Doherty Design & Planning Limited

ENERGY STATEMENT

(To Accompany Detailed Planning Application)

Site 6 STREATLEY PLACE, LONDON, NW3 1HP

Proposal ERECTION OF FOUR RESIDENTIAL UNITS

> 22nd DECEMBER 2016 Ref. E338-ES-00

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CONTENTS

1.0	SUMMARY OF RECOMMENDATIONS	3
2.0	INTRODUCTION	4
3.0	POLICY CONTEXT	6
4.0	LOW CARBON AND RENEWABLE ENERGY SYSTEMS	9
4.1	Introduction	9
4.2	Baseline Carbon Dioxide Emissions	. 10
4.3	Improved Baseline Carbon Dioxide Emissions – BE LEAN	
4.4	Supplying Energy Efficiently – BE CLEAN	
4.5	District Heat Network	
4.6	Combined Heat and Power	
4.7	Renewable Technologies Considered – BE GREEN	. 16
4.8	Renewables Toolkit Assessment	
4.9	Solar Photovoltaics	
4.10	Domestic Solar Hot Water System	
4.11	Annual Carbon Dioxide Emission Reduction	
4.12		
5.0	OVERHEATING	.28
6.0	CONCLUSION	.30
Apper	ndix A – TER Worksheets	.31
Apper	ndix B – DER Worksheets	.32

List of Tables

Table 1 – Baseline Carbon Dioxide Emissions	10
Table 2 – Actual Carbon Dioxide Emissions	13
Table 3 – Renewable Technology Feasibility Assessment	19
Table 4 – Photovoltaic Carbon Dioxide Emissions	21
Table 5 – Summary of Reduction in Carbon Dioxide Emissions	24
Table 6 – Carbon Dioxide Emissions after each stage of the Energy Hierarchy	26
Table 7 – Regulated carbon dioxide savings from each stage of the Energy Hierarchy	27

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 26.5% reduction in carbon dioxide emissions by making fabric and energy efficiency measures, with a further 40.6% reduction in carbon dioxide emissions by incorporating photovoltaic systems, resulting in a total reduction of 56.3% 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 Design and Planning 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 one and two 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
 - 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 (m ²)	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	82.9	856.91	518.67	38.93	184.18	1598.69	19.28
2	74.1	721.01	497.88	38.93	168.88	1426.7	19.25
3	104.1	922.71	549.2	38.93	214.73	1725.57	16.58
4	63.6	612.17	464.28	38.93	148.93	1264.31	19.88
Flat		TER (k	g/m²/yr)	Ar	ea (m²)	Emission	is (kg/yr)
1	1	19.28			82.9	1,5	98
2	2	19	9.25		74.1	1,4	26
3	3	16	5.58	104.1		1,7	26
4	4		9.88	63.6		1,264	
То	Total				324.7	6,0	14
Ва	Baseline Carbon Dioxide Emissions (kg/yr)					6,0	14

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 0.15 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.

- 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.
- 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.
- With regard to the heating, a combi boiler shall be provided in each dwelling to provide the heating and hot water.
- I) 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.
- 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.
- 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

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.
- 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	82.9	393.04	454.31	122.39	184.18	1153.92	18.94
2	74.1	317.48	438.77	113.53	168.88	1038.66	18.93
3	104.1	426.85	478.2	143.73	214.73	1263.51	16.07
4	63.6	308.23	414.79	90.87	148.66	962.55	19.75
Flat		Emiss	ing CO ₂ ion Rate m ² /yr)	Area (m	²)	Emissions	(kg/yr)
1		13.92			82.9	1,1	54
2		14.02			74.1	1,0	39
3		1	2.14		104.1	1,2	64
4		15.13		63.6		963	
Tota			(543.3	4,4	19	
	Total Residential Emissions (kg/yr)						19
Percentage I	-				gulations	26.5	%
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 26.5%.

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.
- 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 19,139 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
SystemCombined Heat and Power (CHP)Combined Heat and 		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 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	Wood pellet or wood chip fired or dual bio- diesel/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 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.
	fuels derived from plant material can provide boiler heat for space and water heating. Biomass can be burnt directly to provide heat in buildings. Wood from forests, urban tree pruning, farmed coppices or farm and factory waste, is the most common fuel	diesel/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 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

	Description	Commont
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 discreet location.	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 So	ource Heat Pumps	Feasible – 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 PhotoVo	oltaics	Feasible – YES
Solar PhotoV Solar Thermal Hot Water	Solar collectors for low temperature hot water systems require direct isolation, so the chosen location, orientation and tilt are critical.	

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
Wind Power	· · · · · · · · · · · · · · · · · · ·	buildings. 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.
- j) 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 (kgCO ₂ /yr)	Percentage Reduction (%)
No Renewables	4,419	-
Reduction by including 4.0 kWp PV system	1,793	40.6%

 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 40.6% and when combined with the fabric energy efficiency measures from in Table 2 above, a total reduction of 56.3% 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 63-No. panels are required on the proposed developments roof. An indicative layout is shown on the drawing 15012(PA)12. 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 13,386 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 and SBEM calculations for the commercial area, it has been calculated that the baseline carbon dioxide emissions figure for the development is 6,014 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 26.5% improvement in carbon dioxide emissions by fabric and energy efficiencies. In addition, a further reduction of 40.6% in carbon dioxide emissions is possible by the use of renewable technologies, resulting in a total reduction of 56.3%.
- 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	6,014	-		
Development incorporating Energy Efficiency Measures	4,419	26.5%		
Further Reduction in Carbon Dioxide Emissions by incorporating a Renewable Technology				
PV (4.0 kWp)	1,793	40.6%		
Percentage Improvement incorr system	56.3 %			

Table 5 – Summary of Reduction in Carbon Dioxide Emissions

e) It has been demonstrated that it is possible to achieve a 56.3% 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.
- I) 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	6.0
After energy demand reduction	b	4.4
After heat network / CHP	с	4.4
After renewable energy	d	2.6

 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	1.6	(a-b)/a*100	26.5%
Savings from heat network / CHP	b-c	0.0	(b-c)/a*100	0.0%
Savings from renewable energy	c-d	1.8	(c-d)/a*100	29.8%
Cumulative on site savings	a-d=e	3.4	(a-d)/a*100	56.3%
Annual Savings from off-set payment	a-e=f	2.6		
Cumulative savings for off-set payment	f*30=g	78.77		

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.

- 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.
- i) 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 <u>CONCLUSION</u>

- 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 26.5% reduction in carbon dioxide emissions by making improvements in fabric and energy efficiency measures, with a further 40.6% reduction in carbon dioxide emissions by incorporating a photovoltaic system, resulting in a total carbon dioxide emissions reduction of more than 56.3%. 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

TER Worksheet Design - Draft



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

Assessor name	Mr Jason Dohe	erty				As	sessor num	ber	2634		
Client						La	st modified		23/12	/2016	
Address	1 6 Streatley P	lace, London, I	NW3 1HP								
1. Overall dwelling dimens	sions										
			I	Area (m²)			age storey ight (m)		Vo	olume (m³)	
Lowest occupied				82.90] (1a) x		2.40] (2a) =		198.96	(3a)
Total floor area	(1a) + (1b) + (1c) + (1d)	.(1n) =	82.90	(4)						
Dwelling volume						(3a)	+ (3b) + (3d	c) + (3d)(3	3n) =	198.96	(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 fan	S						3	x 10 =		30	(7a)
Number of passive vents							0	x 10 =	- -	0	 (7b)
Number of flueless gas fires	5						0	x 40 =	-	0	(7c)
									Air	changes pei hour	r
Infiltration due to chimneys	s, flues, fans, PSV	s	(6a) + (6b) + (7	a) + (7b) + ((7c) =	30	÷ (5) =	=	0.15	(8)
If a pressurisation test has l	been carried out	or is intended,	proceed to	(17), otherw	vise continu	e from (9) t	o (16)				
Air permeability value, q50,	expressed in cul	oic metres per	hour per sq	uare metre	of envelop	e area				5.00	(17)
If based on air permeability	value, then (18)	= [(17) ÷ 20] +	(8), otherw	ise (18) = (1	6)					0.40	(18)
Number of sides on which t	he dwelling is sh	eltered								2	(19)
Shelter factor							1 -	[0.075 x (1	9)] =	0.85	(20)
Infiltration rate incorporation	ng shelter factor							(18) x (2	20) =	0.34	(21)
Infiltration rate modified fo	r monthly wind s	peed:									
Jan	Feb M	ar Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind spee	d 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 1.3	23 1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
Adjusted infiltration rate (a	llowing for shelte	er and wind fac	ctor) (21) x (22a)m							_
0.43	0.43 0.4		0.37	0.32	0.32	0.32	0.34	0.37	0.38	0.40	(22b)
Calculate effective air chang	ge rate for the ap	plicable case:									-
If mechanical ventilation	•	• •								N/A] (23a)
If balanced with heat red		-			able 4h					N/A	(23c)
d) natural ventilation or				_		1			1		Т.
0.59	0.59 0.		0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)
Effective air change rate	ntor (240) or (24	h) or (24c) or (24d) in (25)								
Effective air change rate - e	0.59 0.1		0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)



3. Heat losses a	and heat lo	ss paramet	er										
Element				Gross rea, m²	Openings m ²		area m²	U-value W/m²K	A x U W		value, /m².K	Ахк, kJ/K	
Window						16	5.05 x	1.33	= 21.28				(27)
Door						1.	.95 x	1.00	= 1.95				(26)
Roof window						2.	.72 x	1.59	= 4.33				(27a)
Ground floor						82	.90 x	0.13	= 10.78				(28a)
External wall						64	.76 x	0.18	= 11.66				(29a)
Party wall						36	5.72 x	0.00	= 0.00				(32)
Roof						33	.80 x	0.13	= 4.39				(30)
Total area of ext	ernal elem	ents ∑A, m²				202	2.18						(31)
Fabric heat loss,	W/K = ∑(A	× U)							(26	5)(30) + (3	32) =	54.39	(33)
Heat capacity Cr	n = ∑(А x к)							(28)	(30) + (32) +	- (32a)(32	2e) =	N/A	(34)
Thermal mass pa	arameter (T	·MP) in kJ/n	n²K									250.00	(35)
Thermal bridges	: Σ(L x Ψ) ca	alculated us	sing Appen	dix K								14.12	(36)
Total fabric heat	loss									(33) + (3	36) =	68.51	(37)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	-
Ventilation heat	loss calcula	ated month	ly 0.33 x (2	25)m x (5)									
	39.02	38.78	38.55	37.44	37.23	36.27	36.27	36.09	36.64	37.23	37.65	38.09	(38)
Heat transfer co	efficient, W	//K (37)m +	- (38)m								•		-
	107.53	107.29	107.05	105.95	105.74	104.78	104.78	104.60	105.15	105.74	106.16	106.60]
		•							Average = ∑	(39)112/	/12 =	105.95	(39)
Heat loss param	eter (HLP),	W/m²K (39	9)m ÷ (4)										_
	1.30	1.29	1.29	1.28	1.28	1.26	1.26	1.26	1.27	1.28	1.28	1.29	7
		•			· ·				Average = ∑	(40)112/	/12 =	1.28	(40)
Number of days	in month (Table 1a)											_
	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)
	L	•						•			•		-
4. Water heati		equiremen	t										-
Assumed occupa												2.52	(42)
Annual average	hot water ι	isage in litre	es per day	Vd,average	e = (25 x N) +	36						93.95	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage	in litres pe	r day for ea	ich month	Vd,m = fac	tor from Tab	ole 1c x (43	3)						_
	103.34	99.58	95.82	92.07	88.31	84.55	84.55	88.31	92.07	95.82	99.58	103.34	
										∑(44)1	.12 =	1127.34	(44)
Energy content	of hot wate	r used = 4.1	l8 x Vd,m x	nm x Tm/3	3600 kWh/m	onth (see	Tables 1b	, 1c 1d)					_
	153.25	134.03	138.31	120.58	115.70	99.84	92.52	106.17	107.43	125.20	136.67	148.41	
										∑(45)1	.12 =	1478.12	(45)
Distribution loss	0.15 x (45)m											_
	22.99	20.10	20.75	18.09	17.36	14.98	13.88	15.92	16.12	18.78	20.50	22.26	(46)
Water storage lo	oss calculate	ed for each	month (55	5) 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 con	tains dedica	ated solar s	torage or c	ledicated V	VWHRS (56)r	m x [(47) -	Vs] ÷ (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 lo	oss for each	month fro	m Table 3										_
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)
Combi loss for e	ach month	from Table	3a, 3b or 3	c									
	50.96	45.83	48.83	45.40	45.00	41.70	43.09	45.00	45.40	48.83	49.11	50.96	(61)

SAP version 9.92

ulated for each month $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$ ator boating T - + - 1 1-~~!~· - 4

Total heat requi	red for wat	er heating o	calculated f	or each mo	onth 0.85 x	(45)m + (4	6)m + (57)n	n + (59)m +	- (61)m				
	204.21	179.87	187.14	165.98	160.70	141.54	135.60	151.17	152.84	174.03	185.78	199.37	(62)
Solar DHW input	calculated	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 wa	ter heater f	or each mo	onth (kWh/i	month) (62	2)m + (63)m	ı							
	204.21	179.87	187.14	165.98	160.70	141.54	135.60	151.17	152.84	174.03	185.78	199.37]
										∑(64)1	.12 = 2	038.24	(64)
Heat gains from	water heat	ing (kWh/n	nonth) 0.2	5 × [0.85 × ((45)m + (61	.)m] + 0.8 ×	: [(46)m + (5	57)m + (59)	m]				
	63.70	56.02	58.20	51.44	49.72	43.62	41.53	46.55	47.07	53.84	57.72	62.09	(65)
			•	•		•				•	•	•	-
5. Internal gain	S												
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains	(Table 5)												
	125.78	125.78	125.78	125.78	125.78	125.78	125.78	125.78	125.78	125.78	125.78	125.78	(66)
Lighting gains (c	alculated in	Appendix	L, equation	L9 or L9a),	also see Ta	able 5							
	20.09	17.85	14.51	10.99	8.21	6.93	7.49	9.74	13.07	16.60	19.37	20.65	(67)
Appliance gains	(calculated	in Appendi	x L, equatio	on L13 or L1	L3a), also se	ee Table 5							
	225.39	227.73	221.84	209.29	193.45	178.57	168.62	166.28	172.18	184.72	200.56	215.45	(68)
Cooking gains (c	alculated ir	n Appendix	L, equation	L15 or L15	a), also see	Table 5							
	35.58	35.58	35.58	35.58	35.58	35.58	35.58	35.58	35.58	35.58	35.58	35.58	(69)
Pump and fan ga	ains (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. evap	oration (Ta	ble 5)											
	-100.62	-100.62	-100.62	-100.62	-100.62	-100.62	-100.62	-100.62	-100.62	-100.62	-100.62	-100.62	(71)
Water heating g	ains (Table	5)											
	85.61	83.37	78.22	71.45	66.83	60.59	55.82	62.57	65.38	72.36	80.17	83.45	(72)
Total internal ga	ins (66)m -	+ (67)m + (6	58)m + (69)	m + (70)m -	+ (71)m + (7	72)m							-
	394.83	392.68	378.31	355.46	332.23	309.82	295.67	302.32	314.36	337.42	363.84	383.29	(73)
												-	-

6. Solar gains

0. Solar gains							_							
			Access factor Table 6d		Area m²		Solar flux W/m ²		g specific data		FF specific d	lata	Gains W	
			Table	ou			vv/m		or Table 6b		or Table		vv	
								7		7		r		-
SouthEast			0.7	7 X	7.54	x	36.79	x 0.9 x	0.63	x	0.70	= [84.78	(77)
SouthWest			0.7	7 X	1.52	×	36.79] x 0.9 x	0.63] x	0.70	=	17.09	(79)
NorthWest			0.7	7 X	1.56	x	11.28] x 0.9 x	0.63	x	0.70	=	5.38	(81)
NorthEast			0.7	7 X	5.43	_ x [11.28	x 0.9 x	0.63	x	0.70	=	18.72	(75)
Horizontal			1.0	0 x [2.72	_ x [26.00	x 0.9 x	0.63	x	0.70	=	28.07	
Solar gains in wa	tts ∑(74)m	(82)m												
	154.05	280.89	429.47	601.30	731.94	751.	.09 714.0	5 613	3.68 488.9	5	323.00	187.98	3 129.54	(83)
Total gains - inte	rnal and so	lar (73)m +	(83)m											
	548.88	673.58	807.78	956.76	1064.17	1060	.91 1009.7	72 916	5.01 803.3	2	660.42	551.82	2 512.83	(84)
7. Mean interna	al tempera	ture (heatin	g season)											
Temperature dur	ring heating	g periods in	the living a	area from T	able 9, Th1	.(°C)							21.00	(85)
	Jan	Feb	Mar	Apr	May	Ju	n Jul	A	ug Sep		Oct	Nov	Dec	
Utilisation factor	for gains for	or living are	a n1,m (se	e Table 9a)	1									
	1.00	0.99	0.98	0.92	0.79	0.6	0 0.45	0.	51 0.78		0.96	0.99	1.00	(86)
Mean internal te	mp of livin	g area T1 (st	eps 3 to 7	in Table 90	:)									

	19.62	19.83	20.16	20.55	20.84	20.97	20.99	20.99	20.89	20.48	19.97	19.59	(87)
Temperature du			the rest of] (-)
	19.84	19.85	19.85	19.86	19.86	19.87	19.87	19.87	19.87	19.86	19.86	19.85	(88)
Utilisation factor					20100	20107	10107	10.07	20107	10.00	10.00	20100] (00)
	1.00	0.99	0.97	0.89	0.73	0.51	0.34	0.39	0.69	0.94	0.99	1.00	(89)
Mean internal te								0.00	0.05	0.51	0.55	1.00] (00)
	18.03	18.33	18.80	19.36	19.72	19.85	19.87	19.87	19.78	19.28	18.55	17.98	(90)
Living area fract		10.55	10.00	19.50	15.72	15.05	15.67	15.67		ving area ÷	·	0.54	(91)
Mean internal te		for the wh	ole dwellin	σ fl Δ x T1 +	·(1 - fl A) x T	2				ing area .	(4) =	0.54] (31)
	18.89	19.14	19.53	20.00	20.32	20.45	20.48	20.47	20.38	19.93	19.32	18.85	(92)
Apply adjustmer								20.47	20.38	19.93	19.52	10.05] (92)
	18.89	19.14	19.53	20.00	20.32	20.45	20.48	20.47	20.38	19.93	19.32	18.85	(93)
	10.09	19.14	19.55	20.00	20.52	20.45	20.48	20.47	20.58	19.95	19.52	10.05] (95)
8. Space heatir	ng requirem	ent											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains, r	յՠ											
	0.99	0.99	0.96	0.90	0.75	0.56	0.40	0.46	0.73	0.94	0.99	1.00	(94)
Useful gains, ηm	nGm, W (94)m x (84)m											-
	545.93	664.62	778.64	856.78	801.93	592.12	402.54	419.45	589.84	622.41	545.63	510.77	(95)
Monthly average	e external te		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	(96)
Heat loss rate fo	or mean inte	rnal tempe	rature, Lm		x [(93)m -	(96)m]				1	1	1], ,
	1568.70	1527.90	1395.17	1176.49	911.81	613.13	406.03	425.91	660.44	986.62	1297.05	1561.32	(97)
Space heating re] (-)
	760.94	580.13	458.70	230.20	81.75	0.00	0.00	0.00	0.00	270.98	541.03	781.61]
										1	·		(98)
Space heating re	equirement	kWh/m²/ve	ear							8)15 <i>,</i> 10	.12 = 3	3705.33]] (98)] (99)
Space heating re	equirement	kWh/m²/ye	ear							1	.12 = 3] (98)] (99)
Space heating re 9a. Energy requ		-		stems inclu	ding micro	-CHP				8)15 <i>,</i> 10	.12 = 3	3705.33	, , , ,
		-		stems inclu	ding micro	-CHP				8)15 <i>,</i> 10	.12 = 3	3705.33	, , , ,
9a. Energy requ	uirements -	individual	heating sys							8)15 <i>,</i> 10	.12 = 3	3705.33	, , , ,
9a. Energy requestions	uirements - e heat from	individual secondary,	heating sys /supplemen							8)15 <i>,</i> 10	.12 = 3 ÷ (4)	44.70] (99)
9a. Energy request Space heating Fraction of space	uirements - e heat from e heat from	individual secondary, main syste	heating sys /supplemen m(s)							8)15, 10 (98)	.12 = 3 ÷ (4)	0.00] (99)] (201)
9a. Energy request of space heating Fraction of space fraction fra	uirements - e heat from e heat from e heat from	individual secondary, main syste main syste	heating sys /supplemen m(s) m 2						∑(9ł	8)15, 10 (98)	.12 = 3 ÷ (4) D1) =	0.00 1.00] (99)] (201)] (202)
9a. Energy request of space heating Fraction of space Fraction Fra	e heat from e heat from e heat from e heat from space heat	individual secondary, main syste main syste from main	heating sys /supplemen m(s) m 2 system 1						∑(9ł	8)15, 10 (98) 1 - (20	12 = 3 ÷ (4) D1) = 3)] =	0.00 1.00 0.00] (99)] (201)] (202)] (202)
9a. Energy requests of space heating Praction of space Fraction of space Fraction of space Fraction of space Fraction of total	e heat from e heat from e heat from e heat from space heat space heat	individual secondary, main syste main syste from main from main	heating sys /supplemen m(s) m 2 system 1						∑(9ł	8)15, 10 (98) 1 - (20	.12 = 3 ÷ (4) 01) = 3)] = 03) = 33) =	0.00 1.00 1.00 1.00] (99)] (201)] (202)] (202)] (202)] (204)
9a. Energy requests of space heating Praction of space Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total	e heat from e heat from e heat from e heat from space heat space heat	individual secondary, main syste main syste from main from main	heating sys /supplemen m(s) m 2 system 1				Jul	Aug	∑(9ł	8)15, 10 (98) 1 - (20	.12 = 3 ÷ (4) 01) = 3)] = 03) = 33) =	0.00 1.00 0.00 0.00 0.00 0.00 0.00] (99)] (201)] (202)] (202)] (202)] (204)] (205)
9a. Energy requests of space heating Praction of space Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total	e heat from e heat from e heat from space heat space heat in system 1 Jan	individual secondary, main syste main syste from main from main (%) Feb	heating sys /supplemen m(s) m 2 system 1 system 2 Mar	ntary syster	n (table 11)			<u>Σ</u> (98 (20	8)15, 10 (98) 1 - (20)2) x [1- (20 (202) x (20	.12 = 3 ÷ (4)	0.00 1.00 0.00 0.00 0.00 0.00 0.00 93.40] (99)] (201)] (202)] (202)] (202)] (204)] (205)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of main	e heat from e heat from e heat from space heat space heat in system 1 Jan	individual secondary, main syste main syste from main from main (%) Feb	heating sys /supplemen m(s) m 2 system 1 system 2 Mar	ntary syster	n (table 11)			<u>Σ</u> (98 (20	8)15, 10 (98) 1 - (20)2) x [1- (20 (202) x (20	.12 = 3 ÷ (4)	0.00 1.00 0.00 0.00 0.00 0.00 0.00 93.40] (99)] (201)] (202)] (202)] (202)] (204)] (205)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of main	e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sys	individual secondary, main syste main syste from main from main (%) Feb stem 1), kW	heating sys /supplemen m(s) m 2 system 1 system 2 Mar /h/month	ntary system Apr	m (table 11 May) Jun	Jul	Aug	∑(98 (20 Sep 0.00	8)15, 10 (98) 1 - (20)2) × [1- (20 (202) × (20 Oct	.12 = 3 ÷ (4)	0.00 1.00 0.00 1.00 0.00 93.40 Dec] (99)] (201)] (202)] (202)] (202)] (204)] (205)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of main	e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sys	individual secondary, main syste main syste from main from main (%) Feb stem 1), kW	heating sys /supplemen m(s) m 2 system 1 system 2 Mar /h/month	ntary system Apr	m (table 11 May) Jun	Jul	Aug	∑(98 (20 Sep 0.00	8)15, 10 (98) 1 - (20)2) x [1- (20 (202) x (20 (202) x (20 Oct 290.13	.12 = 3 ÷ (4)	0.00 1.00 0.00 1.00 0.00 93.40 Dec 836.84] (99)] (201)] (202)] (202)] (202)] (204)] (205)] (206)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of main Space heating fu	e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sys 814.71	individual secondary, main syste main syste from main from main (%) Feb stem 1), kW	heating sys /supplemen m(s) m 2 system 1 system 2 Mar /h/month	ntary system Apr	m (table 11 May) Jun	Jul	Aug	∑(98 (20 Sep 0.00	8)15, 10 (98) 1 - (20)2) x [1- (20 (202) x (20 (202) x (20 Oct 290.13	.12 = 3 ÷ (4)	0.00 1.00 0.00 1.00 0.00 93.40 Dec 836.84] (99)] (201)] (202)] (202)] (202)] (204)] (205)] (206)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mai Space heating fu	e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sys 814.71	individual secondary, main syste main syste from main from main (%) Feb stem 1), kW	heating sys /supplemen m(s) m 2 system 1 system 2 Mar /h/month	ntary system Apr	m (table 11 May) Jun	Jul	Aug	∑(98 (20 Sep 0.00	8)15, 10 (98) 1 - (20)2) x [1- (20 (202) x (20 (202) x (20 Oct 290.13	.12 = 3 ÷ (4)	0.00 1.00 0.00 1.00 0.00 93.40 Dec 836.84] (99)] (201)] (202)] (202)] (202)] (204)] (205)] (206)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mai Space heating fu	e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sys 814.71 ter heater 88.06	individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 621.12	heating sys /supplemen m(s) m 2 system 1 system 2 Mar /h/month 491.11	Apr 246.46	m (table 11 May 87.53) Jun 0.00	Jul 0.00	Aug	Σ(98 (20 Sep 0.00 Σ(21:	8)15, 10 (98) 1 - (20)2) × [1- (20 (202) × (20 (202) × (20 Oct 290.13 1)15, 10	.12 = 3 ÷ (4)	0.00 1.00 0.00 1.00 0.00 1.00 0.00 93.40 Dec 836.84 8967.16] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (211)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mai Space heating fu Water heating Efficiency of wat	e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sys 814.71 ter heater 88.06	individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 621.12	heating sys /supplemen m(s) m 2 system 1 system 2 Mar /h/month 491.11	Apr 246.46	m (table 11 May 87.53) Jun 0.00	Jul 0.00	Aug	Σ(98 (20 Sep 0.00 Σ(21:	8)15, 10 (98) 1 - (20)2) × [1- (20 (202) × (20 (202) × (20 Oct 290.13 1)15, 10	.12 = 3 ÷ (4)	0.00 1.00 0.00 1.00 0.00 1.00 0.00 93.40 Dec 836.84 8967.16] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (211)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mai Space heating fu Water heating Efficiency of wat	e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sys 814.71 ter heater 88.06 uel, kWh/ma	individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 621.12 87.79 onth	heating sys /supplemen m(s) m 2 system 1 system 2 Mar /h/month 491.11	Apr 246.46 85.87	m (table 11 May 87.53 83.44) Jun 0.00 80.30	Jul 0.00 80.30	Aug 0.00 80.30	Σ(98 (20 Sep 0.00 Σ(21) 80.30	8)15, 10 (98) 1 - (20)2) × [1- (20 (202) × (20 (202) × (20 Oct 290.13 1)15, 10 86.16	12 = 3 ÷ (4) (4) (1) = (1) =	0.00 1.00 0.00 1.00 0.00 1.00 0.00 1.00 0.00 1.00 0.00 1.00 0.00 1.00 0.00 93.40 Dec 836.84 3967.16 88.15 226.18] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (211)] (217)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mai Space heating fu Water heating Efficiency of wat	e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sys 814.71 ter heater 88.06 uel, kWh/ma	individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 621.12 87.79 onth	heating sys /supplemen m(s) m 2 system 1 system 2 Mar /h/month 491.11	Apr 246.46 85.87	m (table 11 May 87.53 83.44) Jun 0.00 80.30	Jul 0.00 80.30	Aug 0.00 80.30	Σ(98 (20 Sep 0.00 Σ(21) 80.30	8)15, 10 (98) 1 - (20)2) x [1- (20 (202) x (20 (202) x (20 Oct 290.13 1)15, 10 86.16	12 = 3 ÷ (4) (4) (1) = (1) =	0.00 1.00 0.00 1.00 0.00 1.00 0.00 93.40 Dec 836.84 3967.16 888.15] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (211)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mail Space heating fu Water heating Efficiency of wat Water heating fu	e heat from e heat from e heat from space heat space heat in system 1 Jan Jel (main sys 814.71 ter heater 88.06 uel, kWh/mi 231.91	individual secondary, main syste from main from main (%) Feb stem 1), kW 621.12 87.79 onth 204.89	heating sys /supplemen m(s) m 2 system 1 system 2 Mar /h/month 491.11	Apr 246.46 85.87	m (table 11 May 87.53 83.44) Jun 0.00 80.30	Jul 0.00 80.30	Aug 0.00 80.30	Σ(98 (20 Sep 0.00 Σ(21) 80.30	8)15, 10 (98) 1 - (20)2) × [1- (20 (202) × (20 (202) × (20 Oct 290.13 1)15, 10 86.16	12 = 3 $(4) = 2$ $(4) = 2$ $(3) =$	0.00 1.00 0.00 1.00 0.00 1.00 0.00 1.00 0.00 1.00 0.00 1.00 0.00 1.00 0.00 93.40 Dec 836.84 3967.16 88.15 226.18 2401.23] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (211)] (217)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mai Space heating fu Water heating Efficiency of wat	e heat from e heat from e heat from space heat space heat in system 1 Jan Jel (main sys 814.71 ter heater 88.06 uel, kWh/mi 231.91	individual secondary, main syste from main from main (%) Feb stem 1), kW 621.12 87.79 onth 204.89	heating sys /supplemen m(s) m 2 system 1 system 2 Mar /h/month 491.11	Apr 246.46 85.87	m (table 11 May 87.53 83.44) Jun 0.00 80.30	Jul 0.00 80.30	Aug 0.00 80.30	Σ(98 (20 Sep 0.00 Σ(21) 80.30	8)15, 10 (98) 1 - (20)2) × [1- (20 (202) × (20 (202) × (20 Oct 290.13 1)15, 10 86.16	12 = 3 $(4) = 2$ $(4) = 2$ $(3) =$	0.00 1.00 0.00 1.00 0.00 1.00 0.00 1.00 0.00 1.00 0.00 1.00 0.00 1.00 0.00 93.40 Dec 836.84 3967.16 88.15 226.18] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (211)] (217)

TER Worksheet Design - Draft



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

Assessor name	Mr Jason Doherty					As	sessor num	ber	2634		
Client						Las	st modified		23/12	/2016	
Address	2 6 Streatley Place,	London, N	N3 1HP								
	,,	,									
1. Overall dwelling dimension	ons										
			А	area (m²)			age storey ight (m)		Vo	olume (m³)	
Lowest occupied				74.10] (1a) x		2.40	(2a) =		177.84	(3a)
Total floor area	(1a) + (1b) + (1	Lc) + (1d)(1n) =	74.10] (4)						
Dwelling volume						(3a)	+ (3b) + (3c	:) + (3d)(3	3n) =	177.84	(5)
2. Ventilation rate											
									m	³ per hour	
Number of chimneys							0	x 40 =		0	(6a)
Number of open flues							0	x 10		0] (60)
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)
C C									Air	changes per	•
										hour	1
Infiltration due to chimneys, f				+ (6b) + (7a			30	÷ (5) =		0.17	(8)
If a pressurisation test has been							0 (16)				1
Air permeability value, q50, ex						e area				5.00] (17)
If based on air permeability va			s), otherwi	se (18) = (10	D)					0.42] (18)
Number of sides on which the Shelter factor	aweiling is shelter	ed					1	[0.075 x (1	0)] _ [2	(19) (20)
Infiltration rate incorporating	shalter factor						1 -	(18) x (1		0.85) (20)] (21)
Infiltration rate modified for r		4.						(10) X (2		0.30] (21)
Jan	Feb Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind speed		Дрі	iviay	Jun	Jui	Aug	JCP	000	NOV	Dee	
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] (/
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 (allo					1	I	II			-1], ,
0.45	0.44 0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.40	0.42	(22b)
Calculate effective air change	rate for the application	able case:	•							•	-
If mechanical ventilation: a	air change rate thro	ough system								N/A	(23a)
	very: efficiency in %	6 allowing fo	or in-use fa	ctor from T	able 4h					N/A	(23c)
If balanced with heat recov				. I							
If balanced with heat record d) natural ventilation or wi	hole house positive	e input venti	ilation fron	niort							
	hole house positive	e input venti 0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59] (24d)
d) natural ventilation or w	0.60 0.60	0.58	0.57	1	0.56	0.55	0.56	0.57	0.58	0.59] (24d)



3. Heat losses	and heat lo	ss paramet	er										
Element				Gross rea, m²	Openings m ²		area m²	U-value W/m²K	A x U W	•	/alue, /m².K	Ахк, kJ/K	
Window						14	4.02 x	1.33	= 18.59				(27)
Door						1	.95 x	1.00	= 1.95				(26)
Roof window						2	.56 x	1.59	= 4.07				(27a)
Ground floor						74	.10 x	0.13	= 9.63				(28a)
External wall						55	5.32 x	0.18	= 9.96				(29a)
Party wall						36	6.72 x	0.00	= 0.00				(32)
Roof						29	9.20 x	0.13	= 3.80				(30)
Total area of ext	ternal elem	ents ∑A, m²				17	7.15						(31)
Fabric heat loss,	W/K = ∑(A	× U)							(26	5)(30) + (3	32) =	48.00	(33)
Heat capacity Cr	m = ∑(А x к)							(28)	.(30) + (32) +	- (32a)(32	2e) =	N/A	(34)
Thermal mass p	arameter (T	MP) in kJ/n	n²K									250.00	(35)
Thermal bridges	::Σ(L x Ψ) ca	alculated us	sing Appen	dix K								12.95	(36)
Total fabric heat	t loss									(33) + (3	36) =	60.95	(37)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat	loss calcula	ated month	ly 0.33 x (2	25)m x (5)									
	35.39	35.15	34.92	33.84	33.64	32.70	32.70	32.52	33.06	33.64	34.05	34.47	(38)
Heat transfer co	efficient, W	//K (37)m +	- (38)m										
	96.34	96.10	95.87	94.79	94.59	93.65	93.65	93.47	94.01	94.59	95.00	95.43	
									Average = ∑	(39)112/	/12 =	94.79	(39)
Heat loss param	eter (HLP),	W/m²K (39	9)m ÷ (4)										
	1.30	1.30	1.29	1.28	1.28	1.26	1.26	1.26	1.27	1.28	1.28	1.29]
									Average = ∑	(40)112/	/12 =	1.28	(40)
Number of days	in month (⁻	Table 1a)											
	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)
4. Water heati		equiremen	τ										
Assumed occupa												2.34	(42)
Annual average										. .		89.81	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage	-						-				07.00		٦
	98.79	95.20	91.60	88.01	84.42	80.83	80.83	84.42	88.01	91.60	95.20	98.79	
F			0	.			T-61-41	4 - 4 -1		∑(44)1	.12 =	1077.70	(44)
Energy content						•	1		1 4 9 9 7 9				٦
	146.50	128.13	132.22	115.27	110.61	95.45	88.44	101.49	102.70	119.69	130.65	141.88	
Distribution lass	0.45	\								∑(45)1	.12 =	1413.04	(45)
Distribution loss													
	21.98	19.22	19.83	17.29	16.59	14.32	13.27	15.22	15.41	17.95	19.60	21.28	(46)
Water storage lo		1						1				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	(56)
If the vessel con		1	-	1							1	1	٦
	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 l		1			<u>, .</u>		-		1				п, .
	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 e			1	1	<u> </u>		1		1		i	1	Т.
	50.34	43.82	46.68	43.40	43.02	39.86	41.19	43.02	43.40	46.68	46.95	50.34	(61)

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Total heat requ	ired for wat	er heating o	alculated f	or each mo	onth 0.85 x	(45)m + (4	6)m + (57)n	n + (59)m +	· (61)m				
	196.84	171.95	178.90	158.68	153.63	135.31	129.63	144.51	146.11	166.37	177.60	192.22	(62)
Solar DHW inpu	t calculated	l 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 wa	ater heater f	for each mo	onth (kWh/i	month) (62	2)m + (63)m	ı							
	196.84	171.95	178.90	158.68	153.63	135.31	129.63	144.51	146.11	166.37	177.60	192.22]
										∑(64)1	.12 = 1	951.74	(64)
Heat gains from	water heat	ing (kWh/n	nonth) 0.2	5 × [0.85 ×	(45)m + (61	.)m] + 0.8 ×	[(46)m + (5	57)m + (59)	m]				
	61.30	53.56	55.63	49.18	47.53	41.70	39.70	44.50	45.00	51.47	55.18	59.76	(65)
5. Internal gain	ns												
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains	(Table 5)												
	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	(66)
Lighting gains (o	calculated in	Appendix	L, equation	L9 or L9a),	also see Ta	able 5							
	18.42	16.36	13.31	10.08	7.53	6.36	6.87	8.93	11.99	15.22	17.76	18.94	(67)
Appliance gains	(calculated	in Appendi	x L, equatio	on L13 or L2	L3a), also se	ee Table 5							
	206.67	208.82	203.41	191.91	177.38	163.73	154.61	152.47	157.87	169.38	183.90	197.55	(68)
Cooking gains (calculated ir	n Appendix	L, equation	L15 or L15	a), also see	Table 5							
	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	(69)
Pump and fan g	ains (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. evap	oration (Ta	ble 5)											
	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	(71)
Water heating g	gains (Table	5)											
	82.39	79.70	74.78	68.30	63.89	57.92	53.37	59.81	62.50	69.18	76.64	80.32	(72)
Total internal g	ains (66)m -	+ (67)m + (6	8)m + (69)	m + (70)m ·	+ (71)m + (7	72)m							
	368.61	366.00	352.62	331.41	309.92	289.13	275.97	282.33	293.48	314.90	339.42	357.93	(73)

			Access f Table		Area m²		Solar flux W/m ²		g specific data or Table 6b	I	FF specific da or Table		Gains W	
SouthEast			0.7	7 x	6.55	x	36.79] x 0.9 x	0.63	x	0.70	=	73.65	(77)
NorthEast			0.7	7 X	1.44	x	11.28	x 0.9 x	0.63	x	0.70	=	4.97	(75)
NorthWest			0.7	7 ×	0.90	x	11.28	x 0.9 x	0.63	x	0.70	=	3.10	(81)
SouthWest			0.7	7 × [5.13] x [36.79] x 0.9 x	0.63	x	0.70	=	57.69	(79)
Horizontal			1.00	x C	2.56	x	26.00] x 0.9 x	0.63	x	0.70	=	26.42	
Solar gains in watts	∑(74)m.	(82)m												
16	55.82	295.01	433.23	580.28	685.22	694.6	0 663.7	9 584	.09 484.3	5	334.39	201.00	140.32	(83)
Total gains - internal	and sol	ar (73)m +	(83)m											
53	34.43	661.01	785.85	911.69	995.15	983.7	3 939.7	6 866	5.42 777.8	3	649.28	540.42	498.26	(84)
7. Mean internal te	mperat	ure (heatir	ng season)											
Temperature during	heating	periods in	the living a	area from T	able 9, Th1	L(°C)							21.00	(85)
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	A	ug Sep		Oct	Nov	Dec	
Utilisation factor for	gains fo	or living are	a n1,m (se	e Table 9a)										
1	1.00	0.99	0.97	0.90	0.77	0.58	0.43	0.4	49 0.74		0.94	0.99	1.00	(86)
Mean internal temp	of living	g area T1 (s	teps 3 to 7	in Table 90	:)									

	19.67	19.90	20.22	20.60	20.86	20.97	20.99	20.99	20.91	20.54	20.03	19.63	(87)
Temperature du	ring heating	g periods in	the rest of	dwelling fr	om Table 9	<i>,</i> Th2(°C)							_
	19.84	19.84	19.85	19.86	19.86	19.87	19.87	19.87	19.87	19.86	19.85	19.85	(88)
Utilisation facto	r for gains fo	or rest of d	welling n2,r	n	L], ,
	0.99	0.98	0.96	0.87	0.70	0.49	0.32	0.37	0.65	0.92	0.99	1.00	(89)
Mean internal te					I] ()
	18.10	18.42	18.89	19.41	19.73	19.85	19.87	19.87	19.80	19.35	18.62	18.04	(90)
Living area fract		10.12	10.05	19.11	15.75	19.05	13.07	10.07		ving area ÷	·	0.54	(91)
Mean internal te		for the wh	ole dwellin	oflAxT1+	·(1 - fl A) x T	2					(.)	0.01] (31)
	18.94	19.21	19.60	20.05	20.34	20.45	20.47	20.47	20.40	19.99	19.38	18.90	(92)
Apply adjustmer	LI							20.47	20.40	19.99	19.58	18.90] (52)
	·i							20.47	20.40	10.00	10.29	18.00	(02)
	18.94	19.21	19.60	20.05	20.34	20.45	20.47	20.47	20.40	19.99	19.38	18.90	(93)
8. Space heatir	ng requirem	ent											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains, r	յՠ											
	0.99	0.98	0.95	0.88	0.73	0.54	0.38	0.43	0.70	0.92	0.98	0.99	(94)
Useful gains, ηm	Gm, W (94)m x (84)m	·		LI								. .
	530.44	648.75	748.80	799.51	729.36	531.54	360.00	375.84	541.43	599.85	531.96	495.48	(95)
Monthly average	LI] ()
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate fo	LI						20100			20.00	7.20] (50)
	1410.57	1375.64	1256.39	1056.91	816.90	548.00	362.64	380.45	592.00	888.39	1166.44	1402.48	(97)
Space heating re	LI						302.04	500.45	352.00	000.55	1100.44	1402.40] (57)
space neuting re	654.81	488.47	377.65	185.33	65.13	0.00	0.00	0.00	0.00	214.67	456.83	674.80	1
	054.01	400.47	377.05	105.55	05.15	0.00	0.00	0.00	0.00	214.07	430.83	074.80]
									7/09	2)1 5 10	12 - 2	117 70	(09)
Space beating re	quiromont	$k \wedge h / m^2 / w$	oor						∑(98	8)15 <i>,</i> 10		42.07	(98)
Space heating re	equirement	kWh/m²/ye	ear						∑(98	8)15 <i>,</i> 10 (98)		42.07) (98) (99)
Space heating re		-		stems inclu	ding micro-	СНР			∑(98				, , , ,
		-		stems inclu	ding micro-	СНР			∑(98				, , , ,
9a. Energy requ	uirements -	individual	heating sys						∑(98				, , , ,
9a. Energy request Space heating Fraction of space	uirements - e heat from	individual secondary,	heating sys /supplemen						∑(98	(98)	÷ (4)	42.07] (99)] (201)
9a. Energy request of space heating Fraction of space fraction fra	uirements - e heat from e heat from	individual secondary, main syste	heating sys /supplemen em(s)						∑(98		÷ (4)	42.07 0.00] (99)] (201)] (202)
9a. Energy request of space heating Fraction of space Fraction Fra	e heat from e heat from e heat from e heat from	individual secondary, main syste main syste	heating sys /supplemen em(s) em 2							(98) 1 - (20	÷ (4)	42.07 0.00 1.00 0.00] (99)] (201)] (202)] (202)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total	e heat from e heat from e heat from e heat from space heat	individual secondary, main syste main syste from main	heating sys /supplemen em(s) em 2 system 1							(98) 1 - (20)2) x [1- (20	÷ (4)	42.07 0.00 1.00 0.00 1.00] (99)] (201)] (202)] (202)] (202)] (204)
9a. Energy requests of space heating Praction of space Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total	e heat from e heat from e heat from e heat from space heat space heat	individual secondary, main syste main syste from main from main	heating sys /supplemen em(s) em 2 system 1							(98) 1 - (20	÷ (4)	42.07 0.00 1.00 0.00 1.00 0.00] (99)] (201)] (202)] (202)] (202)] (204)] (205)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total	e heat from e heat from e heat from space heat space heat in system 1	individual secondary, main syste main syste from main from main (%)	heating sys /supplemen em(s) em 2 system 1 system 2	ntary syster	n (table 11)			Διισ	(20	(98) 1 - (20)2) x [1- (20 (202) x (20	÷ (4)	42.07 0.00 1.00 0.00 1.00 0.00 93.40] (99)] (201)] (202)] (202)] (202)] (204)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of main	e heat from e heat from e heat from space heat space heat in system 1 Jan	individual secondary, main syste main syste from main from main (%) Feb	heating sys /supplemen em(s) em 2 system 1 system 2 Mar				Jul	Aug		(98) 1 - (20)2) x [1- (20	÷ (4)	42.07 0.00 1.00 0.00 1.00 0.00] (99)] (201)] (202)] (202)] (202)] (204)] (205)
9a. Energy requests of space heating Praction of space Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total	e heat from e heat from e heat from space heat space heat in system 1 Jan tel (main sys	individual secondary, main syste main syste from main from main (%) Feb stem 1), kW	heating sys /supplemer em(s) em 2 system 1 system 2 Mar Vh/month	ntary syster Apr	m (table 11) May	Jun		-	(20 Sep	(98) 1 - (20)2) x [1- (20 (202) x (20 Oct	÷ (4)	42.07 0.00 1.00 0.00 1.00 0.00 93.40 Dec] (99)] (201)] (202)] (202)] (202)] (204)] (205)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of main	e heat from e heat from e heat from space heat space heat in system 1 Jan	individual secondary, main syste main syste from main from main (%) Feb	heating sys /supplemen em(s) em 2 system 1 system 2 Mar	ntary syster	n (table 11)		Jul 00.0	Aug	(20 Sep 0.00	(98) 1 - (20)2) x [1- (20 (202) x (20 Oct 229.84	÷ (4) D1) = 3)] = D3) = Nov 489.11	42.07 0.00 1.00 0.00 1.00 93.40 Dec 722.49] (99)] (201)] (202)] (202)] (202)] (204)] (205)] (206)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of main Space heating fu	e heat from e heat from e heat from space heat space heat in system 1 Jan tel (main sys	individual secondary, main syste main syste from main from main (%) Feb stem 1), kW	heating sys /supplemer em(s) em 2 system 1 system 2 Mar Vh/month	ntary syster Apr	m (table 11) May	Jun		-	(20 Sep 0.00	(98) 1 - (20)2) x [1- (20 (202) x (20 Oct	÷ (4) D1) = 3)] = D3) = Nov 489.11	42.07 0.00 1.00 0.00 1.00 0.00 93.40 Dec] (99)] (201)] (202)] (202)] (202)] (204)] (205)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mai Space heating fu	e heat from e heat from e heat from space heat space heat in system 1 Jan iel (main sys 701.08	individual secondary, main syste main syste from main from main (%) Feb stem 1), kW	heating sys /supplemer em(s) em 2 system 1 system 2 Mar Vh/month	ntary syster Apr	m (table 11) May	Jun		-	(20 Sep 0.00	(98) 1 - (20)2) x [1- (20 (202) x (20 Oct 229.84	÷ (4) D1) = 3)] = D3) = Nov 489.11	42.07 0.00 1.00 0.00 1.00 93.40 Dec 722.49] (99)] (201)] (202)] (202)] (202)] (204)] (205)] (206)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of main Space heating fu	e heat from e heat from e heat from space heat space heat in system 1 Jan tel (main sys 701.08	individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 522.99	heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month 404.33	Apr 198.43	m (table 11) May 69.73	Jun 0.00	0.00	0.00	(20 Sep 0.00 Σ(21:	(98) 1 - (20)2) × [1- (20 (202) × (20 Oct 229.84 1)15, 10	÷ (4)	42.07 0.00 1.00 0.00 1.00 0.00 93.40 Dec 722.49 3338.01] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (211)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mail Space heating fu Water heating Efficiency of wat	e heat from e heat from e heat from space heat space heat in system 1 Jan iel (main sys 701.08	individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 522.99	heating sys /supplemer em(s) em 2 system 1 system 2 Mar Vh/month	ntary syster Apr	m (table 11) May	Jun		-	(20 Sep 0.00	(98) 1 - (20)2) x [1- (20 (202) x (20 Oct 229.84	÷ (4) D1) = 3)] = D3) = Nov 489.11	42.07 0.00 1.00 0.00 1.00 93.40 Dec 722.49] (99)] (201)] (202)] (202)] (202)] (204)] (205)] (206)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mai Space heating fu	e heat from e heat from e heat from space heat space heat in system 1 Jan iel (main sys 701.08	individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 522.99 87.53 onth	heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month 404.33	Apr 198.43 85.44	m (table 11) May 69.73 83.06	Jun 0.00 80.30	0.00 80.30	0.00	(20 Sep 0.00 Σ(21: 80.30	(98) 1 - (20)2) × [1- (20 (202) × (20 Oct 229.84 1)15, 10 85.69	÷ (4)	42.07 0.00 1.00 0.00 1.00 93.40 Dec 722.49 3338.01 87.95] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (211)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mail Space heating fu Water heating Efficiency of wat	e heat from e heat from e heat from space heat space heat in system 1 Jan iel (main sys 701.08	individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 522.99	heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month 404.33	Apr 198.43	m (table 11) May 69.73	Jun 0.00	0.00	0.00	(20 Sep 0.00 Σ(21:	(98) 1 - (20)2) x [1- (20 (202) x (20 Oct 229.84 1)15, 10 85.69 194.15	÷ (4)	42.07 0.00 1.00 0.00 1.00 0.00 93.40 Dec 722.49 3338.01 3338.01 87.95 218.56] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (211)] (217)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mail Space heating fu Water heating Efficiency of wat Water heating fu	e heat from e heat from e heat from space heat space heat in system 1 Jan iel (main sys 701.08	individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 522.99 87.53 onth	heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month 404.33	Apr 198.43 85.44	m (table 11) May 69.73 83.06	Jun 0.00 80.30	0.00 80.30	0.00	(20 Sep 0.00 Σ(21: 80.30	(98) 1 - (20)2) × [1- (20 (202) × (20 Oct 229.84 1)15, 10 85.69	÷ (4)	42.07 0.00 1.00 0.00 1.00 93.40 Dec 722.49 3338.01 87.95] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (211)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mail Space heating fu Water heating Efficiency of wat	e heat from e heat from e heat from space heat space heat in system 1 Jan iel (main sys 701.08	individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 522.99 87.53 onth	heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month 404.33	Apr 198.43 85.44	m (table 11) May 69.73 83.06	Jun 0.00 80.30	0.00 80.30	0.00	(20 Sep 0.00 Σ(21: 80.30	(98) 1 - (20)2) x [1- (20 (202) x (20 Oct 229.84 1)15, 10 85.69 194.15	÷ (4)	42.07 0.00 1.00 0.00 1.00 0.00 93.40 Dec 722.49 3338.01 3338.01 87.95 218.56] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (211)] (217)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mail Space heating fu Water heating Efficiency of wat Water heating fu	e heat from e heat from e heat from space heat space heat in system 1 Jan tel (main sys 701.08 ter heater 87.85 uel, kWh/mo 224.08	individual secondary, main syste from main from main (%) Feb stem 1), kW 522.99 87.53 onth 196.44	heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month 404.33	Apr 198.43 85.44	m (table 11) May 69.73 83.06	Jun 0.00 80.30	0.00 80.30	0.00	(20 Sep 0.00 Σ(21: 80.30	(98) 1 - (20)2) x [1- (20 (202) x (20 Oct 229.84 1)15, 10 85.69 194.15	÷ (4) D1) = 3)] = Nov 489.11 12 = 87.33 203.38 12 =2	42.07 0.00 1.00 0.00 1.00 0.00 93.40 Dec 722.49 3338.01 3338.01 87.95 218.56] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (211)] (217)

				г		-
Water heating fuel	-				2305.01	
Electricity for pumps, fans and electric keep-hot (Table 4			[]			
central heating pump or water pump within warm air	heating unit		30.00			(230c)
boiler flue fan			45.00	г		(230e)
Total electricity for the above, kWh/year				ĺ	75.00	(231)
Electricity for lighting (Appendix L)				[325.39	(232)
Total delivered energy for all uses		(22	11)(221) + (231) + (23	2)(237b) = [6043.41	(238)
10a. Fuel costs - individual heating systems including n	nicro-CHP					
	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	3338.01	х	3.48	x 0.01 = [116.16	(240)
Water heating	2305.01	х	3.48	x 0.01 = [80.21	(247)
Pumps and fans	75.00	x	13.19	x 0.01 = [9.89	(249)
Electricity for lighting	325.39	x	13.19	x 0.01 = [42.92	(250)
Additional standing charges				[120.00	(251)
Total energy cost			(240)(242) + (24	45)(254) = [369.19	(255)
11a. SAP rating - individual heating systems including r	micro-CHP					
Energy cost deflator (Table 12)				[0.42	(256)
Energy cost factor (ECF)				[1.30	(257)
SAP value				[81.84	
SAP rating (section 13)				[82	(258)
SAP band				[В	
12a. CO ₂ emissions - individual heating systems includi	ing micro-CHP					
	Energy		Emission factor		Emissions	
	kWh/year		kg CO₂/kWh	Г	kg CO₂/year	
Space heating - main system 1	3338.01	x	0.22	= [721.01	(261)
Water heating	2305.01	x	0.22	=	497.88	(264)
Space and water heating	75.00		(261) + (262) + (26	I I	1218.89	(265)
Pumps and fans	75.00	x	0.52	= [38.93	(267)
Electricity for lighting	325.39	х	0.52	= [168.88	(268)
Total CO ₂ , kg/year				65)(271) =	1426.69	(272)
Dwelling CO ₂ emission rate					10.25	(272)
Fluelue				(272) ÷ (4) = [19.25	(273)
El value					83.95	
El rating (section 14)					83.95 84	(273) (274)
					83.95	
El rating (section 14)				(272) ÷ (4) = [[[83.95 84 B	(274)
El rating (section 14) El band	ding micro-CHP Energy kWh/year			(272) ÷ (4) = [[[83.95 84	(274)
El rating (section 14) El band 13a. Primary energy - individual heating systems inclue	Energy	x		(272) ÷ (4) = [[[83.95 84 B Primary Energy	(274)
El rating (section 14) El band 13a. Primary energy - individual heating systems includ Space heating - main system 1	Energy kWh/year	x x	Primary factor	(272) ÷ (4) = [[[83.95 84 B Primary Energy kWh/year) (274)) y
El rating (section 14) El band 13a. Primary energy - individual heating systems includ Space heating - main system 1 Water heating	Energy kWh/year 3338.01		Primary factor	(272) ÷ (4) = [[[[= [= [83.95 84 B Primary Energy kWh/year 4072.37) (274)) (274) y (261)
El rating (section 14) El band	Energy kWh/year 3338.01		Primary factor 1.22 1.22	(272) ÷ (4) = [[[[= [= [83.95 84 B Primary Energy kWh/year 4072.37 2812.12	(274) (274) (261) (264)
El rating (section 14) El band 13a. Primary energy - individual heating systems includ Space heating - main system 1 Water heating Space and water heating	Energy kWh/year 3338.01 2305.01	x	Primary factor 1.22 1.22 (261) + (262) + (26	(272) ÷ (4) = [[[= [33) + (264) = [83.95 84 B Primary Energy kWh/year 4072.37 2812.12 6884.49	(274) (274) (261) (264) (265)
El rating (section 14) El band 13a. Primary energy - individual heating systems includ Space heating - main system 1 Water heating Space and water heating Pumps and fans	Energy kWh/year 3338.01 2305.01 75.00	x x	Primary factor 1.22 1.22 (261) + (262) + (262) 3.07	(272) ÷ (4) = [[[= [3) + (264) = [= [83.95 84 B Primary Energy kWh/year 4072.37 2812.12 6884.49 230.25	(274) (274) (261) (264) (265) (267)

TER Worksheet Design - Draft



Assessor name	Mr Jason	Doherty						As	sessor num	ber	2634		
Client								La	st modified		23/12	/2016	
Address	3 6 Streat	ley Place, I	ondon, N	IW3 1H	Р								
1. Overall dwelling dimen	sions							_					
					Are	ea (m²)			age storey eight (m)		Vo	lume (m³)	
Lowest occupied				[10	04.10](1a) x		2.40	(2a) =		249.84	(3a)
Total floor area	(1a) -	+ (1b) + (1c	:) + (1d)	(1n) = [10	04.10] (4)						
Dwelling volume								(3a)	+ (3b) + (3e	c) + (3d)(3	3n) =	249.84	(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 far	IS								4	x 10 =	-	40	(7a)
Number of passive vents									0	x 10 =	-	0	(7b)
Number of flueless gas fires	5								0	x 40 =	-	0	(7c)
											Air	changes per hour	
Infiltration due to chimney	s, flues, fans	, PSVs			(6a) +	(6b) + (7	a) + (7b) + (7c) =	40	÷ (5) =	=	0.16	(8)
If a pressurisation test has	been carried	l out or is ir	ntended, p	oroceea	l to (17), otherw	vise continu	e from (9) t	o (16)				
Air permeability value, q50	, expressed i	in cubic me	etres per l	nour pe	r squa	re metre	of envelope	e area				5.00	(17)
If based on air permeability	value, then	(18) = [(17) ÷ 20] +	(8) <i>,</i> oth	erwise	(18) = (1	6)					0.41	(18)
Number of sides on which t	the dwelling	is sheltere	d									2	(19)
Shelter factor									1 -	[0.075 x (1	9)] =	0.85	(20)
Infiltration rate incorporati	ng shelter fa	ictor								(18) x (2	20) =	0.35	(21)
Infiltration rate modified for	or monthly w	vind speed:											
Jan	Feb	Mar	Apr	Ma	ay	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind spee	ed from Tabl	e U2											
5.10	5.00	4.90	4.40	4.3	30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
5.10 Wind factor (22)m ÷ 4	5.00	4.90	4.40	4.3	30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22)m ÷ 4	1.25	1.23	1.10	1.(08	0.95	3.80 0.95	3.70 0.93	4.00	4.30	4.50	4.70	(22) (22a)
Wind factor (22)m ÷ 4	1.25	1.23	1.10	1.(08	0.95		1				·	
Wind factor (22)m ÷ 4 1.28 Adjusted infiltration rate (a 0.44	1.25 Ilowing for s 0.44	1.23 shelter and 0.43	1.10 wind fac 0.38	1.()8) x (22a	0.95		1				·	
Wind factor (22)m ÷ 4 1.28 Adjusted infiltration rate (a	1.25 Ilowing for s 0.44	1.23 shelter and 0.43	1.10 wind fac 0.38	1.(tor) (21)8) x (22a	0.95 a)m	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
Wind factor (22)m ÷ 4 1.28 Adjusted infiltration rate (a 0.44 Calculate effective air chan If mechanical ventilation	1.25 Illowing for s 0.44 ge rate for the formation of the second seco	1.23 shelter and 0.43 he applicat e rate throu	1.10 wind fac 0.38 ble case: ugh syster	1.(tor) (21 0.3	08) x (22; 37	0.95 a)m 0.33	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
Wind factor (22)m ÷ 4 1.28 Adjusted infiltration rate (a 0.44 Calculate effective air chan If mechanical ventilation If balanced with heat re	1.25 Illowing for s 0.44 ge rate for the n: air change covery: effic	1.23 shelter and 0.43 he applicat e rate throu iency in %	1.10 wind fac 0.38 ble case: agh system allowing f	1.(tor) (21 0.3	08) x (22; 37 se facto	0.95 a)m 0.33 or from T	0.95	0.93	1.00	1.08	1.13	0.41	(22a) (22b)
Wind factor (22)m ÷ 4 1.28 Adjusted infiltration rate (a 0.44 Calculate effective air chan If mechanical ventilation	1.25 Illowing for s 0.44 ge rate for the n: air change covery: effic	1.23 shelter and 0.43 he applicat e rate throu iency in %	1.10 wind fac 0.38 ble case: agh syster allowing f nput ven	1.(tor) (21 0.3	08) x (22; 37 se facto	0.95 a)m 0.33 or from T	0.95	0.93	1.00	1.08	1.13	1.18 0.41 N/A N/A	(22a) (22b) (23a) (23c)
Wind factor (22)m ÷ 4 1.28 Adjusted infiltration rate (a 0.44 Calculate effective air chan If mechanical ventilation If balanced with heat re d) natural ventilation or 0.60	1.25 Illowing for s 0.44 ge rate for tl n: air change covery: effic whole hous 0.59	1.23 shelter and 0.43 he applicat e rate throu iency in % e positive 0.59	1.10 wind fact 0.38 ble case: allowing f nput ven 0.57	1.(tor) (21 0.: 0.: tilation	08) x (22; 37 se facto from b	0.95 a)m 0.33 or from T	0.95	0.93	1.00	1.08	1.13	1.18 0.41 N/A	(22a) (22b) (23a)
Wind factor (22)m ÷ 4 1.28 Adjusted infiltration rate (a 0.44 Calculate effective air chan If mechanical ventilation If balanced with heat re d) natural ventilation or	1.25 Illowing for s 0.44 ge rate for tl n: air change covery: effic whole hous 0.59	1.23 shelter and 0.43 he applicat e rate throu iency in % e positive 0.59	1.10 wind fact 0.38 ble case: allowing f nput ven 0.57	1.(tor) (21 0.: 0.: tilation	08) x (22; 37 se fact from l 57 25)	0.95 a)m 0.33 or from T oft	0.95 0.33 able 4h	0.93	0.35	1.08 0.37	0.39	1.18 0.41 N/A N/A	(22a) (22b) (23a) (23c)



3. Heat losses a	and heat lo	ss paramet	er										
Element				Gross rea, m²	Openings m ²		area m²	U-value W/m²K	A x U W	•	/alue, /m².K	Ахк, kJ/K	
Window						22	.00 x	1.33	= 29.17				(27)
Door						1.	.95 x	1.00	= 1.95				(26)
Roof window						2.	.06 x	1.59	= 3.28				(27a)
Exposed floor						12	.80 x	0.13	= 1.66				(28b
External wall						83	.50 x	0.18	= 15.03				(29a)
Party wall						23	.52 x	0.00	= 0.00				(32)
Roof						51	66 x	0.13	= 6.72				(30)
Total area of ext	ternal elem	ents ∑A, m²				173	3.97						(31)
Fabric heat loss,	W/K = ∑(A	× U)							(26	5)(30) + (3	32) =	57.81	(33)
Heat capacity Cr	m = ∑(А x к)							(28)	(30) + (32) -	+ (32a)(3	2e) =	N/A	(34)
Thermal mass pa	arameter (T	MP) in kJ/n	n²K									250.00	(35)
Thermal bridges	:: Σ(L x Ψ) ca	alculated us	ing Appen	dix K								16.38	(36)
Total fabric heat	t loss									(33) + (3	36) =	74.18	(37)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat	loss calcula	ated month	ly 0.33 x (2	25)m x (5)									
	49.37	49.05	48.74	47.28	47.01	45.74	45.74	45.51	46.23	47.01	47.56	48.14	(38)
Heat transfer co	efficient, W	//K (37)m +	- (38)m										
	123.55	123.23	122.92	121.47	121.19	119.93	119.93	119.69	120.41	121.19	121.75	122.32	
									Average = 🛛	(39)112/	/12 =	121.47	(39)
Heat loss param	eter (HLP),	W/m²K (39	9)m ÷ (4)										
	1.19	1.18	1.18	1.17	1.16	1.15	1.15	1.15	1.16	1.16	1.17	1.18	
									Average = 🛛	(40)112/	/12 =	1.17	(40)
Number of days	in month (⁻	Table 1a)											
	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)
4. Water heati		equiremen	τ.										
Assumed occupa												2.77	(42)
Annual average									6	0.1		100.09	(43)
List water wear	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage	-						-		00.00	400.00	105.10	110.10	7
	110.10	106.10	102.09	98.09	94.09	90.08	90.08	94.09	98.09	102.09	106.10	110.10	
Energy content.	of hot wata	rucod = 4.1			2600 WMb /m	anth (caa	Tablas 1b	1010		∑(44)1	.12 =	1201.10	(44)
Energy content						-	1		111.4.40	122.20	145.64	450.40	٦
	163.28	142.80	147.36	128.47	123.27	106.37	98.57	113.11	114.46	133.39	145.61	158.12	
Distribution loss		lm								∑(45)1	.12 =	1574.83	(45)
DISTINUTION 1055			22.40	10.07	10.40	45.00	14.70	10.07	47.47	20.04	24.04	22.72	
Water storage k	24.49	21.42	22.10	19.27	18.49	15.96	14.79	16.97	17.17	20.01	21.84	23.72	(46)
Water storage lo		1			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
If the vessel con	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 con		1	-							0.00	0.00	0.00	
Drimonet	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 lo		1		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Combiles	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 e				1	1 4 - 0 - 1				40.6-	F0 6-			
	50.96	46.03	50.96	48.37	47.95	44.42	45.90	47.95	48.37	50.96	49.32	50.96	(61)

(45) (16) (57) (50) (61) 0.05

Total heat required for wa	ter heating	calculated f	or each mo	onth 0.85 x	(45)m + (4	6)m + (57)r	n + (59)m +	(61)m				
214.23	188.83	198.32	176.84	171.22	150.80	144.48	161.06	162.84	184.35	194.93	209.08	(62)
Solar DHW input calculate	d using App	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 water heater	for each mo	onth (kWh/	month) (62	2)m + (63)m	ı							
214.23	188.83	198.32	176.84	171.22	150.80	144.48	161.06	162.84	184.35	194.93	209.08]
									∑(64)1	12 = 2	156.97	(64)
Heat gains from water he	ating (kWh/n	nonth) 0.2	5 × [0.85 ×	(45)m + (61	.)m] + 0.8 ×	[(46)m + (5	57)m + (59)	m]				
67.03	58.99	61.74	54.81	52.97	46.48	44.25	49.60	50.15	57.09	60.74	65.32	(65)
5. Internal gains			-						. .		_	
Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)										[7
138.72	138.72	138.72	138.72	138.72	138.72	138.72	138.72	138.72	138.72	138.72	138.72	(66)
Lighting gains (calculated	in Appendix	L, equation	L9 or L9a),	also see Ta	ble 5							_
23.43	20.81	16.92	12.81	9.58	8.09	8.74	11.36	15.24	19.35	22.59	24.08	(67)
Appliance gains (calculate	d in Appendi	x L, equatio	on L13 or L1	L3a), also se	ee Table 5							
262.79	265.52	258.65	244.02	225.55	208.19	196.60	193.87	200.74	215.37	233.84	251.20	(68)
Cooking gains (calculated	in Appendix	L, equation	L15 or L15	a), also see	Table 5							
36.87	36.87	36.87	36.87	36.87	36.87	36.87	36.87	36.87	36.87	36.87	36.87	(69)
Pump and fan gains (Table	e 5a)											
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evaporation (T	able 5)											
-110.98	-110.98	-110.98	-110.98	-110.98	-110.98	-110.98	-110.98	-110.98	-110.98	-110.98	-110.98	(71)
Water heating gains (Tabl	e 5)											
90.09	87.78	82.98	76.12	71.20	64.55	59.48	66.66	69.66	76.74	84.37	87.79	(72)
Total internal gains (66)m	ı + (67)m + (6	68)m + (69)	m + (70)m ·	+ (71)m + (7	72)m							
443.93	441.72	426.16	400.57	373.94	348.44	332.43	339.50	353.26	379.08	408.41	430.68	(73)

			Access f Table		Area m²		lar flux V/m²		g specific data or Table 6b		FF specific dat or Table 6		Gains W	
NorthWest			0.7	7 x	2.98	x 1	.1.28 x	(0.9 x [0.63	x	0.70	=	10.28	(81)
SouthEast			0.7	7 X	14.59	x 3	6.79 x	(0.9 x [0.63	x	0.70	_ = [164.06	(77)
SouthWest			0.7	7 X	1.12	x 3	6.79 x	(0.9 x [0.63	x	0.70	=	12.59	(79)
NorthEast			0.7	7 X	3.31	x 1	.1.28 x	(0.9 x [0.63	x	0.70	_ = [11.41	(75)
Horizontal			1.0	x C	2.06	x 2	.00 x	(0.9 x [0.63	x	0.70	_ = [21.26	
Solar gains in wa	tts ∑(74)m	(82)m												
	219.60	389.21	569.75	763.41	903.97	917.99	876.55	769	.17 636.7	5	440.48	265.86	186.06	(83)
Total gains - inte	rnal and so	lar (73)m +	· (83)m											
	663.53	830.93	995.91	1163.98	1277.91	1266.43	1208.98	1108	8.68 990.0	0	819.56	674.27	616.74	(84)
7. Mean intern	-	-												
Temperature du	-		-	area from T		L(°C)							21.00	(85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Αι	ug Sep		Oct	Nov	Dec	
Utilisation factor	for gains for	or living are	ea n1,m (se	e Table 9a)										
	1.00	0.99	0.97	0.91	0.78	0.59	0.43	0.4	49 0.75		0.96	0.99	1.00	(86)
Mean internal te	mp of living	g area T1 (s	steps 3 to 7	in Table 90	;)									

	19.74	19.96	20.27	20.63	20.88	20.98	21.00	20.99	20.92	20.57	20.08	19.71	(87)
Temperature du		g periods in	the rest of	dwelling fr	om Table 9), Th2(°C)							
·	19.93	19.93	19.94	19.95	19.95	19.96	19.96	19.96	19.95	19.95	19.94	19.94	(88)
Utilisation facto] (/
	1.00	0.99	0.97	0.89	0.72	0.50	0.33	0.38	0.67	0.94	0.99	1.00	(89)
Mean internal te								0.00	0.07	0.01	0.00	2.00] (00)
	18.26	18.58	19.03	19.54	19.84	19.94	19.96	19.96	19.90	19.47	18.77	18.22	(90)
Living area fract		10.50	15.05	15.54	19.04	19.94	15.50	15.50		ving area ÷	·	0.41	(91)
Mean internal te		for the wh	ole dwellin	σ fl Δ v T1 +	-(1 - fl Δ) v T	-2					(4) -	0.41] (91)
	18.87	19.15	19.54	19.99	20.27		20.38	20.20	20.22	10.02	10.21	18.83	(02)
Apply adjustment						20.37		20.38	20.32	19.92	19.31	18.85	(92)
Apply adjustme			1					20.20	20.22	10.00	10.24	40.00	
	18.87	19.15	19.54	19.99	20.27	20.37	20.38	20.38	20.32	19.92	19.31	18.83	(93)
8. Space heatir	ng requirem	ent											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains. r	าฑ						Ū					
	1.00	0.99	0.96	0.89	0.74	0.53	0.37	0.43	0.70	0.93	0.99	1.00	(94)
Useful gains, ηm] (= .)
, (j., , , , , , , , , , , , , , , , , , ,	660.37	819.68	957.33	1032.27	940.72	676.23	451.63	472.69	693.30	766.12	666.88	614.64	(95)
Monthly average					540.72	070.23	431.05	472.05	033.50	700.12	000.00	014.04] (33)
	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate fo							10.00	10.40	14.10	10.00	7.10	4.20] (90)
	1800.22	1755.54	1602.70	, w ((39)m 1346.70	1038.08	691.72	452.70	476.62	740.00	1120 41	1485.91	1780.24	
Space beating r							453.70	476.62	748.82	1129.41	1485.91	1789.34	_ (97)
Space heating re			1				0.00	0.00	0.00	270.20	500 70	072.07	1
	848.04	628.90	480.15	226.39	72.43	0.00	0.00	0.00	0.00	270.29	589.70	873.97	
									5/0/	~~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~	40		
Concern hearting an	· · · · · ·	LAN/L- / 2 /							∑(98	8)15, 10		989.88] (98)
Space heating re	equirement	kWh/m²/ye	ear						∑(98	8)15 <i>,</i> 10 (98)		3989.88 38.33	(98) (99)
Space heating re				stems inclu	ding micro	-CHP			Σ(ð8				יינ ר
9a. Energy req				stems inclu	ding micro	-СНР			∑(98				יינ ר
9a. Energy req Space heating	uirements -	individual	heating sys						∑(98			38.33] (99)
9a. Energy requestions of space heating Fraction of space	uirements - e heat from	individual secondary	heating sys /supplemen						∑(98	(98)	÷ (4)	0.00] (99)] (201)
9a. Energy req Space heating Fraction of space Fraction of space	uirements - e heat from e heat from	individual secondary, main syste	heating sys /supplement em(s)						∑(98		÷ (4)	38.33 0.00 1.00] (99)] (201)] (202)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space	uirements - e heat from e heat from e heat from	individual secondary, main syste main syste	heating sys /supplemen em(s) em 2							(98) 1 - (20	÷ (4)	38.33 0.00 1.00 0.00] (99)] (201)] (202)] (202)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total	uirements - e heat from e heat from e heat from space heat	individual secondary, main syste main syste from main	heating sys /supplemen em(s) em 2 system 1							(98) 1 - (20)2) x [1- (20	÷ (4)	38.33 0.00 1.00 0.00 1.00] (99)] (201)] (202)] (202)] (202)] (204)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total	e heat from e heat from e heat from e heat from space heat space heat	individual secondary main syste main syste from main from main	heating sys /supplemen em(s) em 2 system 1							(98) 1 - (20	÷ (4)	38.33 0.00 1.00 0.00 1.00 0.00] (99)] (201)] (202)] (202)] (202)] (204)] (205)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total	uirements - e heat from e heat from e heat from space heat space heat in system 1	individual secondary main syste main syste from main from main (%)	heating sys /supplemen em(s) em 2 system 1 system 2	ntary syster	m (table 11			Διισ	(20	(98) 1 - (20)2) x [1- (20 (202) x (20	÷ (4)	38.33 0.00 1.00 0.00 1.00 0.00 93.40] (99)] (201)] (202)] (202)] (202)] (204)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma	e heat from e heat from e heat from space heat space heat in system 1 Jan	individual secondary, main syste main syste from main from main (%) Feb	heating sys /supplemen em(s) em 2 system 1 system 2 Mar				Jul	Aug		(98) 1 - (20)2) x [1- (20	÷ (4)	38.33 0.00 1.00 0.00 1.00 0.00] (99)] (201)] (202)] (202)] (202)] (204)] (205)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total	e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sys	individual secondary main syste main syste from main from main (%) Feb stem 1), kW	heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month	ntary system	m (table 11 May) Jun		-	(20 Sep	(98) 1 - (20)2) x [1- (20 (202) x (20 Oct	÷ (4)	38.33 0.00 1.00 0.00 1.00 0.00 93.40 Dec] (99)] (201)] (202)] (202)] (202)] (204)] (205)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma	e heat from e heat from e heat from space heat space heat in system 1 Jan	individual secondary, main syste main syste from main from main (%) Feb	heating sys /supplemen em(s) em 2 system 1 system 2 Mar	ntary syster	m (table 11		Jul 0.00	Aug 0.00	(20 Sep 0.00	(98) 1 - (20)2) x [1- (20 (202) x (20 Oct 289.39	÷ (4)	38.33 0.00 1.00 0.00 1.00 93.40 Dec 935.73] (99)] (201)] (202)] (202)] (202)] (204)] (205)] (206)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu	e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sys	individual secondary main syste main syste from main from main (%) Feb stem 1), kW	heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month	ntary system	m (table 11 May) Jun		-	(20 Sep 0.00	(98) 1 - (20)2) x [1- (20 (202) x (20 Oct	÷ (4)	38.33 0.00 1.00 0.00 1.00 0.00 93.40 Dec] (99)] (201)] (202)] (202)] (202)] (204)] (205)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating	e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sys 907.97	individual secondary main syste main syste from main from main (%) Feb stem 1), kW	heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month	ntary system	m (table 11 May) Jun		-	(20 Sep 0.00	(98) 1 - (20)2) x [1- (20 (202) x (20 Oct 289.39	÷ (4)	38.33 0.00 1.00 0.00 1.00 93.40 Dec 935.73] (99)] (201)] (202)] (202)] (202)] (204)] (205)] (206)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu	e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sys 907.97 ter heater	individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 673.34	heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month 514.08	Apr 242.39	m (table 11 May 77.55) Jun 0.00	0.00	0.00	(20 Sep 0.00 Σ(21:	(98) 1 - (20)2) × [1- (20 (202) × (20 Oct 289.39 1)15, 10	÷ (4)	38.33 0.00 1.00 0.00 1.00 93.40 Dec 935.73 1271.82] (99)] (201)] (202)] (202)] (202)] (204)] (205)] (206)] (211)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating Efficiency of wat	e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sys 907.97 ter heater 88.16	individual secondary, main syste from main from main (%) Feb stem 1), kW 673.34	heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month	ntary system	m (table 11 May) Jun		-	(20 Sep 0.00	(98) 1 - (20)2) x [1- (20 (202) x (20 Oct 289.39	÷ (4)	38.33 0.00 1.00 0.00 1.00 93.40 Dec 935.73] (99)] (201)] (202)] (202)] (202)] (204)] (205)] (206)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating	e heat from e heat from e heat from space heat space heat space heat Jan uel (main sys 907.97 ter heater 88.16 uel, kWh/m	individual secondary, main syste main syste from main (%) Feb stem 1), kW 673.34 87.85 onth	heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month 514.08	Apr 242.39 85.67	m (table 11 May 77.55 83.06) Jun 0.00 80.30	0.00 80.30	0.00	(20 Sep 0.00 Σ(21: 80.30	(98) 1 - (20)2) × [1- (20 (202) × (20 Oct 289.39 1)15, 10 86.01	÷ (4)	38.33 0.00 1.00 0.00 1.00 0.00 93.40 Dec 935.73 1271.82 888.26] (99)] (201)] (202)] (202)] (202)] (204)] (205)] (206)] (211)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating Efficiency of wat	e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sys 907.97 ter heater 88.16	individual secondary, main syste from main from main (%) Feb stem 1), kW 673.34	heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month 514.08	Apr 242.39	m (table 11 May 77.55) Jun 0.00	0.00	0.00	(20 Sep 0.00 Σ(21:	(98) 1 - (20)2) x [1- (20 (202) x (20 Oct 289.39 1)15, 10 86.01 214.33	÷ (4) D1) = 3)] = 03) = Nov 631.37 12 =4 87.66 222.36	38.33 0.00 1.00 0.00 1.00 0.00 93.40 Dec 935.73 271.82 88.26 88.26] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (211)] (217)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating Efficiency of wat	e heat from e heat from e heat from space heat space heat space heat Jan uel (main sys 907.97 ter heater 88.16 uel, kWh/m	individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 673.34 87.85 onth	heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month 514.08	Apr 242.39 85.67	m (table 11 May 77.55 83.06) Jun 0.00 80.30	0.00 80.30	0.00	(20 Sep 0.00 Σ(21: 80.30	(98) 1 - (20)2) × [1- (20 (202) × (20 Oct 289.39 1)15, 10 86.01	÷ (4) D1) = 3)] = 03) = Nov 631.37 12 =4 87.66 222.36	38.33 0.00 1.00 0.00 1.00 0.00 93.40 Dec 935.73 1271.82 888.26] (99)] (201)] (202)] (202)] (202)] (204)] (205)] (206)] (211)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating Efficiency of wat	e heat from e heat from e heat from space heat space heat space heat Jan uel (main sys 907.97 ter heater 88.16 uel, kWh/m	individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 673.34 87.85 onth	heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month 514.08	Apr 242.39 85.67	m (table 11 May 77.55 83.06) Jun 0.00 80.30	0.00 80.30	0.00	(20 Sep 0.00 Σ(21: 80.30	(98) 1 - (20)2) x [1- (20 (202) x (20 Oct 289.39 1)15, 10 86.01 214.33	÷ (4) D1) = 3)] = 03) = Nov 631.37 12 =4 87.66 222.36	38.33 0.00 1.00 0.00 1.00 0.00 93.40 Dec 935.73 271.82 88.26 88.26] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (211)] (217)
 9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating Efficiency of wat Water heating fu 	uirements - e heat from e heat from e heat from space heat space heat in system 1 Jan Jel (main sys 907.97 ter heater 88.16 uel, kWh/m 243.00	individual secondary, main syste from main from main (%) Feb stem 1), kW 673.34 87.85 onth 214.95	heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month 514.08	Apr 242.39 85.67	m (table 11 May 77.55 83.06) Jun 0.00 80.30	0.00 80.30	0.00	(20 Sep 0.00 Σ(21: 80.30	(98) 1 - (20)2) x [1- (20 (202) x (20 Oct 289.39 1)15, 10 86.01 214.33	÷ (4) D1) = 3)] = D3) = Nov 631.37 12 =4 87.66 222.36 .12 =2	38.33 0.00 1.00 0.00 1.00 0.00 93.40 Dec 935.73 271.82 88.26 88.26] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (211)] (217)

Water heating fuel	- 0			2542.61	
Electricity for pumps, fans and electric keep-hot (Table 4					
central heating pump or water pump within warm air	r 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)				413.75	(232)
Total delivered energy for all uses		(2	11)(221) + (231) + (232)(2	237b) = 7303.17	(238)
10a. Fuel costs - individual heating systems including n	micro-CHP				
	Fuel kWh/year		Fuel price	Fuel cost £/yea	
Space heating - main system 1	4271.82	х	3.48 x 0.0	01 = 148.66	(240)
Water heating	2542.61	х	3.48 x 0.0	01 = 88.48	(247)
Pumps and fans	75.00	x	13.19 x 0.0	9.89	(249)
Electricity for lighting	413.75	x	13.19 x 0.0)1 = 54.57	(250)
Additional standing charges				120.00	(251)
Total energy cost			(240)(242) + (245)	(254) = 421.61	(255)
11a. SAP rating - individual heating systems including	micro-CHP				
Energy cost deflator (Table 12)				0.42	(256)
Energy cost factor (ECF)				1.19	(257)
SAP value				83.43	
SAP rating (section 13)				83	(258)
SAP band				В	
12a. CO ₂ emissions - individual heating systems includ	ing micro-CHP				
	Energy kWh/year		Emission factor kg CO ₂ /kWh	Emissions kg CO₂/yea	r
Space heating - main system 1	4271.82	x	0.22 =		(261)
Water heating	2542.61	x	0.22 =	549.20	(264)
Space and water heating			(261) + (262) + (263) +	L	(265)
Pumps and fans	75.00	x	0.52 =		(267)
Electricity for lighting	413.75	x	0.52 =		(268)
Total CO ₂ , kg/year			(265)		(272)
Dwelling CO ₂ emission rate				÷ (4) = 16.58	(273)
El value				84.49	
El rating (section 14)				84	(274)
El band				В	
13a. Primary energy - individual heating systems inclu	ding micro CHP				
Toa. Primary energy - includudar neating systems inclu	Energy		Primary factor	Primary Ener	
Space heating main system 1	kWh/year		1.22	kWh/year	
Space heating - main system 1	4271.82	x	1.22 =		(261)
		Х	1.22 =		(264)
-	2542.61		(261) + (262	(264) - 0242 CO	
Space and water heating			(261) + (262) + (263) +		
Space and water heating Pumps and fans	75.00	x	3.07 =	230.25	(267)
Space and water heating Pumps and fans Electricity for lighting		x x		230.25 1270.20	(267)
Water heating Space and water heating Pumps and fans Electricity for lighting Primary energy kWh/year Dwelling primary energy rate kWh/m2/year	75.00		3.07 =	230.25	(267)

Water heating fuel	_			l	2401.23	
Electricity for pumps, fans and electric keep-hot (Table 4f						
central heating pump or water pump within warm air	heating unit		30.00			(230
boiler flue fan			45.00	r		(230 7
Total electricity for the above, kWh/year				l	75.00	_ (231
Electricity for lighting (Appendix L)				l	354.87	_ (232
Total delivered energy for all uses		(2:	11)(221) + (231) + (232	2)(237b) = [6798.26	(238
10a. Fuel costs - individual heating systems including m	hicro-CHP					
	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	3967.16	х	3.48	x 0.01 = [138.06	(240
Nater heating	2401.23	х	3.48	x 0.01 = [83.56	(247
Pumps and fans	75.00	x	13.19	x 0.01 = [9.89	(249
Electricity for lighting	354.87	x	13.19	x 0.01 =	46.81	(250
Additional standing charges				[120.00	(251
Total energy cost			(240)(242) + (24	15)(254) = [398.32	(255
11a. SAP rating - individual heating systems including n	nicro-CHP					
nergy cost deflator (Table 12)				[0.42	(256
Energy cost factor (ECF)				[1.31	(257
SAP value				[81.75	
SAP rating (section 13)				[82	(258
SAP band				[В	
12a. CO ₂ emissions - individual heating systems includi	ng micro-CHP					
	Energy		Emission factor		Emissions	
	kWh/year		kg CO₂/kWh		kg CO₂/year	
Space heating - main system 1	3967.16	x	0.22	= [856.91	(261
Nater heating	2401.23	x	0.22	= ((264
Space and water heating			0.22	l	518.67	
			(261) + (262) + (26	3) + (264) = [1375.57	-
	75.00	x	·	3) + (264) = [= [(265
Pumps and fans	75.00	x x	(261) + (262) + (26	[1375.57	(265 (267
Pumps and fans Electricity for lighting			(261) + (262) + (26 0.52 0.52	= [1375.57 38.93] (265] (267] (268
Pumps and fans Electricity for lighting Total CO ₂ , kg/year			(261) + (262) + (26 0.52 0.52 (26	= [1375.57 38.93 184.18] (265] (267] (268] (272
Pumps and fans Electricity for lighting Fotal CO ₂ , kg/year Dwelling CO ₂ emission rate El value			(261) + (262) + (26 0.52 0.52 (26	= [= [55)(271) = [1375.57 38.93 184.18 1598.68] (265] (267] (268] (272
Pumps and fans Electricity for lighting Fotal CO ₂ , kg/year Dwelling CO ₂ emission rate			(261) + (262) + (26 0.52 0.52 (26	= [= [55)(271) = [1375.57 38.93 184.18 1598.68 19.28] (265] (267] (268] (272] (273
Pumps and fans Electricity for lighting Fotal CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14)			(261) + (262) + (26 0.52 0.52 (26	= [= [55)(271) = [1375.57 38.93 184.18 1598.68 19.28 83.25) (265) (267) (268) (272) (273
Pumps and fans Electricity for lighting Fotal CO ₂ , kg/year Dwelling CO ₂ emission rate	354.87		(261) + (262) + (26 0.52 0.52 (26	= [= [55)(271) = [1375.57 38.93 184.18 1598.68 19.28 83.25 83) (265) (267) (268) (272) (273) (274
Pumps and fans Electricity for lighting Fotal CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14)	354.87		(261) + (262) + (26 0.52 0.52 (26	= [= [272) ÷ (4) = [[1375.57 38.93 184.18 1598.68 19.28 83.25 83) (265) (267) (268) (272) (273) (274
Pumps and fans Electricity for lighting Fotal CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14) El band 13a. Primary energy - individual heating systems includ	354.87 ling micro-CHP Energy		(261) + (262) + (26 0.52 0.52 (26	= [= [272) ÷ (4) = [[1375.57 38.93 184.18 1598.68 19.28 83.25 83 B Primary Energy	(265) (267) (268) (272) (273) (273) (274)
Pumps and fans Electricity for lighting Fotal CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14) El band 13a. Primary energy - individual heating systems includ Epace heating - main system 1	354.87 ling micro-CHP Energy kWh/year	x	(261) + (262) + (26 0.52 0.52 (26 (= [= [272) ÷ (4) = [[1375.57 38.93 184.18 1598.68 19.28 83.25 83 B Primary Energy kWh/year) (265) (267) (268) (272) (273) (274) (274) (261
Pumps and fans Electricity for lighting Fotal CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14) El band 13a. Primary energy - individual heating systems includ Epace heating - main system 1 Vater heating	iing micro-CHP Energy kWh/year 3967.16	x	(261) + (262) + (26 0.52 (26 (26 (26) Primary factor 1.22	= [= [272) ÷ (4) = [[= [= [1375.57 38.93 184.18 1598.68 19.28 83.25 83 B Primary Energy kWh/year 4839.94	(265) (267) (268) (272) (273) (274) (274) (274) (261) (264)
Pumps and fans Electricity for lighting Fotal CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14) El band 13a. Primary energy - individual heating systems includ Epace heating - main system 1 Vater heating Epace and water heating	iing micro-CHP Energy kWh/year 3967.16	x	(261) + (262) + (26 0.52 (26 (26 (26 (26)	= [= [272) ÷ (4) = [[= [= [1375.57 38.93 184.18 1598.68 19.28 83.25 83 B Primary Energy kWh/year 4839.94 2929.51	(265) (267) (268) (272) (273) (274) (274) (274) (264) (264) (265)
Pumps and fans Electricity for lighting Fotal CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14) El band 13a. Primary energy - individual heating systems includ Epace heating - main system 1 Vater heating Epace and water heating Epace and fans	354.87 ling micro-CHP Energy kWh/year 3967.16 2401.23	x x x	(261) + (262) + (26 0.52 (26 (26 (Primary factor 1.22 (261) + (262) + (26	= [= [272) ÷ (4) = [[= [3) + (264) = [1375.57 38.93 184.18 1598.68 19.28 83.25 83 B Primary Energy kWh/year 4839.94 2929.51 7769.44	(265 (267 (268 (272 (273 (273 (274 (274 (261 (264 (265 (267
Pumps and fans Electricity for lighting Fotal CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14) El band	354.87 ling micro-CHP Energy kWh/year 3967.16 2401.23 75.00	x x x x	(261) + (262) + (26 0.52 (26 (26 (Primary factor 1.22 (261) + (262) + (26 3.07	= [= [55)(271) = [272) ÷ (4) = [[= [3) + (264) = [= [1375.57 38.93 184.18 1598.68 19.28 83.25 83 B Primary Energy kWh/year 4839.94 2929.51 7769.44 230.25	(265) (267) (268) (272) (273) (273) (274)

TER Worksheet Design - Draft



Client Address 1. Overall dwelling dimensi	4 6 Streatl	ley Place, L	andan NW					La	st modified		23/12	/2016	
	4 6 Streatl	ey Place, L	andan NW										
			-000000.199	N3 1HP									
1. Overall dwelling dimensi				10 111									
	ons												
					Area	(m²)			rage storey eight (m)		Vo	olume (m³)	
Lowest occupied				Γ	2.2	0	(1a) x		2.40	(2a) =		5.28	(3a)
+1					61.4	10	(1b) x		2.40	(2b) =		147.36	(3b)
Total floor area	(1a) +	+ (1b) + (1c	:) + (1d)(1	1n) = 🗌	63.6	50	(4)						
Dwelling volume								(3a)) + (3b) + (3d	c) + (3d)(3	n) =	152.64	(5)
2. Ventilation rate									·				
											m	³ per hour	
Number of chimneys									0	x 40 =		0	(6a)
Number of open flues									0	x 20 =		0	(6b)
Number of intermittent fans									2	x 10 =		20	(7a)
Number of passive vents									0	x 10 =		0	(7b)
Number of flueless gas fires									0	x 40 =		0	(7c)
											Air	changes pe hour	er
Infiltration due to chimneys,	flues, fans,	PSVs		((6a) + (6	b) + (7a	ı) + (7b) + (7c) =	20	÷ (5) =		0.13	(8)
If a pressurisation test has be	en carried	out or is in	itended, pr	roceed t	to (17),	otherwi	ise continu	e from (9)	to (16)				
Air permeability value, q50, e	expressed in	n cubic me	tres per ho	our per	square	metre o	of envelope	e area				5.00	(17)
If based on air permeability v	alue, then	(18) = [(17) ÷ 20] + (8	3), other	rwise (1	8) = (16	5)					0.38	(18)
Number of sides on which th	e dwelling	is sheltered	d									1	(19)
Shelter factor									1 -	[0.075 x (19)] =	0.93	(20)
Infiltration rate incorporating	shelter fac	ctor								(18) x (2	D) = 🗌	0.35	(21)
Infiltration rate modified for	monthly w	ind speed:											
Jan	Feb	Mar	Apr	May	y	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind speed	from Table	e U2											
5.10	5.00	4.90	4.40	4.30	C C	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	8	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
Adjusted infiltration rate (allo	owing for s	helter and	wind facto	or) (21)	x (22a)r	n							
0.45	0.44	0.43	0.39	0.38	8	0.33	0.33	0.33	0.35	0.38	0.40	0.41	(22b)
Calculate effective air change	erate for th	ne applicab	le case:										_
If mechanical ventilation:	air change	rate throu	gh system									N/A	(23a)
		ionavin 0/ .	allowing fo	or in-use	e factor	from Ta	able 4h					N/A	(23c)
If balanced with heat reco	overy: effici	ency in %	anowing ic									,	
	•		-									, 	_



	0.60	0.60	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)
3. Heat losses	and heat lo	ss naramet	or										
Element	and heat to	ss paramet		Gross rea, m²	Openings m ²		area m²	U-value W/m²K	A x U W,		value, /m².K	Ахк, kJ/K	
Window			-	,				1.33	= 16.92	7	,	,	(27)
Door							.95 x	1.00	= 10.52				(26)
Roof window							.20 x	1.59	= 1.91				(20) (27a)
External wall							.78 x	0.18	= 10.58				(29a)
Party wall							.52 x	0.00	= 0.00				(32)
Roof								0.13	= 7.65				(32)
Total area of ext	ternal elem	ents 50 m²					3.55	0.15	- 7.05				(31)
Fabric heat loss,		_					5.55		(26)(30) + (32) =	39.01	(33)
Heat capacity Cr		•						(28)	.(30) + (32) +			N/A	(34)
Thermal mass p			n²K					(20)	.(50) + (52) +	(520)(5	20, -	250.00	(35)
Thermal bridges				div K								11.02] (36)] (36)
Total fabric heat										(33) + (36) -	50.03	(37)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat					inay	Jun	501	746	Seb	000		Dee	
Ventilation near	30.27	30.07	29.88	28.97	28.80	28.01	28.01	27.86	28.31	28.80	29.15	29.51	(38)
Heat transfer co	L			20.57	20.00	20.01	20.01	27.00	20.31	20.00	25.15	25.51] (50)
	80.30	80.10	79.91	79.00	78.83	78.04	78.04	77.89	78.34	78.83	79.18	79.54	7
	00.50	00.10	75.51	75.00	70.05	70.04	70.04		Average = Σ		·	79.00	 (39)
Heat loss param	eter (HI P)	W/m²K (30))m ÷ (4)						Average - Z	(55)112,	/ 12	75.00] (33)
	1.26	1.26	1.26	1.24	1.24	1.23	1.23	1.22	1.23	1.24	1.24	1.25	7
	1.20	1.20	1.20	1.24	1.24	1.25	1.25		Average = Σ		·	1.24	 (40)
Number of days	in month (Table 1a)							/Weruge - Z	(40)112,		1.24] (40)
	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)
	01.00	20.00	01.00		01.00	00100	01.00	01.00	00.00	02.00	00.00	01.00	
4. Water heati	ng energy r	equiremen	t										
Assumed occupa	ancy, N											2.08	(42)
Annual average	hot water u	usage in litre	es per day '	Vd,average	= (25 x N) +	36						83.63	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage	e in litres pe	r day for ea	ach month '	Vd,m = fact	tor from Tab	le 1c x (43	3)						
	92.00	88.65	85.31	81.96	78.61	75.27	75.27	78.61	81.96	85.31	88.65	92.00	
										∑(44)1	.12 =	1003.59	(44)
Energy content	of hot wate	r used = 4.1	L8 x Vd,m x	nm x Tm/3	3600 kWh/m	onth (see	Tables 1b	, 1c 1d)					
	136.43	119.32	123.13	107.35	103.00	88.88	82.36	94.51	95.64	111.46	121.67	132.12	
										∑(45)1	.12 =	1315.87	(45)
Distribution loss	s 0.15 x (45)m											
	20.46	17.90	18.47	16.10	15.45	13.33	12.35	14.18	14.35	16.72	18.25	19.82	(46)
Water storage lo	oss calculat	ed for each	month (55	5) 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 con	tains dedic	ated solar s	torage or d	edicated W	VWHRS (56)၊	m x [(47) -	Vs] ÷ (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 l	oss for each	n month fro	m Table 3										
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)
Combi loss for e	ach month	from Table	3a, 3b or 3	с									
	46.88	40.80	43.47	40.42	40.06	37.12	38.36	40.06	40.42	43.47	43.72	46.88	(61)

SAP version 9.92

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

Total heat requir	red for wat	er heating o	alculated f	or each mo	onth 0.85 x	(45)m + (4	6)m + (57)n	n + (59)m +	· (61)m				
	183.31	160.12	166.60	147.76	143.06	126.00	120.72	134.57	136.06	154.93	165.39	179.00	(62)
Solar DHW input	calculated	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 wat	ter heater f	or each mo	nth (kWh/i	month) (62	2)m + (63)m	1							
	183.31	160.12	166.60	147.76	143.06	126.00	120.72	134.57	136.06	154.93	165.39	179.00	
										∑(64)1	.12 = 1	817.53	(64)
Heat gains from	water heat	ing (kWh/n	nonth) 0.25	5 × [0.85 ×	(45)m + (61	.)m] + 0.8 ×	[(46)m + (5	57)m + (59)	m]				-
	57.08	49.87	51.81	45.80	44.26	38.83	36.97	41.44	41.91	47.93	51.38	55.65	(65)
5. Internal gain	S												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains	(Table 5)												
	104.07	104.07	104.07	104.07	104.07	104.07	104.07	104.07	104.07	104.07	104.07	104.07	(66)
Lighting gains (ca	alculated in	Appendix I	., equation	L9 or L9a),	also see Ta	ible 5							
	16.22	14.40	11.71	8.87	6.63	5.60	6.05	7.86	10.55	13.40	15.64	16.67	(67)
Appliance gains	(calculated	in Appendi	x L, equatio	on L13 or L1	L3a), also se	ee Table 5							
	181.93	183.81	179.06	168.93	156.15	144.13	136.10	134.21	138.97	149.10	161.88	173.90	(68)
Cooking gains (ca	alculated ir	Appendix	L, equation	L15 or L15	a), also see	Table 5							
	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	(69)
Pump and fan ga	ins (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. evapo	oration (Tal	ble 5)											
	-83.26	-83.26	-83.26	-83.26	-83.26	-83.26	-83.26	-83.26	-83.26	-83.26	-83.26	-83.26	(71)
Water heating g	ains (Table	5)											
	76.72	74.22	69.63	63.61	59.49	53.93	49.70	55.70	58.20	64.42	71.37	74.80	(72)
Total internal ga	ins (66)m -	+ (67)m + (6	8)m + (69)	m + (70)m ·	+ (71)m + (7	72)m							
	332.09	329.66	317.63	298.63	279.49	260.88	249.07	255.00	264.95	284.14	306.11	322.59	(73)

		Access Tabl		Area m²		lar flux W/m²		g specific data or Table 6b		FF specific da or Table		Gains W	
NorthWest		0.7	77 x [1.73	x 🗌	11.28	x 0.9 x	0.63] x	0.70	= [5.97	(81)
SouthEast		0.7	77 X	8.46	x	36.79	x 0.9 x	0.63] x	0.70	= [95.13	(77)
SouthWest		0.7	77 x	0.65	x	36.79	x 0.9 x	0.63] x	0.70	= [7.31	(79)
NorthEast		0.7	77 x [1.92	_ x	11.28	x 0.9 x	0.63] x	0.70	= [6.62	(75)
Horizontal		1.0	00 x [1.20	x	26.00	x 0.9 x	0.63] x	0.70	= [12.38	
Solar gains in watts ∑(74	1)m(82)m	1											
127.4	1 225.8	3 330.63	443.06	524.68	532.83	508.78	3 446	.43 369.5	3	255.59	154.25	107.95	(83)
Total gains - internal and	l solar (73)	m + (83)m											
459.5	0 555.4	9 648.25	741.69	804.17	793.71	757.85	5 701	.42 634.4	7	539.73	460.36	430.54	(84)
7. Mean internal temp	erature (he	ating season)										_
Temperature during hea	ting period	s in the living	area from	Table 9, Thi	L(°C)							21.00	(85)
Jan	Feb	Mar	Apr	May	Jun	Jul	Au	ıg Sep		Oct	Nov	Dec	
Utilisation factor for gain	ns for living	area n1,m (s	ee Table 9a)									
1.00	0.99	0.97	0.91	0.79	0.60	0.45	0.	50 0.75		0.95	0.99	1.00	(86)
Mean internal temp of li	ving area T	1 (steps 3 to	7 in Table 9	c)									

	19.72	19.93	20.23	20.59	20.85	20.97	20.99	20.99	20.91	20.55	20.06	19.68	(87)
Temperature du							20.55	20.33	20.51	20.55	20.00	15.00] (0,)
i emperatare ac	19.87	19.87	19.88	19.89	19.89	19.90	19.90	19.90	19.89	19.89	19.88	19.88	(88)
Utilisation facto					19.09	13.50	15.50	15.50	15.05	15.05	19.00	19.00] (00)
	0.99	0.99	0.96	0.88	0.72	0.51	0.34	0.39	0.67	0.92	0.99	1.00	(89)
Mean internal to								0.55	0.07	0.52	0.55	1.00] (03)
	18.19	18.49	18.93	19.43	19.75	19.88	19.90	19.90	19.83	19.39	18.70	18.14	(90)
Living area fract		10.45	10.55	15.45	15.75	19.00	15.50	15.50		ving area ÷		0.64	(91)
Mean internal to		for the wh	ole dwellin	σfIA x T1 +	-(1 - fl A) x T	2				ving area .	(4) =	0.04] (31)
	19.16	19.40	19.76	20.17	20.45	20.57	20.59	20.59	20.52	20.13	19.57	19.12	(92)
Apply adjustme								20.33	20.52	20.15	15.57	13.12] (52)
	19.16	19.40	19.76	20.17	20.45	20.57	20.59	20.59	20.52	20.13	19.57	19.12	(93)
	19.10	13.40	15.70	20.17	20.45	20.57	20.35	20.33	20.52	20.15	15.57	13.12] (55)
8. Space heating	ng requirem	ent											
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains, r	յՠ											
	0.99	0.98	0.96	0.89	0.76	0.57	0.41	0.46	0.72	0.93	0.99	0.99	(94)
Useful gains, ηπ	nGm <i>,</i> W (94)m x (84)m											
	456.20	546.14	621.40	661.22	608.79	450.10	308.99	321.87	455.95	502.37	453.55	428.20	(95)
Monthly averag	e external te	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	(96)
Heat loss rate fo	or mean inte	ernal tempe	erature, Lm	, W [(39)m	x [(93)m -	(96)m]							
	1193.47	1161.79	1059.33	890.41	689.94	465.97	311.64	326.43	502.63	751.21	986.99	1186.80	(97)
Space heating re	equirement,	kWh/mon	th 0.024 x	[(97)m - (9	5)m] x (41)ı	m							
	548.53	413.71	325.82	165.02	60.38	0.00	0.00	0.00	0.00	105 14	204.00	FC4 40	1
		415.71	323.82	105.02	00.58	0.00	0.00	0.00	0.00	185.14	384.08	564.40]
		415.71	525.82	105.02	00.38	0.00	0.00	0.00		8)15 <i>,</i> 10	·	2647.07] (98)
Space heating re				105.02	00.38	0.00	0.00	0.00			.12 = 2]] (98)] (99)
	equirement	kWh/m²/ye	ear				0.00	0.00		8)15, 10	.12 = 2	2647.07	, , , ,
9a. Energy req	equirement	kWh/m²/ye	ear				0.00	0.00		8)15, 10	.12 = 2	2647.07	, , , ,
9a. Energy req Space heating	equirement uirements -	kWh/m²/ye	ear heating sys	stems inclu	iding micro	-CHP	0.00	0.00		8)15, 10	.12 = 2	41.62] (99)
9a. Energy req Space heating Fraction of spac	equirement uirements - e heat from	kWh/m²/ye individual secondary,	ear heating sys /supplemen	stems inclu	iding micro	-CHP	0.00	0.00		3)15, 10 (98)	.12 = 2 ÷ (4)	0.00] (99)] (201)
9a. Energy req Space heating Fraction of spac Fraction of spac	equirement uirements - e heat from e heat from	kWh/m²/ye individual secondary, main syste	ear heating sys /supplemen em(s)	stems inclu	iding micro	-CHP	0.00	0.00		8)15, 10	.12 = 2 ÷ (4)	2:647.07 41.62 0.00 1.00] (99)] (201)] (202)
9a. Energy req Space heating Fraction of spac Fraction of spac Fraction of spac	equirement uirements - e heat from e heat from e heat from	kWh/m²/ye individual secondary, main syste main syste	ear heating sys /supplemen em(s) em 2	stems inclu	iding micro	-CHP	0.00	0.00	Σ(ə	3)15, 10 (98) 1 - (20	12 = 2 ÷ (4) D1) =	2647.07 41.62 0.00 1.00 0.00] (99)] (201)] (202)] (202)
9a. Energy req Space heating Fraction of spac Fraction of spac Fraction of spac Fraction of total	equirement uirements - e heat from e heat from e heat from l space heat	kWh/m²/ye individual secondary, main syste main syste from main	ear heating sys /supplemen em(s) em 2 system 1	stems inclu	iding micro	-CHP	0.00	0.00	Σ(ə	1)15, 10 (98) 1 - (20	.12 = 2 ÷ (4) D1) = 3)] =	2:647.07 41.62 0.00 1.00 0.00 1.00] (99)] (201)] (202)] (202)] (202)] (204)
9a. Energy req Space heating Fraction of spac Fraction of spac Fraction of spac Fraction of total Fraction of total	equirement uirements - e heat from e heat from e heat from l space heat	kWh/m²/ye individual secondary, main syste main syste from main from main	ear heating sys /supplemen em(s) em 2 system 1	stems inclu	iding micro	-CHP	0.00	0.00	Σ(ə	3)15, 10 (98) 1 - (20	.12 = 2 ÷ (4)	2:647.07 41.62 0.00 1.00 0.00 1.00 0.00] (99)] (201)] (202)] (202)] (202)] (204)] (205)
9a. Energy req Space heating Fraction of spac Fraction of spac Fraction of spac Fraction of total	equirement uirements - e heat from e heat from l space heat l space heat in system 1	kWh/m²/ye individual secondary, main syste main syste from main from main (%)	ear heating sys /supplemen em(s) em 2 system 1 system 2	stems inclu	iding micro m (table 11	-CHP)			<u>Σ</u> (9)	3)15, 10 (98) 1 - (20)2) x [1- (20 (202) x (20	12 = 2 ÷ (4)	2647.07 41.62 0.00 1.00 0.00 1.00 0.00 93.40] (99)] (201)] (202)] (202)] (202)] (204)
9a. Energy req Space heating Fraction of spac Fraction of spac Fraction of spac Fraction of total Fraction of total Efficiency of ma	equirement uirements - e heat from e heat from e heat from l space heat l space heat in system 1 Jan	kWh/m²/ye individual secondary, main syste main syste from main from main (%) Feb	ear heating sys /supplemen em(s) em 2 system 1 system 2 Mar	stems inclu	iding micro	-CHP	Jul	Aug	Σ(ə	1)15, 10 (98) 1 - (20	.12 = 2 ÷ (4)	2:647.07 41.62 0.00 1.00 0.00 1.00 0.00] (99)] (201)] (202)] (202)] (202)] (204)] (205)
9a. Energy req Space heating Fraction of spac Fraction of spac Fraction of spac Fraction of total Fraction of total	equirement uirements - e heat from e heat from l space heat l space heat in system 1 Jan uel (main sys	kWh/m²/ye individual secondary, main syste main syste from main from main (%) Feb stem 1), kW	ear heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month	stems inclu ntary system Apr	iding micro m (table 11 May	-CHP) Jun	Jul	Aug	Σ(98 (20 Sep	3)15, 10 (98) 1 - (20)2) x [1- (20 (202) x (20 Oct	12 = 2 ÷ (4)	2647.07 41.62 0.00 1.00 0.00 1.00 0.00 93.40 Dec] (99)] (201)] (202)] (202)] (202)] (204)] (205)
9a. Energy req Space heating Fraction of spac Fraction of spac Fraction of spac Fraction of total Fraction of total Efficiency of ma	equirement uirements - e heat from e heat from e heat from l space heat l space heat in system 1 Jan	kWh/m²/ye individual secondary, main syste main syste from main from main (%) Feb	ear heating sys /supplemen em(s) em 2 system 1 system 2 Mar	stems inclu	iding micro m (table 11	-CHP)			∑(98 (20 Sep 0.00	8)15, 10 (98) 1 - (20)2) x [1- (20 (202) x (20 (202) x (20 Oct 198.22	12 = 2 ÷ (4) (4) (1) = (1) =	2:647.07 41.62 0.00 1.00 0.00 1.00 0.00 93.40 Dec 604.29] (99)] (201)] (202)] (202)] (202)] (204)] (205)] (206)
9a. Energy req Space heating Fraction of spac Fraction of spac Fraction of spac Fraction of total Fraction of total Efficiency of ma Space heating fu	equirement uirements - e heat from e heat from l space heat l space heat in system 1 Jan uel (main sys	kWh/m²/ye individual secondary, main syste main syste from main from main (%) Feb stem 1), kW	ear heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month	stems inclu ntary system Apr	iding micro m (table 11 May	-CHP) Jun	Jul	Aug	∑(98 (20 Sep 0.00	3)15, 10 (98) 1 - (20)2) x [1- (20 (202) x (20 Oct	12 = 2 ÷ (4) (4) (1) = (1) =	2647.07 41.62 0.00 1.00 0.00 1.00 0.00 93.40 Dec] (99)] (201)] (202)] (202)] (202)] (204)] (205)
9a. Energy req Space heating Fraction of spac Fraction of spac Fraction of spac Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating	equirement uirements - e heat from e heat from e heat from I space heat I space heat in system 1 Jan uel (main sys 587.29	kWh/m²/ye individual secondary, main syste main syste from main from main (%) Feb stem 1), kW	ear heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month	stems inclu ntary system Apr	iding micro m (table 11 May	-CHP) Jun	Jul	Aug	∑(98 (20 Sep 0.00	8)15, 10 (98) 1 - (20)2) x [1- (20 (202) x (20 (202) x (20 Oct 198.22	12 = 2 ÷ (4) (4) (1) = (1) =	2:647.07 41.62 0.00 1.00 0.00 1.00 0.00 93.40 Dec 604.29] (99)] (201)] (202)] (202)] (202)] (204)] (205)] (206)
9a. Energy req Space heating Fraction of spac Fraction of spac Fraction of spac Fraction of total Fraction of total Efficiency of ma Space heating fu	equirement uirements - e heat from e heat from l space heat l space heat in system 1 Jan uel (main sys 587.29 ter heater	kWh/m²/ye individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 442.95	ear heating sys /supplemen em(s) em 2 system 1 system 1 system 2 Mar Vh/month 348.84	stems inclu ntary system Apr 176.68	ding micro m (table 11 May 64.64	-CHP) Jun 0.00	Jul 0.00	Aug 0.00	Σ(98 (20 Sep 0.00 Σ(21:	8)15, 10 (98) 1 - (20)2) x [1- (20 (202) x (20 (202) x (20 Oct 198.22 1)15, 10	$ \begin{array}{c} 12 = 2 \\ \div (4) \\ 01) = \\ \hline \\ 3)] = \\ \hline \\ 03) = \\ \hline \\ Nov \\ \hline \\ 411.22 \\ .12 = \\ \hline \\ 22 \\ \hline \\ 22 \\ \hline \\ 12 = \\ \hline \\ 22 \\ 22$	2647.07 41.62 0.00 1.00 0.00 1.00 93.40 Dec 604.29 2834.13] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (211)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating Efficiency of wat	equirement uirements - e heat from e heat from e heat from l space heat l space heat in system 1 Jan uel (main sys 587.29 ter heater 87.64	kWh/m²/ye individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 442.95	ear heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month	stems inclu ntary system Apr	iding micro m (table 11 May	-CHP) Jun	Jul	Aug	∑(98 (20 Sep 0.00	8)15, 10 (98) 1 - (20)2) x [1- (20 (202) x (20 (202) x (20 Oct 198.22	12 = 2 ÷ (4) (4) (1) = (1) =	2:647.07 41.62 0.00 1.00 0.00 1.00 0.00 93.40 Dec 604.29] (99)] (201)] (202)] (202)] (202)] (204)] (205)] (206)
9a. Energy req Space heating Fraction of spac Fraction of spac Fraction of spac Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating	equirement uirements - e heat from e heat from e heat from l space heat l space heat l space heat usystem 1 Jan uel (main sys 587.29 ter heater 87.64 uel, kWh/m	kWh/m²/ye individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 442.95 87.33 onth	ear heating sys /supplemen em(s) em 2 system 1 system 1 system 2 Mar Vh/month 348.84 86.71	stems inclu ntary system Apr 176.68 85.33	ding micro m (table 11 May 64.64 83.05	-CHP) Jun 0.00 80.30	Jul 0.00 80.30	Aug 0.00 80.30	Σ(93 (20 Sep 0.00 Σ(21) 80.30	8)15, 10 (98) 1 - (20)2) x [1- (20 (202) x (20 (202) x (20 Oct 198.22 1)15, 10	$ \begin{array}{c} 12 = 2 \\ (4) \\ (4) \\ (1) = \\ (1) \\ (1) \\ (1) \\ (1) \\ (2) \\ (3) \\$	2:647.07 41.62 0.00 1.00 0.00 1.00 0.00 93.40 Dec 604.29 2:834.13 87.74] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (211)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating Efficiency of wat	equirement uirements - e heat from e heat from e heat from l space heat l space heat in system 1 Jan uel (main sys 587.29 ter heater 87.64	kWh/m²/ye individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 442.95	ear heating sys /supplemen em(s) em 2 system 1 system 1 system 2 Mar Vh/month 348.84	stems inclu ntary system Apr 176.68	ding micro m (table 11 May 64.64	-CHP) Jun 0.00	Jul 0.00	Aug 0.00	Σ(98 (20 Sep 0.00 Σ(21:	8)15, 10 (98) 1 - (20)2) × [1- (20 (202) × (20 (202) × (20 Oct 198.22 1)15, 10 85.50	12 = 2 (4) $(1) = $ (1)	2647.07 41.62 0.00 1.00 0.00 1.00 0.00 93.40 Dec 604.29 2834.13 87.74 87.74] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (211)] (217)
 9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating for Water heating Efficiency of water Water heating for 	equirement uirements - e heat from e heat from e heat from l space heat l space heat l space heat usystem 1 Jan uel (main sys 587.29 ter heater 87.64 uel, kWh/m	kWh/m²/ye individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 442.95 87.33 onth	ear heating sys /supplemen em(s) em 2 system 1 system 1 system 2 Mar Vh/month 348.84 86.71	stems inclu ntary system Apr 176.68 85.33	ding micro m (table 11 May 64.64 83.05	-CHP) Jun 0.00 80.30	Jul 0.00 80.30	Aug 0.00 80.30	Σ(93 (20 Sep 0.00 Σ(21) 80.30	8)15, 10 (98) 1 - (20)2) x [1- (20 (202) x (20 (202) x (20 Oct 198.22 1)15, 10	12 = 2 (4) $(1) = $ (1)	2:647.07 41.62 0.00 1.00 0.00 1.00 0.00 93.40 Dec 604.29 2:834.13 87.74] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (211)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating Efficiency of wat Water heating fu	equirement uirements - e heat from e heat from l space heat l space heat in system 1 Jan Jel (main sys 587.29 ter heater 87.64 uel, kWh/m 209.16	kWh/m²/ye individual secondary, main syste main syste from main (%) Feb stem 1), kW 442.95 87.33 onth 183.34	ear heating sys /supplemen em(s) em 2 system 1 system 1 system 2 Mar Vh/month 348.84 86.71	stems inclu ntary system Apr 176.68 85.33	ding micro m (table 11 May 64.64 83.05	-CHP) Jun 0.00 80.30	Jul 0.00 80.30	Aug 0.00 80.30	Σ(93 (20 Sep 0.00 Σ(21) 80.30	8)15, 10 (98) 1 - (20)2) × [1- (20 (202) × (20 (202) × (20 Oct 198.22 1)15, 10 85.50	12 = 2 $(4) = 2$ $(4) = 2$ $(4) = 2$ $(3) =$	2:647.07 41.62 0.00 1.00 0.00 1.00 0.00 93.40 Dec 604.29 2:834.13 2:834.13 87.74 87.74 2:04.01 2:149.42] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (211)] (217)
 9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating for Water heating Efficiency of water Water heating for 	equirement uirements - e heat from e heat from l space heat l space heat in system 1 Jan Jel (main sys 587.29 ter heater 87.64 uel, kWh/m 209.16	kWh/m²/ye individual secondary, main syste main syste from main (%) Feb stem 1), kW 442.95 87.33 onth 183.34	ear heating sys /supplemen em(s) em 2 system 1 system 1 system 2 Mar Vh/month 348.84 86.71	stems inclu ntary system Apr 176.68 85.33	ding micro m (table 11 May 64.64 83.05	-CHP) Jun 0.00 80.30	Jul 0.00 80.30	Aug 0.00 80.30	Σ(98 (20 Sep 0.00 Σ(21) 80.30	8)15, 10 (98) 1 - (20)2) × [1- (20 (202) × (20 (202) × (20 Oct 198.22 1)15, 10 85.50	12 = 2 $(4) = 2$ $(4) = 2$ $(4) = 2$ $(3) =$	2647.07 41.62 0.00 1.00 0.00 1.00 0.00 93.40 Dec 604.29 2834.13 87.74 87.74] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (211)] (217)

					24.40.42	
Water heating fuel	c)				2149.42	
Electricity for pumps, fans and electric keep-hot (Table 4)						(220.)
central heating pump or water pump within warm air	heating unit		30.00			(230c)
boiler flue fan			45.00		75.00	(230e)
Total electricity for the above, kWh/year					75.00	(231)
Electricity for lighting (Appendix L)					286.42	(232)
Total delivered energy for all uses		(21	11)(221) + (231) + (23	2)(237b) =	5344.97	(238)
10a. Fuel costs - individual heating systems including m	nicro-CHP					
	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	2834.13	x	3.48	x 0.01 =	98.63	(240)
Water heating	2149.42	x	3.48	x 0.01 =	74.80	(247)
Pumps and fans	75.00	×	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	286.42	x	13.19	x 0.01 =	37.78	(250)
Additional standing charges					120.00	(251)
Total energy cost			(240)(242) + (2	45)(254) =	341.10	(255)
11a. SAP rating - individual heating systems including r	nicro-CHP					
Energy cost deflator (Table 12)					0.42	(256)
Energy cost factor (ECF)					1.32	(257)
SAP value					81.60	Ī
SAP rating (section 13)					82	(258)
SAP band					В]
						_
12a. CO ₂ emissions - individual heating systems includi	Energy		Emission factor		Emissions	
	kWh/year		kg CO ₂ /kWh		kg CO ₂ /year	
Space heating - main system 1	2834.13	x	0.22	=	612.17	(261)
Water heating	2149.42	x	0.22	=	464.28	(264)
Space and water heating			(261) + (262) + (2	63) + (264) =		(265)
Pumps and fans			. , . , .	03) + (204) =	1076.45	
i unps unu runs	75.00	x	0.52	=	1076.45 38.93	(267)
	75.00 286.42	x x				
Electricity for lighting			0.52	=	38.93	(267)
Electricity for lighting Total CO ₂ , kg/year			0.52 0.52 (2	= =	38.93 148.65] (267)] (268)
Electricity for lighting Total CO ₂ , kg/year Dwelling CO ₂ emission rate			0.52 0.52 (2	= = :65)(271) =	38.93 148.65 1264.02	(267) (268) (272)
Electricity for lighting Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value			0.52 0.52 (2	= = :65)(271) =	38.93 148.65 1264.02 19.87	(267) (268) (272)
Electricity for lighting Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14)			0.52 0.52 (2	= = :65)(271) =	38.93 148.65 1264.02 19.87 84.40	(267) (268) (272) (273)
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 includ	286.42		0.52 0.52 (2	= = :65)(271) =	38.93 148.65 1264.02 19.87 84.40 84	(267) (268) (272) (273)
Electricity for lighting Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14) El band	286.42		0.52 0.52 (2	= = :65)(271) =	38.93 148.65 1264.02 19.87 84.40 84] (267)] (268)] (272)] (273)] (274)]
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 incluc	286.42 ding micro-CHP Energy		0.52 0.52 (2	= = :65)(271) =	38.93 148.65 1264.02 19.87 84.40 84 B Primary Energy] (267)] (268)] (272)] (273)] (274)]
Electricity for lighting Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14) El band	286.42 ding micro-CHP Energy kWh/year	x	0.52 (2 Primary factor	= = 265)(271) = (272) ÷ (4) =	38.93 148.65 1264.02 19.87 84.40 84 B Primary Energy kWh/year	(267) (268) (272) (273) (273) (274)
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 includ Space heating - main system 1	286.42 ding micro-CHP Energy kWh/year 2834.13	x	0.52 (2 Primary factor	= = (272) ÷ (4) = = =	38.93 148.65 1264.02 19.87 84.40 84 B Primary Energy kWh/year 3457.63	(267) (268) (272) (273) (273) (274) (274)
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 includ Space heating - main system 1 Water heating Space and water heating	286.42 ding micro-CHP Energy kWh/year 2834.13	x	0.52 (2 Primary factor 1.22 1.22	= = (272) ÷ (4) = = =	38.93 148.65 1264.02 19.87 84.40 84 B Primary Energy kWh/year 3457.63 2622.30	(267) (268) (272) (273) (273) (274) (274) (261) (264)
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 includ Space heating - main system 1 Water heating	286.42 ding micro-CHP Energy kWh/year 2834.13 2149.42	x x x	0.52 (2 Primary factor 1.22 (261) + (262) + (2	= = (272) ÷ (4) = = = 63) + (264) =	38.93 148.65 1264.02 19.87 84.40 84 B Primary Energy kWh/year 3457.63 2622.30 6079.93	(267) (268) (272) (273) (273) (274) (274) (261) (264) (265)
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 includ Space heating - main system 1 Water heating Space and water heating Pumps and fans	286.42 ding micro-CHP Energy kWh/year 2834.13 2149.42 75.00	x x x x	0.52 (2 Primary factor 1.22 (261) + (262) + (2 3.07	= = (272) ÷ (4) = = = 63) + (264) = =	38.93 148.65 1264.02 19.87 84.40 84 B Primary Energy kWh/year 3457.63 2622.30 6079.93 230.25	(267) (268) (272) (273) (273) (273) (274) (274) (261) (264) (265) (267)

Energy Statement

Appendix B – DER Worksheets

DER Worksheet Design - Draft



Total floor area (1a) + (1b) + (1c) + (1d)(1n) = 82.90 (4) Dwelling volume (3a) + (3b) + (3c) + (3d)(3n) = 198.96 (5) 2. Ventilation rate m¹ per hour Number of chimneys Number of open flues 0 x 40 = 0 (6a) Number of intermittent fans 0 x 10 = 0 (7b) Number of flueless gas fires 0 x 40 = 0 (7c) Number of flueless gas fires (6a) + (6b) + (7a) + (7b) + (7c) = 0 x 40 = 0 (7c) Air changes per hour hour Infiltration due to chimneys, flues, fans, PSVs (6a) + (6b) + (7a) + (7b) + (7c) = 0 x 40 = 0 (17) If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Air changes per hour per square metre of envelope area 3.00 (17) If based on air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 0.15 (18) Number of sides on which the dwelling is sheltered 0.15 (18) (20)	Assessor name	Mr Jason Doh	erty					As	ssessor num	iber	2634		
I. Overall dwelling dimensions Area (m ²) Average storey height (m) Volume (m ²) height (m) Lowest occupied 82.90 (1a) x 2.40 (2a) = 198.96 (3a) Total floor area (1a) + (1b) + (1c) + (1d)(1n) = 82.90 (4) (2a) + (2b) + (3c) + (3d)(3n) = 198.96 (5) 2. Ventilation rate 0 x40 = 0 (6a) Number of chimneys 0 x40 = 0 (6b) Number of fluess spas fires 0 x10 = 0 (7b) Number of flueless gas fires 0 x10 = 0 (7c) Air charges per hour 0 x40 = 0 (8) If a pressurisation test has been carried out or is intended, proceed to (7b), rherwise containe from (9 to (16) 0.5 0.0 (8) Air charges per hour 1 (10.75 x (19)) = 0.5 2.00 19) Infitration rate incorporating shelter factor 1 (10.75 x (19)) = 0.3 12) Infitration rate incorporating shelter factor 1.08 0.95 0.95 0.93 1.00 1.01 1.01 0.01 0.14 <	Client							La	st modified		23/12	/2016	
I. Overall dwelling dimensions Area (m ²) Average storey height (m) Volume (m ²) height (m) Lowest occupied 82.90 (1a) x 2.40 (2a) = 198.96 (3a) Total floor area (1a) + (1b) + (1c) + (1d)(1n) = 82.90 (4) (2a) + (2b) + (3c) + (3d)(3n) = 198.96 (5) 2. Ventilation rate 0 x40 = 0 (6a) Number of chimneys 0 x40 = 0 (6b) Number of fluess spas fires 0 x10 = 0 (7b) Number of flueless gas fires 0 x10 = 0 (7c) Air charges per hour 0 x40 = 0 (8) If a pressurisation test has been carried out or is intended, proceed to (7b), rherwise containe from (9 to (16) 0.5 0.0 (8) Air charges per hour 1 (10.75 x (19)) = 0.5 2.00 19) Infitration rate incorporating shelter factor 1 (10.75 x (19)) = 0.3 12) Infitration rate incorporating shelter factor 1.08 0.95 0.95 0.93 1.00 1.01 1.01 0.01 0.14 <	Address	16 Streatlev I	Place. Lor	ndon. N	W3 1HP								
Area (m ²) Average storey height (m) Volume (m ²) Lowest occupied (1a) + (1b) + (1c) + (1d)(1n) = 32.90 (1a) × 2.40 $2a$ = 198.96 $(3a)$ Total foor area (1a) + (1b) + (1c) + (1d)(1n) = 32.90 (d) $(3a) + (3b) + (3c) + (3d)(3n) =$ 198.96 (5) Control of the co	///////////////////////////////////////	10 Streatey I			W3 111								
height (m) Lowest occupied 2.2.90 (1.a) × 2.4.00 (2.a)	1. Overall dwelling dimen	sions											
Total floor area (1a) + (1b) + (1c) + (1d)(1n) = 82.90 (4) (3a) + (3b) + (3c) + (3d)(3n) = 198.96 (5) Owelling volume (3a) + (3b) + (3c) + (3d)(3n) = 198.96 (5) a. (b) + (3c) + (3d)(3n) = 198.96 (5) a. (b) + (3c) +						Area (m²)			-		Vo	olume (m³)	
Dwelling volume (3a) + (3b) + (3c) + (3d)(3n) = 198.96 (5) 2. Ventilation rate (3a) + (3b) + (3c) + (3d)(3n) = 198.96 (5) Number of chimneys 0 x 40 = 0 (6a) Number of open flues 0 x 10 = 0 (6a) Number of intermittent fans 0 x 10 = 0 (7a) Number of flueless gas fires 0 x 40 = 0 (7c) Number of flueless gas fires (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 changes per hour Air changes per hour Air premaebility value, q50, expressed in cubic metres per hour per square metre of envelope area 3.00 (17) 116 Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 3.00 (17) If a persuification test may belter factor 1 - (0.075 x (19)] = 0.85 (20) 199 Infiltration rate incorporating shelter factor (13) 1.08 0.35 0.3.70 4.00 4.30 4.50 4.70 (22) 191 Monthly average wind speed from Table U2 1.10 1.08 0.35 0.95 0.93 1.00 1.08 1.13 1.18 (22a) 22a) Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m 0.16 0.16 0.14 0.14 0.14 0.12 0.12	Lowest occupied					82.90	(1a) x		2.40] (2a) =		198.96	(3a)
2. Ventilation rate m ⁹ per hour Number of chimneys 0 x 40 = 0 (6a) Number of open flues 0 x 10 = 0 (7a) Number of flueless gas fires 0 x 10 = 0 (7b) Number of flueless gas fires 0 x 10 = 0 (7c) Air changes per hour 0 x 10 = 0 (7c) Air changes per hour 0 x 10 = 0 (7c) Air changes per hour 0 x 10 = 0 (7c) Air changes per hour 0 x 10 = 0 (7c) Air changes per hour 0 x 10 = 0 (7c) Air changes per hour 0 10 0.15 (15) Number of sides on which the dwelling is sheltered 2 (19) 0.15 (15) Number of sides on which the dwelling is sheltered 1 (10.075 x (19)] = 0.85 (20) Infiltration rate incorporating shelter factor 1 (10.075 x (19)] = 0.85 (20) Monthy average wind speed from Table U2 5.10 5.00 4.90<	Total floor area	(1a) + (1l	o) + (1c) +	- (1d)(1n) =	82.90	(4)						
m ¹ per hour Number of chimneys $\begin{timesemble}{0.5emble}{$	Dwelling volume							(3a)) + (3b) + (3	c) + (3d)(3	3n) =	198.96	(5)
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 (7a) Number of flueless gas fires 0 x 10 = 0 (7b) Number of flueless gas fires 0 x 10 = 0 (7c) Air changes per hour per square metre of envelope area 3.00 (17) if a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) 3.00 (17) if based on air permeability value, etb(18) = ((17) ÷ 20) + (8), otherwise (18) = (16) 0.15 (18) Number of sides on which the welling is sheltered 0.15 (18) Number of sides on which the welling shelter factor 10 0.03 (20) Infiltration rate incorporating shelter factor 10 0.15 (18) Si 10 5.00 4.90 4.30 3.80 3.70 4.00 4.30 4.70 (22) Infiltration rate (allowing for shelter and wind factor) (21) x (22) m 12	2. Ventilation rate												
Number of open flues											m	³ per hour	
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 0 x 40 = 0 (7c) Air changes per hour 0 x 40 = 0 (7c) Air changes per hour 0 x 40 = 0 (7c) 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) ÷ 20] + (8), otherwise (18) = (16) 0.15 (18) Number of sides on which the dwelling is sheltered 1<-(0.075 x (19)] =	Number of chimneys								0	x 40 =		0	(6a)
Number of passive vents 0 x 10 = 0 (7b) Number of flueless gas fires 0 x 40 = 0 (7c) Number of flueless gas fires (6a) + (6b) + (7a) + (7b) + (7c) = 0 x 40 = 0 (7c) Air changes per hour 1 0 x 40 = 0 (7c) Air changes per hour Infiltration due to chimneys, flues, fans, PSV (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) 0 1.15 (18) Air permeability value, 450, expressed in cubic metres per hour per square metre of envelope area 3.00 (17) If based on air permeability value, then (18) = [(17) + 20] + (8), otherwise (18) = (16) 0.15 (18) Number of sides on which the dwelling is shelter 2 (19) 0.35 (20) Infiltration rate incorporating shelter factor (18) x (20) = 0.13 (21) Infiltration rate incorporating shelter 4.90 4.40 4.30 3.80 3.70 4.00 4.30 4.50 4.70 (22) Monthly average wind speed from T	Number of open flues								0	x 20 =	: [0	(6b)
Number of flueless gas fires 0 x 40 = 0 (7c) Air changes per hour (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) 3.00 (17) 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) ÷ 20] + (8), otherwise (18) = (16) 0.15 (18) Number of sides on which the dwelling is shelter factor 1 - [0.075 x (19)] = 0.85 (20) Infiltration rate incorporating shelter factor (18) × (20) = 0.13 (21) Infiltration rate modified for monthly wind speed 1 - [0.075 x (19)] = 0.85 (20) Infiltration rate incorporating shelter factor (18) × (20) = 0.13 (21) Infiltration rate incorporating shelter factor (18) × (20) = 0.13 (21) Infiltration rate incorporating shelter factor (18) × (20) = 0.13 (21) Infiltration rate incorporating shelter factor (18) × (20) = 0.13 (21) Infiltration rate incorporating shelter factor (19)	Number of intermittent fan	S							0	x 10 =	: [0	(7a)
Air changes per hour Air changes per hour hour (6a) + (6b) + (7a) + (7b) + (7c) = ① + (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, ethen (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.15 (18) If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 2 (19) Number of sides on which the dwelling is shettered 2 (19) 0.85 (20) Infiltration rate incorporating shetter factor 1 - [0.075 x (19)] = 0.85 (21) Infiltration rate modified for monthly wind speed: (18) x (20) = 0.13 (21) Infiltration rate modified for monthly wind speed: (12) (12) (12) (12) (12) (13) (21) Infiltration rate modified for monthly wind speed: U Seep Oct Nov Dec Monthly average wind speed from Table U2	Number of passive vents								0	x 10 =	: [0	(7b)
how how how high high field how how high how how 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 3.00 (17) field Implicit permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 3.00 (17) field Implicit permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 1.515 (12) Implicit permeability value, q50, expressed in cubic metres per hour per square metre of envelope area Implicit permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 0.15 (18) Implicit permeability value, q50, expressed in cubic metres per hour per square metre of envelope area Implicit permeability value, q50, expressed in cubic metres per hour per square metre of envelope area Implicitit permeabile t	Number of flueless gas fires	;							0	x 40 =	: [0	(7c)
Infiltration due to chimneys, flues, fans, PSVs (6a) + (6b) + (7a) + (7b) + (7c) = 0 (5) = 0.00 (8) If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) 3.00 (17) 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) + 20] + (8), otherwise (18) = (16) 0.15 (18) Number of sides on which the welling is sheltered 1 - [0.075 x (19]] = 0.85 (20) (18) x (20) = (0.13 (21) (18) x (20) = (18) x (20) = (0.13 (21) (22)m + (128 (22)m + (128 (22)m + (128 (21) (22)m + (128 (22)m + (23) (22										-	Air		r
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) 3.00 (17) 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, q50, expressed in cubic metres per hour per square metre of envelope area 3.00 (17) If based on 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, q50, expressed in cubic metres per hour per square metre of envelope area 0.15 (18) Number of sides on which the dwelling is sheltered 2 (19) 0.85 (20) Shelter factor 1 - [0.075 x (19)] = 0.85 (20) (21) Infiltration rate incorporating shelter factor (18) x (20) = 0.13 (21) Infiltration rate modified for monthly wind speed: (18) x (20) = 0.13 (21) Monthly average wind speed from Table U2 5.10 5.00 4.90 4.40 4.30 3.80 3.70 4.00 4.30 4.70 (22) Monthly average wind speed from Table U2 1.28 1.25 1.23 1.01 1.08 0.95 0.93	Infiltration due to chimneys	. flues. fans. PS	/s		(6	a) + (6b) + (7	7a) + (7b) +	(7c) =	0	÷ (5) =			(8)
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) ÷ 20] + (8), otherwise (18) = (16) 0.15 (18) Number of sides on which the dwelling is sheltered 2 (19) Shelter factor $1 - [0.075 \times (19)] =$ 0.85 (20) Infiltration rate incorporating shelter factor $(18) \times (20) =$ 0.13 (21) Infiltration rate modified for monthly wind speet: $(18) \times (20) =$ 0.13 (21) Infiltration rate modified for monthly wind speet: $(18) \times (20) =$ 0.13 (21) Infiltration rate modified for monthly wind speet: $(12) \times (12) $				nded, p				· ·	to (16)] (-)			
Number of sides on which the dwelling is sheltered	Air permeability value, q50,	expressed in cu	ibic metre	es per h	our per s	quare metre	e of envelop	e area				3.00	(17)
Shelter factor $1 - [0.075 \times (19]] = 0.85 (20)$ (18) $\times (20) = 0.13$ (21) Infiltration rate incorporating shelter factor $(18) \times (20) = 0.13$ (21) Infiltration rate modified for monthly wind speed: $(18) \times (20) = 0.13$ (21) Monthly average wind speed from Table U2 $(18) \times (20) = 0.13$ (22) 5.10 5.00 4.90 4.40 4.30 3.80 3.70 4.00 4.30 4.50 4.70 (22) Wind factor (22)m $\div 4$ 1.28 1.25 1.23 1.10 1.08 0.95 0.93 1.00 1.08 1.13 1.18 (22a) Adjusted infiltration rate (allowing for shelter and wind factor) (21) $\times (22a)m$ 0.12 0.12 0.13 0.14 0.14 0.12 0.12 0.13 0.14 0.14 0.12 0.12 0.13 0.14 0.14 0.12 0.12 0.13 0.14 0.14 0.12 0.21 0.13 0.14 0.14 0.12 0.21 0.13 0.14 0.14 0.12 0.21 0.13 0.14 0.14 0.12 0.21 0.23 0.50 <	If based on air permeability	value, then (18) = [(17) ÷	- 20] + (8	8), otherv	vise (18) = (1	L6)					0.15	(18)
(18) x (20) = 0.13 (21) (18) x (20) = 0.13 (21) Infiltration rate modified for monthly wind speed: Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Monthly average wind speed from Table U2 5.10 5.00 4.90 4.40 4.30 3.80 3.70 4.00 4.30 4.50 4.70 (22) Wind factor (22)m $\div 4$ 1.28 1.25 1.23 1.10 1.08 0.95 0.93 1.00 1.08 1.13 1.18 (22a) Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m 0.16 0.16 0.16 0.14 0.14 0.12 0.12 0.13 0.14 0.14 0.15 (22b) Calculate effective air change rate for the applicable case: 0.50 $0.23a$ 0.50 $(23a)$ If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h 79.90 $(23c)$ a 79.90 $(23c)$ a) If balanced mechanical ventilation with heat recovery (M	Number of sides on which t	he dwelling is sh	neltered									2	(19)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Monthly average wind speed from Table U2 $5.10 5.00 4.90 4.40 4.30 3.80 3.70 4.00 4.30 4.40 4.30 3.80 3.70 4.00 4.30 4.40 4.30 3.80 3.70 4.00 4.30 4.40 4.30 4.40 4.30 3.80 3.70 4.30 4.40 4.30 4.40 4.30 4.40 4.30 4.40 4.30 4.30 4.30 4.50 4.70 6.22 Modulated infiltration rate (allowing for shelter and wind factor) (21) x (22a)m 0.16$	Shelter factor								1 -	[0.075 x (1	9)] =	0.85	(20)
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 ibelter and wind factor) (21) x (22a)m 0.16 0.16 0.16 0.16 0.14 0.12 0.12 0.13 0.14 0.15 (22b) Calculate effective air change rate for the applicable case: If mechanical ventilation: air change rate through system 0.50 (23a) 0.50 (23a) 0.26 0.26 0.26 0.24 0.22 0.22 0.23 0.24 0.24 0.25 (24a) a) If balanced with heat recovery: efficiency in X allowing for in-use factor from Table Ah 0.22 0.22 0.23 0.24	Infiltration rate incorporation	ng shelter factor								(18) x (2	20) =	0.13	(21)
Monthly average wind speed from Table U2 5.10 5.00 4.90 4.40 4.30 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 0.13 0.14 0.14 0.15 (22b) Calculate effective air change rate for the applicable case: 0.50 (23a) 0.50 (23a) If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h 79.90 (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 0.22 0.22 0.23 0.24 0.25 (24a) Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25) 4 0.22 0.22 0.22 0.23 0.24 0.24 0.25 (24a)	Infiltration rate modified fo	r monthly wind	speed:										_
5.10 5.00 4.90 4.40 4.30 3.80 3.70 4.00 4.30 4.50 4.70 (22) Wind factor (22)m ÷ 4 1.28 1.25 1.23 1.10 1.08 0.95 0.93 1.00 1.08 1.13 1.18 (22a) Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m 0.16 0.16 0.14 0.14 0.12 0.12 0.13 0.14 0.14 0.15 (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 79.90 (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 0.22 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)	Jan	Feb N	/lar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor (22)m ÷ 4 1.28 1.25 1.23 1.10 1.08 0.95 0.93 1.00 1.08 1.13 1.18 (22a) Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m 0.16 0.16 0.16 0.14 0.14 0.12 0.12 0.13 0.14 0.14 0.15 (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 79.90 (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 0.22 0.22 0.22 0.23 0.24 0.25 (24a) Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25) <	Monthly average wind spee	d from Table U2	2										
1.28 1.25 1.23 1.10 1.08 0.95 0.93 1.00 1.08 1.13 1.18 (22a) Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m 0.16 0.16 0.16 0.14 0.12 0.12 0.12 0.13 0.14 0.14 0.15 (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 79.90 (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 0.22 0.22 0.22 0.23 0.24 0.25 (24a) Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	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)
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 (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 79.90 (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 0.22 0.22 0.23 0.24 0.25 (24a) Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25) Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25) 0.22 0.22 0.23 0.24 0.25 (24a)	Wind factor (22)m ÷ 4												
0.16 0.16 0.14 0.14 0.12 0.12 0.13 0.14 0.14 0.15 (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 79.90 (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 0.22 0.22 0.22 0.23 0.24 0.25 (24a) Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	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)
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 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)	Adjusted infiltration rate (a	llowing for shelt	er and wi	ind fact	or) (21) x	(22a)m							
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 79.90 (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 0.22 0.22 0.22 0.23 0.24 0.25 (24a) Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25) Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25) 0.22 0.22 0.23 0.24 0.25 (24a)	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)
If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h 79.90 (23c) a) If balanced mechanical ventilation with heat recovery (MVHR) (22b)m + (23b) x [1 - (23c) ÷ 100] 0.26 0.26 0.24 0.24 0.22 0.22 0.22 0.23 0.24 0.25 (24a) Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	Calculate effective air chang	ge rate for the a	pplicable	case:									
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)	If mechanical ventilation	: air change rate	e through	n system	n							0.50	(23a)
0.26 0.26 0.24 0.24 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)	If balanced with heat red	covery: efficienc	y in % all	owing fo	or in-use	factor from	Table 4h					79.90	(23c)
Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	a) If balanced mechanica	al ventilation wi	th heat re	ecovery	(MVHR) (22b)m + (23	3b) x [1 - (23	c) ÷ 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)
0.26 0.26 0.24 0.24 0.22 0.22 0.22 0.23 0.24 0.24 0.25 (25)	Effective air change rate - e	nter (24a) or (24	4b) or (24	c) or (24	4d) 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 lo	ss paramet	er										
Element				Gross rea, m²	Openings m ²		area m²	U-value W/m²K	A x U W	•	/alue, /m².K	Ахк, kJ/K	
Window						17	7.77 x	1.15	= 20.35				(27)
Door						1	.95 x	0.55	= 1.07				(26)
Roof window						3	.00 x	0.96	= 2.88				(27a)
Ground floor						82	2.90 x	0.15	= 12.44				(28a)
External wall						64	l.76 x	0.13	= 8.42				(29a)
Party wall						36	5.72 x	0.00	= 0.00				(32)
Roof						33	8.80 x	0.09	= 3.01				(30)
Total area of ext	ternal elem	ents ∑A, m²				20	4.18						(31)
Fabric heat loss,	, W/K = ∑(A	× U)							(20	5)(30) + (3	32) =	48.17	(33)
Heat capacity Cr	m = ∑(А х к)							(28)	.(30) + (32) -	+ (32a)(3	2e) =	N/A	(34)
Thermal mass p	arameter (T	MP) in kJ/r	n²K									200.00	(35)
Thermal bridges	s: Σ(L x Ψ) ca	alculated us	sing Appen	dix K								16.35	(36)
Total fabric heat	t loss									(33) + (3	36) =	64.51	(37)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat	t loss calcula	ated month	ly 0.33 x (2	25)m x (5)									
	17.27	17.06	16.85	15.81	15.60	14.55	14.55	14.34	14.97	15.60	16.02	16.43	(38)
Heat transfer co	oefficient, W	//K (37)m +	- (38)m										
	81.79	81.58	81.37	80.32	80.11	79.07	79.07	78.86	79.48	80.11	80.53	80.95]
									Average = 2	(39)112/	/12 =	80.27	(39)
Heat loss param	neter (HLP),	W/m²K (39	9)m ÷ (4)										
	0.99	0.98	0.98	0.97	0.97	0.95	0.95	0.95	0.96	0.97	0.97	0.98	
									Average = 2	(40)112/	/12 =	0.97	(40)
Number of days	in month (⁻	Table 1a)											
	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)
4. Water heati		equiremen	L									2.52	
Assumed occup					(25	26						2.52	(42)
Annual average	Jan	Feb	es per day Mar		e = (25 x N) + May	Jun	Jul	A	Son	Oct	Nov	93.95 Dec	(43)
Hot water usage				Apr Vd.m.= fact				Aug	Sep	00	NOV	Dec	
not water usage	-		95.82				-	00.21	02.07	05.93		102.24	٦
	103.34	99.58	95.62	92.07	88.31	84.55	84.55	88.31	92.07	95.82 ∑(44)1	99.58	103.34 1127.34	 (44)
Energy content	of hot wate	r used = / 1	l 8 v Vd m v	nm v Tm/3	3600 kWh/m	onth (see	Tables 1h	1c 1d)		2(44)1	.12	1127.34	_ (44)
Energy content	153.25	134.03	138.31	120.58	115.70	99.84	92.52	106.17	107.43	125.20	136.67	148.41	٦
	155.25	134.05	138.51	120.58	115.70	55.04	92.52	100.17	107.45	∑(45)1	·	1478.12	 (45)
Distribution loss	s 0 15 x (45)m								Ζ(45)1	.12	1470.12] (43)
Distribution 1055	22.99	20.10	20.75	18.09	17.36	14.98	13.88	15.92	16.12	18.78	20.50	22.26	(46)
Water storage lo					17.30	14.90	13.88	15.92	10.12	10.70	20.50	22.20	_ (40)
Water storage in	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 con			1					1	0.00	0.00	0.00	0.00	_ (50)
ii the vessel con	0.00	0.00	0.00	0.00	0.00		0.00		0.00	0.00		0.00	7 (57)
Primary circuit l				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(57)
i innary circuit i	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 e					0.00	0.00	0.00	0.00	0.00	0.00	1 0.00	1 0.00] (39)
201101 1035 101 8	31.95	28.84	31.89	30.81	31.80	30.73	31.73	31.77	30.77	31.85	30.88	31.94	(61)
	31.95	20.04	51.05	1 20.01	31.00	50.75	51.75	51.//	50.77	51.05	0.00	51.54	

SAP version 9.92

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

Total heat requi	red for wat	er heating o	calculated f	or each mo	onth 0.85 x	(45)m + (4	6)m + (57)n	n + (59)m +	(61)m				
	185.20	162.88	170.20	151.39	147.50	130.57	124.24	137.94	138.21	157.05	167.55	180.35	(62)
Solar DHW inpu	t calculated	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 wa	iter heater f	or each mo	onth (kWh/	month) (62	2)m + (63)m	ı							
	185.20	162.88	170.20	151.39	147.50	130.57	124.24	137.94	138.21	157.05	167.55	180.35]
										∑(64)1	.12 = 1	853.08	(64)
Heat gains from	water heat	ing (kWh/n	nonth) 0.2	5 × [0.85 × ((45)m + (61	.)m] + 0.8 ×	[(46)m + (5	57)m + (59)	m]				
	58.94	51.78	53.96	47.80	46.42	40.88	38.69	43.24	43.41	49.59	53.16	57.33	(65)
5. Internal gain	าร												
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains	(Table 5)												_
	125.78	125.78	125.78	125.78	125.78	125.78	125.78	125.78	125.78	125.78	125.78	125.78	(66)
Lighting gains (c	alculated in	Appendix	L, equation	L9 or L9a),	also see Ta	able 5							_
	20.09	17.85	14.51	10.99	8.21	6.93	7.49	9.74	13.07	16.60	19.37	20.65	(67)
Appliance gains	(calculated	in Appendi	x L, equatio	on L13 or L1	L3a), also se	ee Table 5							
	225.39	227.73	221.84	209.29	193.45	178.57	168.62	166.28	172.18	184.72	200.56	215.45	(68)
Cooking gains (c	alculated ir	n Appendix	L, equation	L15 or L15	a), also see	Table 5							
	35.58	35.58	35.58	35.58	35.58	35.58	35.58	35.58	35.58	35.58	35.58	35.58	(69)
Pump and fan g	ains (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. evap	oration (Ta	ble 5)											
	-100.62	-100.62	-100.62	-100.62	-100.62	-100.62	-100.62	-100.62	-100.62	-100.62	-100.62	-100.62	(71)
Water heating g	ains (Table	5)											
	79.22	77.05	72.53	66.38	62.39	56.78	52.01	58.12	60.30	66.66	73.84	77.06	(72)
Total internal ga	ains (66)m -	+ (67)m + (6	68)m + (69)	m + (70)m -	+ (71)m + (7	72)m							
	388.45	386.36	372.62	350.40	327.79	306.01	291.86	297.88	309.28	331.71	357.51	376.89	(73)

			Access t Table		Area m²		lar flux V/m²		g pecific data or Table 6b		FF specific da or Table 6		Gains W	
SouthEast			0.7	7 x	8.35	x 3	36.79 x	0.9 x	0.63	х	0.70	=	93.89	(77)
SouthWest			0.7	7 x	1.68	x	36.79 x	0.9 x	0.63	х	0.70	=	18.89	(79
NorthWest			0.7	7 x	1.73	x 1	1.28 x	0.9 x	0.63	х	0.70	=	5.97	(81
NorthEast			0.7	7 x [6.01	x 1	1.28 x	0.9 x	0.63	х	0.70	=	20.72	(75
Horizontal			1.0	0 x [3.00	x 2	26.00 x	0.9 x	0.63	х	0.70	=	30.96	
Solar gains in v	vatts ∑(74)m	n(82)m												
	170.43	310.74	475.04	665.04	809.49	830.66	789.70	678.7	2 540.82	2	357.30	207.96	143.32	(83
Total gains - in	ternal and so	olar (73)m +	- (83)m											
	558.88	697.10	847.66	1015.44	1137.29	1136.67	1081.56	976.6	0 850.10)	689.02	565.47	520.21	(84
7. Mean inter Temperature o	•				able 9, Th	1(°C)							21.00	(85
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		Oct	Nov	Dec	
Utilisation fact	or for gains f	or living ar	ea n1,m (se	e Table 9a)	1									
		0.98	0.93	0.81	0.62	0.44	0.32	0.37	0.62	- 1	0.90	0.98	0.99	(86

	19.87	20.12	20.46	20.79	20.95	20.99	21.00	21.00	20.96	20.70	20.21	19.82	(87)
Temperature du	ring heating	g periods in	the rest of	dwelling fr	om Table 9), Th2(°C)							
	20.09	20.10	20.10	20.11	20.11	20.12	20.12	20.12	20.12	20.11	20.11	20.10	(88)
Utilisation factor	LI				-	-		-] (/
	0.99	0.97	0.92	0.77	0.57	0.38	0.26	0.30	0.55	0.87	0.98	0.99	(89)
Mean internal te								0.00	0.00	0.07	0.50	0.55] (00)
	19.06	19.31	19.64	19.95	20.08	20.12	20.12	20.12	20.10	19.88	19.41	19.02	(90)
Living area fracti		19.51	15.04	19.95	20.00	20.12	20.12	20.12		ving area ÷		0.54	(91)
Mean internal te		for the wh	ole dwellin	α fl Λ ∨ T1 ⊥	./1 _ fl	-7				vilig alea .	(4) -	0.54] (91)
Wear internal te	· · · · · ·						20.00	20.00	20.57	20.22	10.04	10.40	
A sea ha e divertare e	19.50	19.75	20.08	20.40	20.55	20.59	20.60	20.60	20.57	20.32	19.84	19.46	(92)
Apply adjustmer	·i												
	19.50	19.75	20.08	20.40	20.55	20.59	20.60	20.60	20.57	20.32	19.84	19.46	(93)
8. Space heatin	g requirem	ent											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor	^r for gains. r	ım		•	•			Ū.					
	0.99	0.97	0.92	0.79	0.60	0.41	0.29	0.34	0.58	0.88	0.97	0.99	(94)
Useful gains, ηm	LI			0.75	0.00	0.11	0.25	0.01	0.50	0.00	0.57	0.55] (3 !)
oberar gamb, rim	551.93	674.89	776.59	799.16	679.89	469.80	315.37	329.77	495.46	602.97	550.59	515.41	(95)
Monthly average	LI				079.89	409.80	515.57	323.77	495.40	002.97	550.55	515.41] (33)
wontiny average	4.30	4.90	6.50		11.70	14.60	16.60	16.40	14.10	10.60	7 10	4.20	
Heat loss rate fo	LI			8.90			10.00	10.40	14.10	10.00	7.10	4.20	(96)
Heat loss rate fo	I						245.02	220.00	544.00	770.00	4000.00	4224.04	
	1243.02	1211.13	1104.97	924.04	708.94	473.66	315.92	330.86	514.03	778.92	1026.26	1234.91	(97)
Space heating re	· · · · · · · · · · · · · · · · · · ·						0.00	0.00	0.00				1
	514.17	360.36	244.32	89.92	21.61	0.00	0.00	0.00	0.00	130.90	342.49	535.31]
									∑(98	8)15, 10		239.07] (98)] (98)
Space heating re	quirement	kWh/m²/ye	ear							(98)	÷ (4)	27.01	(99)
9a. Energy requ	uirements -	individual	1		dina miana								
			heating sys	stems inclu	aing micro	-CHP							
Space heating			heating sys	tems inclu	aing micro-	-СНР							
Space heating Fraction of space	e heat from	secondary										0.00	(201)
Fraction of space			/supplemei							1 - (2)	01) =	0.00	(201)
Fraction of space	e heat from	main syste	/supplemei em(s)							1 - (2)	01) =	1.00	(202)
Fraction of space Fraction of space Fraction of space	e heat from e heat from	main syste main syste	/supplemen em(s) em 2						(20			1.00 0.00	(202) (202)
Fraction of space Fraction of space Fraction of space Fraction of total	e heat from e heat from space heat	main syste main syste from main	/supplemen em(s) em 2 system 1						(20)2) x [1- (20	3)] =	1.00 0.00 1.00	(202) (202) (204)
Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total	e heat from e heat from space heat space heat	main syste main syste from main from main	/supplemen em(s) em 2 system 1						(20		3)] = 03) =	1.00 0.00 1.00 0.00	(202) (202) (204) (205)
Fraction of space Fraction of space Fraction of space Fraction of total	e heat from e heat from space heat space heat n system 1	main syste main syste from main from main (%)	/supplemen m(s) m 2 system 1 system 2	ntary syster	n (table 11			Aug.		02) x [1- (20 (202) x (20	(3)] = (3) =	1.00 0.00 1.00 0.00 93.20	(202) (202) (204)
Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mai	e heat from e heat from space heat space heat n system 1 Jan	main syste main syste from main from main (%) Feb	/supplemen m(s) m 2 system 1 system 2 Mar				Jul	Aug	(20 Sep)2) x [1- (20	3)] = 03) =	1.00 0.00 1.00 0.00	(202) (202) (204) (205)
Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total	e heat from e heat from space heat space heat n system 1 Jan el (main sys	main syste main syste from main from main (%) Feb stem 1), kW	/supplemen m(s) m 2 system 1 system 2 Mar /h/month	ntary syster	m (table 11 May) Jun		_	Sep)2) x [1- (20 (202) x (20 Oct	3)] = 33) = Nov	1.00 0.00 1.00 0.00 93.20 Dec	(202) (202) (204) (205)
Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mai	e heat from e heat from space heat space heat n system 1 Jan	main syste main syste from main from main (%) Feb	/supplemen m(s) m 2 system 1 system 2 Mar	ntary syster	n (table 11		Jul 0.00	Aug 0.00	Sep 0.00)2) × [1- (20 (202) × (20 Oct 140.46	3)] = 3) = Nov 367.47	1.00 0.00 1.00 93.20 Dec 574.37	(202) (202) (204) (205) (206)
Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mai Space heating fu	e heat from e heat from space heat space heat n system 1 Jan el (main sys	main syste main syste from main from main (%) Feb stem 1), kW	/supplemen m(s) m 2 system 1 system 2 Mar /h/month	ntary syster	m (table 11 May) Jun		_	Sep 0.00)2) x [1- (20 (202) x (20 Oct	3)] = 3) = Nov 367.47	1.00 0.00 1.00 0.00 93.20 Dec	(202) (202) (204) (205)
Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mai Space heating fu Water heating	e heat from e heat from space heat space heat n system 1 Jan el (main sys 551.68	main syste main syste from main from main (%) Feb stem 1), kW	/supplemen m(s) m 2 system 1 system 2 Mar /h/month	ntary syster	m (table 11 May) Jun		_	Sep 0.00)2) × [1- (20 (202) × (20 Oct 140.46	3)] = 3) = Nov 367.47	1.00 0.00 1.00 93.20 Dec 574.37	(202) (202) (204) (205) (206)
Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mai Space heating fu	e heat from e heat from space heat space heat n system 1 Jan el (main sys 551.68	main syste main syste from main from main (%) Feb stem 1), kW	/supplemen m(s) m 2 system 1 system 2 Mar /h/month	ntary syster	m (table 11 May) Jun		_	Sep 0.00)2) × [1- (20 (202) × (20 Oct 140.46	3)] = 3) = Nov 367.47	1.00 0.00 1.00 93.20 Dec 574.37	(202) (202) (204) (205) (206)
Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mai Space heating fu Water heating Efficiency of wat	e heat from space heat space heat n system 1 Jan el (main sys 551.68 er heater 89.33	main syste main syste from main from main (%) Feb stem 1), kW 386.65	/supplemen m(s) m 2 system 1 system 2 Mar /h/month	ntary syster	m (table 11 May) Jun		_	Sep 0.00)2) × [1- (20 (202) × (20 Oct 140.46	3)] = 3) = Nov 367.47	1.00 0.00 1.00 93.20 Dec 574.37	(202) (202) (204) (205) (206)
Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mai Space heating fu Water heating	e heat from space heat space heat n system 1 Jan el (main sys 551.68 er heater 89.33	main syste main syste from main from main (%) Feb stem 1), kW 386.65	/supplemen m(s) m 2 system 1 system 2 Mar /h/month 262.14	Apr 96.48	m (table 11 May 23.19) Jun 0.00	0.00	0.00	Sep 0.00 Σ(21:)2) x [1- (20 (202) x (20 Oct 140.46 1)15, 10	3)] = ()3) = Nov 367.47 .12 =2	1.00 0.00 1.00 93.20 Dec 574.37 2402.44	(202) (202) (204) (205) (206) (206)
Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mai Space heating fu Water heating Efficiency of wat	e heat from space heat space heat n system 1 Jan el (main sys 551.68 er heater 89.33	main syste main syste from main from main (%) Feb stem 1), kW 386.65	/supplemen m(s) m 2 system 1 system 2 Mar /h/month 262.14	Apr 96.48	m (table 11 May 23.19) Jun 0.00	0.00	0.00	Sep 0.00 Σ(21:)2) x [1- (20 (202) x (20 Oct 140.46 1)15, 10	3)] = ()3) = Nov 367.47 .12 =2	1.00 0.00 1.00 93.20 Dec 574.37 2402.44	(202) (202) (204) (205) (206) (206)
Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mai Space heating fu Water heating Efficiency of wat	e heat from space heat space heat n system 1 Jan el (main sys 551.68 er heater 89.33 Jel, kWh/mo	main syste main syste from main from main (%) Feb stem 1), kW 386.65 89.18 onth	/supplemen m(s) m 2 system 1 system 2 Mar /h/month 262.14	Apr 96.48 88.17	m (table 11 May 23.19 87.40) Jun 0.00 87.00	0.00 87.00	0.00	Sep 0.00 Σ(21: 87.00)2) x [1- (20 (202) x (20 Oct 140.46 1)15, 10 88.43	3)] = 3)] = Nov 367.47 12 =2 89.12 188.00	1.00 0.00 1.00 93.20 Dec 574.37 2402.44 89.37	(202) (202) (204) (205) (206) (206)
Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mai Space heating fu Water heating Efficiency of wat	e heat from space heat space heat n system 1 Jan el (main sys 551.68 er heater 89.33 Jel, kWh/mo	main syste main syste from main from main (%) Feb stem 1), kW 386.65 89.18 onth	/supplemen m(s) m 2 system 1 system 2 Mar /h/month 262.14	Apr 96.48 88.17	m (table 11 May 23.19 87.40) Jun 0.00 87.00	0.00 87.00	0.00	Sep 0.00 Σ(21: 87.00)2) x [1- (20 (202) x (20 Oct 140.46 1)15, 10 88.43	3)] = 3)] = Nov 367.47 12 =2 89.12 188.00	1.00 0.00 1.00 93.20 Dec 574.37 2402.44 89.37 201.80	(202) (202) (204) (205) (206) (206) (211)
Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mai Space heating fu Water heating Efficiency of wat	e heat from space heat space heat n system 1 Jan el (main sys 551.68 er heater 89.33 uel, kWh/mo 207.32	main syste main syste from main from main (%) Feb stem 1), kW 386.65 89.18 0nth 182.64	/supplemen m(s) m 2 system 1 system 2 Mar /h/month 262.14	Apr 96.48 88.17	m (table 11 May 23.19 87.40) Jun 0.00 87.00	0.00 87.00	0.00	Sep 0.00 Σ(21: 87.00)2) x [1- (20 (202) x (20 Oct 140.46 1)15, 10 88.43	3)] = 3)] = Nov 367.47 12 =2 89.12 188.00 .12 =2	1.00 0.00 1.00 93.20 Dec 574.37 2402.44 89.37 201.80	(202) (202) (204) (205) (206) (206) (211)

Water heating fuel			2099.69
Electricity for pumps, fans and electric keep-hot (Table 4	lf)		
mechanical ventilation fans - balanced, extract or pos	sitive input from outside	160.81	(230a)
central heating pump or water pump within warm air	r heating unit	30.00	(230c)
boiler flue fan		45.00	(230e)
Total electricity for the above, kWh/year			235.81 (231)
Electricity for lighting (Appendix L)			354.87 (232)
Total delivered energy for all uses		(211)(221) + (231) + (232)(237b)	= 5092.81 (238)
10a. Fuel costs - individual heating systems including n	micro-CHP		
	Fuel kWh/year	Fuel price	Fuel cost £/year
Second heating main system 1		x 0.01 =	-
Space heating - main system 1			83.60 (240)
Water heating Pumps and fans	2099.69 ×		73.07 (247) 31.10 (249)
			<u>31.10</u> (249) 46.81 (250)
Electricity for lighting	354.87 ×	13.19 X 0.01 -	
Additional standing charges		(240)(242) + (245)(254)	120.00 (251) = 354.58 (255)
Total energy cost		(240)(242) + (245)(254)	= 354.58 (255)
11a. SAP rating - individual heating systems including i	micro-CHP		
Energy cost deflator (Table 12)			0.42 (256)
Energy cost factor (ECF)			1.16 (257)
SAP value			83.76
SAP rating (section 13)			84 (258)
SAP band			В
12a. CO ₂ emissions - individual heating systems includ	ing micro-CHP		
	Energy	Emission factor	Emissions
	kWh/year	kg CO₂/kWh	kg CO₂/year
Space heating - main system 1	2402.44 x		518.93 (261)
Water heating	2099.69 ×		453.53 (264)
Space and water heating		(761) + (767) + (762) + (767)	
Pumps and fans		(261) + (262) + (263) + (264)	
	235.81 ×	=	122.39 (267)
Electricity for lighting	235.81 × 354.87 ×	0.52 = 0.52 =	122.39 (267) 184.18 (268)
Total CO ₂ , kg/year		0.52 = 0.52 = (265)(271)	122.39 (267) 184.18 (268) = 1279.02 (272)
Total CO ₂ , kg/year Dwelling CO ₂ emission rate		0.52 = 0.52 =	$\begin{array}{c} \hline 122.39 \\ \hline 184.18 \\ \hline (268) \\ \hline 1879.02 \\ \hline (272) \\ \hline 15.43 \\ \hline (273) \\ \hline \end{array}$
Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value		0.52 = 0.52 = (265)(271)	$ \begin{array}{c} 122.39 \\ 184.18 \\ 268 \\ 1279.02 \\ (272) \\ 15.43 \\ 86.60 \\ \end{array} $
Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14)		0.52 = 0.52 = (265)(271)	$ \begin{array}{c} 122.39 \\ 184.18 \\ (268) \\ = 1279.02 \\ (272) \\ = 15.43 \\ (273) \\ \hline 86.60 \\ \hline 87 \\ (274) \end{array} $
Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value		0.52 = 0.52 = (265)(271)	$ \begin{array}{c} 122.39 \\ 184.18 \\ 268 \\ 1279.02 \\ (272) \\ 15.43 \\ 86.60 \\ \end{array} $
Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14)	<u>354.87</u> x	0.52 = 0.52 = (265)(271)	$ \begin{array}{c} 122.39 \\ 184.18 \\ (268) \\ = 1279.02 \\ (272) \\ = 15.43 \\ (273) \\ \hline 86.60 \\ \hline 87 \\ (274) \end{array} $
Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14) El band	<u>354.87</u> x	0.52 = 0.52 = (265)(271)	$ \begin{array}{c} 122.39 \\ 184.18 \\ (268) \\ = 1279.02 \\ (272) \\ = 15.43 \\ (273) \\ \hline 86.60 \\ \hline 87 \\ (274) \end{array} $
Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14) El band	354.87 × ding micro-CHP Energy	0.52 = 0.52 = (265)(271) (272) ÷ (4)	122.39 (267) 184.18 (268) 1279.02 (272) 15.43 (273) 86.60 (274) B Primary Energy
Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14) El band 13a. Primary energy - individual heating systems inclue	ding micro-CHP Energy kWh/year	0.52 = 0.52 = (265)(271) (272) ÷ (4)	122.39 (267) 184.18 (268) 1279.02 (272) 15.43 (273) 86.60 87 87 (274) B Primary Energy kWh/year
Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14) El band 13a. Primary energy - individual heating systems inclue Space heating - main system 1	ding micro-CHP Energy kWh/year 2402.44 x	0.52 = 0.52 = (265)(271) (272) ÷ (4)	122.39 (267) 184.18 (268) 1279.02 (272) 15.43 (273) 86.60 (274) 87 (274) 8 (274) 8 (261) 2930.98 (261) 2561.62 (264)
Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14) El band 13a. Primary energy - individual heating systems inclus Space heating - main system 1 Water heating	ding micro-CHP Energy kWh/year 2402.44 x	$Primary factor$ $(265)(271)$ $(272) \div (4)$ $(272) \div (4)$ $(272) = (261) + (262) + (263) + (264)$	122.39 (267) 184.18 (268) 1279.02 (272) 15.43 (273) 86.60 (274) 87 (274) 8 (274) 8 (261) 2930.98 (261) 2561.62 (264)
Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14) El band 13a. Primary energy - individual heating systems inclue Space heating - main system 1 Water heating Space and water heating	354.87 x ding micro-CHP Energy KWh/year 2402.44 x 2099.69 x	$Primary factor$ $(265)(271)$ $(272) \div (4)$	122.39 (267) 184.18 (268) 1279.02 (272) 15.43 (273) 86.60 (274) 87 (274) 8 (274) 8 (274) 8 (274) 9 (274) 10 (274) 11 (274) 11 (274) 11 (274) 11 (274) 12 (274) 13 (274) 14 (274) 15 (274) 16 (274) 17 (274) 18 (274) 19 (274) 10 (274) 10 (261) 11 (2561.62) (264) 12 (261) (265)
Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14) El band 13a. Primary energy - individual heating systems inclus Space heating - main system 1 Water heating Space and water heating Pumps and fans	354.87 x 354.87 x ding micro-CHP Energy KWh/year 2402.44 x 2402.44 x 2099.69 x 235.81 x x	$Primary factor$ $(265)(271)$ $(272) \div (4)$	122.39 (267) 184.18 (268) 1279.02 (272) 15.43 (273) 86.60 (274) 87 (274) 8 (274) 8 (261) 2930.98 (261) 2561.62 (264) 5492.60 (265) 723.93 (267)

DER Worksheet Design - Draft



Assessor name	Mr Jason	Doherty					As	sessor num	ber	2634		
Client							La	st modified		23/12	/2016	
Address	2 6 Streat	ley Place, L	ondon. N	W3 1HP								
		,,-	,									
1. Overall dwelling dimen	sions											
					Area (m²)			age storey eight (m)		Vo	olume (m³)	
Lowest occupied					74.10	<mark>](1a)</mark> x		2.40	(2a) =		177.84	(3a)
Total floor area	(1a) -	+ (1b) + (1c)) + (1d)	(1n) =	74.10	(4)						
Dwelling volume							(3a)	+ (3b) + (3c	c) + (3d)(3	3n) =	177.84	(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 fan	IS							0	x 10 =	: [0	(7a)
Number of passive vents								0	x 10 =	· _	0	(7b)
Number of flueless gas fires	5							0	x 40 =	: [0	(7c)
										Air	changes per hour	-
Infiltration due to chimneys	s flues fans	DS\/c		10	5a) + (6b) + (7	(2) + (7b) + (7b)	(7c) -	0	÷ (5) =	-	0.00	(8)
If a pressurisation test has l			tended r					-	. (5) -		0.00] (0)
Air permeability value, q50,								0 (10)			3.00	(17)
If based on air permeability							0 0.00				0.15	(18)
Number of sides on which t				en etner		,					2	(19)
Shelter factor								1 -	[0.075 x (1	9)] =	0.85] (==)
Infiltration rate incorporation	ng shelter fa	ctor										(20)
	0								(18) X (20) =	0.13	(20)
Infiltration rate modified fo	or monthly w	vind speed:							(18) x (2	20) =	0.13	(20) (21)
Infiltration rate modified fo	or monthly w Feb	vind speed: Mar	Apr	Мау	Jun	Jul	Aug	Sep	(18) x (. Oct	20) = Nov	0.13 Dec	, , , ,
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep				, , , ,
	Feb	Mar	Apr 4.40	May 4.30		Jul 3.80	Aug 3.70	Sep] (21)
Jan Monthly average wind spee	Feb ed from Tabl	Mar e U2				-	-		Oct	Nov	Dec	, , , ,
Jan Monthly average wind spee 5.10	Feb ed from Tabl	Mar e U2			3.80	-	-		Oct	Nov	Dec] (21)
Jan Monthly average wind spee 5.10 Wind factor (22)m ÷ 4	Feb ed from Tabl 5.00 1.25	Mar e U2 4.90 1.23	4.40	4.30	3.80	3.80	3.70	4.00	Oct 4.30	Nov	Dec] (21)
Jan Monthly average wind spec 5.10 Wind factor (22)m ÷ 4 1.28	Feb ed from Tabl 5.00 1.25	Mar e U2 4.90 1.23	4.40	4.30	3.80 0.95 ((22a)m	3.80	3.70	4.00	Oct 4.30	Nov	Dec] (21)
Jan Monthly average wind spee 5.10 Wind factor (22)m ÷ 4 1.28 Adjusted infiltration rate (a	Feb ed from Tabl 5.00 1.25 llowing for s 0.16	Mar e U2 4.90 1.23 helter and 0.16	4.40 1.10 wind fact 0.14	4.30 1.08 tor) (21) ×	3.80 0.95 ((22a)m	3.80	3.70 0.93	4.00	Oct 4.30 1.08	Nov 4.50	Dec 4.70 1.18] (21)] (22)] (22a)
Jan Monthly average wind spee 5.10 Wind factor (22)m ÷ 4 1.28 Adjusted infiltration rate (a 0.16	Feb ed from Tabl 5.00 1.25 Ilowing for s 0.16 ge rate for th	Mar e U2 4.90 1.23 helter and 0.16 he applicab	4.40 1.10 wind fact 0.14 le case:	4.30 1.08 tor) (21) × 0.14	3.80 0.95 ((22a)m	3.80	3.70 0.93	4.00	Oct 4.30 1.08	Nov 4.50	Dec 4.70 1.18] (21)] (22)] (22a)
Jan Monthly average wind spee 5.10 Wind factor (22)m ÷ 4 1.28 Adjusted infiltration rate (a 0.16 Calculate effective air changed	Feb ed from Tabl 5.00 1.25 Ilowing for s 0.16 ge rate for th n: air change	Mar e U2 4.90 1.23 thelter and 0.16 he applicab	4.40 1.10 wind fact 0.14 le case: gh system	4.30 1.08 tor) (21) × 0.14	3.80 0.95 (22a)m 0.12	3.80 0.95 0.12	3.70 0.93	4.00	Oct 4.30 1.08	Nov 4.50	Dec 4.70 1.18 0.15] (21)] (22)] (22a)] (22b)
Jan Monthly average wind spee 5.10 Wind factor (22)m ÷ 4 1.28 Adjusted infiltration rate (a 0.16 Calculate effective air chang If mechanical ventilation	Feb ed from Tabl 5.00 1.25 Ilowing for s 0.16 ge rate for th n: air change covery: effic	Mar e U2 4.90 1.23 helter and 0.16 he applicab e rate throu, iency in % a	4.40 1.10 wind fact 0.14 le case: gh system allowing f	4.30 1.08 tor) (21) × 0.14 n for in-use	3.80 0.95 (22a)m 0.12	3.80 0.95 0.12 Table 4h	3.70 0.93 0.12	4.00	Oct 4.30 1.08	Nov 4.50	Dec 4.70 1.18 0.15 0.50] (21)] (22)] (22a)] (22b)] (23a)
Jan Monthly average wind spee 5.10 Wind factor (22)m ÷ 4 1.28 Adjusted infiltration rate (a 0.16 Calculate effective air chang If mechanical ventilation If balanced with heat ree	Feb ed from Tabl 5.00 1.25 Ilowing for s 0.16 ge rate for th n: air change covery: effic	Mar e U2 4.90 1.23 helter and 0.16 he applicab e rate throu, iency in % a	4.40 1.10 wind fact 0.14 le case: gh system allowing f	4.30 1.08 tor) (21) × 0.14 n for in-use	3.80 0.95 (22a)m 0.12 factor from - (22b)m + (23	3.80 0.95 0.12 Table 4h	3.70 0.93 0.12	4.00	Oct 4.30 1.08	Nov 4.50	Dec 4.70 1.18 0.15 0.50] (21)] (22)] (22a)] (22b)] (23a)
Jan Monthly average wind spee 5.10 Wind factor (22)m ÷ 4 1.28 Adjusted infiltration rate (a 0.16 Calculate effective air chang If mechanical ventilation If balanced with heat rea a) If balanced mechanica	Feb ed from Tabl 5.00 1.25 Ilowing for s 0.16 ge rate for th n: air change covery: effic al ventilation 0.26	Mar e U2 4.90 1.23 thelter and 0.16 the applicab e rate throug iency in % a n with heat 0.26	4.40 1.10 wind fact 0.14 le case: gh system allowing f recovery 0.24	4.30 1.08 tor) (21) × 0.14 n for in-use v (MVHR) 0.24	3.80 0.95 (22a)m 0.12 factor from (22b)m + (23 0.22	3.80 0.95 0.12 Table 4h	3.70 0.93 0.12 c) ÷ 100]	4.00	Oct 4.30 1.08 0.14	Nov 4.50 1.13 0.14	Dec 4.70 1.18 0.15 0.50 79.90] (21)] (22)] (22a)] (22b)] (22b)] (23a)] (23c)



3. Heat losses a	and heat lo	ss paramet	er										
Element				Gross rea, m²	Openings m ²		area m²	U-value W/m²K	A x U W	•	/alue, /m².K	Ахк, kJ/K	
Window						16	5.41 x	1.15	= 18.79				(27)
Door						1	.95 x	0.55	= 1.07				(26)
Roof window						3	.00 x	0.96	= 2.88				(27a)
Ground floor						74	.10 x	0.15	= 11.12				(28a)
External wall						55	.32 x	0.13	= 7.19				(29a)
Party wall						36	5.72 x	0.00	= 0.00				(32)
Roof						29	0.20 x	0.09	= 2.60				(30)
Total area of ext	ternal elem	ents ∑A, m²				17	9.98						(31)
Fabric heat loss,	W/K = ∑(A	× U)							(26	5)(30) + (32) =	43.65	(33)
Heat capacity Cr	m = ∑(А x к)							(28)	.(30) + (32) -	+ (32a)(3	2e) =	N/A	(34)
Thermal mass pa	arameter (T	MP) in kJ/n	n²K									200.00	(35)
Thermal bridges	:: ∑(L x Ψ) ca	alculated us	sing Appen	dix K								15.14	(36)
Total fabric heat	t loss									(33) + (36) =	58.79	(37)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	_
Ventilation heat	loss calcula	ated month	ly 0.33 x (2	25)m x (5)									
	15.44	15.25	15.06	14.13	13.94	13.01	13.01	12.82	13.38	13.94	14.32	14.69	(38)
Heat transfer co	efficient, W	//K (37)m +	- (38)m									•	
	74.23	74.05	73.86	72.92	72.74	71.80	71.80	71.61	72.18	72.74	73.11	73.49	7
		•	•						Average = 2	(39)112	/12 =	72.88	(39)
Heat loss param	eter (HLP),	W/m²K (39	9)m ÷ (4)										
	1.00	1.00	1.00	0.98	0.98	0.97	0.97	0.97	0.97	0.98	0.99	0.99	7
		•							Average = 2	(40)112,	/12 =	0.98	(40)
Number of days	in month (⁻	Table 1a)											
	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)
	L	•						·	•		•	•	
4. Water heati		equiremen	t										-
Assumed occupa												2.34	(42)
Annual average	hot water u	isage in litre	es per day	Vd,average	e = (25 x N) +	36						89.81	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage	e in litres pe	r day for ea	ach month	Vd,m = fac	tor from Tab	le 1c x (43	3)		-		-	-	_
	98.79	95.20	91.60	88.01	84.42	80.83	80.83	84.42	88.01	91.60	95.20	98.79	
										∑(44)1	.12 =	1077.70	(44)
Energy content	of hot wate	r used = 4.1	L8 x Vd,m x	nm x Tm/3	3600 kWh/m	onth (see	Tables 1t	o, 1c 1d)	-			_	_
	146.50	128.13	132.22	115.27	110.61	95.45	88.44	101.49	102.70	119.69	130.65	141.88	
										∑(45)1	.12 =	1413.04	(45)
Distribution loss	0.15 x (45)m							-			_	_
	21.98	19.22	19.83	17.29	16.59	14.32	13.27	15.22	15.41	17.95	19.60	21.28	(46)
Water storage lo	oss calculate	ed for each	month (55	5) 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 con	tains dedica	ated solar s	torage or c	ledicated V	VWHRS (56)r	m x [(47) -	Vs] ÷ (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 lo	oss for each	month fro	m Table 3										_
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)
Combi loss for e	ach month	from Table	3a, 3b or 3	c									
	31.92	28.81	31.85	30.78	31.77	30.71	31.71	31.75	30.75	31.82	30.85	31.91	(61)

SAP version 9.92

0.05 (15) (16) (57) (50) (61)

Total heat requi	red for wat	er heating o	alculated f	or each mo	onth 0.85 x	(45)m + (4	6)m + (57)r	n + (59)m +	· (61)m				
	178.43	156.94	164.07	146.05	142.38	126.15	120.15	133.24	133.45	151.51	161.50	173.79	(62)
Solar DHW inpu	t calculated	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 wa	ter heater f	or each mo	onth (kWh/i	month) (62	2)m + (63)m	ı							
	178.43	156.94	164.07	146.05	142.38	126.15	120.15	133.24	133.45	151.51	161.50	173.79]
										∑(64)1	.12 = 1	787.66	(64)
Heat gains from	water heat	ing (kWh/n	nonth) 0.2	5 × [0.85 ×	(45)m + (61	.)m] + 0.8 ×	[(46)m + (57)m + (59)	m]				
	56.69	49.81	51.93	46.02	44.72	39.41	37.33	41.68	41.84	47.75	51.15	55.15	(65)
5. Internal gair	IS												
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains	(Table 5)												_
	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	(66)
Lighting gains (c	alculated in	Appendix I	L, equation	L9 or L9a),	also see Ta	ble 5							_
	18.42	16.36	13.31	10.08	7.53	6.36	6.87	8.93	11.99	15.22	17.76	18.94	(67)
Appliance gains	(calculated	in Appendi	x L, equatio	on L13 or L1	L3a), also se	ee Table 5							
	206.67	208.82	203.41	191.91	177.38	163.73	154.61	152.47	157.87	169.38	183.90	197.55	(68)
Cooking gains (c	alculated ir	n Appendix	L, equation	L15 or L15	a), also see	Table 5							
	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	(69)
Pump and fan ga	ains (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. evap	oration (Tal	ble 5)											
	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	(71)
Water heating g	ains (Table	5)											
	76.20	74.12	69.79	63.92	60.11	54.74	50.18	56.03	58.10	64.18	71.05	74.13	(72)
Total internal ga	ins (66)m -	+ (67)m + (6	58)m + (69)	m + (70)m ·	+ (71)m + (7	72)m							
	362.42	360.42	347.64	327.02	306.14	285.95	272.79	278.55	289.09	309.90	333.83	351.74	(73)

		Access f Table		Area m²		lar flux V/m²		g specific data or Table 6b		FF specific da or Table 6		Gains W	
SouthEast		0.7	7 X	7.67	x	86.79 x	0.9 x [0.63	x	0.70	=	86.25	(77)
NorthEast		0.7	7 X	1.68	x	1.28 x	0.9 x [0.63	x	0.70	=	5.79	(75)
NorthWest		0.7	7 X	1.05	x	1.28 x	0.9 x [0.63	x	0.70	=	3.62	(81
SouthWest		0.77	7 X	6.01	x 3	36.79 x	0.9 x [0.63	x	0.70	=	67.58	(79
lorizontal		1.00	D x	3.00	x	26.00 x	0.9 x [0.63	x	0.70	=	30.96	
Solar gains in watts ∑(74)m	.(82)m												
194.20	345.48	507.34	679.52	802.38	813.35	777.28	683.	.97 567.19)	391.60	235.39	164.34	(83)
otal gains - internal and sola	ır (73)m +	(83)m											
556.62	705.90	854.98	1006.54	1108.53	1099.30	1050.07	962.	.52 856.28	3	701.50	569.22	516.08	(84)
7. Mean internal temperatu													7.
emperature during heating	periods ir	the living a	area from T	able 9, Th1	L(°C)							21.00	(85)
Jan	Feb	Mar	Apr	May	Jun	Jul	Au	g Sep		Oct	Nov	Dec	
Jtilisation factor for gains for	r living are	ea n1,m (se	e Table 9a)										
0.99	0.96	0.90	0.77	0.59	0.41	0.30	0.3	0.56		0.86	0.97	0.99	(86)
Mean internal temp of living													

	19.93	20.20	20.54	20.83	20.96	20.99	21.00	21.00	20.97	20.76	20.28	19.87	(87)
Temperature du] (-)
	20.08	20.08	20.09	20.10	20.10	20.11	20.11	20.11	20.11	20.10	20.09	20.09	(88)
Utilisation facto					20120						20.00	20100] (00)
	0.98	0.96	0.88	0.73	0.54	0.36	0.24	0.28	0.50	0.82	0.96	0.99	(89)
Mean internal te								0.20	0.50	0.02	0.50	0.55] (00)
	19.11	19.38	19.70	19.97	20.07	20.11	20.11	20.11	20.09	19.92	19.47	19.06	(90)
Living area fract		19.50	15.70	19.97	20.07	20.11	20.11	20.11		ving area ÷		0.54	(91)
Mean internal te		for the wh	ole dwellin	σ fI Δ x T1 +	-(1 - fl A) x T	72				ving area .	(4) =	0.54] (31)
	19.55	19.82	20.15	20.43	20.55	20.58	20.59	20.59	20.57	20.37	19.90	19.50	(92)
Apply adjustme								20.39	20.37	20.37	19.90	19.50] (92)
	19.55	19.82	20.15	20.43	20.55	20.58	20.59	20.59	20.57	20.37	19.90	19.50	(93)
	19.55	19.82	20.15	20.45	20.55	20.56	20.59	20.39	20.57	20.57	19.90	19.50] (95)
8. Space heatir	ng requirem	ent											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains, r	յՠ											
	0.98	0.95	0.89	0.74	0.56	0.39	0.27	0.31	0.53	0.83	0.96	0.99	(94)
Useful gains, ηm	nGm, W (94)m x (84)m											_
	546.35	672.37	757.09	749.83	622.56	426.76	285.88	299.14	454.84	583.67	546.98	509.00	(95)
Monthly average	e external te	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	(96)
Heat loss rate fo	or mean inte	rnal tempe	erature, Lm,	W [(39)m	x [(93)m -	(96)m]				•		•	-
	1132.00	1105.06	1008.10	840.92	643.62	429.59	286.27	299.88	466.70	710.55	935.96	1124.23	(97)
Space heating re	equirement,	kWh/mon	th 0.024 x	[(97)m - (9	5)m] x (41)ı	m					•		-
	435.72	290.77	186.75	65.58	15.67	0.00	0.00	0.00	0.00	94.39	280.07	457.73	1
				05.50	10.07	0.00	0.00	0.00	0.00	54.55	200.07		
		200177	100110	03.50	15.07	0.00	0.00	0.00		8)15, 10	· · · · ·	1826.68] (98)
Space heating re	equirement			00.50	13.07	0.00	0.00	0.00			.12 = 1]] (98)] (99)
	•	kWh/m²/ye	ear				0.00	0.00		8)15, 10	.12 = 1	826.68	, , , ,
Space heating re	•	kWh/m²/ye	ear				0.00	0.00		8)15, 10	.12 = 1	826.68	, , , ,
	•	kWh/m²/ye	ear					0.00		8)15, 10	.12 = 1	826.68	, , , ,
9a. Energy req	uirements -	kWh/m²/ye	ear heating sys	stems inclu	ding micro	-CHP	0.00	0.00		8)15, 10	.12 = 1	826.68	, , , ,
9a. Energy req Space heating	uirements - e heat from	kWh/m²/ye individual secondary,	ear heating sys /supplemer	stems inclu	ding micro	-CHP	0.00	0.00		8)15, 10	.12 = 1 ÷ (4)	24.65] (99)
9a. Energy req Space heating Fraction of space	uirements - e heat from e heat from	kWh/m²/ye individual secondary, main syste	ear heating sys /supplemer m(s)	stems inclu	ding micro	-CHP	0.00	0.00		8)15, 10 (98)	.12 = 1 ÷ (4)	0.00] (99)] (201)
9a. Energy req Space heating Fraction of space Fraction of space	uirements - e heat from e heat from e heat from	kWh/m²/ye individual secondary, main syste main syste	ear heating sys /supplemen m(s) m 2	stems inclu	ding micro	-CHP	0.00	0.00	Σ(ə	8)15, 10 (98)	12 = 1 ÷ (4) 01) =	1.00] (99)] (201)] (202)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space	e heat from e heat from e heat from e heat from space heat	kWh/m²/ye individual secondary, main syste main syste from main	ear heating sys /supplemen m(s) m 2 system 1	stems inclu	ding micro	-CHP	0.00	0.00	Σ(ə	8)15, 10 (98) 1 - (20	.12 = 1 ÷ (4)	1826.68 24.65 0.00 1.00 0.00] (99)] (201)] (202)] (202)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total	e heat from e heat from e heat from e heat from space heat space heat	kWh/m²/ye individual secondary, main syste main syste from main from main	ear heating sys /supplemen m(s) m 2 system 1	stems inclu	ding micro	-CHP		0.00	Σ(ə	8)15, 10 (98) 1 - (20	12 = 1 ÷ (4)	1826.68 24.65 0.00 1.00 0.00 1.00] (99)] (201)] (202)] (202)] (202)] (204)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total	e heat from e heat from e heat from e heat from space heat space heat	kWh/m²/ye individual secondary, main syste main syste from main from main	ear heating sys /supplemen m(s) m 2 system 1	stems inclu	ding micro	-CHP	Jul	Aug	Σ(ə	8)15, 10 (98) 1 - (20	12 = 1 ÷ (4)	.826.68 24.65 0.00 1.00 0.00 1.00 0.00] (99)] (201)] (202)] (202)] (202)] (204)] (205)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total	e heat from e heat from e heat from space heat space heat in system 1 Jan	kWh/m²/ye individual secondary, main syste main syste from main from main (%) Feb	ear heating sys /supplemen m(s) m 2 system 1 system 2 Mar	stems inclu	ding micro m (table 11	-CHP)			<u>Σ</u> (9)	8)15, 10 (98) 1 - (20)2) x [1- (20 (202) x (20	.12 = 1 ÷ (4)	826.68 24.65 0.00 1.00 0.00 1.00 0.00 93.20] (99)] (201)] (202)] (202)] (202)] (204)] (205)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma	e heat from e heat from e heat from space heat space heat in system 1 Jan	kWh/m²/ye individual secondary, main syste main syste from main from main (%) Feb	ear heating sys /supplemen m(s) m 2 system 1 system 2 Mar	stems inclu	ding micro m (table 11	-CHP)			<u>Σ</u> (9)	8)15, 10 (98) 1 - (20)2) x [1- (20 (202) x (20	.12 = 1 ÷ (4)	826.68 24.65 0.00 1.00 0.00 1.00 0.00 93.20] (99)] (201)] (202)] (202)] (202)] (204)] (205)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma	e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sys	kWh/m²/ye individual secondary, main syste main syste from main from main (%) Feb stem 1), kW	ear heating sys /supplemer m(s) m 2 system 1 system 2 Mar /h/month	stems inclu ntary system Apr	ding micro m (table 11 May	-CHP) Jun	Jul	Aug	∑(98 (20 Sep 0.00	8)15, 10 (98) 1 - (20)2) x [1- (20 (202) x (20 Oct	12 = 1 ÷ (4)	826.68 24.65 0.00 1.00 0.00 1.00 0.00 93.20 Dec] (99)] (201)] (202)] (202)] (202)] (204)] (205)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma	e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sys	kWh/m²/ye individual secondary, main syste main syste from main from main (%) Feb stem 1), kW	ear heating sys /supplemer m(s) m 2 system 1 system 2 Mar /h/month	stems inclu ntary system Apr	ding micro m (table 11 May	-CHP) Jun	Jul	Aug	∑(98 (20 Sep 0.00	8)15, 10 (98) 1 - (20)2) x [1- (20 (202) x (20 (202) x (20 Oct 101.28	12 = 1 ÷ (4)	0.00 1.00 0.00 1.00 0.00 93.20 Dec 491.13] (99)] (201)] (202)] (202)] (202)] (204)] (205)] (206)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu	e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sys 467.51	kWh/m²/ye individual secondary, main syste main syste from main from main (%) Feb stem 1), kW	ear heating sys /supplemer m(s) m 2 system 1 system 2 Mar /h/month	stems inclu ntary system Apr	ding micro m (table 11 May	-CHP) Jun	Jul	Aug	∑(98 (20 Sep 0.00	8)15, 10 (98) 1 - (20)2) x [1- (20 (202) x (20 (202) x (20 Oct 101.28	12 = 1 ÷ (4)	0.00 1.00 0.00 1.00 0.00 93.20 Dec 491.13] (99)] (201)] (202)] (202)] (202)] (204)] (205)] (206)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating	e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sys 467.51	kWh/m²/ye individual secondary, main syste main syste from main from main (%) Feb stem 1), kW	ear heating sys /supplemen m(s) m 2 system 1 system 2 Mar /h/month	stems inclu ntary system Apr	ding micro m (table 11 May	-CHP) Jun	Jul	Aug	∑(98 (20 Sep 0.00	8)15, 10 (98) 1 - (20)2) x [1- (20 (202) x (20 (202) x (20 Oct 101.28	12 = 1 ÷ (4)	0.00 1.00 0.00 1.00 0.00 93.20 Dec 491.13] (99)] (201)] (202)] (202)] (202)] (204)] (205)] (206)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating	e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sys 467.51 ter heater 89.25	kWh/m²/ye individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 311.98	ear heating sys /supplemen m(s) m 2 system 1 system 2 Mar /h/month 200.38	stems inclu ntary system Apr 70.36	ding micro m (table 11 May 16.81	-CHP) Jun 0.00	Jul 0.00	Aug 0.00	Σ(98 (20 Sep 0.00 Σ(21:	8)15, 10 (98) 1 - (20)2) x [1- (20 (202) x (20 (202) x (20 Oct 101.28 1)15, 10	12 = 1 $(4) = 1$ $(4) = 1$ $(1) = 1$ $(3) = 1$ $(3) = 1$ (300.51) $(12 = 1)$	826.68 24.65 24.65 0.00 1.00 0.00 1.00 93.20 Dec 491.13 959.96] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (211)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating Efficiency of wat	e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sys 467.51 ter heater 89.25	kWh/m²/ye individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 311.98	ear heating sys /supplemen m(s) m 2 system 1 system 2 Mar /h/month 200.38	stems inclu ntary system Apr 70.36	ding micro m (table 11 May 16.81	-CHP) Jun 0.00	Jul 0.00	Aug 0.00	Σ(98 (20 Sep 0.00 Σ(21:	8)15, 10 (98) 1 - (20)2) x [1- (20 (202) x (20 (202) x (20 Oct 101.28 1)15, 10	12 = 1 $(4) = 1$ $(4) = 1$ $(1) = 1$ $(3) = 1$ $(3) = 1$ (300.51) $(12 = 1)$	826.68 24.65 24.65 0.00 1.00 0.00 1.00 93.20 Dec 491.13 959.96] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (211)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating Efficiency of wat	e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sys 467.51 ter heater 89.25 uel, kWh/ma	kWh/m²/ye individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 311.98 89.05 onth	ear heating sys /supplemen m(s) m 2 system 1 system 2 Mar /h/month 200.38	Apr 70.36 87.97	ding micro m (table 11 May 16.81 87.31	-CHP) Jun 0.00 87.00	Jul 0.00 87.00	Aug 0.00 87.00	Σ(93 (20 Sep 0.00 Σ(21) 87.00	8)15, 10 (98) 1 - (20)2) x [1- (20 (202) x (20 (202) x (20 Oct 101.28 1)15, 10	12 = 1 (4) (4) $(1) = $ $(3) =$.826.68 .826.68 24.65 0.00 1.00 0.00 1.00 0.00 1.00 0.00 1.00 0.00 1.00 0.00 93.20 Dec 491.13 1959.96 89.30] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (211)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating Efficiency of wat	e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sys 467.51 ter heater 89.25 uel, kWh/ma	kWh/m²/ye individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 311.98 89.05 onth	ear heating sys /supplemen m(s) m 2 system 1 system 2 Mar /h/month 200.38	Apr 70.36 87.97	ding micro m (table 11 May 16.81 87.31	-CHP) Jun 0.00 87.00	Jul 0.00 87.00	Aug 0.00 87.00	Σ(93 (20 Sep 0.00 Σ(21) 87.00	8)15, 10 (98) 1 - (20)2) × [1- (20 (202) × (20 (202) × (20 0ct 101.28 1)15, 10 888.20	12 = 1 (4) (4) $(1) = $ $(3) =$.826.68 24.65 0.00 1.00 0.00 1.00 0.00 93.20 Dec 491.13 1959.96 89.30 194.62] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (211)] (217)
 9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of main Space heating fu Water heating Efficiency of wate Water heating fu 	e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sys 467.51 ter heater 89.25 uel, kWh/ma	kWh/m²/ye individual secondary, main syste main syste from main (%) Feb stem 1), kW 311.98 89.05 onth 176.24	ear heating sys /supplemen m(s) m 2 system 1 system 2 Mar /h/month 200.38	Apr 70.36 87.97	ding micro m (table 11 May 16.81 87.31	-CHP) Jun 0.00 87.00	Jul 0.00 87.00	Aug 0.00 87.00	Σ(93 (20 Sep 0.00 Σ(21) 87.00	8)15, 10 (98) 1 - (20)2) × [1- (20 (202) × (20 (202) × (20 0ct 101.28 1)15, 10 888.20	12 = 1 (4) (4) $(1) = $ $(3) =$.826.68 24.65 0.00 1.00 0.00 1.00 0.00 93.20 Dec 491.13 1959.96 89.30 194.62] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (211)] (217)

central heating pump or water pump within warm air heating unit 30.00 (1) bolier flue fan 45.00 (2) Cotal electricity for lighting (Appendix L) 225.39 (1) Total electricity for lighting (Appendix L) 225.39 (1) Space heating - main system 1 295.96 x 3.48 x 0.01 6.87.11 Year heating 225.73 x 3.19 x 0.01 6.87.11 (2) Pumps and fans 228.74 x 13.19 x 0.01 228.85 (1) Vater heating 225.39 x 13.19 x 0.01 228.85 (1) Cotal electricity for lighting 325.39 x 13.19 x 0.01 228.85 (1) Catal energy cost (240)(242) + (245)(254) = 30.64 (242) - (245)(254) = 30.64 (242) - (242) - (245)(254) = 30.64 (242) - (242) - (245)(254) = (242) - (242) - (245)(254) = (252) - (27) - (28) - (2				
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Dwelling CO2 emission rate $(272) \div (4) =$ 15.44 (El value 87.13 87 (El rating (section 14) 87 (B El band B B B 13a. Primary energy - individual heating systems including micro-CHP Energy kWh/year Primary factor Primary Energy kWh/year Space heating - main system 1 1959.96 x 1.22 = 2391.15 (Water heating 2027.80 x 1.22 = 2473.91 (Space and water heating (261) + (262) + (263) + (264) = 4865.06 (Pumps and fans 218.74 x 3.07 = 671.53 (Electricity for lighting 325.39 x 3.07 = 998.94 (Electricity for lighting	325.39 x	0.52 =	168.88 (268)
EI value 87.13 EI rating (section 14) 87 El band 8 Idividual heating systems including micro-CHP Energy kWh/year Primary factor Primary Energy kWh/year Space heating - main system 1 1959.96 x 1.22 = 2391.15 (Water heating 2027.80 x 1.22 = 2473.91 (Space and water heating (261) + (262) + (263) + (264) = 4865.06 (Pumps and fans 218.74 x 3.07 = 671.53 (Electricity for lighting 325.39 x 3.07 = 998.94 (Total CO ₂ , kg/year		(265)(271)	= 1143.76 (272)
El rating (section 14)87El bandB 13a. Primary energy - individual heating systems including micro-CHPEnergy kwh/yearPrimary factorPrimary Energy kwh/year Space heating - main system 11959.96x1.22=2391.15(Water heating2027.80x1.22=2473.91(Space and water heating(261) + (262) + (263) + (264) =4865.06(Pumps and fans218.74x3.07=671.53(Electricity for lighting325.39x3.07=998.94(Dwelling CO ₂ emission rate		(272) ÷ (4)	= 15.44 (273)
El bandB 13a. Primary energy - individual heating systems including micro-CHP Energy kWh/yearPrimary factorPrimary Energy kWh/yearSpace heating - main system 11959.96x1.22=2391.15(Water heating2027.80x1.22=2473.91(Space and water heating(261) + (262) + (263) + (264) =4865.06(Pumps and fans218.74x3.07=671.53(Electricity for lighting325.39x3.07=998.94(El value			87.13
13a. Primary energy - individual heating systems including micro-CHPEnergy kWh/yearPrimary factorPrimary Energy kWh/yearSpace heating - main system 11959.96x1.22=2391.15(Water heating2027.80x1.22=2473.91(Space and water heating(261) + (262) + (263) + (264) =4865.06(Pumps and fans218.74x3.07=671.53(Electricity for lighting325.39x3.07=998.94(El rating (section 14)			87 (274)
Energy $kWh/year$ Primary factorPrimary Energy $kWh/year$ Space heating - main system 11959.96x1.22=2391.15(Water heating2027.80x1.22=2473.91(Space and water heating(261) + (262) + (263) + (264) =4865.06(Pumps and fans218.74x3.07=671.53(Electricity for lighting325.39x3.07=998.94(El band			В
kWh/yearkWh/yearSpace heating - main system 11959.96x 1.22 = 2391.15 (Water heating2027.80x 1.22 = 2473.91 (Space and water heating(261) + (262) + (263) + (264) = 4865.06 (Pumps and fans218.74x 3.07 = 671.53 (Electricity for lighting 325.39 x 3.07 = 998.94 (13a. Primary energy - individual heating systems inclu	ding micro-CHP		
Space heating - main system 11959.96x 1.22 = 2391.15 (Water heating2027.80x 1.22 = 2473.91 (Space and water heating $(261) + (262) + (263) + (264) =$ 4865.06 (Pumps and fans 218.74 x 3.07 = 671.53 (Electricity for lighting 325.39 x 3.07 = 998.94 (Primary factor	
Water heating 2027.80 x 1.22 = 2473.91 (Space and water heating (261) + (262) + (263) + (264) = 4865.06 (Pumps and fans 218.74 x 3.07 = 671.53 (Electricity for lighting 325.39 x 3.07 = 998.94 (Share heating - main system 1	-	1 22 -	_
Space and water heating $(261) + (262) + (263) + (264) = 4865.06$ (Pumps and fans 218.74 xBlectricity for lighting 325.39 x 3.07 = 998.94 (
Pumps and fans 218.74 x 3.07 = 671.53 (Electricity for lighting 325.39 x 3.07 = 998.94 (-	X		
Electricity for lighting 325.39 x 3.07 = 998.94 (218 7/		
		225 20	3 07 –	
Dwelling primary energy rate kWh/m2/year 88.20	Primary energy kWh/year	325.39 x	3.07 =	998.94 (268) 6535.54 (272)

DER Worksheet Design - Draft



Assessor name	Mr Jason	Doherty					As	sessor num	ber	2634		
Client							La	st modified		23/12	/2016	
Address	3 6 Streat	ley Place,	ondon, N	W3 1HP								
1. Overall dwelling dimen	sions											
				þ	area (m²)			age storey eight (m)		Vo	olume (m³)	
Lowest occupied					104.10](1a) x		2.40	(2a) =		249.84	(3a)
Total floor area	(1a) -	+ (1b) + (1o	c) + (1d)(1n) =	104.10] (4)						
Dwelling volume							(3a)	+ (3b) + (3	c) + (3d)(3	3n) = 🦳	249.84] (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 fan	IS							0) x 10 =	-	0	(7a)
Number of passive vents								0) x 10 =	-	0	(7b)
Number of flueless gas fires	S							0] x 40 =	-	0	(7c)
										Air	changes per hour	•
Infiltration due to chimneys	s, flues, fans,	, PSVs		(6a)) + (6b) + (7	a) + (7b) + (7c) =	0	÷ (5) =	-	0.00	(8)
If a pressurisation test has	been carried	out or is i	ntended, p	roceed to (17), otherw	vise continue	e from (9) t	o (16)				-
Air permeability value, q50	, expressed i	n cubic me	etres per h	our per sq	uare metre	of envelope	e area				3.00	(17)
If based on air permeability	value, then	(18) = [(17	') ÷ 20] + (8), otherwi	se (18) = (1	6)					0.15	(18)
Number of sides on which t	the dwelling	is sheltere	d								2	(19)
Shelter factor								1 -	[0.075 x (1	9)] =	0.85	(20)
Infiltration rate incorporati	ng shelter fa	ctor							(18) x (2	20) =	0.13	(21)
Infiltration rate modified for	or monthly w	ind speed	:									
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind spee	ed from Tabl	e U2										
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22)m ÷ 4												
1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
Adjusted infiltration rate (a	llowing for s	helter and	wind fact	or) (21) x (2	22a)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 chan	ge rate for tl	he applical	ole case:									
calculate effective all chair	a. air changa	rate throu	igh system	1							0.50	(23a)
If mechanical ventilation	n: air change											-
	-		allowing for	or in-use fa	ctor from T	able 4h					79.90	(23c)
If mechanical ventilation	covery: effic	iency in %	-				c) ÷ 100]				79.90	(23c)
If mechanical ventilation If balanced with heat re	covery: effic	iency in %	-				c) ÷ 100]	0.23	0.24	0.24	79.90 0.25] (23c)] (24a)
If mechanical ventilation If balanced with heat re a) If balanced mechanic	covery: effic al ventilatior 0.26	iency in % n with hea 0.26	t recovery 0.24	(MVHR) (2 0.24	2b)m + (23l	o) x [1 - (23d		0.23	0.24	0.24	1	



3. Heat losses a	and heat lo	ss paramet	er										
Element				Gross rea, m²	Openings m ²		area m²	U-value W/m²K	A x U W	•	/alue, /m².K	Ахк, kJ/K	
Window						27	7.11 x	1.15	= 31.04	ŀ			(27)
Door						1	.95 x	0.55	= 1.07				(26)
Roof window						2	.54 x	0.96	= 2.44				(27a)
Exposed floor						12	2.80 x	0.15	= 1.92				(28b
External wall						83	3.50 x	0.13	= 10.86	5			(29a)
Party wall						23	3.52 x	0.00	= 0.00				(32)
Roof						51	L.66 x	0.09	= 4.60				(30)
Total area of ext	ternal elem	ents ∑A, m²				17	9.56						(31)
Fabric heat loss,	W/K = ∑(A	× U)							(2	6)(30) + (32) =	51.93	(33)
Heat capacity Cr	m = ∑(А x к)							(28)	.(30) + (32)	+ (32a)(3	2e) =	N/A	(34)
Thermal mass pa	arameter (T	MP) in kJ/n	n²K									200.00	(35)
Thermal bridges	::Σ(L x Ψ) ca	alculated us	ing Appen	dix K								24.42	(36)
Total fabric heat	t loss									(33) + (3	36) =	76.35	(37)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat	loss calcula	ated month	ly 0.33 x (2	25)m x (5)									
	21.69	21.43	21.16	19.85	19.59	18.27	18.27	18.01	18.80	19.59	20.11	20.64	(38)
Heat transfer co	efficient, W	//K (37)m +	- (38)m										
	98.04	97.77	97.51	96.20	95.93	94.62	94.62	94.36	95.15	95.93	96.46	96.99	
									Average = 2	<u>∑(</u> 39)112,	/12 =	96.13	(39)
Heat loss param	eter (HLP),	W/m²K (39	9)m ÷ (4)										
	0.94	0.94	0.94	0.92	0.92	0.91	0.91	0.91	0.91	0.92	0.93	0.93	
									Average = 2	<u>∑(</u> 40)112,	/12 =	0.92	(40)
Number of days	in month (⁻	Table 1a)											
	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)
4. Water heati		equiremen	τ.										
Assumed occupa												2.77	(42)
Annual average								•	6	0.1		100.09	(43)
List water wear	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage	-							04.00	00.00	102.00	406.40	440.40	7
	110.10	106.10	102.09	98.09	94.09	90.08	90.08	94.09	98.09	102.09	106.10	110.10	
Energy content	of hot wata	r used = 4.1			2600 WMb /m	anth (car	Tablas 1k	1 a 1 d)		∑(44)1	.12 =	1201.10	(44)
Energy content						•	1		111.1.10	422.20	145.64	450.42	٦
	163.28	142.80	147.36	128.47	123.27	106.37	98.57	113.11	114.46	133.39	145.61	158.12	
Distribution loss		1.00								∑(45)1	.12 =	1574.83	(45)
Distribution loss			22.40	10.07	10.40	45.00	4470	10.07	47.47	20.01	24.04	22.72	
Water storage k	24.49	21.42	22.10	19.27	18.49	15.96	14.79	16.97	17.17	20.01	21.84	23.72	(46)
Water storage lo		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	0.00	0.00	(56)
If the vessel con		1	-				1		0.00	0.00	0.00	0.00	
Defense are all to t	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 lo		1		0.07					0.07		0.07		7
Combiles	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 e				1		20	• • = ·			0.05	22.5		
	31.98	28.87	31.93	30.85	31.84	30.76	31.76	31.81	30.81	31.89	30.91	31.97	(61)

SAP version 9.92

0.05 (15) (16) (57) (50) (61) . . .

Total heat required for w	ater heating	calculated f	or each mo	onth 0.85 x	(45)m + (4	6)m + (57)n	n + (59)m +	(61)m				
195.2	6 171.67	179.29	159.32	155.11	137.14	130.33	144.92	145.27	165.29	176.52	190.09	(62)
Solar DHW input calculat	ed using App	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 water heate	r for each mo	onth (kWh/	month) (62	2)m + (63)m	ı							
195.2	5 171.67	179.29	159.32	155.11	137.14	130.33	144.92	145.27	165.29	176.52	190.09]
									∑(64)1	12 = 1	950.21	(64)
Heat gains from water he	ating (kWh/r	nonth) 0.2	5 × [0.85 ×	(45)m + (61	.)m] + 0.8 ×	[(46)m + (5	57)m + (59)	m]				
62.28	54.70	56.98	50.43	48.95	43.06	40.71	45.56	45.76	52.33	56.14	60.57	(65)
E totomal action												
5. Internal gains			-		_				-		_	
Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5												_
138.7	138.72	138.72	138.72	138.72	138.72	138.72	138.72	138.72	138.72	138.72	138.72	(66)
Lighting gains (calculated	in Appendix	L, equation	L9 or L9a),	also see Ta	able 5							
23.43	20.81	16.92	12.81	9.58	8.09	8.74	11.36	15.24	19.35	22.59	24.08	(67)
Appliance gains (calculat	ed in Append	ix L, equatio	on L13 or L1	L3a), also se	ee Table 5							
262.7	265.52	258.65	244.02	225.55	208.19	196.60	193.87	200.74	215.37	233.84	251.20	(68)
Cooking gains (calculated	in Appendix	L, equation	L15 or L15	a), also see	Table 5							
36.87	36.87	36.87	36.87	36.87	36.87	36.87	36.87	36.87	36.87	36.87	36.87	(69)
Pump and fan gains (Tab	e 5a)											
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evaporation (Table 5)											
-110.9	3 -110.98	-110.98	-110.98	-110.98	-110.98	-110.98	-110.98	-110.98	-110.98	-110.98	-110.98	(71)
Water heating gains (Tab	le 5)											
83.72	81.40	76.59	70.04	65.79	59.81	54.72	61.24	63.56	70.33	77.98	81.41	(72)
Total internal gains (66)	n + (67)m + (6	58)m + (69)	m + (70)m ·	+ (71)m + (7	72)m							
437.5	435.34	419.77	394.49	368.53	343.70	327.67	334.08	347.16	372.67	402.02	424.30	(73)

			Access f Table		Area m²		blar flux W/m²		speci	g fic data able 6b		FF specific da or Table 6		Gains W	
NorthWest			0.77	7 X	3.68	x	11.28	x 0.9 x	0	.63	x	0.70	=	12.69	(81)
SouthEast			0.77	7 X	17.97	x 🗌	36.79 >	x 0.9 x	0	.63	x	0.70	=	202.07	(77)
SouthWest			0.77	7 X	1.38	x	36.79	x 0.9 x	0	.63	x	0.70	=	15.52	(79)
NorthEast			0.77	7 X [4.08	x	11.28	x 0.9 x	0	.63	x	0.70	=	14.07	(75)
Horizontal			1.00) x	2.54	x	26.00 >	x 0.9 x	0	.63	x	0.70	=	26.21	
Solar gains in watt	s ∑(74)m	(82)m													
	270.55	479.53	702.02	940.71	1113.98	1131.27	1080.20	947	.84	784.60)	542.72	327.55	5 229.23	(83)
Total gains - intern	al and sol	lar (73)m +	(83)m												
	708.10	914.87	1121.79	1335.20	1482.51	1474.97	1407.88	128	1.92	1131.7	6	915.39	729.57	653.53	(84)
7. Mean internal															⊐
Temperature durir	0 0		U			. ,								21.00	(85)
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Au	ug	Sep		Oct	Nov	Dec	
Utilisation factor for	or gains fo	or living are	ea n1,m (se	e Table 9a)											
	0.99	0.97	0.91	0.77	0.58	0.41	0.30	0.3	34	0.56		0.87	0.98	0.99	(86)
Mean internal tem	np of living	g area T1 (s	steps 3 to 7	in Table 9c	:)										

	19.95	20.23	20.56	20.85	20.97	21.00	21.00	21.00	20.98	20.77	20.29	19.90	(87)
Temperature du			the rest of	f dwelling fi	rom Table 9								
·	20.13	20.13	20.14	20.15	20.15	20.16	20.16	20.16	20.16	20.15	20.14	20.14	(88)
Utilisation factor] (,
	0.99	0.96	0.89	0.74	0.53	0.36	0.24	0.28	0.50	0.83	0.97	0.99	(89)
Mean internal te				I	I			0.20	0.50	0.00	0.57	0.55] (00)
	19.18	19.45	19.77	20.03	20.13	20.16	20.16	20.16	20.14	19.98	19.53	19.13	(90)
Living area fracti		13.43	15.77	20.05	20.15	20.10	20.10	20.10		ving area ÷	·	0.41	(91)
Mean internal te		for the wh	ole dwellin	α fl Λ v T1 μ	.(1 _ fl A) v T	7					(4) -	0.41] (31)
	19.49	19.77	20.09	20.37		1	20.50	20.50	20.40	20.20	19.84	10.45	
Annhuadiustmar					20.47	20.50		20.50	20.49	20.30	19.84	19.45	(92)
Apply adjustmer			-					20.50	20.40	20.20	10.04	40.45	
	19.49	19.77	20.09	20.37	20.47	20.50	20.50	20.50	20.49	20.30	19.84	19.45	(93)
8. Space heatin	ıg requirem	ent											
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor	r for gains. r	าm		•				Ū					
	0.99	0.96	0.89	0.75	0.55	0.38	0.26	0.30	0.53	0.84	0.97	0.99	(94)
Useful gains, ηm] (0 - 7
, (, -	698.51	878.18	1002.03	995.22	819.64	555.88	369.10	386.72	595.26	769.61	706.68	647.20	(95)
Monthly average					015.04	555.00	505.10	500.72	333.20	705.01	700.00	047.20] (33)
wontiny average	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate fo				1			10.00	10.40	14.10	10.00	7.10	4.20] (30)
	1489.51	1453.93	1325.59	1103.27	841.59	558.40	260.41	387.33	607.71	930.82	1228.97	1479 50	
Space heating re							369.41	387.33	607.71	930.82	1228.97	1478.59] (97)
space heating re	-			1			0.00	0.00	0.00	110.04	276.05	C10 55	1
	588.51	386.90	240.72	77.79	16.33	0.00	0.00	0.00	0.00		376.05	618.55	
									∑(98	8)15, 10	.12 =	424.79	(98)
		LAND 1								(00)	. (4)	22.20	(00)
Space heating re	equirement	kWh/m²/ye	ear							(98)	÷ (4)	23.29	(99)
Space heating re 9a. Energy requ	-	-		stems inclu	ding micro	-СНР				(98)	÷ (4)	23.29	(99)
	-	-		stems inclu	iding micro	-СНР				(98)	÷ (4)	23.29	(99)
9a. Energy requ Space heating	uirements -	individual	heating sys							(98)	÷ (4)		
9a. Energy request Space heating Fraction of space	uirements - e heat from	individual secondary,	heating sys /supplemen									0.00] (201)
9a. Energy requ Space heating Fraction of space Fraction of space	uirements - e heat from e heat from	individual secondary, main syste	heating sys /supplemen m(s)							(98) 1 - (20		0.00] (201)] (202)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space	e heat from e heat from e heat from e heat from	individual secondary, main syste main syste	heating sys /supplemen m(s) m 2						(20	1 - (20	01) =	0.00 1.00 0.00] (201)] (202)] (202)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total	e heat from e heat from e heat from e heat from space heat	individual secondary, main syste main syste from main	heating sys /supplemen m(s) m 2 system 1						(20	1 - (20 02) x [1- (20	01) = []] []] =	0.00 1.00 0.00 1.00] (201)] (202)] (202)] (204)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total	e heat from e heat from e heat from e heat from space heat space heat	individual secondary, main syste main syste from main from main	heating sys /supplemen m(s) m 2 system 1						(20	1 - (20	01) = 3)] = 03) =	0.00 1.00 0.00 1.00 0.00] (201)] (202)] (202)] (202)] (204)] (205)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total	e heat from e heat from e heat from e heat from space heat space heat n system 1	individual secondary, main syste main syste from main from main (%)	heating sys /supplemen m(s) m 2 system 1 system 2	ntary system	m (table 11)		Διισ		1 - (20)2) x [1- (20 (202) x (20	D1) = 3)] = D3) =	0.00 1.00 0.00 1.00 0.00 93.20] (201)] (202)] (202)] (204)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mai	e heat from e heat from e heat from e heat from space heat space heat n system 1 Jan	individual secondary, main syste main syste from main from main (%) Feb	heating sys /supplemen m(s) m 2 system 1 system 2 Mar				Jul	Aug	(20 Sep	1 - (20 02) x [1- (20	01) = 3)] = 03) =	0.00 1.00 0.00 1.00 0.00] (201)] (202)] (202)] (202)] (204)] (205)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total	e heat from e heat from e heat from space heat space heat n system 1 Jan tel (main sys	individual secondary, main syste main syste from main from main (%) Feb stem 1), kW	heating sys /supplemen m(s) m 2 system 1 system 2 Mar /h/month	ntary system	m (table 11 May) Jun		-	Sep	1 - (20)2) x [1- (20 (202) x (20 Oct	01) = 3)] = 03) = Nov	0.00 1.00 0.00 1.00 0.00 93.20 Dec] (201)] (202)] (202)] (202)] (204)] (205)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mai	e heat from e heat from e heat from e heat from space heat space heat n system 1 Jan	individual secondary, main syste main syste from main from main (%) Feb	heating sys /supplemen m(s) m 2 system 1 system 2 Mar	ntary system	m (table 11)	Jul 0.00	Aug	Sep 0.00	1 - (20)2) x [1- (20 (202) x (20 Oct 128.69	D1) = 3)] = D3) = Nov 403.49	0.00 1.00 0.00 1.00 93.20 Dec 663.68] (201)] (202)] (202)] (204)] (205)] (206)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of main Space heating fu	e heat from e heat from e heat from space heat space heat n system 1 Jan tel (main sys	individual secondary, main syste main syste from main from main (%) Feb stem 1), kW	heating sys /supplemen m(s) m 2 system 1 system 2 Mar /h/month	ntary system	m (table 11 May) Jun		-	Sep 0.00	1 - (20)2) x [1- (20 (202) x (20 Oct	D1) = 3)] = D3) = Nov 403.49	0.00 1.00 0.00 1.00 0.00 93.20 Dec] (201)] (202)] (202)] (202)] (204)] (205)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mai Space heating fu Water heating	e heat from e heat from e heat from space heat space heat n system 1 Jan tel (main sys 631.45	individual secondary, main syste main syste from main from main (%) Feb stem 1), kW	heating sys /supplemen m(s) m 2 system 1 system 2 Mar /h/month	ntary system	m (table 11 May) Jun		-	Sep 0.00	1 - (20)2) x [1- (20 (202) x (20 Oct 128.69	D1) = 3)] = D3) = Nov 403.49	0.00 1.00 0.00 1.00 93.20 Dec 663.68] (201)] (202)] (202)] (204)] (205)] (206)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of main Space heating fu	e heat from e heat from e heat from space heat space heat n system 1 Jan tel (main sys 631.45	individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 415.13	heating sys /supplemen m(s) m 2 system 1 system 2 Mar /h/month 258.29	Apr 83.47	m (table 11 May 17.52) Jun 0.00	0.00	0.00	Sep 0.00 Σ(21:	1 - (20)2) x [1- (20 (202) x (20 Oct 128.69 1)15, 10	01) = 3)] = 03) = Nov 403.49 12 =2	0.00 1.00 0.00 1.00 93.20 Dec 663.68 2601.71] (201)] (202)] (202)] (204)] (205)] (206)] (211)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mai Space heating fu Water heating Efficiency of wat	uirements - e heat from e heat from e heat from space heat space heat space heat n system 1 Jan del (main system 1 631.45 er heater 89.38	individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 415.13	heating sys /supplemen m(s) m 2 system 1 system 2 Mar /h/month	ntary system	m (table 11 May) Jun		-	Sep 0.00	1 - (20)2) x [1- (20 (202) x (20 Oct 128.69	D1) = 3)] = D3) = Nov 403.49	0.00 1.00 0.00 1.00 93.20 Dec 663.68] (201)] (202)] (202)] (204)] (205)] (206)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mai Space heating fu Water heating	e heat from e heat from e heat from e heat from space heat space heat n system 1 Jan el (main sys 631.45 eer heater 89.38 uel, kWh/ma	individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 415.13 89.19 onth	heating sys /supplemen m(s) m 2 system 1 system 2 Mar /h/month 258.29 88.81	Apr 83.47 88.02	m (table 11 May 17.52 87.29) Jun 0.00 87.00	0.00 87.00	0.00	Sep 0.00 Σ(21: 87.00	1 - (20)2) x [1- (20 (202) x (20 Oct 128.69 1)15, 10 88.32	01) = 3)] = 03) = Nov 403.49 12 =2 89.15	0.00 1.00 0.00 1.00 93.20 Dec 663.68 2601.71 89.43] (201)] (202)] (202)] (204)] (205)] (206)] (211)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mai Space heating fu Water heating Efficiency of wat	uirements - e heat from e heat from e heat from space heat space heat space heat n system 1 Jan del (main system 1 631.45 er heater 89.38	individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 415.13	heating sys /supplemen m(s) m 2 system 1 system 2 Mar /h/month 258.29	Apr 83.47	m (table 11 May 17.52) Jun 0.00	0.00	0.00	Sep 0.00 Σ(21:	1 - (20)2) x [1- (20 (202) x (20 Oct 128.69 1)15, 10 88.32 187.15	01) = 3)] = 03) = Nov 403.49 .12 =2 89.15 198.00	0.00 1.00 0.00 1.00 93.20 Dec 663.68 2601.71 89.43 212.56] (201)] (202)] (202)] (204)] (205)] (206)] (211)] (217)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mai Space heating fu Water heating Efficiency of wat	e heat from e heat from e heat from e heat from space heat space heat n system 1 Jan el (main sys 631.45 eer heater 89.38 uel, kWh/ma	individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 415.13 89.19 onth	heating sys /supplemen m(s) m 2 system 1 system 2 Mar /h/month 258.29 88.81	Apr 83.47 88.02	m (table 11 May 17.52 87.29) Jun 0.00 87.00	0.00 87.00	0.00	Sep 0.00 Σ(21: 87.00	1 - (20)2) x [1- (20 (202) x (20 Oct 128.69 1)15, 10 88.32	01) = 3)] = 03) = Nov 403.49 .12 =2 89.15 198.00	0.00 1.00 0.00 1.00 93.20 Dec 663.68 2601.71 89.43] (201)] (202)] (202)] (204)] (205)] (206)] (211)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mai Space heating fu Water heating Efficiency of wat	e heat from e heat from e heat from e heat from space heat space heat n system 1 Jan el (main sys 631.45 eer heater 89.38 uel, kWh/ma	individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 415.13 89.19 onth	heating sys /supplemen m(s) m 2 system 1 system 2 Mar /h/month 258.29 88.81	Apr 83.47 88.02	m (table 11 May 17.52 87.29) Jun 0.00 87.00	0.00 87.00	0.00	Sep 0.00 Σ(21: 87.00	1 - (20)2) x [1- (20 (202) x (20 Oct 128.69 1)15, 10 88.32 187.15	01) = 3)] = 03) = Nov 403.49 .12 =2 89.15 198.00	0.00 1.00 0.00 1.00 93.20 Dec 663.68 2601.71 89.43 212.56] (201)] (202)] (202)] (204)] (205)] (206)] (211)] (217)
9a. Energy requ Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of mai Space heating fu Water heating Efficiency of wat	uirements - e heat from e heat from space heat space heat n system 1 Jan tel (main sys 631.45 cer heater 89.38 uel, kWh/mi 218.45	individual secondary, main syste from main from main (%) Feb stem 1), kW 415.13 89.19 onth 192.48	heating sys /supplemen m(s) m 2 system 1 system 2 Mar /h/month 258.29 88.81	Apr 83.47 88.02	m (table 11 May 17.52 87.29) Jun 0.00 87.00	0.00 87.00	0.00	Sep 0.00 Σ(21: 87.00	1 - (20)2) x [1- (20 (202) x (20 Oct 128.69 1)15, 10 88.32 187.15	01) = 3)] = 03) = Nov 403.49 12 =2 89.15 198.00 .12 =2	0.00 1.00 0.00 1.00 93.20 Dec 663.68 2601.71 89.43 212.56] (201)] (202)] (202)] (204)] (205)] (205)] (206)] (211)] (217)

Water heating fuel			2210.21
Electricity for pumps, fans and electric keep-hot (Table 4f)			2210.21
mechanical ventilation fans - balanced, extract or positive	input from outside	201.93	(230a)
central heating pump or water pump within warm air hea		30.00	(230c)
boiler flue fan		45.00	(230e)
Total electricity for the above, kWh/year		13.00	276.93 (231)
Electricity for lighting (Appendix L)			413.75 (232)
Total delivered energy for all uses		(211)(221) + (231) + (232)	
		(, (, (, (, ()	
10a. Fuel costs - individual heating systems including micro	-CHP		
	Fuel kWh/year	Fuel price	Fuel cost £/year
Space heating - main system 1	2601.71	x 3.48 x	0.01 = 90.54 (240)
Water heating	2210.21	x 3.48 x	0.01 = 76.92 (247)
Pumps and fans	276.93	x 13.19 x	0.01 = 36.53 (249)
Electricity for lighting	413.75	x 13.19 x	0.01 = 54.57 (250)
Additional standing charges			120.00 (251)
Total energy cost		(240)(242) + (245)(254) = <u>378.56</u> (255)
11a. SAP rating - individual heating systems including micro	o-CHP		
Energy cost deflator (Table 12)			0.42 (256)
Energy cost factor (ECF)			1.07 (257)
SAP value			85.12
SAP rating (section 13)			85 (258)
SAP band			В
12a. CO ₂ emissions - individual heating systems including m		Emission factor	Emissions
	nicro-CHP Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO₂/year
	Energy		
12a. CO ₂ emissions - individual heating systems including m	Energy kWh/year	kg CO₂/kWh	kg CO₂/year
12a. CO ₂ emissions - individual heating systems including m Space heating - main system 1	Energy kWh/year 2601.71	kg CO₂/kWh x 0.22	kg CO ₂ /year = 561.97 (261) = 477.41 (264)
12a. CO ₂ emissions - individual heating systems including m Space heating - main system 1 Water heating	Energy kWh/year 2601.71	kg CO2/kWh x 0.22 x 0.22	kg CO ₂ /year = 561.97 (261) = 477.41 (264)
12a. CO ₂ emissions - individual heating systems including m Space heating - main system 1 Water heating Space and water heating	Energy kWh/year 2601.71 2210.21	kg CO ₂ /kWh x 0.22 x 0.22 (261) + (262) + (263	$kg CO_2/year$ = 561.97 (261) = 477.41 (264) + (264) = 1039.37 (265)
12a. CO ₂ emissions - individual heating systems including m Space heating - main system 1 Water heating Space and water heating Pumps and fans	Energy kWh/year 2601.71 2210.21 276.93	kg CO2/kWh x 0.22 x 0.22 (261) + (262) + (263) x 0.52 x 0.52	kg CO2/year= 561.97 (261)= 477.41 (264)+ (264) = 1039.37 (265)= 143.73 (267)
12a. CO ₂ emissions - individual heating systems including m Space heating - main system 1 Water heating Space and water heating Pumps and fans Electricity for lighting	Energy kWh/year 2601.71 2210.21 276.93	kg CO2/kWh x 0.22 x 0.22 (261) + (262) + (263) x 0.52 x 0.52 x 0.52	kg CO2/year= 561.97 (261)= 477.41 (264)+ (264) = 1039.37 (265)= 143.73 (267)= 214.73 (268)
12a. CO₂ emissions - individual heating systems including m 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 2601.71 2210.21 276.93	kg CO2/kWh x 0.22 x 0.22 (261) + (262) + (263) x 0.52 x 0.52 x 0.52	kg CO2/year = 561.97 (261) = 477.41 (264)) + (264) = 1039.37 (265) = 143.73 (267) = 214.73 (268))(271) = 1397.84 (272)
12a. CO ₂ emissions - individual heating systems including m 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 2601.71 2210.21 276.93	kg CO2/kWh x 0.22 x 0.22 (261) + (262) + (263) x 0.52 x 0.52 x 0.52	kg CO2/year= 561.97 (261)= 477.41 (264)+ (264) = 1039.37 (265)= 143.73 (267)= 214.73 (268))(271) = 1397.84 (272)72) \div (4) = 13.43 (273)
12a. CO ₂ emissions - individual heating systems including m 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 2601.71 2210.21 276.93	kg CO2/kWh x 0.22 x 0.22 (261) + (262) + (263) x 0.52 x 0.52 x 0.52	kg CO2/year= 561.97 (261)= 477.41 (264)+ (264) = 1039.37 (265)= 143.73 (267)= 214.73 (268)(271) = 1397.84 (272)72) ÷ (4) = 13.43 (273) 87.44
12a. CO ₂ emissions - individual heating systems including m 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 2601.71 2210.21 276.93 413.75	kg CO2/kWh x 0.22 x 0.22 (261) + (262) + (263) x 0.52 x 0.52 x 0.52	kg CO2/year= 561.97 (261)= 477.41 (264)+ (264) = 1039.37 (265)= 143.73 (267)= 214.73 (268)(271) = 1397.84 (272)72) \div (4) = 13.43 (273) 87.44 87 (274)
12a. CO2 emissions - individual heating systems including m Space heating - main system 1 Water heating Space and water heating Pumps and fans Electricity for lighting Total CO2, kg/year Dwelling CO2 emission rate El value El rating (section 14)	Energy kWh/year 2601.71 2210.21 276.93 413.75 micro-CHP Energy	kg CO2/kWh x 0.22 x 0.22 (261) + (262) + (263) x 0.52 x 0.52 x 0.52	kg CO2/year = 561.97 (261) = 477.41 (264) + (264) = 1039.37 (265) = 143.73 (267) = 214.73 (268))(271) = 1397.84 (272) 72) ÷ (4) = 13.43 (273) 87.44 87 (274) B Primary Energy
12a. CO ₂ emissions - individual heating systems including m 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	Energy kWh/year 2601.71 2210.21 276.93 413.75	kg CO ₂ /kWh x 0.22 x 0.22 (261) + (262) + (263) x 0.52 x 0.52 (265) (265) (265) (265)	kg CO2/year= 561.97 (261)= 477.41 (264)+ (264) = 1039.37 (265)= 143.73 (267)= 214.73 (268)(271) = 1397.84 (272)72) ÷ (4) = 13.43 (273) 87.44 87 (274)BB
12a. CO ₂ emissions - individual heating systems including m 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 2601.71 2210.21 276.93 413.75 Micro-CHP Energy kWh/year	kg CO2/kWh x 0.22 x 0.22 (261) + (262) + (263) x 0.52 x 0.52 x 0.52 x 0.52 x 0.52 y 0.52 y	kg CO2/year= 561.97 (261)= 477.41 (264)+ (264) = 1039.37 (265)= 143.73 (267)= 214.73 (268)(271) = 1397.84 (272)72) ÷ (4) = 13.43 (273) 87.44 87 (274)BB
12a. CO2 emissions - individual heating systems including m Space heating - main system 1 Water heating Space and water heating Pumps and fans Electricity for lighting Total CO2, kg/year Dwelling CO2 emission rate El value El rating (section 14) El band 13a. Primary energy - individual heating systems including Space heating - main system 1	Energy kWh/year 2601.71 2210.21 276.93 413.75 micro-CHP Energy kWh/year 2601.71	kg CO2/kWh x 0.22 x 0.22 (261) + (262) + (263) x 0.52 x 1.22 x 1.22	kg CO2/year= 561.97 (261)= 477.41 (264)+ (264) = 1039.37 (265)= 143.73 (267)= 214.73 (268)(271) = 1397.84 (272)72) ÷ (4) = 13.43 (273) 87.44 87 (274)BB
12a. CO2 emissions - individual heating systems including m Space heating - main system 1 Water heating Space and water heating Pumps and fans Electricity for lighting Total CO2, kg/year Dwelling CO2 emission rate El value El rating (section 14) El band Space heating - main system 1 Water heating	Energy kWh/year 2601.71 2210.21 276.93 413.75 micro-CHP Energy kWh/year 2601.71	kg CO2/kWh x 0.22 x 0.22 (261) + (262) + (263) x 0.52 x 1.22	kg CO2/year= 561.97 (261)= 477.41 (264)+ (264) = 1039.37 (265)= 143.73 (267)= 214.73 (268)(271) = 1397.84 (272)72) ÷ (4) = 13.43 (273) 87.44 87 (274)BB
12a. CO2 emissions - individual heating systems including m Space heating - main system 1 Water heating Space and water heating Pumps and fans Electricity for lighting Total CO2, kg/year Dwelling CO2 emission rate El value El rating (section 14) El band Space heating - main system 1 Water heating Space and water heating	Energy kWh/year 2601.71 2210.21 276.93 413.75 micro-CHP Energy kWh/year 2601.71 2210.21	kg CO2/kWh x 0.22 x 0.22 (261) + (262) + (263) x 0.52 x 0.52 x 0.52 x 0.52 x 0.52 x 0.52 x 1.22 x 1.22 (261) + (262) + (263)	kg CO2/year= 561.97 (261)= 477.41 (264)+ (264) = 1039.37 (265)= 143.73 (267)= 214.73 (268)
12a. CO2 emissions - individual heating systems including m Space heating - main system 1 Water heating Space and water heating Pumps and fans Electricity for lighting Total CO2, kg/year Dwelling CO2 emission rate El value El rating (section 14) El band Space heating - main system 1 Water heating Space and water heating Pumps and fans	Energy kWh/year 2601.71 2210.21 276.93 413.75 micro-CHP Energy kWh/year 2601.71 2210.21	kg CO2/kWh x 0.22 x 0.22 (261) + (262) + (263) x 0.52 x 0.52 x 0.52 x 0.52 x 0.52 x 0.52 x 1.22 x 3.07	kg CO2/year= 561.97 (261)= 477.41 (264)+ (264) = 1039.37 (265)= 143.73 (267)= 214.73 (268))(271) = 1397.84 (272)72) ÷ (4) = 13.43 (273) 87.44 87 (274)BBPrimary Energy kWh/year= 3174.08 (261)= 2696.46 (264)+ (264) = 5870.54 (265)= 850.18 (267)

Dwelling primary energy rate kWh/m2/year

76.76

(273)

DER Worksheet Design - Draft



Assessor name	Mr Jason D	oherty					As	sessor num	ber	2634		
Client		•						st modified			2/2016	
Address	4 6 Streatle			2 1 U D							,	
Address	4030000	ey Place, Lo		2 105								
1. Overall dwelling dim	ensions											·
				Α	rea (m²)			age storey ight (m)		Vo	olume (m³)	
Lowest occupied					2.20	(1a) x		2.40	(2a) =		5.28	(3a)
+1					61.40](1b) x		2.40	(2b) =		147.36	(3b)
Total floor area	(1a) +	(1b) + (1c)	+ (1d)(1r	n) =	63.60	(4)	L] , ,			
Dwelling volume	ζ,	. , . ,		,] , ,	(3a)	+ (3b) + (3	c) + (3d)(3	n) =	152.64	(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 f	fans							0] x 10 =		0	(7a)
Number of passive vents								0] x 10 =		0	(7b)
Number of flueless gas fi	res							0] x 40 =		0	(7c)
										A :		
										Air	changes pe hour	r
Infiltration due to chimne	eys, flues, fans, I	PSVs		(6a)	+ (6b) + (7a	a) + (7b) + (¹	7c) =	0] ÷ (5) =			(8)
Infiltration due to chimne If a pressurisation test ha	-		tended, pro					-] ÷ (5) =		hour	7
	as been carried c	out or is int		ceed to (1	17), otherw	ise continue	e from (9) t	-] ÷ (5) =		hour	7
If a pressurisation test ha	as been carried o 50, expressed in	out or is int cubic met	res per hou	oceed to (1 ur per squ	17), otherw are metre	<i>ise continue</i> of envelope	e from (9) t	-] ÷ (5) =		hour] (8)
<i>If a pressurisation test ha</i> Air permeability value, q!	as been carried c 50, expressed in lity value, then (2	out or is int cubic met 18) = [(17)	res per hou ÷ 20] + (8),	oceed to (1 ur per squ	17), otherw are metre	<i>ise continue</i> of envelope	e from (9) t	-] ÷ (5) =		hour 0.00 3.00] (8)] (17)
If a pressurisation test ha Air permeability value, q If based on air permeabil	as been carried c 50, expressed in lity value, then (2	out or is int cubic met 18) = [(17)	res per hou ÷ 20] + (8),	oceed to (1 ur per squ	17), otherw are metre	<i>ise continue</i> of envelope	e from (9) t	o (16)] ÷ (5) = [0.075 x (19		hour 0.00 3.00 0.15) (8)) (17)) (18)
If a pressurisation test ha Air permeability value, q! If based on air permeabil Number of sides on whic	as been carried c 50, expressed in lity value, then (th the dwelling is	out or is int cubic met 18) = [(17) s sheltered	res per hou ÷ 20] + (8),	oceed to (1 ur per squ	17), otherw are metre	<i>ise continue</i> of envelope	e from (9) t	o (16)	_)] = [hour 0.00 3.00 0.15 1) (8)) (17)) (18)] (19)
If a pressurisation test ha Air permeability value, q! If based on air permeabil Number of sides on whic Shelter factor	as been carried c 50, expressed in lity value, then (h the dwelling is ating shelter fact	out or is int cubic met 18) = [(17) s sheltered tor	res per hou ÷ 20] + (8),	oceed to (1 ur per squ	17), otherw are metre	<i>ise continue</i> of envelope	e from (9) t	o (16)	[0.075 x (19)] = [hour 0.00 3.00 0.15 1 0.93) (8)) (17)) (18)] (19)] (20)
If a pressurisation test ha Air permeability value, q! If based on air permeabil Number of sides on whic Shelter factor Infiltration rate incorpora	as been carried c 50, expressed in lity value, then (h the dwelling is ating shelter fact	out or is int cubic met 18) = [(17) s sheltered tor	res per hou ÷ 20] + (8),	oceed to (1 ur per squ	17), otherw are metre	<i>ise continue</i> of envelope	e from (9) t	o (16)	[0.075 x (19)] = [hour 0.00 3.00 0.15 1 0.93) (8)) (17)) (18)] (19)] (20)
If a pressurisation test ha Air permeability value, q! If based on air permeabil Number of sides on whic Shelter factor Infiltration rate incorpora Infiltration rate modified	as been carried c 50, expressed in lity value, then (th the dwelling is ating shelter fact for monthly wir Feb	out or is int cubic met 18) = [(17) s sheltered tor nd speed: Mar	res per hou ÷ 20] + (8),	oceed to (1	17), otherw are metre e se (18) = (16	ise continue of envelope 5)	e from (9) t	2 (16) 1 -	[0.075 x (19 (18) x (2	())] = [()) = [hour 0.00 3.00 0.15 1 0.93 0.14) (8)) (17)) (18)] (19)] (20)
If a pressurisation test ha Air permeability value, q If based on air permeabil Number of sides on whic Shelter factor Infiltration rate incorpora Infiltration rate modified Jan	as been carried c 50, expressed in lity value, then (th the dwelling is ating shelter fact for monthly wir Feb peed from Table	out or is int cubic met 18) = [(17) s sheltered tor nd speed: Mar	res per hou ÷ 20] + (8),	oceed to (1	17), otherw are metre e se (18) = (16	ise continue of envelope 5)	e from (9) t	2 (16) 1 -	[0.075 x (19 (18) x (2	())] = [()) = [hour 0.00 3.00 0.15 1 0.93 0.14) (8)) (17)) (18)] (19)] (20)
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If a pressurisation test has Air permeability value, q! If based on air permeabil Number of sides on whic Shelter factor Infiltration rate incorpora Infiltration rate modified Jan Monthly average wind sp 5.10 Wind factor (22)m ÷ 4	as been carried of 50, expressed in lity value, then (1 th the dwelling is ating shelter fact for monthly wir Feb beed from Table 5.00	tor Mar U2 1.23	Apr 4.40	May 4.30	17), otherw are metre o are (18) = (16 Jun 3.80	ise continue of envelope 5) Jul 3.80	Aug 3.70	5 (16) 1 - Sep 4.00	[0.075 x (19 (18) x (2 Oct 4.30	())] = [0) = [Nov 4.50	hour 0.00 3.00 0.15 1 0.93 0.14 Dec 4.70) (8)) (17)) (18)) (19)] (20)] (21)] (22)
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If a pressurisation test ha Air permeability value, q If based on air permeabil Number of sides on whic Shelter factor Infiltration rate incorpora Infiltration rate modified Jan Monthly average wind sp 5.10 Wind factor (22)m ÷ 4 1.28 Adjusted infiltration rate 0.18	as been carried of 50, expressed in lity value, then (1 th the dwelling is ating shelter fact for monthly wir Feb beed from Table 5.00 1.25 (allowing for sh 0.17 ange rate for the	but or is int cubic met 18) = [(17) s sheltered tor nd speed: Mar U2 4.90 1.23 elter and v 0.17 e applicabl	Apr 4.40 1.10 0.15 e case:	May 4.30 (21) x (2	17), otherw are metre o e (18) = (16 Jun 3.80 0.95 2a)m	ise continue of envelope 5) Jul 3.80 0.95	Aug 3.70	2 (16) 1 - Sep 4.00 1.00	[0.075 x (19 (18) x (2 Oct 1.08	())] = [()) = [()) = [()) = [() = [() = [] () = [_] () = [] ()	hour 0.00 3.00 0.15 1 0.93 0.14 Dec 4.70 1.18) (8)) (17)) (18)] (19)] (20)] (21)
If a pressurisation test ha Air permeability value, q If based on air permeabil Number of sides on whic Shelter factor Infiltration rate incorpora Infiltration rate modified Jan Monthly average wind sp 5.10 Wind factor (22)m ÷ 4 1.28 Adjusted infiltration rate 0.18 Calculate effective air cha	as been carried c 50, expressed in lity value, then (1 ih the dwelling is ating shelter fact for monthly wir Feb beed from Table 5.00 1.25 (allowing for sh 0.17 ange rate for the ion: air change r	but or is int cubic met 18) = [(17) is sheltered tor nd speed: Mar U2 4.90 1.23 elter and v 0.17 e applicabl	Apr 4.40 1.10 wind factor 0.15 e case: gh system	May 4.30 (21) x (2 0.15	17), otherw are metre of se (18) = (16 Jun 3.80 0.95 2a)m 0.13	ise continue of envelope 5) Jul 3.80 0.95 0.13	Aug 3.70	2 (16) 1 - Sep 4.00 1.00	[0.075 x (19 (18) x (2 Oct 1.08	())] = [()) = [()) = [()) = [() = [() = [] () = [_] () = [] ()	hour 0.00 3.00 0.15 1 0.93 0.14 Dec 4.70 4.70 1.18 0.16) (8)) (17)) (18)) (19)] (20)] (20)] (21)) (22)] (22a)] (22b)
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If a pressurisation test ha Air permeability value, q If based on air permeabil Number of sides on whic Shelter factor Infiltration rate incorpora Infiltration rate modified Jan Monthly average wind sp 5.10 Wind factor (22)m ÷ 4 1.28 Adjusted infiltration rate 0.18 Calculate effective air cha If mechanical ventilat If balanced with heat	as been carried c 50, expressed in lity value, then (1 th the dwelling is ating shelter fact for monthly wir Feb beed from Table 5.00 1.25 (allowing for sh 0.17 ange rate for the ion: air change r recovery: efficien hical ventilation	but or is int cubic met 18) = [(17) s sheltered tor nd speed: Mar U2 4.90 1.23 elter and v 0.17 e applicabl rate throug ency in % a	Apr 4.40 1.10 wind factor 0.15 c case: gh system llowing for	May 4.30 (21) x (2 0.15 in-use fac	17), otherw are metre of a (18) = (16 Jun 3.80 0.95 2a)m 0.13	ise continue of envelope 5) Jul 3.80 0.95 0.13 able 4h	Aug 3.70 0.13	2 (16) 1 - Sep 4.00 1.00	[0.075 x (19 (18) x (2 Oct 1.08	())] = [()) = [()) = [()) = [() = [() = [] () = [_] () = [] ()	hour 0.00 3.00 0.15 1 0.93 0.14 Dec 4.70 4.70 0.16 0.50] (8)] (17)] (18)] (19)] (20)] (21)] (22)] (22a)] (22a)] (22b)] (23a)



Roof window 2.54 x 0.96 = 2.44 (27a)External wall 58.78 x 0.13 = 7.64 (29a)Party wall 23.52 x 0.00 = 0.00 (32)		0.28	0.27	0.27	0.25	0.25	0.2	23	0.23	0.23		0.24	0.25	0.26	0.26	(25)	
Image: Strates, or opening and set area, an	2.11																
sares, m² m² A, m² W/m²K B/m²K B/m²K <t< th=""><th>3. Heat losses</th><th>and heat lo</th><th>ss paramet</th><th>ter</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></t<>	3. Heat losses	and heat lo	ss paramet	ter													
Door 1.95 x 0.55 = 1.07 (26) Boof window 2.54 x 0.96 = 2.44 (27) Party wall 2.35 x 0.09 = 0.00 (22) Roof incluses, W/x $[0, x + v]$ 1.92.55 x 0.09 = 5.24 (33) Boof incluse, W/x $[0, x + v]$ 1.92.55 x 0.09 = 5.24 (33) Boof incluse, W/x $[0, x + v]$ 1.92.55 x 0.09 = 5.24 (33) Boof incluse, W/x $[0, x + v]$ $[28], (30) + (32) + (32), (32) = M/A (33) Heard range, Scaludef conditive, 0.33 X/25 mx N/X (33) (36) (36) Total fabric heat loss 13.80 13.62 12.75 12.88 11.70 11.70 11.33 12.05 12.27 (38) Mean addee cofficient, W/x (37) main K Main Ma$	Element			а								A x U W/					
Rod vindow 2.56 x 0.06 = 2.44 (27) External vall 9.7.6 7.6.6 (28) Party wall 2.52 x 0.03 = 0.00 (32) Soor 19.25 9.000 = 5.24 (33) Fainci heat (055, W/K = [A × X) 19.24 (26)(30) + (32) = A7.44 (33) Heat capacity (C = [X × X) 19.24 (28)(32) + (32) = (A7.44 (33) Thermal bridges; [L × W) calculated using Appendix K (28)(32) + (32) = (A7.44 (33) Total abric heat loss calculated monthly 0.33 + (25) m + (5) (31) + (36) = (32) Total abric heat loss calculated monthly 0.33 + (25) m + (5) (31) m + (3) (20) 1 2.58 12.92 13.27 (38) Heat transfer Coefficient, W/K (37)m + (38)m 1.20 1.10 1.10 1.13 1.20 1.24 7.74 76.62 75.62 75.62 75.62 75.62 75.62 75.62 75.62 75.62 75.62 75.62 75.62 75.62 75.62 75.62 75.62 75.62 75.62	Window						[27.2	11 x [1.15	=	31.04				(27)	
External wall 58.72 x 0.02 7.64 (28) Party wall 2.35.21 x 0.00 = 0.00 (32) Roof 58.86 x 0.09 = 5.24 (33) Roof cal area of external elements ΣA , m ² (28)(30) + (32) + (32)(33) + (30) + (32) + (32)(33) + (30) + (32) + (32)(33) + (30) + (32) + (32)(33) + (30) + (32) + (32)(33) + (30) + (32) + (32)(33) + (30) + (32) + (32)(33) + (30) + (32) + (32)(33) + (30) + (32) + (32)(33) + (30) + (32) + (32)(33) + (30) + (32) + (32)(33) + (30) + (32) + (32)(33) + (30) + (32) +	Door						[1.9	5 x	0.55	=	1.07				(26)	
party wall 23.32 x 0.00 = 0.00 (2) Roof 58.86 x 0.09 = 5.24 (3) Total area of extrmal elements ΣA , m ² (26)(30) + (32) = 47.34 (3) Batric heat loss, W/K = $\Sigma (A \times U)$ (26)(30) + (32) = 47.34 (3) Heat capacity Cm = $\Sigma (A \times U)$ (26)(30) + (32) = 47.34 (3) Thermal bridges: $\Sigma (L \times U)$ calculated using Appendix K (28)(30) + (32) = 47.34 (3) Total abric heat loss calculated using Appendix K (23) + (36) = 63.92 (27) Total abric heat loss calculated using Appendix K (28)(29) + (32) = 73.80 77.72 77.54 76.67 76.49 76.84 77.19 Meat loss parameter (HLP), W/m ^K ((37)m + (38)m	Roof window						[2.5	4 x	0.96	=	2.44				(27a)	
Roaf 58.86 x 0.00 = 5.24 (30) Total area determal elements £A, m ² (26)(30) + (32) + (32), (32) = 47.44 (33) Pathic beart loss, W/K = £(A × U) (26)(30) + (32) + (52a)(32a) = N/A (34) Thermal mass parameter (TMP) in k/m ³ K (26)(30) + (32) + (52a)(32a) = N/A (36) Thermal mass parameter (TMP) in k/m ³ K (36) 66.92 (37) Tatal fabric heat loss Feb Mar Apr May Jun Jul Aug Sep Ot Nov Dec 1307 1320 1326 12.75 12.75 12.75 12.75 75.62 75.62 75.62 75.64 75.84 77.89 77.72 77.75 76.67 76.49 75.62 75.62 75.62 75.62 75.62 75.61 75.62	External wall						[58.7	78 x	0.13	=	7.64				(29a)	
Total area of external elements $5A$, m^2 [149,24] (15) Fabric heat loss, $W(k = g(A \times L))$ (26)(30) + (32) = (37.4) (33) Heat capacity Cm = $g(A \times K)$ (28)(30) + (32) + (32) = (32) (33) Heat capacity Cm = $g(A \times K)$ (28)(30) + (32) + (32) = (32) (32) (32) (32) (32) (32) (32) (32)	Party wall						[23.5	52 x	0.00	=	0.00				(32)	
Fabric heat loss, W/K $\leq \Sigma(A \times U)$ (26)(30) + (32) = 47.44 (33) Heat capacity Cm $\geq \Sigma(A \times M)$ (28)(30) + (32) + (32)(32e) = N/A (34) Thermal margings parameter (TMP) in kl/m ² K (28)(30) + (32) + (32)(32e) = N/A (34) Thermal bridges (SL × W) calculated using Appendix K (20)(30) + (32) + (32)(32e) = N/A (34) Total fabric heat loss (33) + (35) = 0.3.9 (33) + (36) = 0.3.9 Total fabric heat loss calculated using Appendix K (33) + (36) = 0.3.9 (37) Tam Thinges (SL × W) calculated using Appendix K (33) + (36) = 0.3.9 (37) Tam Thinges (SL × W) calculated using Appendix K (33) + (36) = 0.3.9 (37) Tam Thinges (SL × W) calculated using Appendix K (38) (36) = 0.3.9 (37) Heat transfer coefficient, W/K (37)m + (38)m (37) (36) 7.6.67 7.6.49 7.5.62 7.5.42 7.5.47 7.6.49 7.6.84 7.1.9 Average = $\Sigma(39)$ 1212 1.20 1.21 1.20 1.21 1.21 1.22 4.22 4.24 4.33 Heat loss parameter (HLP), W/m ² K (19)m + (4) 1.22 1.22 1.22 1.21 1.20 1.11 1.19 1.20 1.21 1.21	Roof						[58.8	86 x	0.09	=	5.24				(30)	
(28)(30) + (32) + (32)(32) + (32) (24) (24) (28)(30) + (32) + (32)(32) + (32) (24) (26) (35) Total fabric lowal (MP) In KJ/m*K 200.00 (35) (31) 104 Aug Sep Oct Nov Dec (31) 13.80 13.62 12.75 12.58 11.70 11.73 12.05 12.92 13.27 13.83 13.62 12.75 12.62 75.62 75.44 75.97 76.49 76.84 77.19 Average = $\Sigma(39)12/12 = -56.62$ 76.49 76.84 77.19 Average = $\Sigma(39)12/12 = -56.62$ 76.49 76.84 77.19 Average = $\Sigma(39)12/12 = -56.62$ 76.62 75.41 75.97 76.49 76.84 77.19 Average = $\Sigma(39)12/12 = -56.62$ 75.62 75.44 75.97 76.49 76.84 77.19 Average = $\Sigma(39)12/12 = -56.62$ 75.62 75.41 75.97 76.49 76.84 77.19 Average = $\Sigma(39)12/12 = -56.62$ 76.62 76.49 76.84 77.19 Average = $\Sigma(39)12/12 = -56.62$ 75.47	Total area of ext	ternal elem	ents ∑A, m ²	2			[149.	24							(31)	
Thermal mass parameter (TMP) in kJ/m²K	Fabric heat loss,	, W/K = ∑(A	× U)				_					(26)	(30) + (32) =	47.44	(33)	
Thermal bridges: 16.48 17.49 16.48 77.49 76.49 $76.$	Heat capacity C	m = ∑(А x к)								(28).	(30	0) + (32) +	(32a)(3	2e) =	N/A	(34)	
Total fabric heat loss (3) + (36) = (3) + (36) = (3) + (36) = (3) + (36) = (3) + (36) = (3) + (36) = (3) + (36) = (3) + (36) = (3) + (36) = (3) + (36) = (3) + (36) = (3) + (36) = (3) + (36) = (3) + (36) = (3) + (36) = (3) + (3) = (3) + (3) = (3) + (3) = (3) + (3) = (3) + (3) = (3) + (3) = (3) + (3) = (3) + (3) = (3) + (3) = (3) + (3) = (3) + (3) = (4) = (4) = <th< td=""><td>Thermal mass p</td><td>arameter (T</td><td>MP) in kJ/r</td><td>m²K</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>200.00</td><td>(35)</td></th<>	Thermal mass p	arameter (T	MP) in kJ/r	m²K											200.00	(35)	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 13.97 13.80 13.62 12.75 12.58 11.70 11.53 12.05 12.58 12.92 13.27 (38) Heat transfer coefficient, W/K (37)m + (38)m 77.54 76.49 75.62 75.62 75.44 75.97 76.49 76.84 77.19 Average = $\Sigma(39)112/12 = (76.62)$ 1.22 1.20 1.40 Number of days in month (Table 1a) 1.22 1.22 1.24 1.20 1.20	Thermal bridges	s: Σ(L x Ψ) ca	alculated u	sing Appen	dix K										16.48	(36)	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 13.97 13.80 13.62 12.75 12.58 11.70 11.53 12.05 12.58 12.92 13.27 (38) Heat transfer coefficient, W/K (37)m + (38)m	Total fabric heat	t loss											(33) + (36) =	63.92	(37)	
13.97 13.80 13.62 12.75 12.58 11.70 11.70 11.53 12.05 12.58 12.92 13.27 (38) Heat transfer coefficient, W/K (37)m + (38)m T7.89 77.72 77.54 76.67 76.49 75.62 75.62 75.44 75.97 76.49 76.84 77.19 Average = $5(39)112/12$ 76.62 1.52 1.22 1.22 1.22 1.22 1.22 1.22 1.21 1.20 1.19 1.19 1.19 1.20 1.21 1.21 1.21 1.21 1.22 (40) Number of days in month (Table 1a) Verage = $5(40)112/12$ = (40) Average = $5(40)112/12$ = (40) Also a 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 3		Jan	Feb	Mar	Apr	May	Ju	n	Jul	Aug		Sep			Dec		
13.97 13.80 13.62 12.75 12.58 11.70 11.70 11.53 12.05 12.58 12.92 13.27 (38) Heat transfer coefficient, W/K (37)m + (38)m T7.89 77.72 77.54 76.67 76.49 75.62 75.62 75.44 75.97 76.49 76.84 77.19 Average = $5(39)112/12$ 76.62 1.52 1.22 1.22 1.22 1.22 1.22 1.22 1.21 1.20 1.19 1.19 1.19 1.20 1.21 1.21 1.21 1.21 1.22 (40) Number of days in month (Table 1a) Verage = $5(40)112/12$ = (40) Average = $5(40)112/12$ = (40) Also a 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 3	Ventilation heat	t loss calcula	ated month	nly 0.33 x (2	25)m x (5)	·											
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		13.97	13.80	13.62	12.75	12.58	11.	70	11.70	11.53		12.05	12.58	12.92	13.27	(38)	
Average = $\sum (39)112/12 = 76.62$ (39) Average = $\sum (39)112/12 = 76.62$ (39) Heat loss parameter (HLP), W/m ³ K (39)m \div (4) 1.22 1.22 1.21 1.20 1.19 1.19 1.19 1.20 1.21 1.21 Average = $\sum (40)112/12 = 1.20$ (40) Number of days in month (Table 1a) 2.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 40) Average end Stand S	Heat transfer co	efficient, W	//K (37)m -	+ (38)m				I						•			
Average = $\sum (39)112/12 = 76.62$ (39) Average = $\sum (39)112/12 = 76.62$ (39) Heat loss parameter (HLP), W/m ² K (39)m ÷ (4) Log 1.22 1.22 1.22 1.21 1.20 1.19 1.19 1.19 1.20 1.21 1.21 L21 Average = $\sum (40)112/12 = 1.20$ (40) Number of days in month (Table 1a) 2.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 (40) 4. Water heating energy requirement Assumed occupancy, N Auge Sep Oct Nov Dec May Jun Jul Aug Sep Oct Nov Dec May May Jun Jul Aug Sep Oct Nov Dec Motion of the water usage in litres per day Vd, average = (25 x N) + 36 2.08 (42) Auge Sep Oct Nov Dec May Jun Jul Aug Sep Oct Nov Dec May 100 Aug Sep Oct Nov Dec Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d) 136.43 119.32 123.13 107.35 103.00 88.88 82.36 94.51 95.64 111.46 121.67 132.12 S (44) S (45) Auge Sep Oct Nov Occ E (45) C (41)12 = 1003.59 (44) C (42) <td cols<="" td=""><td></td><td>Г</td><td>1</td><td></td><td>76.67</td><td>76.49</td><td>75.</td><td>62</td><td>75.62</td><td>75.44</td><td></td><td>75.97</td><td>76.49</td><td>76.84</td><td>77.19</td><td></td></td>	<td></td> <td>Г</td> <td>1</td> <td></td> <td>76.67</td> <td>76.49</td> <td>75.</td> <td>62</td> <td>75.62</td> <td>75.44</td> <td></td> <td>75.97</td> <td>76.49</td> <td>76.84</td> <td>77.19</td> <td></td>		Г	1		76.67	76.49	75.	62	75.62	75.44		75.97	76.49	76.84	77.19	
Heat loss parameter (HLP), W/m ³ K (39)m + (4) 1.22 1.22 1.22 1.22 1.22 1.22 1.22 1.22 1.22 1.22 1.20 1.19 1.19 1.19 1.19 1.19 1.19 1.20 1.21 1.20 (40) Number of days in month (Table 1a) 31.00 30.00 30.0 30.00 30.0 30.00 30.0 30.00 30.0 30.00 30.0 30.00 30.0 30.00 30.0 30.			ļ	1	1						Av	erage = Σ(39)112	/12 =	76.62	(39)	
$ \begin{array}{ c c c c c c c } \hline 1.22 & 1.22 & 1.21 & 1.20 & 1.19 & 1.19 & 1.19 & 1.20 & 1.21 & 1.21 \\ \hline \ $	Heat loss param	eter (HLP),	W/m²K (39	9)m ÷ (4)								21082 21	,				
Average = $\sum (40)112/12 = (1.20)$ (40) Number of days in month (Table 1a) 31.00 28.00 31.00 30.00 31.00			1		1.21	1.20	1.1	19	1.19	1.19		1.19	1.20	1.21	1.21		
Number of days in month (Table 1 a) 31.00 28.00 31.00 30.00 31.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 30.00 31.00 400 4.Water heating energy requirement 2.08 Mar Apr May Jun Jul Aug Sep Oct Nov Dec And Pr May Jun Jul Aug Sep Oct Nov Dec Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d) [136.43 119.32 123.13 107.35 103.00 88.88 82.36 94.51 95.64 111.46 121.67 132.12 [2(45)112 = [315.87 (45) [45]			Į	1	1	1					Av	erage = Σ(40)112	/12 =		(40)	
31.00 28.00 31.00 30.00 <t< td=""><td>Number of days</td><td>in month (⁻</td><td>Table 1a)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>2.02</td><td>-,</td><td></td><td></td><td></td></t<>	Number of days	in month (⁻	Table 1a)									2.02	-,				
4. Water heating energy requirement Assumed occupancy, N	,			31.00	30.00	31.00	30.	00	31.00	31.00		30.00	31.00	30.00	31.00	(40)	
Assumed occupancy, N 2.08 (42) Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 83.63 (43) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) 20.00 88.65 85.31 81.96 78.61 75.27 75.27 78.61 81.96 85.31 88.65 92.00 Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d) 136.43 119.32 123.13 107.35 103.00 88.88 82.36 94.51 95.64 111.46 121.67 132.12 ζ (45) Distribution loss 0.15 x (45)m ζ (45) ζ (45) ζ (45) ζ (45) ζ (45) ζ (45) ζ (46) ζ (45) ζ (46) ζ (47) ζ (45) </td <td></td>																	
83.63 (43) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) 92.00 88.65 85.31 81.96 78.61 75.27 78.61 81.96 85.31 88.65 92.00 $\Sigma(44)112 =$ 1003.59 (44) Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d) Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d) 136.43 119.32 123.13 107.35 103.00 88.88 82.36 94.51 95.64 111.46 121.67 132.12 [45) Distribution loss 0.15 x (45)m 20.46 17.90 18.47 16.10 15.45 13.33 12.35 14.18 14.35 16.72 18.25 19.82 (46) Mare Kars 6.000 0.00 0.00 0.00 <td>4. Water heati</td> <td>ng energy r</td> <td>equiremen</td> <td>it</td> <td></td>	4. Water heati	ng energy r	equiremen	it													
Jan Feb Mar Apr May Jun Jun Aug Sep Oct Nov Dec Hot water usage in litres per day for each most V, m = factor from Table 1 c x (43) 92.00 88.65 85.31 81.96 78.61 75.27 75.27 78.61 81.96 85.31 88.65 92.00 $Q2(4)$ 88.65 85.31 81.96 78.61 75.27 75.27 78.61 81.96 85.31 88.65 92.00 $Q2(4)$ 88.65 85.31 81.96 78.61 75.27 75.27 78.61 81.96 85.31 88.65 92.00 $Q2(4)$ $Q2.00$ $Q2(4)$ $Q2.01$ $Q2(4)$ $Q2.01$ $Q2(4)$ $Q2.02$ $Q2(4)$	Assumed occup	ancy, N													2.08	(42)	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) 92.00 88.65 85.31 81.96 78.61 75.27 75.27 78.61 81.96 85.31 88.65 92.00 χ (44)12 = 1003.59 (44) Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d) 136.43 119.32 123.13 107.35 103.00 88.88 82.36 94.51 95.64 111.46 121.67 132.12 χ (45)112 = 1315.87 (45) Distribution loss 0.15 x (45)m 20.46 17.90 18.47 16.10 15.45 13.33 12.35 14.18 14.35 16.72 18.25 19.82 (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 0.0	Annual average	hot water u	isage in litr	es per day	Vd,average	= (25 x N) +	36								83.63	(43)	
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$		Jan	Feb	Mar	Apr	May	Ju	n	Jul	Aug		Sep	Oct	Nov	Dec		
$\sum_{\lambda} (44) = \sum_{\lambda} (44)$ Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d) $136.43 \ 119.32 \ 123.13 \ 107.35 \ 103.00 \ 88.88 \ 82.36 \ 94.51 \ 95.64 \ 111.46 \ 121.67 \ 132.12 \ (45)$ Distribution loss 0.15 x (45)m $\boxed{20.46 \ 17.90 \ 18.47 \ 16.10 \ 15.45 \ 13.33 \ 12.35 \ 14.18 \ 14.35 \ 16.72 \ 18.25 \ 19.82 \ (46)}$ Water storage loss calculated for each month (55) x (41)m $0.00 \ $	Hot water usage	e in litres pe	er day for ea	ach month	Vd,m = fact	tor from Tab	le 1c	x (43)									
Energy content of hot water used = $4.18 \times Vd$, m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d) 136.43 119.32 123.13 107.35 103.00 88.88 82.36 94.51 95.64 111.46 121.67 132.12 Σ (45)112 = 1315.87 (45) (45) Distribution loss 0.15 x (45)m 16.10 15.45 13.33 12.35 14.18 14.35 16.72 18.25 19.82 (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 66) If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] \div (47), else (56) 0.00 0.00 0.00 <td< td=""><td></td><td>92.00</td><td>88.65</td><td>85.31</td><td>81.96</td><td>78.61</td><td>75.</td><td>27</td><td>75.27</td><td>78.61</td><td></td><td>81.96</td><td>85.31</td><td>88.65</td><td>92.00</td><td></td></td<>		92.00	88.65	85.31	81.96	78.61	75.	27	75.27	78.61		81.96	85.31	88.65	92.00		
136.43 119.32 123.13 107.35 103.00 88.88 82.36 94.51 95.64 111.46 121.67 132.12 ∑(45)112 =													∑(44)1	.12 =	1003.59	(44)	
$\sum_{i=1}^{n} \sum_{i=1}^{n} \sum_{i$	Energy content	of hot wate	r used = 4.:	18 x Vd <i>,</i> m x	nm x Tm/3	3600 kWh/m	onth	(see T	Fables 1b,	, 1c 1d)							
Distribution loss 0.15 x (45)m 20.46 17.90 18.47 16.10 15.45 13.33 12.35 14.18 14.35 16.72 18.25 19.82 (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 (56) If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56) 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 3 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		136.43	119.32	123.13	107.35	103.00	88.	88	82.36	94.51		95.64	111.46	121.67	132.12		
20.46 17.90 18.47 16.10 15.45 13.33 12.35 14.18 14.35 16.72 18.25 19.82 (46) Water storage loss calculated for each month (55) x (41)m 0.00													∑(45)1	.12 =	1315.87	(45)	
Water storage loss calculated for each month (55) x (41)m 0.00 0.0	Distribution loss	s 0.15 x (45)m														
0.00 0.00		20.46	17.90	18.47	16.10	15.45	13.	33	12.35	14.18		14.35	16.72	18.25	19.82	(46)	
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (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 0.00 0.00 0.00 0.00 0.00 (57) Primary circuit loss for each month from Table 3 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 Combi loss for each month from Table 3a, 3b or 3c Combi loss for each month from Table 3a, 3b or 3c Combi loss for each month from Table 3a, 3b or 3c	Water storage lo	oss calculate	ed for each	month (5	5) x (41)m												
0.00 (57) Primary circuit loss for each month from Table 3 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		0.00	0.00	0.00	0.00	0.00	0.0	00	0.00	0.00		0.00	0.00	0.00	0.00	(56)	
Primary circuit loss for each month from Table 3 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	If the vessel con	tains dedica	ated solar s	storage or c	ledicated W	WHRS (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 (59) Combi loss for each month from Table 3a, 3b or 3c		0.00	0.00	0.00	0.00	0.00	0.0	00	0.00	0.00		0.00	0.00	0.00	0.00	(57)	
Combi loss for each month from Table 3a, 3b or 3c	Primary circuit l	oss for each	n month fro	om Table 3													
		0.00	0.00	0.00	0.00	0.00	0.0	00	0.00	0.00		0.00	0.00	0.00	0.00	(59)	
<u>31.87</u> 28.76 31.81 30.74 31.73 30.68 31.68 31.71 30.71 31.78 30.80 31.86 (61)	Combi loss for e	ach month	from Table	3a, 3b or 3	c												
		31.87	28.76	31.81	30.74	31.73	30.	68	31.68	31.71		30.71	31.78	30.80	31.86	(61)	

SAP version 9.92

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

Total heat required fo	r water	heating c	alculated f	or each mo	nth 0.85 x	(45)m + (40	6)m + (57)n	n + (59)m +	(61)m				
168	3.29	148.08	154.93	138.08	134.73	119.56	114.04	126.23	126.35	143.24	152.47	163.98	(62)
Solar DHW input calcu	lated us	sing Appe	ndix G or A	ppendix 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 he	ater for	each mo	nth (kWh/r	month) (62	2)m + (63)m	ı							_
168	3.29	148.08	154.93	138.08	134.73	119.56	114.04	126.23	126.35	143.24	152.47	163.98	
										∑(64)1	12 = 1	689.98	(64)
Heat gains from water heating (kWh/month) $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$													
53	.33	46.86	48.89	43.38	42.18	37.22	35.30	39.35	39.48	45.00	48.15	51.89	(65)
5. Internal gains								_					
J	an	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table	e 5)												
104	1.07	104.07	104.07	104.07	104.07	104.07	104.07	104.07	104.07	104.07	104.07	104.07	(66)
Lighting gains (calcula	ted in A _l	ppendix L	, equation	L9 or L9a),	also see Ta	ble 5							
16	.22	14.41	11.72	8.87	6.63	5.60	6.05	7.86	10.55	13.40	15.64	16.67	(67)
Appliance gains (calcu	lated in	Appendix	< L, equatio	on L13 or L1	l3a), also se	ee Table 5							
183	1.93	183.81	179.06	168.93	156.15	144.13	136.10	134.21	138.97	149.10	161.88	173.90	(68)
Cooking gains (calcula	ted in A	ppendix L	, equation	L15 or L15	a), also see	Table 5							
33	.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	33.41	(69)
Pump and fan gains (T	able 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. evaporatio	n (Table	e 5)											
-83	8.26	-83.26	-83.26	-83.26	-83.26	-83.26	-83.26	-83.26	-83.26	-83.26	-83.26	-83.26	(71)
Water heating gains (⁻	Table 5)												
71	.68	69.74	65.71	60.25	56.70	51.70	47.45	52.89	54.83	60.49	66.88	69.75	(72)
Total internal gains (6	66)m + (6	67)m + (6	8)m + (69)ı	m + (70)m -	+ (71)m + (7	72)m							
327	7.04	325.18	313.71	295.27	276.69	258.64	246.82	252.19	261.57	280.21	301.62	317.54	(73)

		Access f Table		Area m²	-	olar flux W/m²		•	g fic data able 6b		FF specific da or Table (Gains W	
NorthWest		0.7	7 x	3.68	x	11.28] x 0.9 x	0	.63	х	0.70	:	= [12.69	(81)
SouthEast		0.7	7 X	17.97	x	36.79] x 0.9 x	0	.63	х	0.70	:	=	202.07	(77)
SouthWest		0.7	7 X	1.38	x	36.79] x 0.9 x	0	.63	х	0.70	:	=	15.52	(79)
NorthEast		0.7	7 X	4.08	x	11.28] x 0.9 x	0	.63	х	0.70	:	=	14.07	(75)
Horizontal		1.0	0 x [2.54	x	26.00] x 0.9 x	0	.63	х	0.70	:	=	26.21]
Solar gains in watts ∑(74)n	n(82)m														
270.55	479.53	702.02	940.71	1113.98	1131.27	/ 1080.2	20 94	7.84	784.60)	542.72	327	.55	229.23	(83)
Total gains - internal and so	olar (73)m +	- (83)m													
597.60	804.71	1015.73	1235.98	1390.67	1389.92	1327.0	03 120	0.03	1046.1	8	822.93	629	.17	546.77	(84)
7. Mean internal tempera	iture (heati	ng season)													
Temperature during heatin	g periods ir	n the living a	area from T	able 9, Th1	(°C)							[21.00	(85)
Jan	Feb	Mar	Apr	Мау	Jun	Jul	Α	ug	Sep		Oct	No	v	Dec	
Utilisation factor for gains f	or living are	ea n1,m (se	e Table 9a)	1											
0.98	0.93	0.84	0.67	0.49	0.35	0.25	0.	29	0.49		0.79	0.9) 5	0.98	(86)
Mean internal temp of livin	g area T1 (s	steps 3 to 7	in Table 90	:)											

					1					-		-	-
	19.76	20.13	20.53	20.84	20.96	20.99	21.00	21.00	20.97	20.75	20.18	19.69	(8
emperature du	ring heatin	g periods in	the rest of	dwelling f	rom Table 9	9, Th2(°C)							
	19.90	19.90	19.90	19.92	19.92	19.93	19.93	19.93	19.92	19.92	19.91	19.91	(88
ilisation facto	r for gains f	or rest of d	welling n2,r	m									
	0.97	0.92	0.81	0.63	0.44	0.29	0.19	0.22	0.42	0.74	0.93	0.98	(89
ean internal te	emperature	in the rest	of dwelling	T2 (follow	v steps 3 to	7 in Table 9	c)						
	18.80	19.16	19.53	19.80	19.89	19.93	19.93	19.93	19.91	19.74	19.23	18.74	(9
ing area fract	ion								Liv	ving area ÷	(4) =	0.64	 (9
ean internal to	emperature	for the wh	ole dwellin	g fLA x T1 -	+(1 - fLA) x ⁻	Т2							
	19.41	19.78	20.17	20.46	20.57	20.60	20.61	20.61	20.59	20.38	19.83	19.34	(9)
oply adjustme													
.,	19.41	19.78	20.17	20.46	20.57	20.60	20.61	20.61	20.59	20.38	19.83	19.34	(9
	15.41	15.70	20.17	20.40	20.57	20.00	20.01	20.01	20.55	20.50	15.05	15.54	
. Space heatir	ng requirem	nent											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
ilisation facto	r for gains,	ηm											
	0.97	0.92	0.82	0.65	0.47	0.32	0.23	0.26	0.46	0.76	0.93	0.97	(9
eful gains, ηπ	iGm, W (94	1)m x (84)m										•	
	577.71	737.06	830.99	806.82	659.45	450.91	302.56	316.51	480.54	627.96	587.42	533.07) (9
onthly average												1	_ (-
	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20) (9
at loss rate fo		ļ			-		10.00	10.40	14.10	10.00	7.10	4.20	_ (5
	1177.07	1156.47	1059.72	886.21	678.55	453.98	303.09	317.48	492.68	748.06	978.55	1168.61	
ana haating r							303.09	317.48	492.08	748.00	978.55	1108.01	(9
ace heating re	quirement	, күүнүннөн	un 0.024 X	[[]]] - []]	5)III] X (41)								
	445.00	204.05	470.40	57.46	44.24		0.00	0.00	0.00	00.00	201.62	472.05	٦
	445.92	281.85	170.18	57.16	14.21	0.00	0.00	0.00	0.00	89.36	281.62	472.85]
1		1		57.16	14.21		0.00	0.00		3)15, 10	.12 =	1813.14	-
ace heating re		1		57.16	14.21		0.00	0.00		3)15, 10	I		-
-	equirement	kWh/m²/ye	ear			0.00	0.00	0.00		3)15, 10	.12 =	1813.14	-
a. Energy req	equirement	kWh/m²/ye	ear			0.00	0.00	0.00		3)15, 10	.12 =	1813.14] (9)] (9)
a. Energy requare heating	equirement	kWh/m²/ye	ear heating sys	stems inclu	uding micro	0.00 -CHP	0.00	0.00		3)15, 10	.12 =	28.51	_ (9)
a. Energy requarter acce heating accion of space	equirement uirements - e heat from	kWh/m²/ye individual secondary,	ear heating sys /supplemer	stems inclu	uding micro	0.00 -CHP	0.00	0.00		3)15, 10 (98)	.12 = ÷ (4)	0.10] (9] (2
a. Energy req ace heating action of spac action of spac	equirement uirements - e heat from e heat from	kWh/m²/ye individual secondary, main syste	ear heating sys /supplemer m(s)	stems inclu	uding micro	0.00 -CHP	0.00	0.00		3)15, 10	.12 = ÷ (4)	0.10 0.90] (9] (2] (2
a. Energy req ace heating action of spac action of spac action of spac	equirement uirements - e heat from e heat from e heat from	kWh/m²/ye individual secondary, main syste	ear heating sys /supplemer m(s) m 2	stems inclu	uding micro	0.00 -CHP	0.00	0.00	∑(ð	3)15, 10 (98) 1 - (20	.12 = ÷ (4) 01) =	0.10 0.90 0.00] (9] (2] (2] (2
a. Energy req ace heating action of spac action of spac action of spac action of spac	equirement uirements - e heat from e heat from e heat from space heat	kWh/m²/ye individual secondary, main syste main syste from main	ear heating sys /supplemen m(s) m 2 system 1	stems inclu	uding micro	0.00 -CHP	0.00	0.00	∑(ð	3)15, 10 (98) 1 - (20	.12 = ÷ (4) 01) = (3)] =	0.10 0.90 0.90 0.90] (9] (2] (2] (2] (2
a. Energy req bace heating action of spac action of spac action of spac action of total action of total	equirement uirements - e heat from e heat from space heat space heat	kWh/m²/ye individual secondary, main syste main syste from main	ear heating sys /supplemen m(s) m 2 system 1	stems inclu	uding micro	0.00 -CHP	0.00	0.00	∑(ð	3)15, 10 (98) 1 - (20	.12 = ÷ (4) 01) = (3)] =	1813.14 28.51 0.10 0.90 0.00 0.90 0.00 0.90] (9] (9] (2] (2] (2] (2] (2] (2
ba. Energy requestion of space heating action of space action of space action of space action of total action of total ficiency of ma	equirement uirements - e heat from e heat from e heat from space heat space heat in system 1	kWh/m²/ye individual secondary, main syste main syste from main from main (%)	ear heating sys /supplemen m(s) m 2 system 1 system 2	stems inclu	uding micro	0.00 -CHP	0.00	0.00	∑(ð	3)15, 10 (98) 1 - (20	.12 = ÷ (4) 01) = (3)] =	1813.14 28.51 0.10 0.90 0.00 0.90 0.00 93.20] (9] (9] (2] (2] (2] (2] (2] (2] (2
a. Energy req ace heating action of spac action of spac action of spac action of total action of total ficiency of ma	equirement uirements - e heat from e heat from space heat space heat in system 1 ondary/sup	kWh/m²/ye individual secondary, main syste main syste from main from main (%) plementary	ear heating sys /supplemer m(s) m 2 system 1 system 2 y system (%	stems inclu ntary syste	uding micro m (table 11	0.00 -CHP			∑(98 (20	3)15, 10 (98) 1 - (20)2) x [1- (20 (202) x (20	.12 = ÷ (4) 01) = (3)] = 03) =	1813.14 28.51 0.10 0.90 0.00 0.90 0.00 93.20 65.00) (9) (9) (2) (2) (2) (2) (2) (2) (2) (2
a. Energy req bace heating action of spac action of spac action of spac action of total action of total ficiency of ma ficiency of sec	equirement uirements - e heat from e heat from space heat space heat in system 1 ondary/sup Jan	kWh/m²/ye individual secondary, main syste main syste from main from main (%) plementary Feb	ear heating sys /supplemer m(s) m 2 system 1 system 1 system 2 r system (% Mar	stems inclu	uding micro	0.00 -CHP	0.00	0.00 Aug	∑(ð	3)15, 10 (98) 1 - (20	.12 = ÷ (4) 01) = (3)] =	1813.14 28.51 0.10 0.90 0.00 0.90 0.00 93.20	-
a. Energy req acce heating action of spac action of spac action of spac action of total action of total ficiency of ma ficiency of sec	equirement uirements - e heat from e heat from space heat space heat in system 1 ondary/sup Jan	kWh/m²/ye individual secondary, main syste main syste from main from main (%) plementary Feb	ear heating sys /supplemer m(s) m 2 system 1 system 1 system 2 r system (% Mar	stems inclu ntary syste	uding micro m (table 11	0.00 -CHP			∑(98 (20	3)15, 10 (98) 1 - (20)2) x [1- (20 (202) x (20	.12 = ÷ (4) 01) = (3)] = 03) =	1813.14 28.51 0.10 0.90 0.00 0.90 0.00 93.20 65.00] (9] (9] (2] (2] (2] (2] (2] (2] (2
a. Energy req ace heating action of spac action of spac action of spac action of total action of total ficiency of ma	equirement uirements - e heat from e heat from space heat space heat in system 1 ondary/sup Jan	kWh/m²/ye individual secondary, main syste main syste from main from main (%) plementary Feb	ear heating sys /supplemer m(s) m 2 system 1 system 1 system 2 r system (% Mar	stems inclu ntary syste	uding micro m (table 11	0.00 -CHP			∑(98 (20	3)15, 10 (98) 1 - (20)2) x [1- (20 (202) x (20	.12 = ÷ (4) 01) = (3)] = 03) =	1813.14 28.51 0.10 0.90 0.00 0.90 0.00 93.20 65.00] (9] (9] (2] (2] (2] (2] (2] (2] (2
a. Energy req ace heating action of spac action of spac action of spac action of total action of total ficiency of ma	equirement uirements - e heat from e heat from e heat from space heat space heat space heat in system 1 ondary/sup Jan uel (main sy	kWh/m²/ye individual secondary, main syste main syste from main from main (%) plementary Feb stem 1), kW	ear heating sys /supplemer m(s) m 2 system 1 system 2 r system 2 r system (% Mar /h/month	stems inclu ntary syste) Apr	uding micro m (table 11 May	0.00 -CHP	Jul	Aug	∑(98 (20 Sep 0.00	3)15, 10 (98) 1 - (20)2) x [1- (20 (202) x (20 (202) x (20	.12 = ÷ (4) 01) = 3)] = 03) = Nov 271.95	0.10 0.90 0.90 0.90 0.90 0.90 0.90 0.90] (9] (9] (2] (2] (2] (2] (2] (2] (2] (2
a. Energy req ace heating action of spac action of spac action of spac action of total action of total ficiency of ma ficiency of sec ace heating fu	equirement uirements - e heat from e heat from e heat from space heat space heat space heat in system 1 ondary/sup Jan uel (main sy 430.61	kWh/m²/ye individual secondary, main syste main syste from main from main (%) plementary Feb stem 1), kW 272.17	ear heating sys /supplemer m(s) m 2 system 1 system 2 r system 2 r system (% Mar /h/month 164.33	stems inclu ntary syste) Apr	uding micro m (table 11 May	0.00 -CHP	Jul	Aug	∑(98 (20 Sep 0.00	3)15, 10 (98) 1 - (20)2) × [1- (20 (202) × (20 (202) × (20 Oct 86.29	.12 = ÷ (4) 01) = 3)] = 03) = Nov 271.95	0.10 0.90 0.00 0.90 0.00 93.20 65.00 Dec 456.61] (9] (9] (2] (2] (2] (2] (2] (2] (2] (2
a. Energy req ace heating action of spac action of spac action of spac action of total action of total ficiency of ma ficiency of sec ace heating fu	equirement uirements - e heat from e heat from e heat from space heat space heat space heat in system 1 ondary/sup Jan uel (main sy 430.61	kWh/m²/ye individual secondary, main syste main syste from main from main (%) plementary Feb stem 1), kW 272.17	ear heating sys /supplemer m(s) m 2 system 1 system 2 r system 2 r system (% Mar /h/month 164.33	stems inclu ntary syste) Apr	uding micro m (table 11 May	0.00 -CHP	Jul	Aug	∑(98 (20 Sep 0.00	3)15, 10 (98) 1 - (20)2) × [1- (20 (202) × (20 (202) × (20 Oct 86.29	.12 = ÷ (4) 01) = 3)] = 03) = Nov 271.95	0.10 0.90 0.00 0.90 0.00 93.20 65.00 Dec 456.61] (9] (9] (2] (2] (2] (2] (2] (2] (2] (2
a. Energy req pace heating action of spac action of spac action of spac action of total action of total ficiency of ma ficiency of sec pace heating fu	equirement uirements - e heat from e heat from space heat space heat in system 1 ondary/sup Jan uel (main sy 430.61	kWh/m²/ye individual secondary, main syste main syste from main from main (%) plementary Feb stem 1), kW 272.17	ear heating sys /supplemer m(s) m 2 system 1 system 1 system 2 r system (% Mar /h/month 164.33	stems inclu htary syste) Apr 55.20	May	0.00 -CHP	Jul 0.00	Aug 0.00	Σ(98 (20 Sep 0.00 Σ(21: 0.00	3)15, 10 (98) 1 - (20)2) × [1- (20 (202) × (20 (202) × (20 0ct 86.29 1)15, 10	.12 = ÷ (4) 01) = 3)] = 03) = Nov 271.95 .12 = 43.33	0.10 0.90 0.00 0.90 0.00 93.20 65.00 Dec 456.61 1750.89] (9] (9] (2] (2] (2] (2] (2] (2] (2] (2
a. Energy req ace heating action of spac action of spac action of spac action of total action of total action of total iciency of ma ficiency of sec ace heating fu	equirement uirements - e heat from e heat from space heat space heat in system 1 ondary/sup Jan uel (main sy 430.61	kWh/m²/ye individual secondary, main syste main syste from main from main (%) plementary Feb stem 1), kW 272.17	ear heating sys /supplemer m(s) m 2 system 1 system 1 system 2 r system (% Mar /h/month 164.33	stems inclu htary syste) Apr 55.20	May	0.00 -CHP	Jul 0.00	Aug 0.00	Σ(98 (20 Sep 0.00 Σ(21: 0.00	3)15, 10 (98) 1 - (20) (202) x [1- (20) (202) x (20) (202) x (20) Oct <u>86.29</u> 1)15, 10	.12 = ÷ (4) 01) = 3)] = 03) = Nov 271.95 .12 = 43.33	1813.14 28.51 0.10 0.90 0.00 90 0.00 93.20 65.00 Dec 456.61 1750.89 72.75] (9] (9] (2] (2] (2] (2] (2] (2] (2] (2
a. Energy req pace heating action of spac action of spac action of spac action of total action of total ficiency of ma ficiency of sec pace heating fu	equirement uirements - e heat from e heat from e heat from space heat space heat space heat in system 1 ondary/sup Jan uel (main sy 430.61 uel (seconda 68.60	kWh/m²/ye individual secondary, main syste main syste from main from main (%) plementary Feb stem 1), kW 272.17	ear heating sys /supplemer m(s) m 2 system 1 system 1 system 2 r system (% Mar /h/month 164.33	stems inclu htary syste) Apr 55.20	May	0.00 -CHP	Jul 0.00	Aug 0.00	Σ(98 (20 Sep 0.00 Σ(21: 0.00	3)15, 10 (98) 1 - (20) (202) x [1- (20) (202) x (20) (202) x (20) Oct <u>86.29</u> 1)15, 10	.12 = ÷ (4) 01) = 3)] = 03) = Nov 271.95 .12 = 43.33	1813.14 28.51 0.10 0.90 0.00 90 0.00 93.20 65.00 Dec 456.61 1750.89 72.75] (9] (9] (2] (2] (2] (2] (2] (2] (2] (2
bace heating re bace heating bace heating faction of space faction of space faction of space faction of total ficiency of ma ficiency of seco bace heating fur bace heating fur	equirement uirements - e heat from e heat from e heat from space heat space heat space heat in system 1 ondary/sup Jan uel (main sy 430.61 uel (seconda 68.60	kWh/m²/ye individual secondary, main syste main syste from main from main (%) plementary Feb stem 1), kW 272.17	ear heating sys /supplemer m(s) m 2 system 1 system 1 system 2 r system (% Mar /h/month 164.33	stems inclu htary syste) Apr 55.20	May	0.00 -CHP	Jul 0.00	Aug 0.00	Σ(98 (20 Sep 0.00 Σ(21: 0.00	3)15, 10 (98) 1 - (20) (202) x [1- (20) (202) x (20) (202) x (20) Oct <u>86.29</u> 1)15, 10	.12 = ÷ (4) 01) = 3)] = 03) = Nov 271.95 .12 = 43.33	1813.14 28.51 0.10 0.90 0.00 90 0.00 93.20 65.00 Dec 456.61 1750.89 72.75) (9) (9) (2) (2) (2) (2) (2) (2) (2) (2

										_
188.61 166.40	174.94	157.19	154.39	137.42	131.08	145.09	145.23	162.54 17	1.37 183.65	
								∑(219a)112 =	1917.90	(219)
Annual totals										-
Space heating fuel - main system 1									1750.89	
Space heating fuel - secondary									278.94	
Water heating fuel									1917.90	
Electricity for pumps, fans and elect	ric keep-hot (Table 4f)						_		
mechanical ventilation fans - bal	anced, extract	t or positive	e input fron	n outside			100.09			(230a)
central heating pump or water p	ump within w	arm air hea	ating unit				30.00			(230c)
boiler flue fan							45.00			(230e)
Total electricity for the above, kWh/	year								175.09	(231)
Electricity for lighting (Appendix L)									286.43	(232)
Total delivered energy for all uses						(211)(221	L) + (231) +	- (232)(237b) =	4409.26	(238)
10a. Fuel costs - individual heating	systems incl	uding micro	o-CHP							
		0		Fuel		FL	uel price		Fuel	
			kV	Wh/year					cost £/year	
Space heating - main system 1			1	.750.89	×		3.48	x 0.01 =	60.93	(240)
Space heating - secondary				278.94	×		4.23	x 0.01 =	11.80	(242)
Water heating			1	.917.90	x		3.48	x 0.01 =	66.74	(247)
Pumps and fans				175.09	x		13.19	x 0.01 =	23.09	(249)
Electricity for lighting				286.43	x		13.19	x 0.01 =	37.78	(250)
Additional standing charges									120.00	(251)
Total energy cost						(2	40)(242)	+ (245)(254) =	320.35	(255)
11a. SAP rating - individual heating	systems inc	luding micr	o-CHP							
Energy cost deflator (Table 12)	, , ,								0.42	(256)
Energy cost factor (ECF)									1.24	(257)
SAP value									82.72	
SAP rating (section 13)									83	(258)
SAP band									В]
										-
12a. CO ₂ emissions - individual hea	ating systems	including					-			
				Energy Nh/year			sion facto CO₂/kWh	r	Emissions kg CO ₂ /year	
Space heating - main system 1			1	.750.89	x		0.22	_ =	378.19	(261)
Space heating - secondary				278.94	х		0.02] =	5.30	(263)
Water heating				.917.90	х		0.22] =	414.27	(264)
Space and water heating						(26	1) + (262)	_ + (263) + (264) =	797.76	(265)
Pumps and fans				175.09	x		0.52	=	90.87	(267)
Electricity for lighting				286.43	х		0.52] =	148.66	(268)
Total CO ₂ , kg/year								 (265)(271) =	1037.29	(272)
Dwelling CO ₂ emission rate								(272) ÷ (4) =	16.31	(273)

El value

El rating (section 14)

EI band

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

Energy kWh/year Primary factor

Primary Energy kWh/year

87.20

87

В

(274)

Space heating - main system 1	1750.89	x	1.22		2136.08	(261)
						- · ·
Space heating - secondary	278.94	x	1.04	=	290.10	(263)
Water heating	1917.90	x	1.22	=	2339.84	(264)
Space and water heating			(261) + (262) +	(263) + (264) =	4766.03	(265)
Pumps and fans	175.09	x	3.07	=	537.54	(267)
Electricity for lighting	286.43	x	3.07	=	879.34	(268)
Primary energy kWh/year					6182.91	(272)
Dwelling primary energy rate kWh/m2/year					97.22	(273)