20 (96)							
Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]										
1033.98 1010.17 920.78 764.41 584.46 390.30	261.77 273.80	424.41 648.36	855.75 1024.02 (97)							
Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m										
265.75 169.10 101.98 33.15 7.98 0.00	0.00 0.00	0.00 45.91	156.94 281.82							
		∑(98)15, 10)12 = 1062.63 (98)							
Space heating requirement kWh/m²/year		(98	3) ÷ (4) 13.61 (99)							
		(98	8) ÷ (4) 13.61 (99)							
9a. Energy requirements - individual heating systems including micro-CHP		(98	3) ÷ (4) 13.61 (99)							
9a. Energy requirements - individual heating systems including micro-CHP Space heating		(98								
9a. Energy requirements - individual heating systems including micro-CHP Space heating Fraction of space heat from secondary/supplementary system (table 11)			0.00 (201)							
9a. Energy requirements - individual heating systems including micro-CHP Space heating										
9a. Energy requirements - individual heating systems including micro-CHP Space heating Fraction of space heat from secondary/supplementary system (table 11)		1-($(201) = \begin{array}{c} 0.00 & (201) \\ 1.00 & (202) \\ \hline 0.00 & (202) \end{array}$							
9a. Energy requirements - individual heating systems including micro-CHP Space heating Fraction of space heat from secondary/supplementary system (table 11) Fraction of space heat from main system(s)			$(201) = \begin{array}{c} 0.00 & (201) \\ 1.00 & (202) \\ \hline 0.00 & (202) \end{array}$							
9a. Energy requirements - individual heating systems including micro-CHP Space heating Fraction of space heat from secondary/supplementary system (table 11) Fraction of space heat from main system(s) Fraction of space heat from main system 2		1-($ \begin{array}{c cccc} 0.00 & (201) \\ (201) & 1.00 & (202) \\ \hline 0.00 & (202) \\ (203)] & 1.00 & (204) \end{array} $							
9a. Energy requirements - individual heating systems including micro-CHP Space heating Fraction of space heat from secondary/supplementary system (table 11) Fraction of space heat from main system(s) Fraction of space heat from main system 2 Fraction of total space heat from main system 1		1 - ((202) x [1- (2	$ \begin{array}{c cccc} 0.00 & (201) \\ (201) & 1.00 & (202) \\ \hline 0.00 & (202) \\ (203)] & 1.00 & (204) \end{array} $							
9a. Energy requirements - individual heating systems including micro-CHP Space heating Fraction of space heat from secondary/supplementary system (table 11) Fraction of space heat from main system(s) Fraction of space heat from main system 2 Fraction of total space heat from main system 1 Fraction of total space heat from main system 2	Jul Aug	1 - ((202) x [1- (2	$ \begin{array}{c cccc} 0.00 & (201) \\ (201) & 1.00 & (202) \\ \hline 0.00 & (202) \\ (203)] & 1.00 & (204) \\ (203) & 0.00 & (205) \end{array} $							
9a. Energy requirements - individual heating systems including micro-CHP Space heating Fraction of space heat from secondary/supplementary system (table 11) Fraction of space heat from main system(s) Fraction of space heat from main system 2 Fraction of total space heat from main system 1 Fraction of total space heat from main system 2 Efficiency of main system 1 (%)	Jul Aug	1 - ((202) x [1- (2 (202) x ($ \begin{array}{c cccc} & 0.00 & (201) \\ & 2001) = & 1.00 & (202) \\ & 0.00 & (202) \\ & 203)] = & 1.00 & (204) \\ & (203) = & 0.00 & (205) \\ & & 93.20 & (206) \end{array} $							
9a. Energy requirements - individual heating systems including micro-CHP Space heating Fraction of space heat from secondary/supplementary system (table 11) Fraction of space heat from main system(s) Fraction of space heat from main system 2 Fraction of total space heat from main system 1 Fraction of total space heat from main system 2 Efficiency of main system 1 (%) Jan Feb Mar Apr May Jun	Jul Aug 0.00 0.00	1 - ((202) x [1- (2 (202) x ($ \begin{array}{c cccc} & 0.00 & (201) \\ & 2001) = & 1.00 & (202) \\ & 0.00 & (202) \\ & 203)] = & 1.00 & (204) \\ & (203) = & 0.00 & (205) \\ & & 93.20 & (206) \end{array} $							
9a. Energy requirements - individual heating systems including micro-CHP Space heating Fraction of space heat from secondary/supplementary system (table 11) Fraction of space heat from main system(s) Fraction of space heat from main system 2 Fraction of total space heat from main system 1 Fraction of total space heat from main system 2 Efficiency of main system 1 (%) Jan Feb Mar Apr May Jun Space heating fuel (main system 1), kWh/month		1 - ((202) x [1- (2 (202) x (0.00 (201) (201) = 1.00 (202) 0.00 (202) (203)] = 1.00 (204) (203) = 0.00 (205) 93.20 (206) Nov Dec							
9a. Energy requirements - individual heating systems including micro-CHP Space heating Fraction of space heat from secondary/supplementary system (table 11) Fraction of space heat from main system(s) Fraction of space heat from main system 2 Fraction of total space heat from main system 1 Fraction of total space heat from main system 2 Efficiency of main system 1 (%) Jan Feb Mar Apr May Jun Space heating fuel (main system 1), kWh/month		1 - ((202) x [1- (2 (202) x (Sep Oct	0.00 (201) (201) = 1.00 (202) 0.00 (202) (203)] = 1.00 (204) (203) = 0.00 (205) 93.20 (206) Nov Dec							
9a. Energy requirements - individual heating systems including micro-CHP Space heating Fraction of space heat from secondary/supplementary system (table 11) Fraction of space heat from main system(s) Fraction of space heat from main system 2 Fraction of total space heat from main system 1 Fraction of total space heat from main system 2 Efficiency of main system 1 (%) Jan Feb Mar Apr May Jun Space heating fuel (main system 1), kWh/month 285.13 181.44 109.42 35.57 8.56 0.00		1 - ((202) x [1- (2 (202) x (Sep Oct	0.00 (201) (201) = 1.00 (202) 0.00 (202) (203)] = 1.00 (204) (203) = 0.00 (205) 93.20 (206) Nov Dec							
9a. Energy requirements - individual heating systems including micro-CHP Space heating Fraction of space heat from secondary/supplementary system (table 11) Fraction of space heat from main system(s) Fraction of space heat from main system 2 Fraction of total space heat from main system 1 Fraction of total space heat from main system 2 Efficiency of main system 1 (%) Jan Feb Mar Apr May Jun Space heating fuel (main system 1), kWh/month 285.13 181.44 109.42 35.57 8.56 0.00		1 - ((202) x [1- (2 (202) x (Sep Oct	0.00 (201) (201) = 1.00 (202) 0.00 (202) (203)] = 1.00 (204) (203) = 0.00 (205) 93.20 (206) Nov Dec							
9a. Energy requirements - individual heating systems including micro-CHP Space heating Fraction of space heat from secondary/supplementary system (table 11) Fraction of space heat from main system(s) Fraction of space heat from main system 2 Fraction of total space heat from main system 1 Fraction of total space heat from main system 2 Efficiency of main system 1 (%) Jan Feb Mar Apr May Jun Space heating fuel (main system 1), kWh/month 285.13 181.44 109.42 35.57 8.56 0.00 Water heating Efficiency of water heater	0.00 0.00	1 - ((202) x [1- (2 (202) x (Sep Oct 0.00 49.26 Σ(211)15, 10	0.00 (201) (201) = 1.00 (202) 0.00 (202) (203)] = 1.00 (204) (203) = 0.00 (205) 93.20 (206) Nov Dec 168.39 302.38 012 = 1140.16 (211)							
9a. Energy requirements - individual heating systems including micro-CHP Space heating Fraction of space heat from secondary/supplementary system (table 11) Fraction of space heat from main system(s) Fraction of space heat from main system 2 Fraction of total space heat from main system 1 Fraction of total space heat from main system 2 Efficiency of main system 1 (%) Jan Feb Mar Apr May Jun Space heating fuel (main system 1), kWh/month 285.13 181.44 109.42 35.57 8.56 0.00 Water heating Efficiency of water heater 88.87 88.62 88.19 87.57 87.16 87.00 Water heating fuel, kWh/month	0.00 0.00	1 - ((202) x [1- (2 (202) x (Sep Oct 0.00 49.26 Σ(211)15, 10	0.00 (201) 2001) = 1.00 (202) 0.00 (202) 203)] = 1.00 (204) 203) = 0.00 (205) 93.20 (206) Nov Dec 168.39 302.38 012 = 1140.16 (211)							
9a. Energy requirements - individual heating systems including micro-CHP Space heating Fraction of space heat from secondary/supplementary system (table 11) Fraction of space heat from main system(s) Fraction of space heat from main system 2 Fraction of total space heat from main system 1 Fraction of total space heat from main system 2 Efficiency of main system 1 (%) Jan Feb Mar Apr May Jun Space heating fuel (main system 1), kWh/month 285.13 181.44 109.42 35.57 8.56 0.00 Water heating Efficiency of water heater 88.87 88.62 88.19 87.57 87.16 87.00 Water heating fuel, kWh/month	0.00 0.00 87.00 87.00	1 - ((202) x [1- (2 (202) x (Sep Oct 0.00 49.26 Σ(211)15, 10	0.00							
9a. Energy requirements - individual heating systems including micro-CHP Space heating Fraction of space heat from secondary/supplementary system (table 11) Fraction of space heat from main system(s) Fraction of space heat from main system 2 Fraction of total space heat from main system 1 Fraction of total space heat from main system 2 Efficiency of main system 1 (%) Jan Feb Mar Apr May Jun Space heating fuel (main system 1), kWh/month 285.13 181.44 109.42 35.57 8.56 0.00 Water heating Efficiency of water heater 88.87 88.62 88.19 87.57 87.16 87.00 Water heating fuel, kWh/month	0.00 0.00 87.00 87.00	1 - ((202) x [1- (2 (202) x (Sep Oct 0.00 49.26 Σ(211)15, 10 87.00 87.71	0.00							
9a. Energy requirements - individual heating systems including micro-CHP Space heating Fraction of space heat from secondary/supplementary system (table 11) Fraction of space heat from main system(s) Fraction of space heat from main system 2 Fraction of total space heat from main system 1 Fraction of total space heat from main system 2 Efficiency of main system 1 (%) Jan Feb Mar Apr May Jun Space heating fuel (main system 1), kWh/month 285.13 181.44 109.42 35.57 8.56 0.00 Water heating Efficiency of water heater 88.87 88.62 88.19 87.57 87.16 87.00 Water heating fuel, kWh/month 204.46 180.35 189.42 169.74 166.20 147.46	0.00 0.00 87.00 87.00	1 - ((202) x [1- (2 (202) x (Sep Oct 0.00 49.26 Σ(211)15, 10 87.00 87.71	0.00							
9a. Energy requirements - individual heating systems including micro-CHP Space heating Fraction of space heat from secondary/supplementary system (table 11) Fraction of space heat from main system (s) Fraction of space heat from main system 2 Fraction of total space heat from main system 1 Fraction of total space heat from main system 2 Efficiency of main system 1 (%) Jan Feb Mar Apr May Jun Space heating fuel (main system 1), kWh/month 285.13 181.44 109.42 35.57 8.56 0.00 Water heating Efficiency of water heater 88.87 88.62 88.19 87.57 87.16 87.00 Water heating fuel, kWh/month 204.46 180.35 189.42 169.74 166.20 147.46	0.00 0.00 87.00 87.00	1 - ((202) x [1- (2 (202) x (Sep Oct 0.00 49.26 Σ(211)15, 10 87.00 87.71	0.00 (201) (201) (202) (203) = 1.00 (202) (203) = 1.00 (204) (203) = 0.00 (205) (206)							
9a. Energy requirements - individual heating systems including micro-CHPSpace heatingFraction of space heat from secondary/supplementary system (table 11)Fraction of space heat from main system(s)Fraction of space heat from main system 2Fraction of total space heat from main system 2Efficiency of main system 1 (%)Jan Feb Mar Apr May JunSpace heating fuel (main system 1), kWh/month285.13181.44109.4235.578.560.00Water heatingEfficiency of water heater88.8788.6288.1987.5787.1687.00Water heating fuel, kWh/month204.46180.35189.42169.74166.20147.46Annual totalsSpace heating fuel - main system 1	0.00 0.00 87.00 87.00	1 - ((202) x [1- (2 (202) x (Sep Oct 0.00 49.26 Σ(211)15, 10 87.00 87.71	0.00							

Electricity for pumps, fans and electric keep-hot (Table 4f)			
mechanical ventilation fans - balanced, extract or positive input from outside	157.81		(230a)
central heating pump or water pump within warm air heating unit	30.00		(230c)
boiler flue fan	45.00		(230e)
Total electricity for the above, kWh/year		232.81	(231)
Electricity for lighting (Appendix L)		339.17	(232)
Total delivered energy for all uses	(211)(221) + (231) + (232)(237b) =	3782.47	(238)

10a. Fuel costs - individual heating systems including micro-CHP	,					
	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	1140.16	x	3.48	x 0.01 =	39.68	(240)
Water heating	2070.33	x	3.48	x 0.01 =	72.05	(247)
Pumps and fans	232.81	x	13.19	x 0.01 =	30.71	(249)
Electricity for lighting	339.17	x	13.19	x 0.01 =	44.74	(250)
Additional standing charges					120.00	(251)
Total energy cost			(240)(242) +	(245)(254) =	307.17	(255)
11a. SAP rating - individual heating systems including micro-CHI	P					
Energy cost deflator (Table 12)					0.42	(256)
Energy cost factor (ECF)					1.05	(257)
SAP value					85.38	
SAP rating (section 13)					85	(258)
SAP band					В	

12a. CO₂ emissions - individual heating system	s including micro-CHP				
	Energy kWh/year	Emission facto kg CO₂/kWh	r	Emissions kg CO ₂ /year	
Space heating - main system 1	1140.16	0.216	=	246.27	(261)
Water heating	2070.33	0.216	=	447.19	(264)
Space and water heating		(261) + (262)	+ (263) + (264) =	693.47	(265)
Pumps and fans	232.81	0.519	=	120.83	(267)
Electricity for lighting	339.17	0.519	=	176.03	(268)
Total CO ₂ , kg/year			(265)(271) =	990.32	(272)
Dwelling CO₂ emission rate			(272) ÷ (4) =	12.68	(273)
El value				89.22	
El rating (section 14)				89	(274)
El band				В]

	Energy kWh/year		Primary factor		Primary Energy kWh/year	r
Space heating - main system 1	1140.16	x	1.22	=	1390.99	(261
Water heating	2070.33	x	1.22	=	2525.80	(264
Space and water heating			(261) + (262) +	(263) + (264) =	3916.80	(265
Pumps and fans	232.81	x	3.07	=	714.73	(267
Electricity for lighting	339.17	x	3.07	=	1041.25	(268
Primary energy kWh/year					5672.78	(272
Dwelling primary energy rate kWh/m2/year					72.63	(273



Assessor name	Mr Jason Doherty	Assessor number	2634
Client		Last modified	07/06/2018
Address	4 6 Streatley Place, London, NW3 1HP		

1. Overall dwelling dime	nsions	Area (m²)		Average storey height (m)	Volume (m³)
Lowest occupied +1 Total floor area	(1a) + (1b) + (1c) + (1d)(1n) =	67.70	1a) x 1b) x 4)	2.50 (2a) = 3.00 (2b) =	50.50 (3a) 203.10 (3b)
Dwelling volume	(14) + (10) + (10) + (10)(111) -	87.90 (4)	(3a) + (3b) + (3c) + (3d)	(3n) = 253.60 (5)
2. Ventilation rate					m³ per hour

		m³ per hour	
0	x 40 =	0	(6a)
0	x 20 =	0	(6b)
0	x 10 =	0	(7a)
0	x 10 =	0	(7b)
0	x 40 =	0	(7c)
		Air changes pe hour	r
	0 0	0	0

Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) =	0	÷ (5) =	0.00	(8)
If a pressurisation test has been carried out or is intended,	proceed to (17), otherwise continue from	(9) to (16)			_

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

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

Number of sides on which the dwelling is sheltered

Shelter factor

Infiltration rate incorporating shelter factor

Infiltration rate modified for monthly wind speed:													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind speed from Table U2													
	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22)	m ÷ 4												
	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)

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

0.16 0.16 0.16 0.14 0.12 0.12 0.12 0.13 0.14 0.14 0.15 0.14 (22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system

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

a) If balanced mechanical ventilation with heat recovery (MVHR) (22b)m + (23b) x [1 - (23c) ÷ 100]

0.26 0.26 0.26 0.24 0.24 0.22 0.22 0.22 0.23 0.24 0.24 0.25 (24a)

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



0.50

3.00

0.15

2

0.85

0.13

1 - [0.075 x (19)] =

 $(18) \times (20) =$

(17)

(18)

(19)

(20)

(23a)

				Gross	Openings	Net are		U-value	A x U W		alue,	Αхκ,	
			а	rea, m²	m²	A, m²		W/m²K			m².K	kJ/K	
Vindow						34.53	x	1.15	= 39.54				(
Door						1.95	x	0.55	= 1.07	\exists			(
Roof window						0.96	x	0.96	= 0.92				(
external wall						107.5	7 x	0.13	= 13.98				(
Party wall						13.00	x	0.00	= 0.00				(
Roof						84.14	x	0.09	= 7.49				(
Total area of ex	xternal elem	ents ∑A, m²	2			229.1	5						_ (
abric heat loss	s, W/K = ∑(A	× U)							(26	5)(30) + (3	32) =	63.01	(
Heat capacity (Cm = ∑(A x κ))						(28)	.(30) + (32) -	+ (32a)(32	:e) =	N/A	(
hermal mass _l	parameter (1	TMP) in kJ/r	n²K									150.00	(
Thermal bridge	es: Σ(L x Ψ) c	alculated us	sing Appen	dix K								11.70	(
Total fabric hea	at loss									(33) + (3	6) =	74.70	(
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation hea	at loss calcul	ated month	ly 0.33 x (25)m x (5)									
	22.02	21.75	21.48	20.15	19.88	18.55	18.55	18.28	19.08	19.88	20.41	20.95	(
Heat transfer c	oefficient, V	V/K (37)m +	+ (38)m										
	96.72	96.45	96.19	94.85	94.58	93.25	93.25	92.98	93.78	94.58	95.12	95.65	
									Average = \(\)	(39)112/	12 =	94.79	(
Heat loss parar	meter (HLP),	W/m ² K (39	9)m ÷ (4)										
	1.10	1.10	1.09	1.08	1.08	1.06	1.06	1.06	1.07	1.08	1.08	1.09	
									Average = 5	(40)112/	12 =	1.08	(
		- II 4 \											
Number of day	s in month (Table 1a)											
Number of day	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(
	31.00	28.00		30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(
4. Water heat	31.00	28.00		30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	'	
4. Water heat	31.00 ting energy r	28.00	t				31.00	31.00	30.00	31.00	30.00	2.60	
4. Water heat	31.00 ting energy r pancy, N e hot water t	28.00 requirement usage in litro	t es per day	Vd,average	e = (25 x N) +	36						2.60 95.85	
4. Water heat	31.00 ting energy r pancy, N e hot water r Jan	28.00 requirementusage in litro	t es per day Mar	Vd,average Apr	e = (25 x N) + : May	36 Jun	31.00 Jul	31.00 Aug	30.00 Sep	31.00 Oct	30.00	2.60	
4. Water heat Assumed occup	31.00 ting energy r pancy, N e hot water r Jan ge in litres pe	28.00 requirementusage in litro Feb er day for ea	es per day Mar ach month	Vd,averago Apr Vd,m = fac	e = (25 x N) + May ctor from Tabl	36 Jun le 1c x (43)	Jul	Aug	Sep	Oct	Nov	2.60 95.85 Dec	
4. Water heat Assumed occup	31.00 ting energy r pancy, N e hot water r Jan	28.00 requirementusage in litro	t es per day Mar	Vd,average Apr	e = (25 x N) + : May	36 Jun le 1c x (43)				Oct 97.77	Nov 101.60	2.60 95.85 Dec	
4. Water heat Assumed occup Annual average Hot water usage	31.00 ting energy r pancy, N e hot water t Jan ge in litres pe	28.00 requirementusage in litro Feb er day for ea	es per day Mar ach month	Vd,averago Apr Vd,m = fac 93.93	e = (25 x N) + : May ctor from Tabl	36 Jun le 1c x (43) 86.27	Jul 86.27	Aug 90.10	Sep	Oct	Nov 101.60	2.60 95.85 Dec	
4. Water heat Assumed occup Annual average Hot water usage	31.00 ting energy repancy, Note that water to Jan ge in litres per 105.44	28.00 requiremen usage in litro Feb er day for ea 101.60 er used = 4.3	es per day Mar ach month 97.77	Vd,averago Apr Vd,m = fac 93.93	e = (25 x N) + . May ctor from Tabl 90.10 /3600 kWh/ma	36 Jun le 1c x (43) 86.27 onth (see Ta	Jul 86.27 bles 1b, 1	Aug 90.10 1c 1d)	Sep 93.93	Oct 97.77 Σ(44)1	Nov 101.60 12 =	2.60 95.85 Dec 105.44 1150.22	
4. Water heat Assumed occup Annual average Hot water usage	31.00 ting energy r pancy, N e hot water t Jan ge in litres pe	28.00 requirementusage in litro Feb er day for ea	es per day Mar ach month	Vd,averago Apr Vd,m = fac 93.93	e = (25 x N) + : May ctor from Tabl	36 Jun le 1c x (43) 86.27 onth (see Ta	Jul 86.27	Aug 90.10	Sep	Oct 97.77 Σ(44)1	Nov 101.60 12 = 139.44	2.60 95.85 Dec 105.44 1150.22	
4. Water heat Assumed occup Annual average Hot water usage	31.00 ting energy repancy, Nee hot water to Jan ge in litres per 105.44 t of hot water to 156.36	zequirement usage in litro Feb er day for ea 101.60 er used = 4.3	es per day Mar ach month 97.77	Vd,averago Apr Vd,m = fac 93.93	e = (25 x N) + . May ctor from Tabl 90.10 /3600 kWh/ma	36 Jun le 1c x (43) 86.27 onth (see Ta	Jul 86.27 bles 1b, 1	Aug 90.10 1c 1d)	Sep 93.93	Oct 97.77 Σ(44)1	Nov 101.60 12 = 139.44	2.60 95.85 Dec 105.44 1150.22	
4. Water heat Assumed occup Annual average Hot water usage	31.00 ting energy repancy, Note that water to Jan ge in litres per 105.44 tof hot water to 156.36	28.00 requirement usage in litro Feb er day for each 101.60 er used = 4.3 136.75	es per day Mar ach month 97.77 18 x Vd,m x 141.12	Vd,average	e = (25 x N) + : May ctor from Tabl 90.10 /3600 kWh/mi 118.05	36 Jun le 1c x (43) 86.27 onth (see Ta	Jul 86.27 bles 1b, 1	Aug 90.10 1c 1d) 108.32	Sep 93.93	Oct 97.77 Σ(44)1 127.74 Σ(45)1	Nov 101.60 12 = 139.44 12 =	2.60 95.85 Dec 105.44 1150.22 151.43 1508.12	
4. Water heat Assumed occup Annual average Hot water usage Energy content	31.00 ting energy repancy, Nee hot water to Jan ge in litres per 105.44 t of hot water to 156.36 ss 0.15 x (45 23.45)	28.00 requirement usage in litro Feb er day for each 101.60 er used = 4.3 136.75 b)m 20.51	es per day Mar ach month 97.77 18 x Vd,m > 141.12	Vd,averago	e = (25 x N) + . May ctor from Tabl 90.10 /3600 kWh/ma	36 Jun le 1c x (43) 86.27 onth (see Ta 101.87	Jul 86.27 bles 1b, 1	Aug 90.10 1c 1d)	Sep 93.93	Oct 97.77 Σ(44)1	Nov 101.60 12 = 139.44	2.60 95.85 Dec 105.44 1150.22	
4. Water heat Assumed occup Annual average Hot water usage Energy content	31.00 ting energy repancy, Note that water to Jan ge in litres per 105.44 tof hot water to 156.36 ss 0.15 x (45) 23.45	28.00 requirement usage in litro Feb er day for each 101.60 er used = 4.3 136.75 o)m 20.51 ed for each	es per day Mar ach month 97.77 18 x Vd,m > 141.12 21.17 month (5	Vd,average Apr Vd,m = fac 93.93 cnm x Tm/ 123.03 18.45 5) x (41)m	e = (25 x N) + : May ctor from Tabl 90.10 /3600 kWh/ma 118.05	36 Jun le 1c x (43) 86.27 onth (see Ta 101.87	Jul 86.27 bles 1b, 194.40	Aug 90.10 1c 1d) 108.32	Sep 93.93 109.61 16.44	Oct 97.77 Σ(44)1 127.74 Σ(45)1 19.16	Nov 101.60 12 = 139.44 12 = 20.92	2.60 95.85 Dec 105.44 1150.22 151.43 1508.12	
4. Water heat Assumed occup Annual average Hot water usage Energy content Distribution los	31.00 ting energy r pancy, N e hot water t Jan ge in litres pe 105.44 t of hot wate 156.36 ss 0.15 x (45 23.45 loss calculat 0.00	28.00 requirement usage in litro Feb er day for ea 101.60 er used = 4.2 136.75 o)m 20.51 ed for each 0.00	es per day Mar ach month 97.77 18 x Vd,m > 141.12 21.17 month (5) 0.00	Vd,averago	e = (25 x N) + May ctor from Tabl 90.10 /3600 kWh/me 118.05 17.71	36 Jun le 1c x (43) 86.27 onth (see Ta 101.87 15.28	Jul 86.27 bles 1b, 1 94.40 14.16	90.10 1c 1d) 108.32 16.25	Sep 93.93	Oct 97.77 Σ(44)1 127.74 Σ(45)1	Nov 101.60 12 = 139.44 12 =	2.60 95.85 Dec 105.44 1150.22 151.43 1508.12	
4. Water heat Assumed occup Annual average Hot water usage Energy content Distribution los	31.00 ting energy repancy, Nee hot water to Jan ge in litres per 105.44 t of hot water to 156.36 ass 0.15 x (45 23.45) loss calculate 0.00 ontains dedicting energy repairs to the control of the co	28.00 requirement usage in litro Feb er day for each 101.60 136.75 i)m 20.51 ed for each 0.00 ated solar s	es per day Mar ach month 97.77 18 x Vd,m > 141.12 21.17 month (5: 0.00 torage or control of the contro	Vd,average	e = (25 x N) + May ctor from Tabl 90.10 /3600 kWh/ma 118.05 17.71 0.00 WWHRS (56)n	36 Jun le 1c x (43) 86.27 onth (see Ta 101.87 15.28 0.00 n x [(47) - Vs]	Jul 86.27 bles 1b, 1 94.40 14.16 0.00] ÷ (47), €	90.10 1c 1d) 108.32 16.25 0.00 else (56)	Sep 93.93 109.61 16.44 0.00	Oct 97.77 Σ(44)1 127.74 Σ(45)1 19.16 0.00	Nov 101.60 12 = 139.44 12 = 20.92 0.00	2.60 95.85 Dec 105.44 1150.22 151.43 1508.12 22.71	
4. Water heat Assumed occup Annual average Hot water usage Energy content Distribution los Water storage f the vessel co	31.00 ting energy r pancy, N e hot water t Jan ge in litres pe 105.44 t of hot wate 156.36 ss 0.15 x (45 23.45 loss calculat 0.00 entains dedic	28.00 requirement usage in litro Feb er day for ea 101.60 er used = 4.2 136.75 0.00 ated solar s 0.00	es per day Mar ach month 97.77 18 x Vd,m x 141.12 21.17 month (5: 0.00 torage or c	Vd,averago	e = (25 x N) + May ctor from Tabl 90.10 /3600 kWh/me 118.05 17.71	36 Jun le 1c x (43) 86.27 onth (see Ta 101.87 15.28	Jul 86.27 bles 1b, 1 94.40 14.16	90.10 1c 1d) 108.32 16.25	Sep 93.93 109.61 16.44	Oct 97.77 Σ(44)1 127.74 Σ(45)1 19.16	Nov 101.60 12 = 139.44 12 = 20.92	2.60 95.85 Dec 105.44 1150.22 151.43 1508.12	
4. Water heat Assumed occup Annual average Hot water usage Energy content Distribution los Water storage f the vessel co	31.00 ting energy repancy, Nee hot water of Jan ge in litres per 105.44 t of hot water of 156.36 as 0.15 x (45 23.45 loss calculated 0.00 entains dediced 0.00 loss for each	28.00 requirement usage in litro Feb er day for each 101.60 20.51 ed for each 0.00 ated solar s 0.00 month fro	es per day Mar ach month 97.77 18 x Vd,m > 141.12 21.17 month (5: 0.00 torage or c 0.00 m Table 3	Vd,average	e = (25 x N) + May ctor from Tabl 90.10 /3600 kWh/ma 118.05 17.71 0.00 WWHRS (56)n 0.00	36 Jun le 1c x (43) 86.27 onth (see Ta 101.87 15.28 0.00 n x [(47) - Vs] 0.00	Jul 86.27 bles 1b, 1 94.40 14.16 0.00 1 ÷ (47), € 0.00	Aug 90.10 1c 1d) 108.32 16.25 0.00 else (56) 0.00	Sep 93.93 109.61 16.44 0.00 0.00	Oct 97.77 Σ(44)1 127.74 Σ(45)1 19.16 0.00 0.00	Nov 101.60 12 = 139.44 12 = 20.92 0.00	2.60 95.85 Dec 105.44 1150.22 151.43 1508.12 22.71 0.00 0.00	
Assumed occup Annual average Hot water usage Energy content Distribution los Water storage If the vessel co	31.00 ting energy r pancy, N e hot water t Jan ge in litres pe 105.44 t of hot wate 156.36 ss 0.15 x (45 23.45 loss calculat 0.00 ontains dedic 0.00 loss for each	28.00 requirement usage in litro Feb er day for ea 101.60 er used = 4.2 136.75 0.00 ated solar s 0.00 month fro 0.00	es per day Mar ach month 97.77 18 x Vd,m x 141.12 21.17 month (5: 0.00 torage or c 0.00 m Table 3 0.00	Vd,average Apr Vd,m = fac 93.93 c nm x Tm/ 123.03 18.45 5) x (41)m 0.00 dedicated \ 0.00 0.00	e = (25 x N) + May ctor from Tabl 90.10 /3600 kWh/ma 118.05 17.71 0.00 WWHRS (56)n	36 Jun le 1c x (43) 86.27 onth (see Ta 101.87 15.28 0.00 n x [(47) - Vs]	Jul 86.27 bles 1b, 1 94.40 14.16 0.00] ÷ (47), €	90.10 1c 1d) 108.32 16.25 0.00 else (56)	Sep 93.93 109.61 16.44 0.00	Oct 97.77 Σ(44)1 127.74 Σ(45)1 19.16 0.00	Nov 101.60 12 = 139.44 12 = 20.92 0.00	2.60 95.85 Dec 105.44 1150.22 151.43 1508.12 22.71	
4. Water heat Assumed occup Annual average Hot water usage Energy content Distribution los Water storage f the vessel co	31.00 ting energy r pancy, N e hot water t Jan ge in litres pe 105.44 t of hot wate 156.36 ss 0.15 x (45 23.45 loss calculat 0.00 ontains dedic 0.00 loss for each	28.00 requirement usage in litro Feb er day for ea 101.60 er used = 4.2 136.75 0.00 ated solar s 0.00 month fro 0.00	es per day Mar ach month 97.77 18 x Vd,m x 141.12 21.17 month (5: 0.00 torage or c 0.00 m Table 3 0.00	Vd,average Apr Vd,m = fac 93.93 c nm x Tm/ 123.03 18.45 5) x (41)m 0.00 dedicated \ 0.00 0.00	e = (25 x N) + May ctor from Tabl 90.10 /3600 kWh/ma 118.05 17.71 0.00 WWHRS (56)n 0.00	36 Jun le 1c x (43) 86.27 onth (see Ta 101.87 15.28 0.00 n x [(47) - Vs] 0.00	Jul 86.27 bles 1b, 1 94.40 14.16 0.00 1 ÷ (47), € 0.00	Aug 90.10 1c 1d) 108.32 16.25 0.00 else (56) 0.00	Sep 93.93 109.61 16.44 0.00 0.00	Oct 97.77 Σ(44)1 127.74 Σ(45)1 19.16 0.00 0.00	Nov 101.60 12 = 139.44 12 = 20.92 0.00	2.60 95.85 Dec 105.44 1150.22 151.43 1508.12 22.71 0.00 0.00	

0.26

0.26

0.24

0.24

0.22

0.22

0.22

0.23

0.24

0.24

0.25

Total fleat requ	uired for wat	er heating o	alculated f	or each mo	onth 0.85 x	(45)m + (4	6)m + (57)r	m + (59)m +	- (61)m				
	188.32	165.61	173.02	153.85	149.86	132.61	126.13	140.10	140.40	159.61	170.34	183.37	(62)
Solar DHW inp	out calculated	d using Appe	endix G or A	Appendix H		•		•	•			•	_
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
Output from w	vater heater	for each mo	nth (kWh/	month) (62	2)m + (63)n	1						•	_
	188.32	165.61	173.02	153.85	149.86	132.61	126.13	140.10	140.40	159.61	170.34	183.37	
										∑(64)1	12 =	1883.22	(64)
Heat gains fror	m water heat	ting (kWh/m	nonth) 0.2	5 × [0.85 ×	(45)m + (61	L)m] + 0.8 ×	[(46)m + (57)m + (59)	m]				_
	59.98	52.68	54.90	48.61	47.20	41.56	39.32	43.96	44.14	50.44	54.09	58.34	(65)
5. Internal ga													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gain	ns (Table 5)												_
	155.75	155.75	155.75	155.75	155.75	155.75	155.75	155.75	155.75	155.75	155.75	155.75	(66)
Lighting gains ((calculated ir	n Appendix I	_, equation	L9 or L9a),	also see Ta	able 5							_
	52.41	46.55	37.86	28.66	21.42	18.09	19.54	25.40	34.10	43.29	50.53	53.87	(67)
Appliance gain	ns (calculated	l in Appendi	x L, equation	on L13 or L	13a), also s	ee Table 5							_
	350.99	354.63	345.45	325.91	301.25	278.07	262.58	258.94	268.12	287.65	312.32	335.50	(68)
Cooking gains	(calculated ir	n Appendix I	L, equation	L15 or L15	ia), also see	Table 5							_
	53.17	53.17	53.17	53.17	53.17	53.17	53.17	53.17	53.17	53.17	53.17	53.17	(69)
Pump and fan	gains (Table	5a)											
	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. eva	aporation (Ta	ble 5)											
	-103.83	-103.83	-103.83	-103.83	-103.83	-103.83	-103.83	-103.83	-103.83	-103.83	-103.83	-103.83	(71)
Water heating	gains (Table	5)											
	80.62	78.40	73.79	67.52	63.45	57.72	52.85	59.09	61.31	67.80	75.12	78.41	(72)
Total internal g	gains (66)m	+ (67)m + (6	8)m + (69)	m + (70)m	+ (71)m + (72)m							
		. , .							474.64				7
	592.10	587.67	565.18	530.18	494.21	461.96	443.06	451.52	471.61	506.84	546.06	575.86	(73)
C Solov going	592.10		565.18	530.18	494.21	461.96	443.06	451.52	4/1.61	506.84	546.06	575.86	<u> </u> (73)
6. Solar gains	592.10					1		451.52			546.06		<u> </u> (73)
6. Solar gains	592.10		Access	factor	494.21 Area m²	Sol	443.06 ar flux	,	g ific data	FF specific c		575.86 Gains W	
6. Solar gains	592.10		Access	factor	Area	Sol	ar flux	spec	g	FF	lata	Gains	<u></u> (73)
6. Solar gains NorthWest	592.10		Access	factor 6d	Area	Sol W	ar flux //m²	spec or T	g ific data	FF specific c or Table	lata	Gains	(73)
	592.10		Access t	factor e 6d	Area m²	Sol W	ar flux //m²	spec or T	g ific data able 6b	FF specific c or Table	lata 6c	Gains W	7
NorthWest	592.10		Access Table	factor e 6d 7 x 7	Area m²	Sol W	ar flux //m² 1.28 x 1.28 x	spec or T 0.9 x (g ific data able 6b	FF specific c or Table 0.70 0.70	lata 6c =	Gains W	(81)
NorthWest NorthEast	592.10		Access Table	factor	Area m² 4.85	X	ar flux //m² 1.28 x 1.28 x 6.79 x	spec or T 0.9 x (0.9 x	g ific data able 6b 0.63 x	FF specific cor Table 0.70 0.70 0.70	lata 6c = [] = [Gains W 16.72 61.27	(81) (75)
NorthWest NorthEast SouthEast	592.10	587.67	0.7 0.7	factor	Area m² 4.85 17.77 11.91	X	ar flux //m² 1.28 x 1.28 x 6.79 x	spec or T 0.9 x (0.9 x	g ific data able 6b 0.63 x 0.63 x	FF specific cor Table 0.70 0.70 0.70	lata 6c = [] = [] = [Gains W 16.72 61.27 133.92	(81) (75)
NorthWest NorthEast SouthEast Horizontal	592.10	587.67	0.7 0.7	factor	Area m² 4.85 17.77 11.91	X	ar flux //m² 1.28 x 1.28 x 6.79 x	spec or T 0.9 x (0.9 x	g ific data able 6b 0.63 x 0.63 x	FF specific cor Table 0.70 0.70 0.70	lata 6c = [] = [] = [Gains W 16.72 61.27 133.92	(81) (75)
NorthWest NorthEast SouthEast Horizontal	592.10 watts ∑(74)m 221.83	587.67 n(82)m 407.47	0.7 0.7 0.7 0.7 1.0	factor	Area m² 4.85 17.77 11.91 0.96	X	ar flux //m² 1.28 x 1.28 x 6.79 x	spec or T 0.9 x (0.9 x (0.9 x (g ific data able 6b 0.63 x 0.63 x 0.63 x	FF specific c or Table 0.70 0.70 0.70 0.70	lata 6c = [Gains W 16.72 61.27 133.92 9.91] (81)] (75)] (77)
NorthWest NorthEast SouthEast Horizontal Solar gains in v	592.10 watts ∑(74)m 221.83	587.67 n(82)m 407.47	0.7 0.7 0.7 0.7 1.0	factor	Area m² 4.85 17.77 11.91 0.96	X	ar flux //m² 1.28 x 1.28 x 6.79 x	spec or T 0.9 x (0.9 x (0.9 x (g ific data able 6b 0.63 x 0.63 x 0.63 x	FF specific c or Table 0.70 0.70 0.70 0.70	lata 6c = [Gains W 16.72 61.27 133.92 9.91] (81)] (75)] (77)
NorthWest NorthEast SouthEast Horizontal Solar gains in v	watts ∑(74)m 221.83 sternal and so 813.93	587.67 n(82)m 407.47 blar (73)m + 995.13	0.7 0.7 0.7 0.7 1.0 634.76 (83)m	factor 6d 7	Area m² 4.85 17.77 11.91 0.96	Sol W x 1 x 1 x 3 x 3 x 2	ar flux //m² 1.28	spec or T 0.9 x (0.9 x (0.9 x (0.9 x (0.9 x (0.9 x (g ific data able 6b 0.63 x 0.63 x 0.63 x	FF specific c or Table 0.70 0.70 0.70 0.70 471.30	lata 6c = [= [=] = [] = [271.13	Gains W 16.72 61.27 133.92 9.91] (81)] (75)] (77)] (83)
NorthWest NorthEast SouthEast Horizontal Solar gains in v	watts ∑(74)m 221.83 sternal and so 813.93	587.67 n(82)m 407.47 blar (73)m + 995.13	0.7 0.7 0.7 0.7 1.0 634.76 (83)m	factor 6d 7	Area m² 4.85 17.77 11.91 0.96	Sol W x 1 x 1 x 3 x 3 x 2	ar flux //m² 1.28	spec or T 0.9 x (0.9 x (0.9 x (0.9 x (0.9 x (0.9 x (g ific data able 6b 0.63 x 0.63 x 0.63 x	FF specific c or Table 0.70 0.70 0.70 0.70 471.30	lata 6c = [= [=] = [] = [271.13	Gains W 16.72 61.27 133.92 9.91] (81)] (75)] (77)] (83)
NorthWest NorthEast SouthEast Horizontal Solar gains in v	watts ∑(74)m	587.67 n(82)m 407.47 plar (73)m + 995.13	Access 1 Table 0.7 0.7 0.7 1.0 634.76 (83)m 1199.94	factor	Area m² 4.85 17.77 11.91 0.96 1137.81	Sol W x 1 x 1 x 3 x 3 x 2 1179.47	ar flux //m² 1.28	spec or T 0.9 x (0.9 x (0.9 x (0.9 x (0.9 x (0.9 x (g ific data able 6b 0.63 x 0.63 x 0.63 x	FF specific c or Table 0.70 0.70 0.70 0.70 471.30	lata 6c = [= [=] = [] = [271.13	Gains W 16.72 61.27 133.92 9.91] (81)] (75)] (77)] (83)
NorthWest NorthEast SouthEast Horizontal Solar gains in v Total gains - in	watts ∑(74)m	587.67 n(82)m 407.47 plar (73)m + 995.13	Access 1 Table 0.7 0.7 0.7 1.0 634.76 (83)m 1199.94	factor	Area m² 4.85 17.77 11.91 0.96 1137.81	Sol W x 1 x 1 x 3 x 3 x 2 1179.47	ar flux //m² 1.28	spec or T 0.9 x (0.9 x (0.9 x (0.9 x (0.9 x (0.9 x (g ific data able 6b 0.63 x 0.63 x 0.63 x	FF specific c or Table 0.70 0.70 0.70 0.70 471.30	lata 6c = [= [=] = [] = [271.13	Gains W 16.72 61.27 133.92 9.91 186.31] (81)] (75)] (77)] (83)
NorthWest NorthEast SouthEast Horizontal Solar gains in v Total gains - in	watts ∑(74)m 221.83 Internal and so 813.93 Trnal temperal during heatin Jan	587.67 n(82)m 407.47 plar (73)m + 995.13 ature (heating periods in Feb	Access 1 Table 0.7 0.7 0.7 1.0 634.76 (83)m 1199.94 ng season) the living Mar	factor 6d 7	Area m² 4.85 17.77 11.91 0.96 1137.81 1632.02 Table 9, That May	Sol W x 1 x 1 x 3 x 3 x 2 1179.47 1641.43	ar flux //m² 1.28 x 1.28 x 6.79 x 6.00 x 1116.41	spec or T 0.9 x (0.9 x	g ific data able 6b 0.63	FF specific c or Table 0.70 0.70 0.70 471.30	lata	Gains W 16.72 61.27 133.92 9.91 186.31 762.18] (81)] (75)] (77)] (83)
NorthWest NorthEast SouthEast Horizontal Solar gains in v Total gains - in 7. Mean inter Temperature of	watts ∑(74)m 221.83 Internal and so 813.93 Trnal temperal during heatin Jan	587.67 n(82)m 407.47 plar (73)m + 995.13 ature (heating periods in Feb	Access 1 Table 0.7 0.7 0.7 1.0 634.76 (83)m 1199.94 ng season) the living Mar	factor 6d 7	Area m² 4.85 17.77 11.91 0.96 1137.81 1632.02 Table 9, That May	Sol W x 1 x 1 x 3 x 3 x 2 1179.47 1641.43	ar flux //m² 1.28 x 1.28 x 6.79 x 6.00 x 1116.41	spec or T 0.9 x (0.9 x	g ific data able 6b 0.63	FF specific c or Table 0.70 0.70 0.70 471.30	lata	Gains W 16.72 61.27 133.92 9.91 186.31 762.18] (81)] (75)] (77)] (83)
NorthWest NorthEast SouthEast Horizontal Solar gains in v Total gains - in 7. Mean inter Temperature of	watts ∑(74)m 221.83 Internal and so 813.93 The properties of	587.67 n(82)m 407.47 blar (73)m + 995.13 ature (heating periods in Feb for living are 0.91	Access to Table 0.7 0.7 0.7 1.0 634.76 (83)m 1199.94 Ing season) the living Mar ea n1,m (season) 0.83	factor 2	Area m² 4.85 17.77 11.91 0.96 1137.81 1632.02 Table 9, Th1 May 0.51	Sol W x 1 x 1 x 3 x 3 x 2 1179.47 1641.43	ar flux //m² 1.28 x 1.28 x 6.79 x 6.00 x 1116.41 1559.47	spec or T 0.9 x (0.9 x	g ific data able 6b 0.63	FF specific cor Table 0.70 0.70 0.70 471.30 978.13	lata	Gains W 16.72 61.27 133.92 9.91 186.31 762.18 21.00 Dec] (81)] (75)] (77)] (83)] (84)
NorthWest NorthEast SouthEast Horizontal Solar gains in v Total gains - in 7. Mean inter Temperature of Utilisation fact	watts ∑(74)m 221.83 Internal and so 813.93 The properties of	587.67 n(82)m 407.47 blar (73)m + 995.13 ature (heating periods in Feb for living are 0.91	Access to Table 0.7 0.7 0.7 1.0 634.76 (83)m 1199.94 Ing season) the living Mar ea n1,m (season) 0.83	factor 2	Area m² 4.85 17.77 11.91 0.96 1137.81 1632.02 Table 9, Th1 May 0.51	Sol W x 1 x 1 x 3 x 3 x 2 1179.47 1641.43	ar flux //m² 1.28 x 1.28 x 6.79 x 6.00 x 1116.41 1559.47	spec or T 0.9 x (0.9 x	g ific data able 6b 0.63	FF specific cor Table 0.70 0.70 0.70 471.30 978.13	lata	Gains W 16.72 61.27 133.92 9.91 186.31 762.18 21.00 Dec] (81)] (75)] (77)] (83)] (84)

Note 100 200	Unitiastion factor for gains for rest of dwelling n2, w Mean internal temperature in the rest of dwelling r2, follow steps 3 to 7 in Table 9c) Mean internal temperature in the rest of dwelling r12, follow steps 3 to 7 in Table 9c) Living area fraction Mean internal temperature for the whole dwelling r14 x 13 + 12 - 61.0 x 12 Living area fraction Mean internal temperature for the whole dwelling r14 x 13 + 12 - 61.0 x 12 Living area fraction Mean internal temperature for the whole dwelling r14 x 13 + 12 - 61.0 x 12 Living area fraction 19 02 19 39 19.85 20.28 20.47 20.54 20.55 20.55 20.55 20.50 20.18 19.53 18.95 (92) Apply adjustment to the mean internal temperature from Table 4e where appropriate 19 0.02 19 39 19.85 20.28 20.47 20.54 20.55 20.55 20.55 20.50 20.18 19.53 18.95 (93) ***Space heating requirement** ***Page 19 0.90 19 39 19.85 20.28 20.47 20.54 20.55 20.55 20.55 20.50 20.18 19.53 18.95 (93) ***Page 19 0.90 19 39 19.85 20.28 20.47 20.54 20.55 20.55 20.55 20.50 20.18 19.53 18.95 (93) ***Page 19 0.90 19 39 19.85 20.28 20.47 20.54 20.55 20.55 20.55 20.50 20.18 19.53 18.95 (93) ***Page 19 0.90 19 39 19.85 20.28 20.28 20.47 20.54 20.55 20.55 20.55 20.50 20.18 19.53 18.95 (93) ***Page 19 0.90 19 39 19.85 20.28 20.28 20.47 20.54 20.55 20.55 20.55 20.50 20.18 19.53 18.95 (93) ***Page 19 0.90 19 39 19.85 20.28 20.28 20.47 20.54 20.55 20.55 20.55 20.50 20.18 19.53 18.95 (93) ***Page 19 0.90 19 39 19.85 20.28 20.28 20.50 20.55 20.55 20.55 20.50 20.18 19.53 18.95 (93) ***Page 19 0.90 19 39 19.85 20.28 20.28 20.55 20.55 20.55 20.55 20.50 20.18 19.53 18.95 (93) ***Page 19 0.90 19 39 19.85 20.28 20.28 20.28 20.55 20.55 20.55 20.55 20.50 20.18 19.53 18.95 (93) ***Page 19 0.90 19 30 19 85 20.28 20.28 20.28 20.55 20.55 20.55 20.55 20.50 20.18 20.55	20.00	ing periods i	n the rest o	f dwelling f	rom Table 9	9 Th2(°C)							
Utilisation factor for gains for rest of dwelling n2, method internal temperature in the rest of dwelling 12 (follow steeps 3 to 7 in Table 9; method internal temperature in the rest of dwelling 12 (follow steeps 3 to 7 in Table 9; method internal temperature in the rest of dwelling 12 (follow steeps 3 to 7 in Table 9; method internal temperature in the rest of dwelling 12 (follow steeps 3 to 7 in Table 9; method internal temperature for the whole dwelling fl. x Y1 + (1 - fl. x) x Y2 (1 - fl. x	Unlikation factor for gains for test of twelling n2, with twelver 1,055 0,50 0,81 0,65 0,64 0,31 0,20 0,24 0,45 0,74 0,91 0,95 0,95 0,96 0		- .	_		1		20.03	20.04	20.03	20.02	20.02	20.01	(88)
Mean internal temperature in the rest of twelling T2 (follow steps 3 to 7 in Table V2 Mean internal temperature in the rest of twelling T2 (follow steps 3 to 7 in Table V2 Mean internal temperature in the rest of twelling T2 (follow steps 3 to 7 in Table V2 Living area fraction	Mean internal temperature in the rest of locality 72 (follow steps are 7 in Table 92 (Utilisation factor for gain		-		20.02	20.03	20.03	20.01	20.03	20.02	20.02	20.01	(00)
Mean internal temperature: in the rest of develling T2 (follow steps 3 to 7 in Table 9c) 18.26 18.70 19.24 19.73 19.95 20.02 20.03 20.03 19.98 19.64 18.88 18.18 690 Living area fraction 19.02 19.39 19.85 20.28 20.47 20.54 20.55 20.55 20.50 20.18 19.53 18.95 692 Apply adjustment to the mean internal temperature from Table 4e where appropriate 19.02 19.39 19.85 20.28 20.47 20.54 20.55 20.55 20.50 20.18 19.53 18.95 693 8. Space heating requires ment: 19.02 19.39 19.85 20.28 20.47 20.54 20.55 20.55 20.50 20.18 19.53 18.95 693 8. Space heating requires ment: 19.02 19.39 19.85 20.28 20.47 20.54 20.55 20.55 20.50 20.18 19.53 18.95 693 8. Space heating requires ment: 19.03 19.85 20.28 20.47 20.54 20.55 20.55 20.50 20.18 19.53 18.95 693 9. Space heating requires ment: 19.04 88.513 96.36 94.83 0.66 0.49 0.33 0.24 0.7 0.48 0.75 0.90 0.95 0.95 19. Space heating requires ment: 19. Space heating requires ment: 19. Space heating requires ment: 19. Space heating requirement. 19. Spa	Mean internal temperature in the rest of dwelling Tz (follow steps 3 to 7 in Table Sy) Image			_		0.46	0.31	0.20	0.24	0.45	0.74	0.91	0.95	(29)
18.26 18.70 19.24 19.73 19.95 20.02 20.03 20.03 19.98 19.64 18.88 18.18 90 19.00 19.00 19.00 19.00 19.00 19.00 19.00 19.00 19.39 19.85 20.28 20.47 20.54 20.55 20.55 20.50 20.18 19.53 18.95 19.00 19.00 19.39 19.85 20.28 20.47 20.54 20.55 20.55 20.50 20.18 19.53 18.95 19.00 19.00 19.39 19.85 20.28 20.47 20.54 20.55 20.55 20.50 20.18 19.53 18.95 19.00 19.00 19.39 19.85 20.28 20.47 20.54 20.55 20.55 20.50 20.18 19.53 18.95 19.00 19.00 19.39 19.85 20.28 20.47 20.54 20.55 20.55 20.50 20.18 19.53 18.95 19.00 19.00 19.00 19.39 19.85 20.28 20.47 20.54 20.55 20.55 20.50 20.18 19.53 18.95 19.00							1		0.21	0.15	0.71	0.51	0.55	(03)
Living area fraction Living area fraction Living area fraction 19.02 19.39 19.85 20.28 20.47 20.54 20.55 20.55 20.50 20.18 19.53 18.95 19.25 20.30	Diving a real fraction Diving a real Foundament Diving a real Di		_	1	1		1		20.03	19 98	19 64	18.88	18 18	(90)
Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2 19.02 19.39 19.85 20.28 20.47 20.54 20.55 20.55 20.50 20.18 19.53 18.95 (92) Apply adjustment to the mean internal temperature from Table 4e where appropriate 19.02 19.39 19.85 20.28 20.47 20.54 20.55 20.55 20.50 20.18 19.53 18.95 (93) 8. Space heating requirement: Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains, n/m 0.94 0.89 0.81 0.66 0.49 0.33 0.24 0.27 0.48 0.75 0.90 0.95 0.94 Useful gains, pmGm, w (94)m x (84)m 761.14 8851.3 966.36 948.36 791.87 546.51 366.75 383.06 574.56 734.67 734.30 720.33 0.95 Monthly average external temperature from Table U1 4.30 4.90 6.50 8.90 11.70 14.60 16.60 16.40 14.10 10.60 7.10 4.20 0.96 Heat loss rate for mean internal temperature, L/m, w (139)m x (193)m x (94)m 492.90 344.21 236.51 94.22 28.18 0.00 0.00 0.00 0.00 127.86 322.79 513.80 59ace heating requirement kWh/m/yvear 546.51 94.22 28.18 0.00 0.00 0.00 0.00 127.86 322.79 513.80 59ace heating requirement individual heating systems including micro-CHP 59ace heating from main systems 1 - (201) =	Mean internal temperature for the whole dwelling flax x T1 + (1 - fLA) x T2 2.055 20.55 20.50 20.18 19.53 18.95 19.20 2.047 20.54 20.55 20.55 20.50 20.18 19.53 18.95 19.20 2.040 2.040 2.040 2.055 2.055 20.50 20.18 19.53 18.95 19.20 2.040 2.040 2.040 2.055 2.055 2.055 2.050 2.018 19.53 18.95 19.20 2.040 2.040 2.045 2.055 2.055 2.055 2.050 2.018 19.53 18.95 19.20 2.040 2.045		10.70	13.24	13.73	13.33	20.02	20.03	20.03					` '
19.02 19.39 19.85 20.28 20.47 20.54 20.55 20.55 20.50 20.18 19.53 18.95 92.	19.02 19.39 19.85 20.28 20.47 20.54 20.55 20.55 20.50 20.18 19.53 18.95 20.55 20.50 20.18 19.53 18.95 20.55 20.50 20.18 19.53 18.95 20.55 20.50 20.18 19.53 18.95 20.55 20.50 20.18 19.53 18.95 20.55 20.50 20.18 19.53 18.95 20.55 20.55 20.50 20.18 19.53 18.95 20.55 20.55 20.50 20.18 19.53 18.95 20.55 20.55 20.50 20.18 19.53 18.95 20.5	-	re for the wi	hole dwellin	ng flAx T1⊣	⊦(1 - fl Δ) x ⁻	Т2			Li	ville area .	() -	0.54	(31)
Apply adjustment to the mean internal temperature from Table 4e where appropriate 19.02 19.39 19.85 20.28 20.47 20.54 20.55 20.55 20.50 20.18 19.53 18.95 (33) 8. Space heating requirements 19.02 19.39 19.85 20.28 20.47 20.54 20.55 20.55 20.50 20.18 19.53 18.95 (33) 8. Space heating requirements 19.02 19.39 19.85 20.28 20.47 20.54 20.55 20.55 20.50 20.18 19.53 18.95 (33) 8. Space heating requirements 19.02 19.39 19.85 20.28 20.47 20.54 20.55 20.55 20.50 20.18 19.53 18.95 (33) 8. Space heating requirements 19.02 19.39 19.85 20.28 20.47 20.54 20.55 20.55 20.50 20.18 19.53 18.95 (33) 8. Space heating requirements from Table U1 10. Space heating requirement from Table U1 10. Space heating requirement hid with the properties of the pr	Apply a djustment to the mean internal temperature from lable 4e where appropriate internal temperature from lable 4e where is a part of the mean internal temperature internal t	-		1	-		1	20.55	20.55	20.50	20.18	19 53	18 95	(92)
Sepace heating requirements Sepace heat from main system Sepace heating requirements Sepace heating requirements Sepace heat from sepace	Space heating requirement Feb. Mar Apr May				1		Į.	1	20.33	20.30	20.10	13.33	10.55	(32)
Sepace heating requirements Sepace heating full not page heat from main system Sepace heat for main system Sepace heat for main system Sepace heat from main system Sepace	Subsect Subs				_				20.55	20.50	20.18	19.53	18.95	(93)
Section Feb. Mark Apr May Jun Jul Aug Sep Oct Nov Decimal Process Proc	Second S	13.02	13.33	13.03	20.20	20.17	20.51	20.33	20.33	20.30	20.10	13.33	10.55	(33)
Useful gains, nmm, w (94)m x (84)m Useful gains, nmm, w (94)m x (84)m To fi.1.4	Useful gains, mmGm, W 94 m x (84)m 761.14 851.31 966.36 948.36 791.87 546.51 366.75 383.06 574.56 734.67 734.30 720.33 (95) 701.14 825.13 966.36 948.36 791.87 546.51 366.75 383.06 574.56 734.67 734.30 720.33 (95) 701.14 825.13 966.36 948.36 791.87 546.51 366.75 383.06 574.56 734.67 734.30 720.33 (95) 701.14 825.13 966.36 948.36 791.87 546.51 366.75 383.06 574.56 734.67 734.30 720.33 (95) 701.14 301.40	8. Space heating require	ment											
Section Sect	Section Sect	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Seption Sept	Space heating requirement Wh/m²/year Space heating requirement Wh/m²/year Space heating requirement Wh/m²/year Space heating requirement Space heat from main system Space heat from main system Space heating fuel (main system Tspace heating	Utilisation factor for gain	s, ηm											
Tell	761.14 885.13 966.36 948.36 791.87 546.51 366.75 383.06 574.56 734.67 734.30 720.33 95 Monthly average external temperature from Table U1 4.90 16.60 16.40 14.10 10.60 7.10 4.20 96 Heat loss rate for mean intemperature, Lm, W [(39)m \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	0.94	0.89	0.81	0.66	0.49	0.33	0.24	0.27	0.48	0.75	0.90	0.95	(94)
Monthly average external temperature from Table U1 4.30	Monthly average external temperature from Table U1 4.30 4.90 6.50 8.90 11.70 14.60 16.60 16.40 14.10 10.60 7.10 4.20 (96) Heat loss rate for mean internal temperature, tm, W (193)m × (193)	Useful gains, ηmGm, W (94)m x (84)n	n										
## Heat loss rate for mean internal temperature, Lm, W [(39)m × [(93)m - (96)m)] ## Heat loss rate for mean internal temperature, Lm, W [(39)m × [(93)m - (96)m)] ## ## ## ## ## ## ## ## ## ## ## ## ##	Heat loss rate for mean intermely ture, Lm, W (39)m x (93)m x (93)	761.14	885.13	966.36	948.36	791.87	546.51	366.75	383.06	574.56	734.67	734.30	720.33	(95)
Heat loss rate for mean intermal temperature, Lm, W [(39)m x [(93)m - (96)m] 1423.63 1397.35 1284.25 1079.21 829.76 553.75 368.27 385.72 600.22 906.52 1182.63 1410.93 (97) Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m 492.90 344.21 236.51 94.22 28.18 0.00 0.00 0.00 0.00 127.86 322.79 513.80 [598]15, 1012 = 2160.47 (98) (98) ÷ (4) 24.58 (99) 92. Energy requirements - individual heating systems including micro-CHP Space heating Fraction of space heat from secondary/supplementary system (table 11) 1.00 (202) Fraction of space heat from main systems 1 - (201) = 1.00 (202) Fraction of space heat from main systems 1 - (201) = 1.00 (202) Fraction of total space heat from main systems 1 - (201) = 1.00 (202) Fraction of total space heat from main systems 1 - (201) = 1.00 (204) Fraction of total space heat from main system 1 - (201) = 1.00 (204) Fraction of total space heat from main systems 1 - (201) = 1.00 (204) Fraction of total space heat from main system 1 - (201) = 1.00 (204) Fraction of total space heat from main systems 1 - (201) = 1.00 (204) Fraction of total space heat from main systems 1 - (201) = 1.00 (204) Fraction of total space heat from main systems 1 - (201) = 1.00 (204) Fraction of total space heat from main systems 1 - (201) = 1.00 (204) Fraction of total space heat from main systems 1 - (201) = 1.00 (204) Fraction of total space heat from main systems 1 - (201) = 1.00 (204) Fraction of total space heat from main systems 1 - (201) = 1.00 (204) Fraction of total space heat from main systems 1 - (201) = 1.00 (204) Fraction of total space heat from main systems 1 - (201) = 1.00 (204) Fraction of total space heat from main systems 1 - (201) = 1.00 (204) Fraction of total space heat from main systems 1 - (201) = 1.00 (204) Fraction of total space heat from main systems 1 - (201)	Heat loss rate for mean intermal temperature, Lm, W \ [(39)m \ 1(93)m \ 96)m] 1423.63 \ 1397.35 \ 1284.25 \ 1079.21 \ 829.76 \ 553.75 \ 368.27 \ 385.72 \ 600.22 \ 906.52 \ 1182.63 \ 1410.93 \ (97) Space heating requirement, \Wh/morth 0.024 \ x \ ((97)m \ 95)m] \ x \ (41) \ 200.00 \ 0.00 \ 0.00 \ 0.00 \ 0.00 \ 0.00 \ 127.86 \ 322.79 \ 513.80 Space heating requirement \Wh/m²/year \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	Monthly average externa	l temperatur	re from Tab	le U1									
1423.63 1397.35 1284.25 1079.21 829.76 553.75 368.27 385.72 600.22 906.52 1182.63 1410.93 97	1423.63 1397.35 1284.25 1079.21 829.76 553.75 368.27 385.72 600.22 906.52 1182.63 1410.93 97) Space heating requirement, kWh/morth	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)
Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m 492.90 344.21 236.51 94.22 28.18 0.00 0.00 0.00 127.86 322.79 513.80 \[\frac{\gamma(98)}{\gamma(98)} \frac{1}{344.21} \frac{236.51}{236.51} 94.22 28.18 0.00 0.00 0.00 0.00 127.86 322.79 513.80 \[\frac{\gamma(98)}{\gamma(98)} \frac{1}{1	Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m	Heat loss rate for mean in	iternal temp	erature, Lm	n, W [(39)m	x [(93)m -	(96)m]							
492.90 344.21 236.51 94.22 28.18 0.00 0.00 0.00 0.00 127.86 322.79 \$13.80 5(98) \(\triangle \tri		1423.6	3 1397.35	1284.25	1079.21	829.76	553.75	368.27	385.72	600.22	906.52	1182.63	1410.93	(97)
Space heating requirements	\$\sigma_{\indisy\cind\cind\cind\tai\sigma_{\inin\tinin\tinin\cind\cind\tinin\tinin\cind\tinin\tiin\tinin\tinin\tinin\tinin\tinin\tinin\tinin\tiin\tinin\tinin\tiin\tinin\tinin\tinin\tinin\t	Space heating requireme	nt, kWh/mor	nth 0.024 x	[(97)m - (9	5)m] x (41)	m							
Space heating requirement kWh/m²/year	Space heating requirements Wh/m²/year Pa. Energy requirements Fraction of space heat from solution system	492.90	344.21	236.51	94.22	28.18	0.00	0.00	0.00	0.00	127.86	322.79	513.80	
9a. Energy requirements - individual heating systems including micro-CHP Space heating Fraction of space heat from secondary/supplementary system (table 11)	Sack pace Pack product Pack									∑(98	8)15, 10	.12 = 2	2160.47	(98)
Space heating Space heat from secondary/supplementary system (table 11)	Space heating Fraction of space heat from secondary/supplementary system (table 11) 0.00 (201) Fraction of space heat from main system(s) 1 - (201) = 1.00 (202) Fraction of space heat from main system 2 2020 x [1 - (203)] = 1.00 (202) Fraction of total space heat from main system 1 2020 x [20] x [20] x [20] = 0.00 (202) Fraction of total space heat from main system 1 2020 x [20] x [20] x [20] = 0.00 (202) Fraction of total space heat from main system 1 30.00 2020 x [20] x [20] x [20] x [20] = 0.00 2020 x [20] x [Space heating requireme	nt kWh/m²/y	year							(98)	÷ (4)	24.58	(99)
Space heating Space heat from secondary/supplementary system (table 11)	Space heating Fraction of space heat from secondary/supplementary system (table 11) 0.00 (201) Fraction of space heat from main system(s) 1 - (201) = 1.00 (202) Fraction of space heat from main system 2 2020 x [1 - (203)] = 1.00 (202) Fraction of total space heat from main system 1 2020 x [20] x [20] x [20] = 0.00 (202) Fraction of total space heat from main system 1 2020 x [20] x [20] x [20] = 0.00 (202) Fraction of total space heat from main system 1 30.00 2020 x [20] x [20] x [20] x [20] = 0.00 2020 x [20] x [0	المسالة المالية	l baatina ar	otomo in di	alia e naisna	CUD							
Fraction of space heat from secondary/supplementary system (table 11) Fraction of space heat from main system(s) Fraction of space heat from main system 2 Fraction of space heat from main system 2 Fraction of total space heat from main system 1 Fraction of total space heat from main system 2 Fraction of total space heat from main system 2 Fraction of total space heat from main system 2 Fraction of total space heat from main system 2 Fraction of total space heat from main system 2 Fraction of total space heat from main system 2 Fraction of total space heat from main system 2 Fraction of total space heat from main system 2 Fraction of total space heat from main system 2 Fraction of total space heat from main system 2 Fraction of total space heat from main system 1 Fraction of total space heat fro	Fraction of space heat from main system(s) Fraction of space heat from main system(s) Fraction of space heat from main system(s) Fraction of space heat from main system 1 Fraction of space heat from main system 2 Fraction of total space heat from main system 2 Fraction of tot		s - Individual	i neating sy	stems inclu	iding micro	э-снр							
Fraction of space heat from main system 2 Fraction of space heat from main system 2 Fraction of total space heat from main system 1 Fraction of total space heat from main system 1 Fraction of total space heat from main system 2 Fraction of total space heat from main system 2 Fraction of total space heat from main system 2 Fraction of total space heat from main system 2 Fraction of total space heat from main system 2 Fraction of total space heat from main system 2 Fraction of total space heat from main system 2 Fraction of total space heat from main system 2 Fraction of total space heat from main system 2 Fraction of total space heat from main system 1	Fraction of space heat from main system 1	Space nearing												
Fraction of space heat from main system 2	Fraction of space heat from main system 1 Fraction of total space heat from main system 1 Fraction of total space heat from main system 1 Fraction of total space heat from main system 2 Fraction of total space heat from main system 2 Efficiency of main system 1 (%) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Fraction of space heat fro	m cacandan	v/sunnlama	ntary cycto	m (tahla 11	1)						0.00	(201)
Fraction of total space heat from main system 1 Fraction of total space heat from main system 2 Efficiency of main system 1 (%) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Space heating fuel (main system 1), kWh/month 528.86 369.32 253.77 101.09 30.24 0.00 0.00 0.00 0.00 137.19 346.34 551.29 \[\begin{array}{c c c c c c c c c c c c c c c c c c c	Fraction of total space heat from main system 1 Fraction of total space heat from main system 2 Efficiency of main system 1 (%) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Space heating fuel (main system 1), kWh/month 528.86 369.32 253.77 101.09 30.24 0.00 0.00 0.00 137.19 346.34 551.29 \[\begin{array}{c ccccccccccccccccccccccccccccccccccc	•	•		entary syste	m (table 11	L)				1 (2	01) -		
Fraction of total space heat from main system 2 (202) x (203) = 0.00 (205) (206) (20	Fraction of total space heat from main system 2 (202) x (203) = 0.00 (205) (20	Fraction of space heat fro	om main syste	em(s)	entary syste	m (table 11	L)				1 - (2	01) =	1.00	(202)
Efficiency of main system 1 (%) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Space heating fuel (main system 1), kWh/month 528.86 369.32 253.77 101.09 30.24 0.00 0.00 0.00 137.19 346.34 551.29 \[\begin{array}{c c c c c c c c c c c c c c c c c c c	Efficiency of main system 1 (%) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Space heating fuel (main system 1), kWh/month 528.86 369.32 253.77 101.09 30.24 0.00 0.00 0.00 0.00 137.19 346.34 551.29 \[\begin{array}{c c c c c c c c c c c c c c c c c c c	Fraction of space heat fro	om main systo om main systo	rem(s)	entary syste	m (table 11	1)			lar.			0.00	(202) (202)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Space heating fuel (main system 1), kWh/month Space heating fuel (main sy	Fraction of space heat from Fraction of space heat from Fraction of total space heat from Fraction of Space heat from Frac	om main systom om main systom oat from mair	eem(s) eem 2 n system 1	entary syste	m (table 11	L)			(20)2) x [1- (20	03)] =	1.00 0.00 1.00	(202) (202) (204)
Space heating fuel (main system 1), kWh/month	Space heating fuel (main system 1), kWh/month 528.86 369.32 253.77 101.09 30.24 0.00 0.00 0.00 137.19 346.34 551.29 Σ(211)15, 1012 = 2318.10 (211) Water heating Efficiency of water heater 89.29 89.14 88.82 88.19 87.49 87.00 87.00 87.00 87.00 88.39 89.07 89.34 (217) Water heating fuel, kWh/month 210.90 185.79 194.80 174.46 171.29 152.42 144.98 161.04 161.38 180.57 191.24 205.26 Σ(219a)112 = 2134.13 (219) Annual totals Space heating fuel - main system 1	Fraction of space heat from Fraction of space heat from Fraction of total space heat Fraction of total space heat from Fraction of Space heat from Fra	om main systo om main systo at from mair at from mair	eem(s) eem 2 n system 1	entary syste	m (table 11	L)			(20)2) x [1- (20	03)] =	1.00 0.00 1.00 0.00	(202) (202) (204) (205)
528.86 369.32 253.77 101.09 30.24 0.00 0.00 0.00 137.19 346.34 551.29 Σ(211)15, 1012 = 2318.10 (211) Water heating Efficiency of water heater 89.29 89.14 88.82 88.19 87.49 87.00 87.00 87.00 87.00 88.39 89.07 89.34 (217) Water heating fuel, kWh/month 210.90 185.79 194.80 174.46 171.29 152.42 144.98 161.04 161.38 180.57 191.24 205.26	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Fraction of space heat from Fraction of space heat from Fraction of total space heat from Fraction of S	om main systo om main systo oat from mair at from mair 1 (%)	em(s) em 2 n system 1 n system 2					•		02) x [1- (20 (202) x (2	03)] =	1.00 0.00 1.00 0.00 93.20	(202) (202) (204) (205)
$\Sigma(211)15, \ 1012 = \boxed{2318.10} \tag{211}$ Water heating Efficiency of water heater $\boxed{89.29 89.14 88.82 88.19 87.49 87.00 87.00 87.00 87.00 88.39 89.07 89.34} \tag{217}$ Water heating fuel, kWh/month $\boxed{210.90 185.79 194.80 174.46 171.29 152.42 144.98 161.04 161.38 180.57 191.24 205.26}$	Space heating fuel - main system 1 Σ(211)15, 1012 =	Fraction of space heat from Fraction of space heat from Fraction of total space heat from Fraction of total space heat from Fraction of total space heat from Fraction of Space heat from Fract	om main systo om main systo at from main at from main 1 (%)	n system 1 n system 2 Mar				Jul	Aug		02) x [1- (20 (202) x (2	03)] =	1.00 0.00 1.00 0.00 93.20	(202) (202) (204) (205)
Water heating Efficiency of water heater 89.29 89.14 88.82 88.19 87.49 87.00 87.00 87.00 87.00 88.39 89.07 89.34 (217) Water heating fuel, kWh/month 210.90 185.79 194.80 174.46 171.29 152.42 144.98 161.04 161.38 180.57 191.24 205.26	Water heating Efficiency of water heater 89.29 89.14 88.82 88.19 87.49 87.00 87.00 87.00 87.00 88.39 89.07 89.34 (217) Water heating fuel, kWh/month 210.90 185.79 194.80 174.46 171.29 152.42 144.98 161.04 161.38 180.57 191.24 205.26 ∑(219a)112 = 2134.13 (219) Annual totals Space heating fuel - main system 1	Fraction of space heat from Fraction of space heat from Fraction of total space heat Fraction of total space heat from Fraction of total space	om main systo om main systo at from mair at from mair 1 (%) Feb system 1), k\	em(s) em 2 n system 1 n system 2 Mar Wh/month	Apr	May	Jun			Sep	02) x [1- (20 (202) x (2 Oct	(3)] = (3) (3) = (3) (Nov	1.00 0.00 1.00 0.00 93.20 Dec	(202) (202) (204) (205)
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89.29 89.14 88.82 88.19 87.49 87.00 87.00 87.00 87.00 88.39 89.07 89.34 (217) Water heating fuel, kWh/month 210.90 185.79 194.80 174.46 171.29 152.42 144.98 161.04 161.38 180.57 191.24 205.26	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Fraction of space heat from Fraction of space heat from Fraction of total space heat Fraction of total space heat Efficiency of main system Jan Space heating fuel (main 528.86)	om main systo om main systo at from mair at from mair 1 (%) Feb system 1), k\	em(s) em 2 n system 1 n system 2 Mar Wh/month	Apr	May	Jun			Sep	02) x [1- (20 (202) x (2 Oct	Nov 346.34	1.00 0.00 1.00 0.00 93.20 Dec	(202) (202) (204) (205) (206)
Water heating fuel, kWh/month 210.90 185.79 194.80 174.46 171.29 152.42 144.98 161.04 161.38 180.57 191.24 205.26	Water heating fuel, kWh/month 210.90 185.79 194.80 174.46 171.29 152.42 144.98 161.04 161.38 180.57 191.24 205.26 Σ(219a)112 = 2134.13 (219) Annual totals Space heating fuel - main system 1	Fraction of space heat from Fraction of space heat from Fraction of total space heat from Jan Space heating fuel (main 528.86)	om main system main system main system at from main at from main 1 (%) Feb system 1), kt 369.32	em(s) em 2 n system 1 n system 2 Mar Wh/month	Apr	May	Jun			Sep	02) x [1- (20 (202) x (2 Oct	Nov 346.34	1.00 0.00 1.00 0.00 93.20 Dec	(202) (202) (204) (205) (206)
210.90 185.79 194.80 174.46 171.29 152.42 144.98 161.04 161.38 180.57 191.24 205.26	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Fraction of space heat from Fraction of space heat from Fraction of total space heat from Jan Space heating fuel (main 528.86) Water heating Efficiency of water heate	om main systom main systom main systom main systom main systom main at from main 1 (%) Feb system 1), kv 369.32	em(s) em 2 n system 1 n system 2 Mar Wh/month 253.77	Apr 101.09	May 30.24	Jun 0.00	0.00	0.00	Sep 0.00 Σ(21:	O2) x [1- (20 (202) x (2 Oct 137.19 1)15, 10	Nov 346.34 .12 = 2	1.00 0.00 1.00 0.00 93.20 Dec 551.29	(202) (202) (204) (205) (206)
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$\Sigma(219a)112 = 2134.13$ (219)	Annual totals Space heating fuel - main system 1 2318.10	Fraction of space heat from Fraction of space heat from Fraction of total space heat from Jan Space heating fuel (main 528.86) Water heating Efficiency of water heate 89.29 Water heating fuel, kWhy	om main system main system main system at from main at from main at from main 1 (%) Feb system 1), kl 369.32	mem(s) em 2 n system 1 n system 2 Mar Wh/month 253.77	Apr 101.09	May 30.24	Jun 0.00	87.00	87.00	Sep 0.00 Σ(21:	O2) x [1- (20 (202) x (2 Oct 137.19 1)15, 10	Nov 346.34 .12 = 2	1.00 0.00 1.00 0.00 93.20 Dec 551.29 2318.10	(202) (202) (204) (205) (206) (211)
Amusual Andreia	Space heating fuel - main system 1 2318.10	Fraction of space heat from Fraction of space heat from Fraction of total space heat from Jan Space heating fuel (main 528.86) Water heating Efficiency of water heate 89.29 Water heating fuel, kWhy	om main system main system main system at from main at from main at from main 1 (%) Feb system 1), kl 369.32	mem(s) em 2 n system 1 n system 2 Mar Wh/month 253.77	Apr 101.09	May 30.24	Jun 0.00	87.00	87.00	Sep 0.00 Σ(21:	02) x [1- (20 (202) x (2 Oct 137.19 1)15, 10 88.39	Nov 346.34 .12 = 2	1.00 0.00 1.00 0.00 93.20 Dec 551.29 2318.10	(202) (202) (204) (205) (206) (211)
		Fraction of space heat from Fraction of space heat from Fraction of total space heat from Jan Space heating fuel (main 528.86) Water heating Efficiency of water heate 89.29 Water heating fuel, kWhy 210.90	om main system main system main system at from main at from main at from main 1 (%) Feb system 1), kl 369.32	mem(s) em 2 n system 1 n system 2 Mar Wh/month 253.77	Apr 101.09	May 30.24	Jun 0.00	87.00	87.00	Sep 0.00 Σ(21:	02) x [1- (20 (202) x (2 Oct 137.19 1)15, 10 88.39	Nov 346.34 .12 = 2	1.00 0.00 1.00 0.00 93.20 Dec 551.29 2318.10	(202) (202) (204) (205) (206) (211)
	water neating ruel 2134.13	Fraction of space heat from Fraction of space heat from Fraction of total space heat from Jan Space heating fuel (main 528.86) Water heating Efficiency of water heate 89.29 Water heating fuel, kWhy 210.90 Annual totals	om main system main system main system main system at from main at from system 1), kN is 369.32	mem(s) em 2 n system 1 n system 2 Mar Wh/month 253.77	Apr 101.09	May 30.24	Jun 0.00	87.00	87.00	Sep 0.00 Σ(21:	02) x [1- (20 (202) x (2 Oct 137.19 1)15, 10 88.39	Nov 346.34 .12 = 2 89.07	1.00 0.00 1.00 0.00 93.20 Dec 551.29 2318.10 89.34 205.26	(202) (202) (204) (205) (206) (211)
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		Fraction of space heat from Fraction of space heat from Fraction of total space heat from Jan Space heating fuel (main 528.86) Water heating Efficiency of water heate 89.29 Water heating fuel, kWhy 210.90 Annual totals Space heating fuel - main from Fraction of Space heating fuel - main fraction of Space	om main system main system main system main system at from main at from system 1), kN is 369.32	em(s) em 2 n system 1 n system 2 Mar Wh/month 253.77	Apr 101.09	May 30.24	Jun 0.00	87.00	87.00	Sep 0.00 Σ(21:	02) x [1- (20 (202) x (2 Oct 137.19 1)15, 10 88.39	Nov 346.34 .12 = 2 89.07 191.24 .12 = 2	1.00 0.00 1.00 0.00 93.20 Dec 551.29 2318.10 89.34 205.26 2134.13	(202) (202) (204) (205) (206) (211)

Electricity for pumps, fans and electric keep-hot (Table 4f)			
mechanical ventilation fans - balanced, extract or positive input from outside	204.97		(230a)
central heating pump or water pump within warm air heating unit	30.00		(230c)
boiler flue fan	45.00		(230e)
Total electricity for the above, kWh/year		279.97	(231)
Electricity for lighting (Appendix L)		370.24	(232)
Total delivered energy for all uses	(211)(221) + (231) + (232)(237b) =	5102.44	(238)

Space heating - main system 1 2318.10 x 3.48 $x 0.01 =$ Water heating 2134.13 x 3.48 $x 0.01 =$ Pumps and fans 279.97 x 13.19 $x 0.01 =$ Electricity for lighting 370.24 x 13.19 $x 0.01 =$,	x 0.01 =	3.48			
Pumps and fans 279.97 x 13.19 x 0.01 =	01 = 74.27 (247)			X	2318.10	Space heating - main system 1
		x 0.01 =	3.48	x	2134.13	Water heating
Electricity for lighting 370.24 x 13.19 x 0.01 =	01 = 36.93 (249)	x 0.01 =	13.19	x	279.97	Pumps and fans
	01 = 48.84 (250)	x 0.01 =	13.19	x	370.24	Electricity for lighting
Additional standing charges	120.00 (251)					Additional standing charges
Total energy cost (240)(242) + (245)(254) :	.(254) = 360.70 (255)	(245)(254) =	(240)(242) +			Total energy cost

11a. SAP rating - individual heating systems including micro-CHP		
Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.14	(257)
SAP value	84.10	
SAP rating (section 13)	84	(258)
SAP band	В	

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	2318.10	x	0.216	=	500.71	(261
Water heating	2134.13	x	0.216	=	460.97	(264)
Space and water heating			(261) + (262) +	(263) + (264) =	961.68	(265)
Pumps and fans	279.97	x	0.519	=	145.31	(267)
Electricity for lighting	370.24	x	0.519	=	192.16	(268)
Total CO₂, kg/year				(265)(271) =	1299.14	(272)
Dwelling CO₂ emission rate				(272) ÷ (4) =	14.78	(273)
El value					86.90]
EI rating (section 14)					87	(274)
EI band					В]

	Energy kWh/year		Primary factor		Primary Energy kWh/year	,
Space heating - main system 1	2318.10	x	1.22	=	2828.08	(261
Water heating	2134.13	x	1.22	=	2603.63	(264
Space and water heating			(261) + (262) + (263) + (264) =	5431.71	(265
Pumps and fans	279.97	x	3.07	=	859.51	(267
Electricity for lighting	370.24	x	3.07	=	1136.65	(268
Primary energy kWh/year					7427.88	(272
Dwelling primary energy rate kWh/m2/year					84.50	(273