

Energy Statement

Centric Close, Camden

On Behalf of Fairview Ventures Limited



LEC2361/R02/01

Low Carbon Energy Consultancy Ltd.

Northampton London Birmingham

T: 0845 119 1188 | W: www.lowenergyconsultancy.co.uk



Document Control

Quality Control

Author:	Sergey Barekyan	Date:	10/01/2017
Checker:	Aaron Sheaf	Date:	10/01/2017
Approver:	Adam Alexander	Date:	06/01/2017

Submission History

Issue No	Comments	Author	Checker	Approver	Date
1	Initial Report	SB	AS	AA	20/12/2016
2	Final Report	SB	AA	AA	10/01/2017
3					
4					
5					



Disclaimer

The opinions and interpretations presented in this report represent our best technical interpretation of the data made available to us. However, due to the uncertainty inherent in the estimation of all parameters, we cannot, and do not guarantee the accuracy or correctness of any interpretation and we shall not, except in the case of gross or wilful negligence on our part, be liable or responsible for any loss, cost damages or expenses incurred or sustained by anyone resulting from any interpretation made by any of our officers, agents or employees.

Except for the provision of professional services on a fee basis, LEC does not have a commercial arrangement with any other person or company involved in the interests that are the subject of this report.

LEC cannot accept any liability for the correctness, applicability or validity for the information they have provided, or indeed for any consequential costs or losses in this regard. Our efforts have been made on a "best endeavours" basis and no responsibility or liability is warranted or accepted by LEC.

Copyright © LEC Ltd



Contents

Prefa	ce			.1
Execu	itive Sui	nmary		.2
1	Introdu	uction		.7
	1.1	Backgrou	nd	. 7
	1.2	Descriptio	on of the Development	. 7
2	Plannir	ng Policies		.8
	2.1	National I	Planning Policy Framework (2012)	. 8
	2.2	The Lond	on Plan	. 8
	2.3	Camden F	Planning Policy	10
		2.3.1	Camden Local Plan	10
		2.3.2	Development Policies	11
	2.4	Sustainab	ility Requirements	11
		2.4.1	Code for Sustainable Homes	11
		2.4.2	BREEAM	11
	2.5	Part L Bui	Iding Regulations	12
		2.5.1	Part L1A 2013	12
		2.5.2	Part L2A 2013	12
	2.6	Summary	of Policy Requirements	12
3	Energy	Strategy /	Approach	13
	3.1	Energy an	d Carbon Assessment Methodology	13
		3.1.1	Residential	13
		3.1.2	Non-residential	13
4	Baselin	e CO₂ Emi	ssions	15
	4.1	Residenti	al Baseline	15
	4.2	Non-resid	ential Baseline	16
	4.3	Total Base	eline	16
5	Energy	Efficiency	(Be Lean)	17
	5.1	Residenti	al	17
		5.1.1	Passive Design	17
		5.1.2	Building Fabric	17
		5.1.3	Energy Efficient Systems	18
	5.2	Non-resid	ential	19
		5.2.1	Passive Design	19
		5.2.2	Building Fabric	20
		5.2.3	Energy Efficient Systems	20



	5.3	CO₂ Savin	gs after Energy Demand Reduction (Be Lean)	. 22
		5.3.1	Residential CO ₂ Savings after Energy Demand Reduction	. 22
		5.3.2	Non-residential CO ₂ Savings after Energy Demand Reduction	. 22
		5.3.3	Total CO ₂ Savings after Energy Demand Reduction	. 23
6	Efficier	ncy Energy	Supply (Be Clean)	.24
	6.1	Residenti	al Energy Demand	. 24
	6.2	Non-resid	lential Energy Demand	. 25
	6.3	Energy Su	pply Options Assessment	. 25
		6.3.1	Connection to Existing District Heating Networks	. 25
		6.3.2	Site-wide Heating Network	. 26
	6.4	Summary	of CO ₂ Reductions from CHP system	. 30
		6.4.1	Residential CO ₂ Savings from CHP System	. 30
		6.4.2	Non-residential CO ₂ Savings from CHP System	. 30
		6.4.3	Total CO ₂ Savings from CHP System	. 31
7	Renew	able Ener	gy (Be Green)	.32
	7.1	Photovolt	aics (PV)	. 32
		7.1.1	Design	. 32
	7.2	Summary	CO2 Savings from Renewable Systems	. 34
		7.2.1	Residential CO ₂ Savings from Renewable Systems	. 34
		7.2.2	Non-residential CO ₂ Savings from Renewable Systems	. 34
		7.2.3	Total CO ₂ Savings from Renewable Systems	. 35
8	Summa	ary and Co	nclusions	.36
Арре	ndix A –	Alternati	ve Renewable Technologies	
Арре	ndix B –	GLA Dom	estic Overheating Checklist	
Арре	ndix C –	CHP Syste	em LCC Assessment Summary	
Арре	ndix D –	- Energimi	zer EM 16NG Specification	

Appendix E – Sample SAP and BRUKL Reports



Preface

Non-Disclosure

This document contains confidential information. In consideration of LEC Ltd disclosing such confidential information this document should be held and maintained in confidence and should only be disclosed to:

- 1 The Client, Fairview Ventures Limited.
- 2 Professional advisors to the client.
- 3 The Local Authority for the site location.
- 4 Clients permitted assignees established by written assignment.
- 5 Professional advisors of permitted assignees.

This document is issued only to the organisations stated above and on the understanding that this practice is not held responsible for the action of others who obtain any unauthorised disclosures of its contents or place any reliance on any part of its findings, fact or opinions, be they specifically stated or implied.

The confidential information in this document shall only be used for the intended purpose.

Freedom of Information

Copies of this document may come into the possession of organisations designated under the Freedom of Information Act 2000. Organisations designated in the 'Act' are requested to respect the above statements relating to confidentiality and copyright.

Enquiries

Any enquiries regarding this document shall be directed to LEC Ltd, telephone 01604 655295, email adam.alexander@lowenergyconsultancy.co.uk



Executive Summary

This Energy Statement supports the planning application for the proposed development of Centric Close, in the London Borough of Camden.

The Energy Strategy follows the London Plan Energy Hierarchy: Be Lean, Be Clean and Be Green. The overriding objective in the formulation of the strategy is to maximise the reductions in total CO_2 emissions through the application of the hierarchy with a cost-effective and technically appropriate approach, and to minimise the emission of other pollutants.

The development site will be built under Part L 2013 of the Building Regulations and in line with the London Plan target to achieve a 35% CO₂ reduction over the Part L 2013 baseline.

The development will reduce regulated CO_2 emissions by incorporating a range of passive design and energy efficiency measures throughout the site, including improved building fabric standards beyond the requirements of Part L of the Building Regulations and energy efficient mechanical and electrical plants. These measures enable the proposed development to exceed Part L 2013 Target Emission Rates (TER) and Target Fabric Energy Efficiency (TFEE) minimum standards through energy efficiency measures alone.

After reduction of the energy demand, the strategy proposes implementation of a gas-fired Combined Heat and Power (CHP) engine and efficient gas-fired boilers connected to a site-wide district heating network (DHN). The DHN will supply hot water and space heating for the entire development.

A Variable Refrigerant Flow (VRF) system has been proposed for the shell only non-residential units to supply space cooling demands.

Photovoltaic Panels (PV) will be provided to supply renewable energy to the development and to reduce the regulated CO_2 emissions of the site.

The regulated energy CO₂ savings expressed in terms of actual and percentage reduction after each stage of the energy hierarchy for residential and non-residential parts of the development are presented below.

Residential

	CO ₂ emissions (tonnes/year)		
	Regulated	Unregulated	Total
Residential Baseline	70.62	83.04	153.66
After energy demand reduction	70.60	83.04	153.63
After use of CHP technology	47.64	83.04	130.67
After use of PV technology	45.78	83.04	128.82

The energy strategy shows that the overall CO_2 emissions from both regulated and unregulated energy can be reduced by circa 24.84 t CO_2 per annum which is equivalent to circa 16.2% reduction.



	Regulated Ene	rgy CO2 savings
	Tonnes per annum	%
Savings from energy demand reduction	0.02	0%
Savings from CHP	22.96	32.5%
Savings from renewables	1.86	3.9%
Total cumulative savings	24.84	35.2%
Annual Savings from off-set payment	45.8	
Cumulative savings for off-set payment (tonnes for 30 years)	1,373.49	

The table shows that the proposed strategy can achieve regulated CO_2 savings of circa 24.84 t CO_2 which is equivalent to circa 35.2% reduction when compared to the baseline. To achieve the zero carbon homes standard, an off-set payment will be made to for the outstanding regulated CO_2 emissions based on the carbon off-set price of £60 per tonne over a 30 year period.

The overall reduction in regulated carbon emissions associated with the proposed design is graphically illustrated in the figure below.





Non-residential

	с	CO ₂ emissions (tonnes/year)		
	Regulated	Unregulated	Total	
Non-residential Baseline	22.19	26.32	48.50	
After energy demand reduction	19.14	26.32	45.46	
After use of CHP technology	17.19	26.32	43.51	
After use of PV technology	14.38	26.32	40.70	

The energy strategy shows that the overall CO_2 emissions from both regulated and unregulated energy can be reduced by circa 7.8 t CO_2 per annum which is equivalent to circa 16.1% reduction.

	Regulated Energy CO ₂ savings	
	Tonnes per annum	%
Savings from energy demand reduction	3.05	13.7%
Savings from CHP	1.95	10.2%
Savings from renewables	2.80	16.3%
Total cumulative savings	7.80	35.2%

The table above shows that the proposed strategy can achieve regulated CO_2 savings of circa 7.8 t CO_2 which is equivalent to circa 35.2% reduction when compared to the baseline.

The overall reduction in regulated carbon emissions associated with the proposed design is graphically illustrated in the figure below.





Entire Development

	CO ₂ emissions (tonnes/year)		
	Regulated	Unregulated	Total
Total CO ₂ Emissions Baseline	92.81	109.35	202.16
After energy demand reduction	89.74	109.35	199.09
After use of CHP technology	64.83	109.35	174.18
After use of PV technology	60.17	109.35	169.52

The energy strategy shows that the overall CO_2 emissions from both regulated and unregulated energy can be reduced by circa 32.64 t CO_2 per annum which is equivalent to circa 16.1% reduction.

	Regulated Energy CO ₂ savings	
	Tonnes per annum	%
Savings from energy demand reduction	3.07	3.3%
Savings from CHP	24.91	27.8%
Savings from renewables	4.66	7.2%
Total cumulative savings	32.64	35.2%



The table above shows that the proposed strategy can achieve regulated CO_2 savings of circa 32.64 t CO_2 which is equivalent to circa 35.2% reduction when compared to the baseline.

The overall reduction in regulated carbon emissions associated with the proposed design is graphically illustrated in the figure below.



Summary

In summary, the proposed energy strategy for the development:

- 1 Informs the built form and orientation of the buildings to respond to daylight and indoor comfort levels;
- 2 Includes optimal building fabric standards, energy efficient design of building services and energy efficient appliances;
- 3 Complies with Part L 2013 Building Regulations and meets TFEE requirements;
- 4 Includes on-site CHP system connected to site-wide heating network to supply hot water and space heating to the residential development;
- 5 Includes renewable energy technologies;
- 6 Meets the 35% regulated energy CO₂ emissions reduction requirement on-site;
- 7 Achieves the zero carbon homes standard for the residential development by making an offset payment the outstanding regulated CO₂ emissions based on the carbon off-set price of £60 per tonne over a 30 year period.
- 8 Achieves BREEAM Excellent ENE 01 mandatory requirement.



1.1 Background

Low Energy Consultancy Limited (LEC) has been instructed by Fairview Ventures Limited (Fairview) to prepare an Energy Statement focusing on the proposed energy strategy for the proposed development of Centric Close, Camden. The Energy Statement has been prepared to support the full planning application in response to the local, regional and national legislation.

To support the planning application this document identifies and describes the energy efficiency design and low carbon/renewable technology options that have been explored and the preferred options for achieving a reduction in carbon emissions. This document has been produced to demonstrate how the proposed development can fulfil the relevant requirements of the National Planning Policy Framework, the London Plan and Camden's Local Plan policies.

In order to achieve the energy and sustainability objectives defined by national, regional and local policies, an assessment has been carried out to identify the most appropriate and viable strategies and technologies to achieve the carbon and renewable reductions. The energy options presented in this report have been considered at a strategic level.

1.2 Description of the Development

The proposed development comprises the demolition of existing buildings and the erection of 76 residential units and 1,139 sqm of commercial floorspace (Use Class B1) over 4, 5, 6 and 7 storeys providing a mix of 1, 2 and 3 bed apartments. The development includes a landscaped courtyard and communal amenity areas.

The redevelopment of the site will make a positive enhancement to the visual appearance of the area, providing much needed homes for the local area, including commercial floorspace to reflect the Council's aspirations for the area.



2 Planning Policies

This section summarises the relevant energy policy context for the development. The national, regional and local policies and regulations related to energy and sustainability are summarised below.

2.1 National Planning Policy Framework (2012)

The National Planning Policy Framework (NPPF) document sets out the Government's planning policies for England and was published on the 27th March 2012.

The NPPF is designed to consolidate all policy statements, circulars and guidance documents into a single, simpler National Planning Policy Framework, making the planning system more user-friendly and transparent. The framework's primary objective is a sustainable development, therefore focussing on the 3 pillars of sustainability. The framework is split into three sections; planning for prosperity (Economic), planning for people (Social) and planning for places (Environmental), each of which outlines guidance to tackle issues such as housing, transport infrastructure, climate change, business and economic development, etc.

In regard to climate change, the NPPF supports a reduction in greenhouse gas emissions and the delivery of renewable and low carbon energy. Climate change is covered in Section 10 '*Meeting the challenge of climate change, flooding and coastal change'*. In summary the framework advises:

To support the move to a low carbon future, local planning authorities should:

- plan for new developments in locations and ways which reduce greenhouse gas emissions;
- actively support energy efficiency improvements to existing buildings; and
- adopting nationally described standards when setting any local requirement for a building's sustainability.

In determining planning applications, local planning authorities should expect a new development to:

- comply with adopted Local Plan policies on local requirements for decentralised energy supply, unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and
- take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

2.2 The London Plan

The London Plan requires all developments to actively tackle climate change through their design as an integral part of sustainable development. Chapter 5: London's Response to Climate Change contains the following crosscutting policies supporting London as an exemplar city in adapting to climate change.

- 1 Policy 5.1 Climate change mitigation
- 2 Policy 5.2 Minimising carbon dioxide emissions
- 3 Policy 5.3 Sustainable design and construction
- 4 Policy 5.5 Decentralised energy networks



- 5 Policy 5.6 Decentralised energy in development proposals
- 6 Policy 5.7 Renewable energy
- 7 Policy 5.8 Innovative energy technologies
- 8 Policy 5.9 Overheating and cooling

The London Plan requires that developments include energy assessments with the planning applications explaining the strategy for carbon emissions reduction based on the energy hierarchy.

The London Plan requires that major development proposals include a detailed energy assessment to demonstrate how the targets for carbon dioxide emission reduction outlined below are to be met within the framework of the energy hierarchy.

Policy 5.2 of the London Plan requires developments to minimise carbon dioxide emissions in accordance with the energy hierarchy:

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

Policy 5.2 also requires major developments to meet the following targets for carbon dioxide emission reduction in buildings. The targets are expressed in the tables below as minimum improvements over Target Emission Rate (TER) outlined in the National Building Regulations.

Residential Buildings

Year	Improvement on 2010 Building Regulations
2013 - 2016	40 % CO ₂ emissions reduction
2016 - 2031	Zero Carbon (from 1 st October 2016)

Non-Residential Buildings

Year	Improvement on 2010 Building Regulations
2013 - 2016	40 % CO ₂ emissions reduction
2016 - 2019	As per the Building Regulation requirements
2019 - 2031	Zero Carbon



Policy 5.6 requires development proposals to select energy systems in accordance with the following hierarchy:

- 1 Connection to existing heating or cooling networks
- 2 Connection to site wide CHP network
- 3 Development of communal heating and cooling networks.

Policy 5.7 requires major developments to provide a reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation where feasible.

In April 2014 the GLA published a revised Sustainable Design and Construction SPG and Energy Planning Guidance which provides direction on how the energy targets need to be assessed and met over new Part L 2013 which came into force on the 6th of April 2014.

As outlined in the Sustainable, Design and Construction SPG, from the 6th April 2014, the Mayor requires a 35% carbon reduction target beyond Part L 2013 of the Building Regulations, which is deemed to be broadly equivalent to the 40% target beyond Part L 2010 (London Plan Policy 5.2 for 2013-2016). This target applies to all Stage 1 applications received by the Mayor on or after 6th April 2014.

The GLA Guidance on Preparing Energy Assessments published in March 2016 states that the zero carbon target for major residential developments will be implemented for Stage 1 schemes on or after the 1st October 2016.

'Zero carbon' homes are defined as homes forming part of major development applications where the residential element of the application achieves at least a 35% reduction in regulated carbon dioxide emissions beyond Part L 2013 on-site. The remaining regulated carbon dioxide emissions, to 100%, are to be off-set through a cash in lieu contribution to the relevant borough to secure delivery of carbon dioxide savings elsewhere

The Mayor's Housing Standard's Viability Assessment assumed a carbon off-set price of £60 per tonne of carbon dioxide for a period of 30 years.

For the period 2016 to 2019, London Plan Policy 5.2 sets the carbon dioxide emissions target for nonresidential development to be in line with Part L of the Building Regulations. This target was intended to align with the then expected improvement to Part L of the Building Regulations. However, the Government announced (in July 2015) that it does not intend to proceed with the proposed 2016 increase in on-site energy efficiency standards, but will keep energy efficiency standards under review.

The GLA Guidance on Preparing Energy Assessments states that the GLA will continue to require that nondomestic development seek to achieve a 35% reduction against Part L 2013.

2.3 Camden Planning Policy

The site falls within the London Borough of Camden therefore the development should also comply with the local planning policies. These are set out in the Camden Core Strategy 2010 and Development Plan Policies 2010.

2.3.1 Camden Local Plan

The Local Development Framework document is the Core Strategy and the key policies relating to energy and sustainability are identified below.



Policy CS13 Reducing the effects of and adapting to climate change requires all development to take measures to minimise the effects of, and adapt to, climate change and encourage all development to meet the highest feasible environmental standards that are financially viable during construction and occupation by:

- minimising carbon emissions from the redevelopment, construction and occupation of buildings by implementing, in order, all of the elements of the following energy hierarchy:
 - ensuring developments use less energy,
 - making use of energy from efficient sources, such as the King's Cross, Gower Street, Bloomsbury and proposed Euston Road decentralised energy networks;
 - generating renewable energy on-site; and
- ensuring buildings and spaces are designed to cope with, and minimise the effects of, climate change.

The Council will have regard to the cost of installing measures to tackle climate change as well as the cumulative future costs of delaying reductions in carbon dioxide emissions.

2.3.2 Development Policies

Development Policy DP22 - Promoting sustainable design and construction will require development to incorporate sustainable design and construction measures. Schemes must:

- demonstrate sustainable development principles
- expect new build housing to meet Code for Sustainable Homes Level 3 by 2010 and Code Level 4 by 2013 and encouraging Code Level 6 (zero carbon) by 2016.
- expect non-domestic developments of 500sqm of floorspace or above to achieve "very good" in BREEAM assessments and "excellent" from 2016 and encouraging zero carbon from 2019.

2.4 Sustainability Requirements

2.4.1 Code for Sustainable Homes

Camden's Core Strategy Policy DP22 requires all new residential developments to be rated against Code for Sustainable Homes Level 4. However, the Deregulation Act 2015, which received Royal Assent on the 26th March 2015, has withdrawn the Code for Sustainable Homes standard, therefore this policy is no longer applicable.

2.4.2 BREEAM

BREEAM (Building Research Establishment's Environmental Assessment Method) is an assessment method established by the Building Research Establishment (BRE) and is used to assess the environmental impact of non-domestic buildings. BREEAM covers a range of issues which are awarded where a building achieves a benchmark performance and is a voluntary standard, although some planning authorities require compliance.

Camden's Development Policy DP22 requires all new non-residential development to be built to at least BREEAM "Excellent" standard.



2.5 Part L Building Regulations

The development will need to comply with the current version of Part L (Part L 2013) which came into force on the 6th April 2014. The residential units will need to comply with Part L1A 2013 and non-residential will need to comply Part L2A 2013.

2.5.1 Part L1A 2013

Approved Document Part L1A 2013 incorporates a number of changes and additions compared to Part L1A 2010. Part L1A 2013 requires new homes to reduce their carbon emissions by a further 6% across the build mix, compared to Part L1A 2010. In addition to achieving an overall carbon emission target, (i.e. TER or Target Emission Rate), there is a further requirement to achieve or better fabric energy efficiency targets (TFEE: "Target Fabric Energy Efficiency"). This means the thermal performance of the building fabric now has its own standards which cannot be compensated by services strategy or renewable features.

2.5.2 Part L2A 2013

Approved Document Part L2A 2013 incorporates a number of changes and additions compared to Part L2A 2010. Part L2A 2013 requires new non-domestic buildings to reduce their carbon emissions by a further 9% across the build mix, compared to Part L2A 2010.

Part L2A 2010 was based on comparing the actual building against a notional building. This approach remains the same for Part L2A 2013, however the notional building has been modified to have more energy efficient building fabric and reduced air permeability. Similar to Part L 2010, the notional building standards will change depending on the type of non-domestic building use.

2.6 Summary of Policy Requirements

The following section provides a summary of local and national planning policy requirements which should be met to achieve compliance.

- Part L 2013 Building Regulations.
- Achieve a minimum of 35% reduction in carbon emissions on-site for residential and nonresidential parts of the development (against current 2013 Building Regulations) by following Lean, Clean and Green principles.
- Achieve zero carbon target for residential development through a cash in lieu contribution.
- Expect to select energy systems in accordance with the following hierarchy:
 - 1 Connection to existing heating or cooling networks
 - 2 Connection to site wide CHP network
 - 3 Development of communal heating and cooling networks
- Provide a 20% reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation, where feasible.
- Meet BREEAM Excellent standard for the shell only non-residential units.



3 Energy Strategy Approach

The proposed energy strategy for the development will follow the London Plan Energy Hierarchy approach of Be Lean, Be Clean and Be Green to enable the maximum viable reductions in regulated and total CO_2 emissions over the baseline.

- Be Lean Use less energy;
- Be Clean Supply energy efficiently;
- Be Green Use renewable energy systems.

The proposed energy supply solutions aim to match energy profiles of the development ensuring effective use. The proposed solutions also take into consideration viability and flexibility of the scheme from a technical and economic point of view by identifying an optimal combination of energy efficiency measures as well as decentralised and renewable energy supply solutions. Applying these principles, Fairview is aiming to achieve the following objectives:

- Comply with the relevant regulatory requirements;
- Improve viability of the scheme by developing a technically robust and viable energy strategy;
- Improve feasibility, operation and management of the energy systems by promoting holistic design methods and solutions.

3.1 Energy and Carbon Assessment Methodology

The CO_2 emissions reduction methodology requires separate energy assessments for the residential and nonresidential floor space. The results from these assessments will be combined to provide an overall CO_2 emissions reduction for the entire development.

3.1.1 Residential

NHER software, which uses the Standard Assessment Procedure (SAP) 2012 methodology to assess compliance with Part L1A, has been used to evaluate an initial CO_2 performance of representative residential dwellings. To assess energy performance of the entire residential development, an energy and carbon assessment model has been produced, which extrapolates the results of the SAP analysis using the weighted average method provided in Part L1A to predict the energy consumption and CO_2 performance of the residential development.

Since the NHER software does not include unregulated energy use (for appliances and cooking), the unregulated CO₂ emissions have been calculated separately using BREDEM methodology.

Although the produced data by the NHER software provides estimations of possible energy and carbon performance of the residential development for assessment purposes, it is not intended to be used as a detailed design tool.

3.1.2 Non-residential

An initial assessment of CO₂ performance of the non-residential unit is carried out using IES VE software. IES VE is an approved tool for calculating compliance with Part L2A which uses the standard National Calculation Methodology (NCM).



An assessment of the energy performance of the development considers regulated energy usage for different building services such as cooling, heating, lighting and ventilation. An estimate is also provided of unregulated electricity use (equipment) associated with computers, small power, and security systems, etc.

Although the produced data by the IES VE software provides estimations of possible energy and carbon performance of the non-residential development for assessment purposes, again it is not intended to be used as a detailed design tool.



4 Baseline CO₂ Emissions

In order to assess CO_2 performance of the proposed energy strategy, a CO_2 emissions baseline needs to be established. This section sets out the approach taken to calculating the baseline CO_2 emissions for the residential and the non-residential parts of the development.

The total baseline CO_2 emissions for the proposed development is defined as regulated CO_2 emissions covered by Building regulations Part L as well as the unregulated CO_2 emissions not covered by Part L. The unregulated CO_2 emissions should be excluded when compliance with the planning policy is calculated.

4.1 Residential Baseline

The regulated CO_2 emissions baseline is based on the Part L1A 2013 Target Emission Rate (TER) performance of representative dwellings. The baseline CO_2 performance has been determined by carrying out SAP 2012 modelling to establish the TERs of sample dwellings. The representative dwellings presented in Table 4.1 were used to carry out the SAP assessment.

Reference	Туре	Location
B-L00-05	1 Bed, 2 People	Block B, Ground Floor
A-L04-60	1 Bed, 2 People	Block A, Mid Floor
B-L04-26	1 Bed, 2 People	Block B, Top Floor
A-L00-28	2 Bed, 3 People	Block A, Ground Floor
A-L04-65	2 Bed, 4 People	Block A, Mid Floor
A-L06-73	2 Bed, 3 People	Block A, Top Floor
B-L00-02	3 Bed, 4 People	Block B, Ground Floor
A-L03-48	3 Bed, 5 People	Block A, Mid Floor
B-L03-19	3 Bed, 5 People	Block B, Top Floor

Table 4.1 Representative sample dwellings

The DER reports for the sample dwellings for each stage of the energy hierarchy have been provided in Appendix D. The TER results of the SAP assessments from the representative dwellings have been extrapolated using a weighted average method to predict the residential CO₂ emissions baseline.



Since SAP and therefore TERs do not include the energy use for appliances and cooking, the unregulated CO_2 emissions have been calculated separately using BREDEM methodology. The regulated, unregulated and total baseline CO_2 emissions for the residential units are summarised in Table 4.2.

Table 4.2 Residential baseline CO2 emissions

	CO ₂ emissions (tonnes/year)			
	Regulated Unregulated Total			
Residential Baseline	70.62	83.04	153.66	

4.2 Non-residential Baseline

For the non-residential units, the CO₂ emissions baseline is determined based on the TER for building services plus other unregulated energy use calculated using IES VE software.

The baseline CO_2 emissions calculated using IES VE software are based on the calculation of the energy consumption of a 'notional' building under the standard National Calculation Methodology (NCM). The IES VE modelling results in the form of BRUKL reports have been provided in Appendix D. The regulated, unregulated and total baseline CO_2 emissions for the non-residential floor spaces are summarised in Table 4.3.

Table 4.3 Non-residential baseline CO₂ emissions

	CO ₂ emissions (tonnes/year)		
	Regulated	Unregulated	Total
Non-residential Baseline	22.19	26.32	48.50

4.3 Total Baseline

For the entire development (residential and non-residential), the CO_2 emissions baseline is determined by combining the residential and non-residential CO_2 baselines together. The total baseline CO_2 emissions for the development as a whole is summarised in Table 4.4.

Table 4.4 Total baseline CO₂ emissions

	CO ₂ emissions (tonnes/year)		
	Regulated Unregulated Total		
Total Baseline	92.81	109.35	202.16



5 Energy Efficiency (Be Lean)

In accordance with the London Plan Energy Hierarchy, the key focus for the proposed energy strategy is to reduce the energy demands of the development as far as practically possible and viable by implementing various energy demand reduction measures. The aim is to achieve Part L 2013 Building Regulations compliance without contribution from low carbon or renewable energy sources.

The proposed design of the development follows sustainable design principals and standards, aiming to use natural resources efficiently, reduce energy consumption and avoid internal overheating as well as contribution to the urban heat island effect.

A range of measures to reduce CO₂ emissions and increase resilience to climate change are proposed to be incorporated into the building design including good building fabric standards as well as energy efficient M&E systems and lighting.

Through adopting best practice in design, and in response to the planning policies, the development has considered sustainable design and construction standards to reduce potential overheating and reliance on air conditioning systems through the following approaches and measures.

5.1 Residential

5.1.1 Passive Design

The development will incorporate passive solar design measures. The buildings incorporate balconies and overhangs for the top floors which help to provide shading, minimising the risk of overheating of the units. The proposed windows aim to maximise daylight and at the same time minimise overheating. The glazing specification will be selected to provide a balance of solar control and access to passive solar gain. The GLA Domestic Overheating Checklist has been completed and included in Appendix B.

Natural ventilation has been considered but due to the high energy efficiency requirements and CO₂ reduction targets as well as noise sources arising from the railway, implementation of a natural ventilation strategy is considered to be inappropriate.

In this case, taking into consideration noise issues, energy efficiency requirements and proposed building fabric standards, it is considered to be more appropriate to implement a mechanical ventilation strategy to ensure compliance with regulations and standards.

Openable windows are proposed albeit they will not be essential to provide a fresh air supply. Nonetheless, they will provide a further allowance to residents and occupiers to control their indoor environment. The openable windows can also be used for purge ventilation.

The ventilation strategy will be reviewed as the design progresses to ensure compliance with all the relevant regulations and standards.

5.1.2 Building Fabric

In order to achieve the Part L 2013 TER and Target Fabric Energy Efficiency (TFEE) targets, good building fabric standards will be used. The minimum building fabric requirements for Part L1A 2013 and the proposed



specification for individual building elements for the residential part of the development are presented in Table 5.1.

	U-values (W/m²K)		
Element	Part L1A 2013 minimum fabric requirements	Proposed specification for the development	
External walls	0.30	0.18	
Roof	0.20	0.16	
Ground floor	0.25	0.20	
Windows [1]	2.00	1.30	
Airtightness	10 (m³/(hm²) at 50 Pa)	4 (m³/(hm²) at 50 Pa)	

Table 5.1 Proposed fabric energy efficiency targets for individual building elements

[1] Glazing performance will need to be reviewed alongside acoustic performance as the design is developed.

Implementing these (or similar) building fabric standards will help to deliver substantial reductions in CO₂ emissions compared with the current building performance and regulations and meet the TFEE targets. The proposed specification should be viewed as guidance.

5.1.3 Energy Efficient Systems

The overarching principle for the selection of the building fabric standards and energy efficient systems is to achieve compliance with Part L1A 2013 requirements only through energy demand reduction measures.

5.1.3.1 Heating and Hot Water

The space heating requirement of the proposed development will be significantly reduced by the proposed fabric, air tightness and ventilation measures.

It is proposed to install a communal heat distribution network to provide space heating and hot water. Specifically, it is proposed to design the heating system to achieve the following:

- Variable flow rate heating system with high delta T and low return temperatures
- High efficiency motors and variable speed pumps for heating
- Appropriate controls for heating
- Temperature and time zoning
- Appropriate insulation of heating pipes
- Low flow and return temperatures

5.1.3.2 Ventilation

Air tightness standards will conform to, and exceed, Approved Document Part L requirements. An improvement of design air permeability rate together with the need to achieve the internal noise standards will require provision of mechanical ventilation. At this stage, it is proposed to provide an energy efficient mechanical ventilation system to meet the noise and fresh air supply requirements.



It is proposed to select a mechanical ventilation system with a low Specific Fan Power (SFP). Additionally, all dwellings will have openable windows and therefore the ability to naturally ventilate should the occupant desire.

5.1.3.3 Cooling

It is not proposed to provide cooling for the residential dwellings for the purposes of Part L. Acceptable internal conditions will be achieved by the incorporation of the proposed passive design measures, ventilation system and openable windows.

5.1.3.4 Lighting

The proposed windows aim to maximise daylight to minimise the need for artificial lighting. The electricity consumption associated with lighting will be further reduced by the provision of 100% energy efficient lighting within the dwellings.

5.1.3.5 Energy Metering and Monitoring

The provision of smart metering will be considered during detailed design stage and implemented if appropriate.

5.2 Non-residential

5.2.1 Passive Design

The non-residential units will be built to a shell only standard, defined as new build works that cover fabric, sub and superstructure of the building only, including external walls, windows, doors (external) and structural floors.

The design of the non-residential units propose to incorporate a number of passive design measures to reduce CO_2 emissions and improve the indoor climate.

The passive solar design will incorporate measures which control solar gain and improve direct and indirect natural lighting.

Internal glare control such as occupant controlled devices and internal blinds should be considered and incorporated by the future tenants as deemed appropriate.

Natural ventilation has been considered for modelling purposes, but due to the high energy efficiency requirements and CO₂ reduction targets as well as noise sources arising from the railway, implementation of a natural ventilation strategy is considered to be inappropriate.

In this case, taking into consideration noise issues, energy efficiency requirements and proposed building fabric standards, it is considered to be more appropriate to implement a mechanical ventilation strategy to ensure compliance with regulations and standards for modelling purposes.

Openable windows are proposed albeit they will not be essential to provide a fresh air supply. Nonetheless, they will provide a further allowance to residents and occupiers to control their indoor environment. The openable windows can also be used for purge ventilation.



The ventilation strategy will be reviewed by the future tenants to ensure compliance with all the relevant regulations and standards.

5.2.2 Building Fabric

Part L of the 2013 Building Regulations for non-residential buildings highlights the need for an energy efficient design. The minimum building fabric requirements for Part L2A 2013 and the proposed specification for individual building elements for the non-residential floor space are presented in Table 5.2.

Table 5.2 Proposed fabric energy efficiency targets for individual building elements

	U-values (W/m²K)		
Element	Part L1A 2013 minimum fabric requirements	Proposed specification for the development	
External walls	0.30	0.18	
Roof	0.20	0.16	
Ground floor	0.25	0.20	
Windows [1]	2.00	1.30	
Airtightness [2]	10 (m³/(hm²) at 50 Pa)	4 (m³/(hm²) at 50 Pa)	

[1] Glazing performance will need to be reviewed alongside acoustic performance as the design is developed.

[2] Default value will be used for the purposes of the shell only assessment, however for the modelling purposes a target value of 4 has been assumed.

Implementing these (or similar) building fabric standards will help to deliver substantial reductions in CO_2 emissions compared with the current building performance and regulations. The proposed specification should be viewed as guidance.

5.2.3 Energy Efficient Systems

Energy demand can be significantly reduced by using energy efficient M&E systems. The recommended indicative energy efficiency measures for the proposed non-residential units are provided below and have been used to carry out the energy and carbon modelling.

As the non-residential units will be provided as shell only, it will be the responsibility of the future tenant to review the proposed energy efficiency measures and incorporate them into the final design as required to meet the regulatory standards. The future tenants may vary the proposed energy efficiency measures/specification for specific requirements and needs.

The overarching principle for final selection of the building fabric standards and energy efficient systems is to achieve compliance with Part L2A 2013 requirements, where feasible.

5.2.3.1 Heating and Hot Water

The space heating requirement of the proposed development will be significantly reduced by the proposed fabric, air tightness and ventilation measures.

It is proposed to install a communal heat distribution network to provide space heating and hot water. Specifically, it is proposed to design the heating system to achieve the following:



- Variable flow rate heating system with high delta T and low return temperatures
- High efficiency motors and variable speed pumps for heating
- Appropriate controls for heating
- Appropriate insulation of heating pipes
- Low flow and return temperatures

5.2.3.2 Lighting

A major energy demand within modern non-residential spaces is generally lighting. Specified lighting in these areas should be low wattage and designed to CIBSE Illuminance levels. Appropriate lighting controls are recommended, such as PIRs and daylight dimmers, allowing light output to be automatically adjusted to suit prevailing conditions. Zoning of lighting circuits also allows greater benefit to be made of natural daylight in the areas where it is available, without compromising light levels further away from windows.

Additionally, high frequency ballasts and control gear will need to be utilised where appropriate to further reduce energy demand.

Display lighting may be required which generate a significant energy demand. Therefore, if applicable, it is proposed that all display lighting will use energy efficient luminaires.

The above will need to be considered at the fit-out stage by the future tenant.

5.2.3.3 Ventilation

Air tightness standards will conform to Approved Document Part L requirements. To achieve the internal noise standards and controlled internal conditions will require provision of mechanical ventilation. At this stage, it is proposed to provide an energy efficient mechanical ventilation system with heat recovery (MVHR) to meet the noise and fresh air supply requirements.

It is recommended to select MVHR with low Specific Fan Powers (SFP). SFP of 1.2 W/l/s is assumed for modelling purposes. This can be achieved by using systems with high efficiency fan motors and 45/90° radius bends and turning vanes in ductwork. The ventilation system should have a high heat recovery efficiency. The MVHR system should be specified to have purge ventilation or boost. An automatic control of MVHR systems, which may take the form of sensors to modulate their performance. All to be considered by the future tenant.

It is recommended to specify MVHR systems with summer by-pass which can overcome the issue of returning hot air to the dwelling by ensuring that it is not passed over the heat exchanger. There are systems available with automatic by-pass which can monitor both internal and external air temperatures. By-pass is initiated when internal temperature is above a set comfort level or is higher than external temperatures.

A more detailed ventilation strategy will be developed by the future tenant with the aim to specify the most appropriate system and achieve a pleasant indoor climate.

5.2.3.4 Cooling

At this stage, it is assumed that cooling may need to be provided to the non-residential unit. Cooling can be effectively provided by an energy efficient cooling system such as Variable Refrigerant Flow (VRF) system. It is recommended to select VRF system with high Coefficient of Performance (COP). COP of 4.5 W/I/s is assumed for modelling purposes.



5.2.3.5 Energy Metering and Monitoring

It is assumed that sub metering in non-residential units of major energy consuming systems together with an accessible energy monitoring and management system or separate accessible energy sub-meters with pulsed or other open protocol will be provided by the future tenants.

5.3 CO₂ Savings after Energy Demand Reduction (Be Lean)

5.3.1 Residential CO₂ Savings after Energy Demand Reduction

Based on the proposed energy efficiency measures, the Dwelling Emission Rate (DER) for each representative dwelling provides an indication of the anticipated regulated CO_2 emissions. The DERs do not include the unregulated energy use for appliances and cooking, these CO_2 emissions have been calculated separately using the BREDEM methodology.

The regulated energy and carbon baselines have been calculated by extrapolating the DER results of the typical dwellings across the entire residential development. The energy demand and CO_2 emissions of the representative dwellings have been inputted into the energy and carbon assessment model which calculated the total CO_2 emissions for the development.

The assessment shows that by implementing the energy efficient design, incorporating enhanced building fabric standards and using efficient energy supply systems, it is possible to achieve compliance with the Part L1A and achieve the TER target with energy efficiency measures alone. The regulated, unregulated and total emissions after energy demand reduction are summarised in Table 5.3.

	CO ₂ emissions (tonnes/year)		
	Regulated	Unregulated	Total
Residential Baseline	70.62	83.04	153.66
After energy demand reduction	70.60	83.04	153.63

Table 5.3 Anticipated residential CO₂ emissions after energy demand reduction

5.3.2 Non-residential CO₂ Savings after Energy Demand Reduction

Based on the proposed energy efficiency measures, the Building Emission Rate (BER) for the non-residential floor space has been calculated using IES VE software which provides indications of the anticipated CO₂ emissions of an 'actual' building under the standard National Calculation Methodology (NCM).

The energy assessment shows that by implementing the energy efficient design, by incorporating enhanced building fabric standards and by using energy efficient systems, the regulated CO_2 emissions of the non-residential floor space can be reduced by circa 3.05 tCO₂ per annum, which equates to circa 13.7% reduction in regulated emissions over the baseline. The regulated, unregulated and total emissions after energy demand reduction are summarised in Table 5.4.



Table 5.4 Anticipated CO₂ emissions after non-residential demand reduction

	CO ₂ emissions (tonnes/year)		
	Regulated	Unregulated	Total
Non-residential Baseline	22.19	26.32	48.50
After energy demand reduction	19.14	26.32	45.46

5.3.3 Total CO₂ Savings after Energy Demand Reduction

The CO₂ assessment shows that by implementing the energy efficient design, incorporating enhanced building fabric standards and using efficient energy systems, the regulated CO₂ emissions can be reduced by circa 3.07 tCO₂ per annum for the entire development, which equates to circa 3.3% reduction in regulated CO₂ emissions over the baseline. The summary of regulated, unregulated and total CO₂ emissions and anticipated savings are presented in Table 5.5.

Table 5.5 Summary of anticipated CO₂ emissions after energy demand reduction

	CO ₂ emissions (tonnes/year)		
	Regulated	Unregulated	Total
Total Baseline	92.81	109.35	202.16
After energy demand reduction	89.74	109.35	199.09



6 Efficiency Energy Supply (Be Clean)

6.1 Residential Energy Demand

The residential energy demand assessment has been carried out to estimate and evaluate the space heating and hot water demands using the SAP methodology. The estimated hot water and space heating demands are as follows:

- Hot water 160,018 kWh/year
- Space heating 78,685 kWh/year

The residential estimated hot water and space heating demand profiles are provided in Figure 6.1.



Figure 6.1: Residential estimated hot water and space heating demand profiles

The estimated residential hot water demand is expected to present a consistent load throughout the year, although there will be peaks and troughs in daily use. These peaks and troughs can be managed through use of a thermal store to transform the hot water load into a consistent base load which can potentially be delivered by a CHP technology connected to a district heating network.

During the summer months space heating may not be needed or its requirement will be relatively low. The space heating demand during colder months of the year, which will be minimised through energy efficiency measures, can also be delivered by the CHP technology. The remaining space heating demand can effectively be supplied by gas boilers which work well, combined with CHP technology.

Mechanical cooling for the residential part of the development is not expected to be required. Therefore, no active cooling supply is proposed for the residential units.



6.2 Non-residential Energy Demand

It is more difficult to assess non-residential heat demand because the non-residential units are designed as shell only and the tenants of the units are unknown. The non-residential energy demand assessment has been carried out to estimate and evaluate the space heating, hot water and comfort cooling demands using the NCM methodology. The estimated hot water, space heating and comfort cooling demands are as follows:

- Hot water 4,886 kWh/year
- Space heating 9,738 kWh/year
- Comfort cooling 14,921 kWh/year

The estimated hot water demand will not be significant. It is expected to present a consistent load throughout the year, although there will be peaks and troughs in daily use. The non-residential hot water demand alone cannot justify use of CHP technology but if combined with the residential hot water demand it will make use of the CHP technology justifiable.

The space heating load does not present a consistent demand and is seasonal in nature. It is also minimised through the application of the proposed energy efficiency measures. During the summer months, the space heating may not be needed or its requirement will be relatively low which means that only some portion of this energy demand can effectively be supplied by CHP. The remaining space heating demand can effectively be supplied by the district heating network gas boilers.

The estimated non-residential cooling load is expected to be all year round, but predominantly during the summer months. This relatively small load can be supplied effectively by either Variable Refrigerant Flow (VRF) systems or conventional air or water cooled chillers. It is considered that use of absorption chillers is unsuitable in this instance due to the relatively small anticipated cooling load and low efficiencies.

The VRF systems are generally more efficient than conventional cooling systems therefore, it is recommend to use them over the conventional cooling systems. It is considered that the use of absorption chillers is unsuitable in this instance due to the relatively small anticipated cooling load and low efficiencies.

6.3 Energy Supply Options Assessment

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

- 1 Connection to existing heating or cooling networks;
- 2 Site wide CHP network;
- 3 Communal heating and cooling.

The inclusion of decentralised heating has been investigated in terms of appropriateness to the proposed development as it can help to provide the greatest reductions in CO₂ emissions.

6.3.1 Connection to Existing District Heating Networks

In response to the London Plan Policy 5.6 hierarchy, an investigation using the London Heat Map was carried out to identify existing and planned district heating networks in the vicinity of the site. The London Heat Map provided in Figure 6.2 indicates that the site is not located within a district heating opportunity area and there are no existing or potential district heating networks in close proximity to the site.



The development falls on the south perimeter of the Kentish Town decentralised energy cluster area which holds potential for the delivery of a decentralised energy network.

This means that district heating or community heating schemes may potentially be developed around the site and there may be a possibility to connect the development to a wider district heating or community heating scheme in the future. Time scales and/or details for any potential heat networks are currently unknown.



Figure 6.2: District heating opportunity areas in the vicinity of the site

Given the lack of nearby district heating or community heating infrastructure to connect to at present or in the near future, on-site energy supply option will need to be implemented.

6.3.2 Site-wide Heating Network

Although the development is relatively small, it has a reasonably high density which can make a site-wide heating network justifiable. The provision of an on-site district heating system will provide an opportunity for the proposed development to be 'future proofed' to make the best use of efficient energy generation with current and future technologies. In particular, such a system will enable the necessary infrastructure to be brought forward to link with other potential decentralised energy generation schemes which may be developed in the area after completion of the proposed development.

The Combined Heat and Power (CHP) technology has been considered for the on-site district heating system. When the technology is applied correctly, it can be much more energy efficient than obtaining energy from conventional gas boilers. It can also help to significantly reduce CO_2 emissions associated with heat supply which can help the development to achieve the CO_2 reduction targets.

The CHP technology requires a relatively consistent heat demand throughout the year and the estimated total hot water and space heating demand of the development is expected to be high enough to make the use of the technology technically justifiable.



A viability assessment has also been carried out which indicates that it is more economical to operate and maintain the on-site district heating system with CHP technology than the same system without the CHP technology.

An initial Life Cycle Cost (LCC) assessment of the on-site heating system with CHP has been carried out and compared with the option which represents the on-site heating system without the use of CHP. The key inputs and outputs of this LCC assessment are provided in Appendix C.

The LCC assessment shows that the LCCs of the on-site heating system with CHP is better than the LCCs of the on-site system without CHP. Although the LCCs for both options are comparable, the assessment shows that it is more beneficial to utilise an on-site heating system with CHP because the system has lower LCCs and can achieve higher CO_2 reduction on-site over the on-site system without CHP.

Taking viability assessment results into account and the CO_2 reduction potential of the assessed options, it is proposed to develop a site-wide heating network with CHP to supply hot water and space heating to the entire development.

Due to the low amount of cooling that may be required by the non-residential units only, it is not viable to provide this from 'waste' heat with a Combined Cooling Heating and Power (CCHP) system, therefore this has been discounted.

6.3.2.1 Heating Network Design

The proposed design of the development's site-wide heating system will incorporate a gas-fired CHP engine, thermal store(s) for hot water storage, back-up/top-up gas-fired boilers, controls and associated ancillary equipment. The space heating and hot water will be supplied to the dwellings via Hydraulic Interface Units (HIUs).

The design of the proposed site-wide heating system will be developed during the detailed design stage. However, the overarching design principle is to design the system in accordance with standards and design recommendations provided within emerging Heat Networks Code of Practice, the London Heat Network Manual and CIBSE AM12 Combined Heat and Power for Buildings.

The design of the site-wide heating system needs to ensure that heat distribution pipework runs are minimised, particularly lateral pipework in the corridors to reduce heating system losses and minimise the risk of overheating. Heating infrastructure including distribution pipework and HIUs will also be properly insulated to minimise heat losses.

On-Site Combined Heat and Power (CHP)

By utilising both the electricity and heat generation of an engine, CHP enables substantial reductions in primary energy demand and CO₂ emissions over conventional methods.

For this development, it is proposed to install a natural gas CHP due to the availability of gas supply and reliability of natural gas engines.

Based on the assessment of the space heating and hot water demand profiles, it is proposed to size the CHP system to supply up to 75% of the total heat demand of the development. It is assumed that the CHP system will supply all annual domestic water demand of the development. Some of the space heating demand will also be supplied by the CHP. The remaining space heating load will be met by energy efficient gas boilers, installed in parallel to the CHP unit.



Based on the available information, a preliminary CHP sizing has been carried out which indicates that the CHP engine would be circa 15-20 kWe /30-40 kWth. There are a number of key technical parameters such as engine efficiencies, NOx emissions, noise levels, etc. which influence selection of the engine. The size of the thermal store must be such that the operation of the CHP is maximised and a full assessment must be undertaken at detail design stage when more accurate information about the heat demand profiles become available. It is estimated that the thermal store size should be circa 2.5-3 m³.

The energy, air quality and cost assessments have been carried out based upon the technical parameters of Energimizer EM 16NG CHP engine. The technical specification of the engine is provided in Appendix D.

Final sizing and selection of the CHP system should be carried out during detailed design stage. The underlining principle for sizing and selecting the CHP system will be to maximise CO₂ reduction and reduce LCCs as well as achieve all other requirements such as low NOx emissions and required noise levels.

The impact of the proposed heating system on local air quality has been assessed and the results are provided in the Air Quality Assessment (AQA) report produced by MLM Consulting Engineers Limited. The AQA report indicates that the NOx emissions from the CHP and boiler are not predicted to have any significant adverse impact on the receptors within the development, as well the existing receptors nearby. It is not necessary to adjust the current proposed stack height (1.0m above roof on Block A), or increase the flue gas exit velocity.

Energy Centre

The CHP and boiler plant together with all the associated ancillary equipment will be located on the ground floor of the tallest block in the Energy Centre, to allow for the exit of flue gases at the highest point. The energy centre has a total floor area of circa 92 m² and this will be sufficient for the development together with the cold water storage tank. A proposed Energy Centre layout is provided in Figure 6.3.



Figure 6.3: Location of Energy Centre



Heating System Operation and Management

The development will be designed to meet onsite heat demands, but will make provision for possible future connection. The design of the heating system is to be completed during detailed design stage but the intention is that the CHP engine will act as a primary heat source followed by the thermal store and top-up gas boilers. Heat will be provided from the CHP engine to meet demand from the building and / or to charge the thermal storage vessel. If the heat demand of the building cannot be met by the CHP, the thermal store will discharge heat into the heating system. If the thermal store contains insufficient heat to meet the required heat demand which exceeds that provided by the CHP, the gas-fired boilers will operate.

The inclusion of a thermal store allows the CHP to run when there is low demand to build up a reserve of heat energy in the stored hot water. This energy can be released to provide heat at periods of peak demand. Releasing stored heat energy in this way means that the use of the top-up gas boilers is reduced and the proportion of heat supplied from the CHP increased. There are other benefits from the thermal store in that the CHP system will run at optimum output for the majority of the time. An optimum run time also reduces the size and life cycle cost of CHP required to meet a given energy load and increases CO₂ savings.

The CHP system should facilitate a minimum circa 5,000 operating hours per year and should improve the financial viability of the heating system operation whilst maintaining the demands of the system to meet variations in hot water and space heating.

The gas boiler system will be sized to provide full hot water demand backup in the event of failure or maintenance of the CHP units. It is estimated that the total capacity of the boiler plant should be circa 500 kW in order to supply peak heating and hot water demand for the development. The boiler system sizing needs to be reassessed during detailed design stage when more specific data is available regarding heat loss calculations.

When there is a sufficient electricity demand in the landlord areas, the electrical output of the CHP system will be fully utilised on site with no export to the grid. If the electricity demand is lower than the electricity supplied by the CHP unit, the surplus will be exported to the grid.

It is not possible to provide specific details regarding the electricity export arrangements due to the lack of specific technical information at this stage. In addition, the utility companies do not generally engage with potential electricity exporters at such an early stage in the project about site specific information related to electricity export arrangements. However, the initial information obtained from low carbon electricity buyers suggest that, at present, when low electricity amounts are exported, some utility suppliers will pay for exported electricity. To receive any payments for the exported electricity, it will also be required to negotiate and agree an electricity export contract with a DNO/electricity buyer.

The electricity export contractual arrangements should be discussed and agreed during later stages of the project. Detailed electricity demand of the landlord areas will need to be carried out and confirmed during later stages of the project when more details about the M&E design of the development is available.

Some of the electricity produced by the CHP may need to be exported to the grid. Therefore, an import and export electricity meter may need to be installed on site and the G59 requirements met to enable the electricity to be exported.

It is not currently possible to confirm an operator of the on-site heating network. The potential operator will require as a minimum information about the energy system design and equipment proposals before engaging with any meaningful discussions about the management and operation of the on-site heating network. This information is currently unavailable as it is too early in the process.



Future-Proofing the District Heat Network Connection

The development will be designed to meet the onsite heat demands only, but will make space provision in the plantroom for possible future connection to near-site energy generation facilities and networks should they become available and feasible in the future. The pipework to the boundary of the site will not be provided as the connection may never be required and this will only add unnecessary costs to the design. However, should the connection become viable in the future, the pipework can easily be installed at a later stage.

6.4 Summary of CO₂ Reductions from CHP system

6.4.1 Residential CO₂ Savings from CHP System

The energy assessment shows that by use of the proposed site-wide heating network with CHP, it is possible to achieve a reduction of CO_2 emissions of approximately 22.94 tCO₂ per annum for the residential part of the development. This is equivalent to a reduction in the regulated CO_2 emissions from the energy efficient building of circa 32.5%. The regulated, unregulated and total regulated emissions savings through use of CHP technology is summarised in Table 6.1.

Table 6.1 Residential CO₂ emissions after use of CHP technology

	CO ₂ emissions (tonnes/year)		
	Regulated	Unregulated	Total
Residential Baseline	70.62	83.04	153.66
After energy demand reduction	70.60	83.04	153.63
After use of CHP technology	47.64	83.04	130.67

6.4.2 Non-residential CO₂ Savings from CHP System

The energy model assessment shows that by use of the proposed on-site heating network with CHP, it is possible to achieve a reduction of CO_2 emissions of approximately 1.95 t CO_2 per annum for the non-residential parts of the development. This is equivalent to a reduction in the regulated CO_2 emissions from the energy efficient building of circa 10.2%. The regulated, unregulated and total regulated emissions savings through use of CHP technology is summarised in Table 6.2.

Table 6.2 Non-residential CO₂ emissions after use of CHP technology

	CO ₂ emissions (tonnes/year)		
	Regulated	Unregulated	Total
Non-residential Baseline	22.19	26.32	48.50
After energy demand reduction	19.14	26.32	45.46
After use of CHP technology	17.19	26.32	43.51



6.4.3 Total CO₂ Savings from CHP System

The energy assessment shows that by use of the proposed site-wide heating network with CHP, it is possible to achieve a reduction of CO_2 emissions of approximately 24.91 t CO_2 per annum for the entire development. This is equivalent to a reduction in the regulated CO_2 emissions from the energy efficient building of circa 27.8%. The regulated, unregulated and total regulated emissions savings through use of CHP technology is summarised in Table 6.3.

Table 6.3 Total CO₂ emissions after use of CHP technology

	CO ₂ emissions (tonnes/year)		
	Regulated	Unregulated	Total
Total Baseline	92.81	109.35	202.16
After energy demand reduction	89.74	109.35	199.09
After use of CHP technology	64.83	109.35	174.18



7 Renewable Energy (Be Green)

The final part of the London Plan Energy Hierarchy is Be Green which seeks renewable energy technologies to be specified to provide a reduction in anticipated carbon dioxide emissions, where feasible.

The CHP engine and heat network strategy restricts the renewable energy technologies which will be feasible and appropriate for the development. Any renewable energy technologies that are to be included must be complementary and not conflict with the CHP engine. The following low and zero carbon technologies have been considered and compared for this particular development:

- Photovoltaic Panels (PV)
- Air Source Heat Pump (ASHP)
- Ground Source Heat Pump (GSHP)
- Wind Turbines
- Biomass Boiler
- Solar Thermal

The assessment of these technologies shows that PV systems are considered to be the most suitable renewable energy technology options for the development. All other renewable energy technology options are considered to be less suitable. The VRF system and PV options are discussed further in the following sections. A summary of the assessment can be found in Appendix A.

7.1 Photovoltaics (PV)

7.1.1 Design

The renewable energy assessment shows that PV systems can be provided to generate renewable power. This technology can work well with all the other proposed technologies (e.g. CHP and gas boilers) and can supply additional CO₂ reductions for parts of the residential and non-residential areas of the development.

PV panels use solar radiation and convert it into usable electricity through the application of semiconductor technology. Solar panel outputs vary depending upon orientation, inclination, solar radiation levels, cloud cover and temperature.

PV panels can be ground mounted, roof mounted or building Integrated (incorporated into the facade of a building). Due to the space limitations and costs, ground mounted and building integrated systems are not being considered for the site, whereas roof mounted systems are considered viable.

PV systems should ideally face south with an incline of 30°, although orientations within 45° of south and other angles can still generate outputs if panels are not over shaded. Optimum design of the PV installation is required to ensure maximum electrical output per kWp installed. There are a number of design considerations to be made to ensure the best use of the system. The key design considerations for designing and installing PV systems are:

- Design of PV installation to optimise inclination and orientation;
- Ensure that PV panels are not overshadowed;
- Ensure correct installation of PV arrays for good ventilation


- Ensure that the electrical wiring from PV arrays to inverters is kept to a minimum to reduce electrical losses;
- Provide sufficient space around PV installations for safe access and maintenance of the modules and other equipment installed on the roof.

The electricity generating potential of PV panels is not dependent on development demand but on suitable available roof space for installation.

The energy assessment indicates that circa 13.9 kW of PV is required for the development to meet the London Plan 35% CO_2 reduction target on-site. Depending on the energy efficiency measures and design and selection of the CHP system, the PV capacity requirement may change during the detailed design stage. The initial assessment suggests that the required PV amount can be accommodated on the identified pitched roofs.

It is proposed to locate the PV panels on the highest roof of the building. The lower roof identified below could be used if the highest roof doesn't provide enough space to accommodate the PV requirement. For aesthetic purposes Fairview will try and avoid the lower roof area. The proposed and available roof areas for PV are illustrated in Figure 7.1.



Figure 7.1 Roof plan for the development indicating proposed areas for solar panels

The PV layout will be fully developed during the detailed design stage.

It is assumed that 1 kWp of PV panels can generate circa 800 kWh per annum which will equate to circa 11,120 kWh/year of renewable electricity generation.

The total system capacity and the estimated total electricity production for the residential and non-residential floor spaces are provided in Table 7.1.



Table 7.1 Proposed PV system capacity and anticipated CO₂ emissions reduction

Use	Estimated total PV system capacity (kW)	Estimated electricity production (kWh/year)
Residential	5.3	4,240
Non-residential	8.6	6,880
Total	13.9	11,120

The non-residential PV capacity will depend on the use of the non-residential units and how the future tenants choose to meet the requirements.

It is proposed to provide a dedicated stand-alone PV system for each non-residential unit. This arrangement will benefit future non-residential tenants as the generated PV electricity can be used within the non-residential units, reducing the reliance on grid electricity. The required PV capacity and roof area will need to be re-assessed and confirmed during the detailed design stage.

7.2 Summary CO₂ Savings from Renewable Systems

7.2.1 Residential CO₂ Savings from Renewable Systems

The energy assessment shows that PV may result in circa 1.86 tCO₂ reduction of regulated CO₂ emissions per annum which equates to circa 3.9% reduction for the residential part of the development. The regulated, unregulated and total emissions after use of PV technology is summarised in Table 7.2.

	CO ₂ emissions (tonnes/year)				
	Regulated	Unregulated	Total		
Residential Baseline	70.62	83.04	153.66		
After energy demand reduction	70.60	83.04	153.63		
After use of CHP technology	47.64	83.04	130.67		
After use of PV technology	45.78	83.04	128.82		

Table 7.2 Residential CO₂ emissions after use of PV technologies

7.2.2 Non-residential CO₂ Savings from Renewable Systems

The energy model assessment shows that PV systems may result in circa 2.8 tCO₂ reduction of regulated CO₂ emissions per annum which equates to circa 16.3% reduction for the non-residential units.

The regulated, unregulated and total emissions after use of PV technology is summarised in Table 7.3.



Table 7.3 Non-residential CO₂ emissions after use of PV technologies

	CO ₂ emissions (tonnes/year)				
	Regulated	Unregulated	Total		
Non-residential Baseline	22.19	26.32	48.50		
After energy demand reduction	19.14	26.32	45.46		
After use of CHP technology	17.19	26.32	43.51		
After use of PV technology	14.38	26.32	40.70		

7.2.3 Total CO₂ Savings from Renewable Systems

The energy model assessment shows that by using the proposed renewable energy technologies for residential and non-residential parts of the development, it is possible to achieve a reduction in CO_2 emissions of approximately 4.66 t CO_2 per annum for the entire development. This is equivalent to a reduction in the regulated CO_2 emissions of circa 7.2%. The regulated, unregulated and total regulated emissions savings through use of the renewable energy technologies is summarised in Table 7.4.

Table 7.4 Total CO₂ emissions after use of renewable technologies

	CO ₂ emissions (tonnes/year)					
	Regulated	Unregulated	Total			
Total CO ₂ Emissions Baseline	92.81	109.35	202.16			
After energy demand reduction	89.74	109.35	199.09			
After use of CHP technology	64.83	109.35	174.18			
After use of PV technology	60.17	109.35	169.52			



8 Summary and Conclusions

The Energy Strategy for the development has been formulated following the London Plan Energy Hierarchy: Be Lean, Be Clean and Be Green. The overriding objective in the formulation of the strategy is to maximise the reductions in total CO_2 emissions through the application of this hierarchy with a cost-effective and technically appropriate approach and to minimise the emission of other pollutants. The energy strategy measures are summarised and presented in Table 8.1.

Table	8.1	The	Energy	Strategy:	Be	Lean,	Be	Clean	and	Be	Green	princip	les	

Energy Hierarchy	Energy Strategy Measures				
Be Lean	Passive design				
	 Optimised design to enable controlled solar gain and improved direct and indirect natural lighting. Incorporation of balconies and overhangs into the design to provide some shading. 				
	Building Fabric				
	Use of optimal building fabric standards.Design with low air permeability rates				
	Energy Efficiency				
	 Energy efficient lighting and appropriate controls Variable speed heating system with high delta T and low return temperatures High efficiency motors and variable speed pumps for heating and ventilation systems High efficiency heating plant and auxiliary equipment Appropriate controls for heating system Appropriate temperature and time zoning Appropriate insulation of heating distribution system Appropriate energy metering and monitoring 				
Be Clean	Energy efficient energy supply				
	• On-site Combined heat and Power (CHP) system connected to a site-wide heating network to supply hot water and space heating to the entire development.				
Be Green	Renewable energy				
	 PV to supply renewable electricity to both residential and non-residential parts of the building. 				



Residential

The summary of the overall reduction in residential CO_2 emissions after each stage of the energy hierarchy is presented in Table 8.2.

Table 8.2 Summary of residential CO₂ emissions after each stage of the Energy Hierarchy

	CO ₂ emissions (tonnes/year)				
	Regulated	Unregulated	Total		
Residential Baseline	70.62	83.04	153.66		
After energy demand reduction	70.60	83.04	153.63		
After use of CHP technology	47.64	83.04	130.67		
After use of PV technology	45.78	83.04	128.82		

The regulated CO₂ savings for the residential development expressed in terms of actual and percentage reduction after each stage of the energy hierarchy are presented in Table 8.3.

The energy strategy shows that the overall CO_2 emissions from both regulated and unregulated energy can be reduced by circa 24.84 t CO_2 per annum which is equivalent to circa 16.2% reduction.

Table 8.3 Summary of residential CO₂ savings from each stage of the Energy Hierarchy

	Regulated Energy CO ₂ savings				
	Tonnes per annum	%			
Savings from energy demand reduction	0.02	0%			
Savings from CHP	22.96	32.5%			
Savings from renewables	1.86	3.9%			
Total cumulative savings	24.84	35.2%			
Annual Savings from off-set payment	45.8				
Cumulative savings for off-set payment (tonnes for 30 years)	1,373.49				

Table 9.3 shows that the proposed strategy can achieve regulated CO_2 savings of circa 24.84 tCO2 which is equivalent to circa 35.2% reduction when compared to the baseline. To achieve the zero carbon homes standard, an off-set payment will be made to for the outstanding regulated CO_2 emissions based on the carbon off-set price of £60 per tonne over a 30 year period.



The overall reduction in regulated carbon emissions associated with the proposed design is graphically illustrated in Figure 8.1.



Figure 8.1 Overall residential reduction in regulated CO₂ emissions compared to Part L baseline emissions

Non-residential

The summary of the overall reduction in residential CO_2 emissions after each stage of the energy hierarchy is presented in Table 8.4.

Table 8.4 Summary of non-residential CO2 emissions after each stage of the Energy Hierarchy

	CO ₂ emissions (tonnes/year)				
	Regulated	Unregulated	Total		
Non-residential Baseline	22.19	26.32	48.50		
After energy demand reduction	19.14	26.32	45.46		
After use of CHP technology	17.19	26.32	43.51		
After use of PV technology	14.38	26.32	40.70		

The regulated CO₂ savings for the non-residential development expressed in terms of actual and percentage reduction after each stage of the energy hierarchy are presented in Table 8.4.



The energy strategy shows that the overall CO₂ emissions from both regulated and unregulated energy can be reduced by circa 7.8 tCO₂ per annum which is equivalent to circa 16.1% reduction.

	Regulated Energy CO ₂ savings			
	Tonnes per annum	%		
Savings from energy demand reduction	3.05	13.7%		
Savings from CHP	1.95	10.2%		
Savings from renewables	2.80	16.3%		
Total cumulative savings	7.80	35.2%		

Table 8.5 Summary of non-residential CO₂ savings from each stage of the Energy Hierarchy

Table 9.5 shows that the proposed strategy can achieve regulated CO_2 savings of circa 7.8 t CO_2 which is equivalent to circa 35.2% reduction when compared to the baseline.

The overall reduction in regulated carbon emissions associated with the proposed design is graphically illustrated in Figure 8.2.

Figure 8.2 Overall non-residential reduction in regulated CO_2 emissions compared to Part L baseline emissions





Entire Development

The summary of the overall reduction in residential CO_2 emissions after each stage of the energy hierarchy is presented in Table 8.6.

	CO ₂ emissions (tonnes/year)				
	Regulated	Unregulated	Total		
Total CO ₂ Emissions Baseline	92.81	109.35	202.16		
After energy demand reduction	89.74	109.35	199.09		
After use of CHP technology	64.83	109.35	174.18		
After use of PV technology	60.17	109.35	169.52		

Table 8.6 Summary of total CO₂ emissions after each stage of the Energy Hierarchy

The regulated CO₂ savings for the entire development expressed in terms of actual and percentage reduction after each stage of the energy hierarchy are presented in Table 8.7.

The energy strategy shows that the overall CO_2 emissions from both regulated and unregulated energy can be reduced by circa 32.64 t CO_2 per annum which is equivalent to circa 16.1% reduction.

Table 9.7 Summary of total CO₂ savings from each stage of the Energy Hierarchy

	Regulated Energy CO ₂ savings				
	Tonnes per annum	%			
Savings from energy demand reduction	3.07	3.3%			
Savings from CHP	24.91	27.8%			
Savings from renewables	4.66	7.2%			
Total cumulative savings	32.64	35.2%			

Table 8.7 shows that the proposed strategy can achieve regulated CO_2 savings of circa 32.64t CO_2 which is equivalent to circa 35.2% reduction when compared to the baseline.

The overall reduction in regulated carbon emissions associated with the proposed design is graphically illustrated in Figure 8.3.





Figure 8.3 Overall total reduction in regulated CO₂ emissions compared to Part L baseline emissions

Summary

In summary, the proposed energy strategy for the development:

- 1 Informs the built form and orientation of the buildings to respond to daylight and indoor comfort levels;
- 2 Includes optimal building fabric standards, energy efficient design of building services and energy efficient appliances;
- 3 Complies with Part L 2013 Building Regulations and meets TFEE requirements;
- 4 Includes on-site CHP system connected to site-wide heating network to supply hot water and space heating to the residential development;
- 5 Includes renewable energy technologies;
- 6 Meets the 35% regulated energy CO₂ emissions reduction requirement on-site;
- 7 Achieves the zero carbon homes standard for the residential development by making an offset payment the outstanding regulated CO_2 emissions based on the carbon off-set price of £60 per tonne over a 30 year period.
- 8 Achieve BREEAM Excellent mandatory Ene 01 energy requirement.



Appendix A – Alternative Renewable Technologies

This appendix presents an assessment of the renewable technology options relative to the site which are considered to be less suitable or unsuitable for this development.

Air Source Heat Pumps

The Air Source Heat pumps (ASHP) can be used as both a source of heating and cooling. ASHP use the same principle operation as GSHPs but the use air instead of water, as a heat source. The downside is that the air temperature and therefore efficiency of the heat pump is reduced in cold weather when the heat is most needed. This means that one either needs to oversize ASHPs to take into account degradation in performance or, alternatively, provide an auxiliary electric heating system. Provision of an auxiliary heater reduces capital cost but adds to running costs and reduces carbon savings.

Outdoor air systems are widely implemented in the form of split systems, with indoor and outdoor units linked by refrigerant pipes running through the wall. Packaged air systems where outdoor air is ducted to an indoor package are also available.

Theoretically, ASHPs could provide heat for a community heating scheme supplying the remaining circa 30% thermal demand by preheating the district heating water.

However, because the ASHPs should be placed on the roofs of the building, it will significantly reduce area available for PV as well as have significant negative aesthetic impact on the development.

Installation of the ASHPs on the roofs would require higher installation costs associated with support and access to the plant and greater need to consider noise impacts.

In addition, they are not very compatible with higher temperature technologies and systems such as CHP systems. Integration of ASHPs in one system with CHP units has significant technical challenges and risks. Therefore, the ASHP system should ideally be installed separately from the CHP system. In either option, the overall heating supply system could become unnecessarily complicated, which would likely increase the costs of the system. Because of the aforementioned issues, this arrangement is unlikely be practical and cost effective and therefore, it is not suitable for this development.

Ground Source Heat Pumps

The ground can be used as both a source of heating and a source of cooling. Ground source heating involves heat pumps, drawing heat from underground, whereas ground source cooling can either use heat pumps or make use of low temperature groundwater directly. Ground Source Heat Pumps (GSHP) are a relatively mature technology and utilise the energy in the ground through a refrigeration cycle. Where GSHP are used for both heating and cooling, depending on the season, this can be a very efficient solution. GSHP can be open loop or closed loop.

Open Loop GSHP system uses groundwater which is taken from an aquifer to supply heating or cooling. The water is then returned to the ground (sometimes via a borehole or sometimes via storm water drainage). Open loop systems require abstraction and discharge licences from the Environment Agency (EA).

Closed loop GSHP system comprises a sealed system of buried pipes, normally containing brine or water/antifreeze solution. The solution is circulated continuously around a closed system. This system requires extensive ground works to bury the coils that extract the low grade heat from the earth. They



therefore require a large area for horizontal burial (40-100m long trench) or a vertical pile (50-100m) which is considerably more expensive but can be used where space is limited.

The ground conditions are currently unknown and may not be suitable to use an open-loop system. To assess ground conditions, it will be required to test bore holes. Generally, use of open-loop systems is associated with the technical, financial risk and other risks. Closed loop systems will unlikely be able to supply heat for the development. In addition, both GSHPs and CHP provide the base heating loads for a development. For this reason, they compete with each other and should not be installed in tandem.

Closed loop GSHP can theoretically be used to supply heating and cooling for the non-residential unit. However, it is not practical and cost effective to provide such system for a small cooling and heating load. Taking this into account, it is recommended to consider other options for the cooling and heating supply of the non-residential unit such air source heat pumps (ASHP).

Because of the aforementioned issues, GSHPs are unlikely be practical and cost effective and therefore, they are not recommended for this development.

Wind Power

Wind energy installations can range from small domestic turbines (1kW) to large commercial turbines (140m tall, 2MW). There are also different designs and styles (horizontal or vertical axis; 1 blade to multiple blades) to suit the location. They generate renewable electricity that can be provided for use on-site, or sold directly to the local electricity network.

Installation of large/medium scale wind turbine(s) could meet the renewable energy and carbon reduction targets however there is no appropriate space for the installation of large/medium scale wind turbines within the site.

Vertical axis turbines have a lower performance than horizontal axis turbines but work better in urban environments. However, effective energy generation through small scale roof mounted wind turbines is not feasible due to the following:

- The average wind speed at the site is estimated to be circa 5.6 m/s at 25 m above ground which is based on NOABLE Wind Map (the wind speed was taken from the Rensmart Wind Map). The wind speed is marginal for effective operation of a wind turbine;
- Issues such as noise, telecoms interference and visual impact are likely to restrict installation of wind turbines;
- Installation of wind turbines on the roofs will have a significant visual impact;
- There will be risks associated with operation and maintenance of the turbines.

Taking into account the above, wind power is not recommended for this development.

Biomass Boilers

Biomass boilers are now regarded as a conventional form of technology with a wide range of sizes and types to meet renewable targets. Biomass boilers use biomass as a fuel source, which is an alternative solid fuel to the conventional fossil fuels and has carbon emissions close to zero. Various types of biomass fuel are in use, the most common being wood chips and pellets.

Although pellets are more expensive than chips, they have greater energy content per unit of weight and require a lower storage volume. Pellet boilers also require less maintenance and produce considerably less ash residue.



There are some local/regional as well as national biomass suppliers who can supply biomass for the site. Biomass would need to be delivered to site in large trucks and the arrangements for supply and storage of the biomass fuel would need careful consideration. It would also require a suitable biomass storage space, which given the space constraints on this site is likely to be restrictive.

The potential reduction in carbon emissions from the installation of biomass boilers can be considerable and this would likely meet the GLA's target for carbon emissions reduction from renewable energy sources. However, although biomass systems have a number of advantages, in the context of this development, the following issues prevent the installation of biomass boilers:

- Likely significant negative impact on local air quality;
- No space availability for fuel delivery and storage;
- Significantly higher capital costs in comparison with gas boiler system;
- Requirements of additional resources for management of the operation;
- The location of the development may not be suitable for large-scale fuel delivery; and,
- Security of biomass supply.

However, like CHP engines, biomass boilers are best designed to provide the base heating. In line with the London Plan Energy Hierarchy, the size of the CHP engine as a Be Clean measure has been maximised. Therefore, a biomass boiler would be in conflict with the CHP engine that has already been specified and has therefore been discounted.

Solar Thermal

Solar Thermal heating systems can contribute to the hot water demand of a dwelling or building. Water or glycol (heat transfer fluid) is circulated to roof level where it is heated using solar energy before being returned to a thermal store in the plant room where heat is exchanged with water from the conventional system. The solar water systems are usually sized to provide circa 60% of the total hot water demand.

The use of solar thermal systems is inappropriate for this development on the basis that the technology is not compatible with the use of CHP as both technologies compete for the same base hot water load.

In addition, the system will produce relatively small CO₂ savings but will have significant negative impact of the cost of the heating system and its practicability. Therefore, solar thermal systems are not recommended for this development.



Appendix B – GLA Domestic Overheating Checklist

Section 1 Site features affec	ting vulnerability to overheating	Yes or No		
Site Location	Urban – with central London or in a high density conurbation	Yes		
	Peri-urban – on the suburban fringes of London	No		
	Busy roads / A roads	No		
Air Quality and / or Noise	Railways / Overground / DLR	Yes		
following in the vicinity of	Airport / Flight Path	No		
buildings	Industrial uses / Waste facility	No (industrial use on site replaced)		
	Will any building be occupied by vulnerable people (e.g. elderly, disabled, young children)?	Unknown		
Proposed building use	Are residents likely to be at home during the day (e.g. students)?	Unknown		
Dwelling aspect	Are there any single aspect units?	Yes		
Glazing ratio	Is the glazing ratio (glazing: internal floor area)greater than 25%	Yes		
	If Yes is this to allow acceptable levels of daylight?	Yes		
	Single storey ground floor units	Yes		
Security – Are there any	Vulnerable areas identified by police Architectural Liaison Officer	Yes		
for ventilation?	Other	The presence of the railway and restrictions imposed by Network Rail regarding allowable opening.		

Section 2 - Design f	eatures implemented to mitigate overheating risk	Response
Landscaping	Will deciduous trees be provided for summer shading (to windows and pedestrian routes)?	Yes
	Will green roofs be provided	Yes



Section 2 - Design f	eatures implemented to mitigate overheating risk	Response
	Will other green or blue infrastructure be provided around buildings for evaporative cooling	No
Materials	Have high albedo (light colour) materials been specified?	Brickwork will likely be buff in colour.
Dwelling aspect	% of total units that are single aspect	30%
	% single aspect with N / NE / NW orientation	0%
	% single aspect with E orientation	21%
	% single aspect with S / SE / SW orientation	
	% single aspect with W orientation	9%
	N / NE / NW	
Glazing ratio – what is the glazing	E	35%
internal floor area on each façade?	S/SE/SW	
	W	36%
Daylighting	What is the average daylight factor range?	GIA to advise
Window opening	Are windows openable?	Yes
Window opening	What is the average percentage of openable area for the windows?	Fully openable to Courtyard façade, restricted opening to railway façade. Assumed 100mm.
Window opening	Fully openable	See above
What is the extent of the opening?	Limited (e.g. for security, safety, wind loading reasons)	See above
Security	Where there are security issues (e.g. ground floor flats) has an alternative night time natural ventilation method been provided (e.g. ventilation grates)?	Windows will be capable of being opened slightly to allow ventilation whilst in a locked position. Restrictors are also provided allowing windows to be opened slightly further but fully open.



Section 2 - Design f	eatures implemented to mitigate overheating risk	Response			
Shading	Is there any external shading?	225mm deep brick reveals as standard, inset balconies, and windows beneath projecting balconies.			
	Is there any internal shading	No. Occupants may install internal blinds/curtains according to their preference.			
Glazing specification	Is there any solar control glazing?	It is proposed to consider solar control glazing.			
	Natural – background	No			
Ventilation - What is the ventilation strategy?	Natural – purge	Purge by openable windows and balcony doors			
	Mechanical – background (e.g. MVHR)	Yes. Contentious extract mechanical ventilation.			
	Mechanical – purge	The use of kitchen booster ventilation system			
	What is the average design air change rate	1.5-2 air changes per hour			
	Is communal heating present?	Yes with CHP.			
Heating system	What is the flow/return temperature?	Proposed design flow and return temperatures are 70/40 °C.			
	Have horizontal pipe runs been minimised?	Yes. The horizontal pipe runs have been minimised by optimal design of the corridors.			
	Do the specifications include insulation levels in line with the London Heat Network Manual	It is proposed to provide insulation levels in line with the London Heat Network Manual.			



Appendix C – CHP System LCC Assessment Summary

LCC Assessment Key Inputs

	Option 1 - Gas Boiler and CHP System	Option 2 - Gas Boiler System	Units
Heating System Technical Inputs			
Estimated Hot Water demand	164,904	164,904	kWh/year
Estimated Space Heating Demand	88,423	88,423	kWh/year
Estimated Landlord Electricity Demand	59,000	59,000	kWh/year
Estimated CHP Electricity Export	22,311	N/A	kWh/year
Heating System Efficiency	90%	90%	%
Gas Boiler Efficiency	94%	94%	%
Contribution from CHP	75%	N/A	%
Estimated Export from CHP	38%	N/A	%
Boiler and CHP Lifecycle	15	15	years
Life Cycle Assessment Period	30	30	years
Heating System Cost Inputs			
Gas Tariff	3.0	3.0	p/kWh
Electricity Export Tariff	4.317	N/A	p/kWh
Electricity Import Tariff	12.0	12.0	p/kWh
Gas Boiler System Capital Costs	27,000	27,000	£
CHP Engine System Costs	54,500	N/A	£
Energy Centre (EC) Cost	240,000	185,500	£
Maintenance of Gas Boiler and CHP Systems	4,167	1,800	£
Heating System Management and Maintenance (excluding HIUs)	25,667	23,300	£
Standing Charges for EC Management and Maintenance Service - Per Property Per Month	29.7	27.0	£



LCC Assessment Key Outputs

Heating System Life Cycle Costs (LCCs)			
Capital	329,469	254,652	£
Capital - Per Property Per Year	145	112	£
Fuel Costs and Income from Electricity Generation	121,219	364,432	£
Average Fuel and Income from Electricity Generation - Per Property Per Year	53	160	£
Standing Charge for EC operation and maintenance	1,099,109	997,749	£
Average Standing Charge for EC operation and maintenance - Per Property Per Year	482	438	£
Life Cycle Heat Costs	1,549,797	1,616,833	£
Average Heat Costs Per Property Per Year (Over 30 Year Period)	680	709	£



Appendix D – Energimizer EM 16NG Specification





Appendix E – Sample SAP and BRUKL Reports

DER Worksheet Design - Draft



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

Assessor name		Miss Jayr	Aiss Jayna Parmar						Assessor number			6549		
Client									Last modified	23/11	23/11/2016			
Address		A-L00-28	A Centric (Close, Lond	on, N8									
1. Overall dwellin	ng dimens	sions												
					ŀ	Area (m²)		A	verage storey height (m)	,	Vo	lume (m³)		
Lowest occupied						73.69	(1a) x	Ē	2.50] (2a) =		184.23	(3a)	
Total floor area		(1a)	+ (1b) + (1d	c) + (1d)(1n) =	73.69	(4)							
Dwelling volume								(3a) + (3b) + (3	3c) + (3d)(3	8n) =	184.23	(5)	
2. Ventilation rat	e													
											mª	³ per hour		
Number of chimne	ys								0	x 40 =		0	(6a)	
Number of open fl	ues								0	x 20 =		0	(6b)	
Number of intermi	ttent fans	S							0	x 10 =		0	(7a)	
Number of passive	vents								0	x 10 =		0	(7b)	
Number of flueless	s gas fires								0	x 40 =		0	(7c)	
											Air c	hanges pe hour	r	
Infiltration due to	chimneys	, flues, fans	s, PSVs		(6a) + (6b) + (7	a) + (7b) + (7c) =	0	÷ (5) =	:	0.00	(8)	
If a pressurisation	test has b	een carried	d out or is ii	ntended, pi	roceed to	(17), otherv	vise continu	e from (9) to (16)					
Air permeability va	ilue, q50,	expressed	in cubic me	etres per h	our per sq	uare metre	of envelope	e area				4.00	(17)	
If based on air peri	meability	value, ther	n (18) = [(17	7) ÷ 20] + (8	3), otherw	ise (18) = (1	6)					0.20	(18)	
Number of sides of	n which tl	he dwelling	; is sheltere	d								2	(19)	
Shelter factor									1	- [0.075 x (1	9)] =	0.85	(20)	
Infiltration rate inc	orporatin	ng shelter fa	actor							(18) x (2	20) =	0.17	(21)	
Infiltration rate mo	odified for	r monthly v	vind speed	:										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average w	vind spee	d from Tab	le U2				_			_		-	_	
	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)	
Wind factor (22)m	÷4						-					-	_	
	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)	
Adjusted infiltratio	on rate (al	lowing for	shelter and	wind facto	or) (21) x (22a)m	1	1				1	-	
	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.20	(22b)	
Calculate effective	air chang	ge rate for t	he applical	ole case:									-	
If mechanical ve	entilation	: air change	e rate throu	ugh system								0.50] (23a)	
If balanced with	n heat rec	covery: effic	ciency in %	allowing fo	or in-use fa	actor from T	able 4h					N/A	_ (23c)	
c) whole house	extract v	entilation o	or positive i	nput venti	lation from	n outside				0	0 = -	0 = 5		
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	_ (24c)	
Effective air chang	e rate - er	nter (24a) o	or (24b) or (24c) or (22	ia) in (25)	0.50	0.50	0	0.50	0.50	0 = 0	0.50	7 (2-)	
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(25)	



3. Heat losses a	and heat los	ss paramet	er										
Element			a	Gross rea, m²	Openings m ²	Net a A, I	area m²	U-value W/m²K	A x U W	/К к-v kJ	/alue, /m².K	Ахк, kJ/K	
Window						23.	06 x	1.24	= 28.50				(27)
Ground floor						73.	69 x	0.20	= 14.74				(28a)
External wall						20.	99 x	0.18	= 3.78				(29a)
Party wall						56.	27 x	0.00	= 0.00				(32)
Total area of ext	ernal eleme	ents ∑A, m²				117	.74						(31)
Fabric heat loss,	W/K = ∑(A	× U)							(26	5)(30) + (32) =	47.01	(33)
Heat capacity Cr	n = ∑(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	lculated us	ing Append	dix K								8.56	(36)
Total fabric heat	loss									(33) + (36) =	55.58	(37)
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat	loss calcula	ted month	ly 0.33 x (2	25)m x (5)									
	30.40	30.40	30.40	30.40	30.40	30.40	30.40	30.40	30.40	30.40	30.40	30.40	(38)
Heat transfer co	efficient, W	/K (37)m +	- (38)m										
	85.97	85.97	85.97	85.97	85.97	85.97	85.97	85.97	85.97	85.97	85.97	85.97	
Heat loss param	eter (HIP)	W/m²K (39))m ÷ (4)						Average = 2	(39)112,	/12 =	85.97	(39)
neut 1055 purun	1 17	1 17	1 17	1 17	1 17	1 17	1 17	1 17	1 17	1 17	1 17	1 17	7
	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17		(40)1 12	/12 =	1 17	
Number of days	in month (1	able 1a)							Average - 2	<u>(</u> +0)112)	12 -	1.17] (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)
4. Water heatin	ng energy r	equiremen	t										
Assumed occupa	ancy, N											2.33	(42)
Annual average	hot water u	sage in litre	es per day \	/d,average	= (25 x N) +	36						89.59	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage	in litres pe	r day for ea	ch month	Vd,m = fact	tor from Tabl	e 1c x (43)							
	98.55	94.97	91.38	87.80	84.22	80.63	80.63	84.22	87.80	91.38	94.97	98.55	
F	(],						T-1-1 41	4 - 4 -1)		∑(44)1	.12 =	1075.10	(44)
Energy content of		rused = 4.1	131 00					, 10 10)	402.45	110.10	120.24	111 51	7
	146.15	127.82	131.90	114.99	110.34	95.21	88.23	101.25	102.45	5(45)1	130.34	141.54	
Distribution loss	0.15 x (45)	ım								<u>}</u> (45)1	.12 =	1409.62	_ (45)
	21.92	19.17	19.79	17.25	16.55	14.28	13.23	15.19	15.37	17.91	19.55	21.23	(46)
Storage volume	(litres) inclu	iding any so	olar or WW	HRS storag	ge within sam	ne vessel						110.00	(47)
Water storage lo	oss:												
b) Manufacturer	's declared	loss factor	is not know	vn									
Hot water sto	orage loss fa	actor from ⁻	Table 2 (kW	/h/litre/day	y)							0.02	(51)
Volume facto	or from Tabl	e 2a										1.03	(52)
Temperature	factor fron	n Table 2b										0.60	(53)
Energy lost fr	om water s	torage (kW	'h/day) (47	') x (51) x (5	52) x (53)							1.03	(54)
Enter (50) or (54) in (55)											1.03	(55)
Water storage lo	oss calculate	ed for each	month (55	5) x (41)m									_

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

	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)
Primary circuit	oss for each	month fro	m Table 3										
	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
Combi loss for e	ach month	from Table	3a. 3b or 3	с	1			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	(61)
Total boat roqui	rod for wat	or heating	colculated f	or oach mo	0.00	$(45)m \pm (4)$	$6)m \pm (57)$	1 + (50)m	↓ (61)m	0.00	0.00	0.00	(01)
iotal field requi										174.00	402.02	100.01	(ca)
	201.42	1/7.75	187.18	168.49	165.62	148.71	143.51	156.52	155.95	174.68	183.83	196.81	(62)
Solar DHW inpu	t calculated	using Appe	endix G or A	ppendix H		1	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	(63)
Output from wa	iter heater f	or each mo	onth (kWh/r	nonth) (62	2)m + (63)n	1							
	201.42	177.75	187.18	168.49	165.62	148.71	143.51	156.52	155.95	174.68	183.83	196.81	
										∑(64)1	12 = 2	060.46	(64)
Heat gains from	water heat	ing (kWh/n	nonth) 0.25	5 × [0.85 × ((45)m + (61	L)m] + 0.8 ×	: [(46)m + (57)m + (59)m]				
	92.82	82.44	88.08	81.03	80.91	74.45	73.56	77.89	76.86	83.92	86.13	91.28	(65)
		1											
5. Internal gair	าร												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains	(Table 5)												
	116.61	116.61	116.61	116.61	116.61	116.61	116.61	116.61	116.61	116.61	116.61	116.61	(66)
Lighting gains (c	alculated in	Appendix	L, equation	L9 or L9a),	also see Ta	able 5						ı	
0 00 (18 34	16 29	13 25	10.03	7 50	6 33	6 84	8 89	11 93	15 15	17.68	18.85	(67)
Appliance gains	(calculated	in Annendi		n 13 or 1	13a) also s	ee Table 5	0.01	0.05	11.55	13.13	17.00	10.05	(07)
Appliance gains				101.05			152.02	151 70	157.17	100.00	102.00	100.07	(60)
	205.75	207.89	202.51	191.05	176.59	T-163.00	153.93	151.79	157.17	168.63	183.08	196.67	(68)
COOKING gains (C	calculated in	Appendix	L, equation	L15 or L15	a), also see	e Table 5						,	
	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	(69)
Pump and fan g	ains (Table !	5a)											
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
Losses e.g. evap	oration (Tal	ole 5)											
	-93.29	-93.29	-93.29	-93.29	-93.29	-93.29	-93.29	-93.29	-93.29	-93.29	-93.29	-93.29	(71)
Water heating g	ains (Table	5)											
	124.75	122.68	118.38	112.54	108.75	103.41	98.87	104.69	106.75	112.80	119.63	122.69	(72)
Total internal ga	ains (66)m +	+ (67)m + (6	58)m + (69)r	n + (70)m ·	+ (71)m + (72)m		•					
-	406.83	404.85	392.13	371.61	350.83	330.73	317.62	323.35	333.84	354.56	378.38	396.20	(73)
								1					()
6. Solar gains													
			Access f	actor	Area	Sol	ar flux		g	FF		Gains	
			Table	6d	m²	v	V/m²	spec	ific data	specific d	lata 	W	
SouthWest			0.77	7 X	23.06	x 3	6.79 x	0.9 x	0.40 x	0.80	=	188.16	(79)
Solar gains in wa	atts ∑(74)m	(82)m											
	188.16	320.50	438.52	543.35	608.60	604.19	582.51	533.83	474.83	354.22	225.37	161.02	(83)
Total gains - inte	ernal and so	lar (73)m +	(83)m										
	594.99	725.34	830.65	914.96	959.42	934.92	900.13	857.18	808.67	708.78	603.75	557.22	(84)
7. Mean intern	al tempera	ture (heati	ng season)										
Temperature du	uring heating	g periods ir	the living a	rea from T	able 9, Th	L(°C)						21.00	(85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains f	or living are	ea n1,m (se	e Table 9a)									
	0.99	0.98	0.95	0.88	0.75	0.57	0.42	0.46	0.68	0.91	0.98	0.99	(86)
	L				•			ı]	

SAP version 9.92

Mean internal te	emp of livin	g area T1 (s	steps 3 to 7	in Table 90	c)								
	19.93	20.14	20.42	20.70	20.90	20.98	21.00	20.99	20.95	20.69	20.24	19.87	(87)
Temperature du	ring heatin	g periods ir	n the rest of	⁻ dwelling f	rom Table	9, Th2(°C)							
	19.95	19.95	19.95	19.95	19.95	19.95	19.95	19.95	19.95	19.95	19.95	19.95	(88)
Utilisation factor	r for gains f	or rest of d	welling n2,	m									
	0.99	0.97	0.94	0.85	0.69	0.48	0.32	0.35	0.60	0.88	0.98	0.99	(89)
Mean internal te	emperature	in the rest	of dwelling	g T2 (follow	, v steps 3 to	7 in Table 9	e)				•		
	18.54	18.85	19.24	19.62	19.86	19.93	19.95	19.94	19.91	19.61	18.99	18.46	(90)
Living area fract	ion	1			1			1	Li	ving area ÷	(4) =	0.39	(91)
Mean internal te	emperature	for the wh	ole dwellin	g fLA x T1 +	+(1 - fLA) x	Т2			_				(/
	19.07	19 35	19 70	20.04	20.26	20.34	20.35	20.35	20.31	20.03	19.47	19.00	(92)
Apply adjustmer	t to the m	an interna	l temperatu	re from Ta		ere annronr	iate	20.33	20.51	20.05	15.47	15.00	(52)
							20.25	20.25	20.21	20.02	10.47	10.00	(02)
	19.07	19.35	19.70	20.04	20.20	20.34	20.35	20.35	20.31	20.03	19.47	19.00	(93)
8. Space heatir	ng requirem	nent											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains,	ηm											
	0.99	0.97	0.93	0.85	0.71	0.52	0.36	0.39	0.63	0.88	0.97	0.99	(94)
Useful gains. nm	Gm. W (94	1)m x (84)m	1										(- <i>1</i>
, I.	587.60	703 64	774 67	778 47	677.95	483.23	321.16	337.44	508 79	625.80	587 52	552.01	(95)
Monthly average	e external t	emperature	e from Tabl	e 1	077.55	103.23	521.10	337.11	500.75	023.00	567.52	552.01	(33)
wontiny average	4 20	4 00	6 50	0	11 70	14.60	16.60	16.40	14.10	10.60	7 10	4 20	(06)
Hoat loss rato fo	4.50	4.50	oraturo Im	10.30	11.70	(06)ml	10.00	10.40	14.10	10.00	7.10	4.20	(90)
fieat loss fate to							222.42	220 50	522.00	010.27	1002 42	1272.40	(07)
Space beating re	1270.10	1242.40	1134.50	957.02	[735.02]	493.10	322.42	339.50	533.98	810.37	1003.42	1272.48	(97)
space nearing re	quirement		un 0.024 x	[(97)m - (9	5)mj x (41,					10-00			1
	507.82	362.08	267.76	128.99	42.91	0.00	0.00	0.00	0.00		342.65	536.03	
									∑(98	8)15, 10	.12 =	2325.56	(98)
Space heating re	equirement	kWh/m²/y	ear							(98)	÷ (4)	31.56	(99)
9b. Energy req	uirements ·	- communit	ty heating s	cheme									
Fraction of space	e heat from	n secondarv	/suppleme	ntarv svste	m (table 1)	1)				'0' if ı	none	0.00	(301)
Fraction of space	e heat from	, communit	v system			,				1 - (3)	01) =	1.00	(302)
Fraction of com	munity heat	t from boile	ers							- (-	,	1.00	(303a)
Fraction of total	snace heat	from com	nunity hoile	ors						(302) x (30	3a) =	1.00	(304a)
Factor for contro	of and char	ging metho	d (Table Acl	(3)) for com	omunity sn	ace heating				(302) x (30		1.00	(305)
Factor for charge	ing method		a (Table 40)	nunity wat	or bosting							1.00	(305)
Distribution loss	factor (Tak	12c for		booting su	vetom							1.00	(206)
Distribution loss		JIE 120) 101	community	neating sy	stem							1.05	(500)
Constanting													
Space neating										1			(0.0)
Annual space he	ating requi	rement							2325.56]			(98)
Space heat from	boilers							(98	8) x (304a) :	x (305) x (30	06) =	2441.84	(307a)
Water heating								· · · · · ·		7			
Annual water he	eating requi	rement						2	2060.46				(64)
Water heat from	n boilers							(64)) x (303a) x	(305a) x (30	06) =	2163.49	(310a)
Electricity used f	for heat dis	tribution					0.02	1 × [(307a)	(307e) + (3	310a)(310	e)] =	46.05	(313)
Electricity for pu	imps, fans a	and electric	keep-hot (Table 4f)						_			
mechanical v	entilation f	ans - balan	ced, extract	or positive	e input froi	m outside			49.67]			(330a)

Total electricity for the above, kWh/year

Electricity for lighting (Appendix L)

Total delivered energy for all uses

	49.67] (331)
	323.94	(332)
(307) + (309) + (310) + (312) + (315) + (331) + (332)(337b) =	4978.94	(338)

10b. Fuel costs - community l	heating scheme						
		Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from boilers		2441.84	x	4.24	x 0.01 =	103.53	(340a)
Water heating from boilers		2163.49	x	4.24	x 0.01 =	91.73	(342a)
Pumps and fans		49.67	x	13.19	x 0.01 =	6.55	(349)
Electricity for lighting		323.94	x	13.19	x 0.01 =	42.73	(350)
Additional standing charges					[120.00	(351)
Total energy cost				(340a)(342e) +	(345)(354) = [364.55	(355)
11b. SAP rating - community	heating scheme						
Energy cost deflator (Table 12)					[0.42	(356)
Energy cost factor (ECF)					[1.29	(357)
SAP value					[82.00]
SAP rating (section 13)					[82	(358)
SAP band					[В]
12b. CO ₂ emissions - commun	nity heating scheme						
		Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from other sources (space heating)						
Efficiency of boilers		94.00					(367a)
CO2 emissions from boilers	[(307a)+(310a)] x 100 ÷ (367a) =	4899.28	x	0.216	= [1058.25	(367)
Electrical energy for communit	y heat distribution	46.05	x	0.52	= [23.90	(372)
Total CO2 associated with com	munity systems					1082.15	(373)
Total CO2 associated with space	e and water heating					1082.15	(376)
Pumps and fans		49.67	x	0.52	= [25.78	(378)
Electricity for lighting		323.94	x	0.52	= [168.13	(379)
Total CO₂, kg/year					(376)(382) = [1276.05	(383)
Dwelling CO₂ emission rate					(383) ÷ (4) = [17.32	(384)
El value					[85.59]
El rating (section 14)					[86	(385)
El band					[В]
13b. Primary energy - commu	unity heating scheme						
		Energy kWh/year		Primary factor		Primary energy (kWh/year)	

Primary energy from other sou	rces (space heating)						
Efficiency of boilers		94.00]				(367a)
Primary energy from boilers	[(307a)+(310a)] x 100 ÷ (367a) =	4899.28] x	1.22	=	5977.12	(367)
Electrical energy for communit	y heat distribution	46.05] x	3.07	=	141.38	(372)
Total primary energy associate	d with community systems					6118.51	(373)
Total primary energy associate	d with space and water heating					6118.51	(376)
Pumps and fans		49.67] x	3.07	=	152.49	(378)
Electricity for lighting		323.94] x	3.07	=	994.50	(379)
Primary energy kWh/year						7265.50	(383)

DER Worksheet Design - Draft



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

Assessor name		Miss Javr	na Parmar						Assessor nun	nber	6549		
Client		,.							Last modified	4	22/11	/2016	
Client									Last modified	1	23/11	/2016	
Address		A-L03-19	A Centric (Close, Lonc	lon, N8								
1. Overall dwelli	ng dimen	sions											
1. Overall awenin	ing unitern					Area (m²)		I	Average storey height (m)	I	Vo	lume (m³)	
Lowest occupied						87.58	(1a) x	Г	2.50	(2a) =		218.95	(3a)
Total floor area		(1a)	+ (1b) + (1	c) + (1d)(1n) =	87.58	(4)			-			-
Dwelling volume									(3a) + (3b) + (3	3c) + (3d)(3	sn) =	218.95	(5)
										_			
2. Ventilation rat	te											3	
								Г		٦.	m	per nour	٦
Number of chimne	eys								0	x 40 =		0] (6a)
Number of open f	lues								0	x 20 =		0	」(6b) □
Number of interm	ittent fan	S							0	x 10 =		0	_ (7a) □
Number of passive	e vents								0	x 10 =		0](7b)
Number of flueles	s gas fires	5						L	0	x 40 =		0	_ (7c)
											Air	hour	r
Infiltration due to	chimnevs	s. flues. fan	s. PSVs		(6a	a) + (6b) + (7	7a) + (7b) + (7c) = [0	÷ (5) =		0.00	(8)
If a pressurisation	test has l	been carried	d out or is i	ntended, p	roceed to	(17), otherv	vise continu	e from	(9) to (16)				
, Air permeability v	alue, q50,	, expressed	in cubic m	etres per h	our per so	uare metre	of envelope	e area	., .,			4.00	(17)
If based on air per	meability	value, ther	n (18) = [(1]	7) ÷ 20] + (8	8), otherw	rise (18) = (1						0.20	(18)
Number of sides o	on which t	he dwelling	g is sheltere	ed								2	(19)
Shelter factor		-							1	- [0.075 x (19	9)] =	0.85	(20)
Infiltration rate in	corporatii	ng shelter fa	actor							(18) x (2	20) =	0.17	(21)
Infiltration rate m	odified fo	r monthly v	vind speed	:									-
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Au	g Sep	Oct	Nov	Dec	
Monthly average	wind spee	ed from Tab	le U2										
	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.7	0 4.00	4.30	4.50	4.70	(22)
Wind factor (22)m	n ÷ 4												
	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.9	3 1.00	1.08	1.13	1.18	(22a)
Adjusted infiltration	on rate (a	llowing for	shelter and	l wind fact	or) (21) x ((22a)m							
	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.1	6 0.17	0.18	0.19	0.20	(22b)
Calculate effective	e air chan	ge rate for t	the applica	ble case:									
If mechanical v	ventilatior	n: air chang	e rate thro	ugh system	1							0.50	(23a)
If balanced wit	h heat reo	covery: effi	ciency in %	allowing for	or in-use f	actor from ⁻	Table 4h					N/A	(23c)
c) whole house	e extract v	entilation o	or positive	input venti	lation fror	n outside							_
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.5	0 0.50	0.50	0.50	0.50	(24c)
Effective air chang	ge rate - e	nter (24a) o	or (24b) or	(24c) or (24	4d) in (25)							- <u>-</u>	_
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.5	0 0.50	0.50	0.50	0.50	(25)



3. Heat losses a	and heat los	ss paramet	er										
Element			а	Gross rea, m²	Openings m ²	Net a A, m	rea 1²	U-value W/m²K	A x U W	//К к-ч kJ	value, /m².K	Ахк, kJ/K	
Window						29.4	5 x	1.24	= 36.39)			(27)
External wall						21.9	7 x	0.18	= 3.95				(29a
Party wall						57.0	5 x	0.00	= 0.00				(32)
Roof						87.5	8 x	0.16	= 14.01				(30)
Total area of ext	ternal eleme	ents ∑A, m²	2			139.0	00						(31)
Fabric heat loss,	W/K = ∑(A	× U)							(2	6)(30) + (32) =	54.36	(33)
Heat capacity Cr	m = ∑(А x к)							(28)	.(30) + (32)	+ (32a)(3	2e) =	N/A	(34)
Thermal mass p	arameter (T	MP) in kJ/r	n²K									250.00	(35)
Thermal bridges	:: Σ(L x Ψ) ca	lculated us	sing Appen	dix K								7.51	(36)
Total fabric heat	t loss		0 11							(33) + (36) =	61.87	(37)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat	loss calcula	ted month	ly 0.33 x (2	25)m x (5)	-			_					
	36.13	36.13	36.13	36.13	36.13	36.13	36.13	36.13	36.13	36.13	36.13	36.13	(38)
Heat transfer co	efficient. W	/K (37)m +	+ (38)m										_ (,
	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	7
	50.00	50.00	50.00	50.00	50.00	50.00	30.00		Average = '	$\Sigma(39)112$	/12 =	98.00	 (39)
Heat loss param	eter (HLP). '	W/m²K (30	9)m ÷ (4)						, werage	2(33)112		50.00	
	1 12	1 12	1 12	1 1 2	1 12	1 1 2	1 1 2	1 12	1 1 2	1 1 2	1 12	1 1 2	7
	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12		(40)1 12	/12 -	1 1 2	
Number of days	in month (T	able 1a)							Average -	2(40)112,	12 -	1.12	_ (40)
Number of days		28.00	21.00	20.00	21.00	20.00	21.00	21.00	20.00	21.00	20.00	21.00	
	51.00	28.00	51.00	30.00	51.00	30.00	51.00	31.00	30.00	51.00	50.00	51.00	_ (40)
4. Water heati	ng energy r	equiremen	t										
Assumed occupa	ancy, N											2.59	(42)
Annual average	hot water u	sage in litre	es per day '	Vd,average	= (25 x N) +	36						95.74	(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)							
	105.31	101.48	97.65	93.82	89.99	86.17	86.17	89.99	93.82	97.65	101.48	105.31	
										<u>Σ</u> (44)1	.12 =	1148.87	(44)
Energy content	of hot wate	r used = 4.2	18 x Vd,m x	nm x Tm/3	3600 kWh/m	onth (see T	ables 1b), 1c 1d)					
	156.18	136.59	140.95	122.89	117.91	101.75	94.28	108.19	109.49	127.59	139.28	151.25	
										Σ(45)1	.12 =	1506.35	 (45)
Distribution loss	0.15 x (45)	m								2(-7			
	23.43	20.49	21.14	18.43	17.69	15.26	14.14	16.23	16.42	19.14	20.89	22.69	(46)
Storage volume	(litres) inclu	iding any s	olar or WW	HRS storag	re within sam	ne vessel	1	10.23	10.12	13.11		110.00] (10)] (47)
Water storage lo					,						L	110100	
h) Manufacture	r's declared	loss factor	is not know	wn									
Hot water st	orage loss fr	ector from	Table 2 (k)	/h/litre/day	v)							0.02	7 (51)
Volumo facto	or from Tabl			vily intrey day	y)							1.02] (51)] (52)
	factor from	e za										0.60	_ (52) _ (52)
Enorgy lost f			(b (day) (4-	7) / [1) / [- 2) y (F 2)							1.02	_ (55) _ (54)
	ioni water s	torage (KM	myuay) (47	7 (T C) X (S	JZJ X (JJ)							1.03	(54) (55)
Enter (50) or (54	+) III (55)	d for c	month /Fr) v (41)								1.03	_ (55)
water storage lo	Jss calculate	eu for each	month (55	5) X (41)M									
	22.01	20.02	22.01	20.00	22.04	20.00	22.01	22.21	20.00	22.01	20.05	22.24	7
-			•										
	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01 (57)	
Primary circuit l	oss for each	month fro	m Table 3										
	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26 (59)	
Combi loss for e	ach month	from Table	3a, 3b or 3	с				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 (61)	
Total heat requi	red for wate	er heating o	alculated f	or each mo	nth 0.85 x	(45)m + (40	6)m + (57)r	n + (59)m +	- (61)m				
·	211 45	186 52	196 23	176 38	173 19	155 24	149 56	163.47	162.98	182 87	192 77	206 53 (62)	
Solar DHW innu	t calculated	using Anne	endix G or A	Annendix H	175.15	155.21	115.50	105.17	102.50	102.07	192.77		
Solar Britt Inpu					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 (63)	
Output from wa	tor bostor f	or oach me	0.00	(67)	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 (03)	
				176.29	172 10	155.24	140 56	162.47	162.08	102.07	102 77	206 52	
	211.45	180.52	190.23	1/0.38	173.19	155.24	149.50	103.47	102.98	5(64)4	192.77	200.53	
11							[/46]			<u>∑</u> (64)1	12 = 2	(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)	imj				
	96.15	85.36	91.09	83.65	83.43	76.63	75.57	80.20	79.20	86.65	89.11	94.51 (65)	
5. Internal gair	ıs												
Ŭ	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains	(Table 5)												
Sector Barris	129 56	129 56	129 56	129 56	129 56	129 56	129 56	129 56	129 56	129 56	129 56	129 56 (66)	
Lighting gains (c	alculated in	Annendix	equation	129.90	also see Ta	129.90	129.50	129.50	129.90	129.50	129.90	129.50 (00)	
				11 42			7.90	10.14	12.60	17.27	20.16	21.40 (67)	
Appliance gains	20.91	10.57		11.45		7.22	7.80	10.14	15.00	17.27	20.10	21.49 (07)	
Appliance gains										100.00			
	234.55	236.99	230.85	217.80	201.31	185.82	175.47	173.04	179.17	192.23	208.71	224.21 (68)	
Cooking gains (c	alculated in	Appendix	L, equation	L15 or L15	a), also see	Table 5							
	35.96	35.96	35.96	35.96	35.96	35.96	35.96	35.96	35.96	35.96	35.96	35.96 (69)	
Pump and fan g	ains (Table S	5a)	[I		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 (70)	
Losses e.g. evap	oration (Tal	ole 5)											
	-103.65	-103.65	-103.65	-103.65	-103.65	-103.65	-103.65	-103.65	-103.65	-103.65	-103.65	-103.65 (71)	
Water heating g	ains (Table	5)											
	129.23	127.02	122.43	116.19	112.13	106.43	101.57	107.79	110.00	116.46	123.76	127.03 (72)	
Total internal ga	ains (66)m +	+ (67)m + (6	58)m + (69)ı	m + (70)m -	+ (71)m + (7	72)m							
	446.57	444.45	430.26	407.29	383.86	361.33	346.71	352.83	364.64	387.83	414.50	434.60 (73)	
C. Calan asian													
6. Solar gains													
			Access f Table	actor 6d	Area m²	Sola W	ar flux //m²	spec	g ific data	FF specific d	ata	Gains	
								or T	able 6b	or Table	6c		
SouthWest			0.7	7 X	29.45	x 3	6.79 x	0.9 x 0	0.40 x	0.80	=	240.29 (79)	
Solar gains in wa	atts ∑(74)m	(82)m											
-	240.29	409.31	560.04	693.91	777.24	771.62	743.92	681.76	606.40	452.37	287.82	205.64 (83)	
Total gains - inte	ernal and so	lar (73)m +	(83)m										
	686.86	853.76	990.29	1101 20	1161 10	1132.95	1090 64	103/ 59	971.04	840.21	702 32	640.24 (84)	
	000.00	000.70	550.25	1101.20	1101.10	1152.55	1050.04	1004.00	571.04	070.21	, 52.52		
7. Mean intern	al tempera	ture (heati	ng season)										
Temperature du	iring heating	g periods in	the living a	area from T	able 9, Th1	.(°C)						21.00 (85)	
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains f	or living are	ea n1,m (se	e Table 9a)									
	0.99	0.98	0.95	0.87	0.72	0.54	0.39	0.43	0.66	0.91	0.98	1.00 (86)	

SAP version 9.92

Mean internal te	emp of livin	g area T1 (s	teps 3 to 7	in Table 90	c)								
	19.97	20.20	20.48	20.75	20.92	20.99	21.00	21.00	20.96	20.72	20.28	19.91	(87)
Temperature du	ring heatin	g periods in	the rest of	f dwelling f	rom Table	9, Th2(°C)							
	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	(88)
Utilisation factor	r for gains f	or rest of d	welling n2,	m									
	0.99	0.97	0.93	0.83	0.66	0.46	0.30	0.34	0.58	0.87	0.98	0.99	(89)
Mean internal te	emperature	in the rest	of dwelling	g T2 (follow	steps 3 to	7 in Table 9	e)					-	
	18.63	18.96	19.35	19.72	19.92	19.98	19.98	19.98	19.96	19.69	19.08	18.55	(90)
Living area fracti	ion			1	1	1		1	Li [,]	ving area ÷	(4) =	0.34	(91)
Mean internal te	emperature	for the wh	ole dwellin	g fLA x T1 +	+(1 - fLA) x	Т2				0	.,		
	19.09	19.39	19.74	20.07	20.26	20.32	20.33	20.33	20.30	20.04	19.49	19.01	(92)
Apply adjustmer	nt to the me	ean internal	l temperatu	ure from Ta	ble 4e wh	ere appropr	iate						(/
	19.09	19 39	19.74	20.07	20.26	20.32	20.33	20.33	20.30	20.04	19.49	19.01	(93)
	19:09	13.35	15.71	20.07	20.20	20.52	20.33	20.55	20.00	20.01	13.13	13.01	(33)
8. Space heatin	ng requirem	nent											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor	r for gains,	ηm											
	0.99	0.97	0.93	0.83	0.68	0.49	0.33	0.37	0.60	0.87	0.97	0.99	(94)
Useful gains, ηm	nGm, W (94	4)m x (84)m	I										
	678.99	827.66	918.02	919.02	788.21	553.04	364.84	383.72	586.13	734.93	683.88	634.87	(95)
Monthly average	e external t	emperature	e from Tabl	e U1									
	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate fo	or mean inte	ernal tempe	erature, Lm	, W [(39)m	x [(93)m -	- (96)m]						_	
	1449.54	1419.78	1297.51	1094.66	838.95	560.78	365.73	385.24	607.84	925.51	1213.90	1451.82	(97)
Space heating re	equirement	, kWh/mon	th 0.024 x	[(97)m - (9	5)m] x (41))m						-	
	573.29	397.91	282.34	126.46	37.75	0.00	0.00	0.00	0.00	141.79	381.62	607.81	
								1	Σ(98	8)15, 10	.12 = 2	2548.97	(98)
Space heating re	equirement	kWh/m²/ve	ear						2.	(98)	÷ (4)	29.10	(99)
1 0	•	,								. ,	.,		
9b. Energy requ	uirements ·	- communit	y heating s	cheme									
Fraction of space	e heat from	secondary,	/suppleme	ntary syste	m (table 1	1)				'0' if r	none	0.00	(301)
Fraction of space	e heat from	o communit	y system							1 - (30	01) =	1.00	(302)
Fraction of com	munity hea	t from boile	rs									1.00	(303a)
Fraction of total	space heat	from comn	nunity boile	ers						(302) x (303	3a) =	1.00	(304a)
Factor for contro	ol and char	ging method	d (Table 4c((3)) for com	nmunity sp	ace heating						1.00	(305)
Factor for chargi	ing method	(Table 4c(3	3)) for comr	nunity wat	er heating							1.00	(305a)
Distribution loss	factor (Tab	ole 12c) for	community	heating sy	rstem							1.05	(306)
Space heating													
Annual space he	ating requi	rement						2	2548.97]			(98)
Space heat from	boilers							(98	8) x (304a) :	- x (305) x (30	06) = 🔀	2676.42	(307a)
Water heating													
Annual water he	eating requi	rement						2	2157.19]			(64)
Water heat from	n boilers							(64)) x (303a) x	_ (305a) x (3(06) = 2	2265.05	(310a)
Electricity used f	for heat dis	tribution					0.01	1 × [(307a)	(307e) + (3	310a)(310	e)] =	49.41	(313)
Electricity for pu	imps, fans a	and electric	keep-hot (Table 4f)					/ (*	, (··		1
mechanical	entilation f	ans - baland	ced. extract	or positive	e input fro	m outside			55.56	1			(<u>330a</u>)
incentinear v		and bulunt			- input ii Oi	outside		L	55.50	L			(5504)

Total electricity for the above, kWh/year

Electricity for lighting (Appendix L)

Total delivered energy for all uses

	55.56	(331)
	369.29	(332)
(307) + (309) + (310) + (312) + (315) + (331) + (332)(337b) =	5366.32	(338)

10b. Fuel costs - community heating scheme						
	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from boilers	2676.42	x	4.24	x 0.01 =	113.48	(340a)
Water heating from boilers	2265.05	x	4.24	x 0.01 =	96.04	(342a)
Pumps and fans	55.56	x	13.19	x 0.01 =	7.33	(349)
Electricity for lighting	369.29	x	13.19	x 0.01 =	48.71	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)(342e) +	(345)(354) =	385.56	(355)
11b. SAP rating - community heating scheme					-	
Energy cost deflator (Table 12)					0.42	(356)
Energy cost factor (ECF)					1.22	(357)
SAP value					82.96]
SAP rating (section 13)					83	(358)
SAP band					В	
12b. CO ₂ emissions - community heating scheme						
	Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from other sources (space heating)						
Efficiency of boilers	94.00					(367a)
CO2 emissions from boilers [(307a)+(310a)] x 100 ÷ (367a) =	5256.88	x	0.216	=	1135.49	(367)
Electrical energy for community heat distribution	49.41	х	0.52	=	25.65	(372)
Total CO2 associated with community systems					1161.13	(373)
Total CO2 associated with space and water heating					1161.13	(376)
Pumps and fans	55.56	x	0.52	=	28.84	(378)
Electricity for lighting	369.29	x	0.52	=	191.66	(379)
Total CO ₂ , kg/year				(376)(382) =	1381.63	(383)
Dwelling CO ₂ emission rate				(383) ÷ (4) =	15.78	(384)
El value					86.04	
El rating (section 14)					86	(385)
El band					В	
13b. Primary energy - community heating scheme						
	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary energy from other sources (space heating)						
Efficiency of boilers	94.00					(367a)
Primary energy from boilers [(307a)+(310a)] x 100 ÷ (367a) =	5256.88	x	1.22	=	6413.39	(367)
Electrical energy for community heat distribution	49.41	x	3.07	=	151.70	(372)
Total primary energy associated with community systems					6565.10	(373)
Total primary energy associated with space and water heating					6565.10	(376)

Total primary energy associated with space and water heating

Pumps and fans

Electricity for lighting

Primary energy kWh/year

170.57

1133.72

7869.39

(378)

(379)

(383)

55.56

369.29

Х

х

3.07

3.07

=

=

DER Worksheet Design - Draft



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

Assessor name		Miss lavr	na Parmar						Assessor num	nher	6549		
											22/14	12010	
Client									Last modified	1	23/11	/2016	
Address		A-L03-48	A Centric	Close, Lond	lon, N8								
1 Overall dwellig	ng dimon	sions											
1. Overall dwellin	ng unnen	SIGHS				Area (m²)		F	Average storey height (m)	1	Vo	lume (m³)	
Lowest occupied						87.21	(1a) x	Г	2.50	(2a) =		218.03	(3a)
Total floor area		(1a)	+ (1b) + (1	c) + (1d)(1n) =	87.21	(4)			-			
Dwelling volume							_		(3a) + (3b) + (3	3c) + (3d)(3	n) =	218.03	(5)
										_			
2. Ventilation rat	te												
										7	m [.]	per nour	٦
Number of chimne	eys								0	」 x 40 =		0	_ (6a)
Number of open f	lues							Ļ	0	」 x 20 =		0	_ (6b)
Number of interm	ittent fan	S							0	」 x 10 =		0] (7a)
Number of passive	e vents							L	0	」 x 10 =		0	_ (7b)
Number of flueles	s gas fires	5						L	0	x 40 =		0	(7c)
											Air o	hanges pei hour	r
Infiltration due to	chimnevs	s. flues. fan	s. PSVs		(6;	a) + (6b) + (7	'a) + (7b) + (7c) = [0	÷ (5) =		0.00	(8)
If a pressurisation	test has l	been carried	d out or is i	ntended, p	roceed to	(17), otherv	vise continu	e from	(9) to (16)		L] (-)
Air permeability v	alue. g50.	. expressed	in cubic m	etres per h	our per so	auare metre	of envelope	e area				4.00	(17)
If based on air per	meability	value. ther	n (18) = [(1 ⁻	7) ÷ 20] + (8	8). otherw	vise (18) = (1	.6)					0.20	(18)
Number of sides o	on which t	he dwelling	g is sheltere	ed	- ,,		-,					2	(19)
Shelter factor		t	,						1	- [0.075 x (1	9)] =	0.85	(20)
Infiltration rate in	corporati	ng shelter fa	actor							(18) x (2	:0) =	0.17	(21)
Infiltration rate m	' odified fo	r monthly v	wind speed	:							,		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	g Sep	Oct	Nov	Dec	
Monthly average	wind spee	ed from Tab	ole U2										
Γ	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	0 4.00	4.30	4.50	4.70	(22)
Wind factor (22)m	ו ÷ 4					·			·			-	-
	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	3 1.00	1.08	1.13	1.18	(22a)
Adjusted infiltration	on rate (a	llowing for	shelter and	d wind fact	or) (21) x	(22a)m							
	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	6 0.17	0.18	0.19	0.20	(22b)
Calculate effective	e air chan	ge rate for t	the applica	ble case:									
If mechanical v	ventilatior	n: air chang	e rate thro	ugh system	ı							0.50	(23a)
If balanced wit	h heat red	covery: effi	ciency in %	allowing for	or in-use f	actor from ⁻	Table 4h					N/A	(23c)
c) whole house	e extract v	entilation o	or positive	input venti	lation fro	m outside							
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(24c)
Effective air chang	ge rate - e	nter (24a) o	or (24b) or	(24c) or (24	4d) in (25)								
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(25)



Element	Gross area, m ²	Openings m ²	Net ar A, m	rea I ²	U-value W/m²K	A x U W,	/Κ κ-ν: kJ/	alue, 'm².K	Ахк, kJ/K	
Window			23.1	7 x	1.24	= 28.63				(27)
External wall			23.1	0 x	0.18	= 4.16				(29a)
Party wall			63.5	2 x	0.00	= 0.00				(32)
Total area of external elements ΣA , m ²			46.2	7						(31)
Fabric heat loss, $W/K = \Sigma(A \times U)$						(26)(30) + (3	2) =	32.79	(33)
Heat capacity Cm = Σ(A x κ)					(28)	(30) + (32) +	(32a)(32	e) =	N/A	(34)
Thermal mass parameter (TMP) in kJ/m²K									250.00	(35)
Thermal bridges: $\Sigma(L \times \Psi)$ calculated using App	endix K								6.50	(36)
Total fabric heat loss							(33) + (3	6) =	39.29	(37)
Jan Feb Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly 0.33 >	(25)m x (5)									
35.97 35.97 35.97	35.97	35.97	35.97	35.97	35.97	35.97	35.97	35.97	35.97	(38)
Heat transfer coefficient, W/K (37)m + (38)m										
75.26 75.26 75.26	75.26	75.26	75.26	75.26	75.26	75.26	75.26	75.26	75.26	
						Average = ∑	(39)112/	12 =	75.26	(39)
Heat loss parameter (HLP), W/m ² K (39)m \div (4)										
0.86 0.86 0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	
						Average = ∑	(40)112/	12 =	0.86	(40)
Number of days in month (Table 1a)										
31.00 28.00 31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)
4. Water heating energy requirement									2.50	(42)
Assumed occupancy, N	v Vd avorago -	- (25 y NI) + 1	26						2.59	(42)
	y vu,average –	- (23 x N) +	30		Aug		Oct	Nov	 	(43)
IAU FEO IVIAU	Δnr	May	lun	Int		Sen		14114	LIEC	
Hot water usage in litres per day for each mon	Apr h Vd.m = facto	May or from Tabl	Jun le 1c x (43)	Jul	Aug	Sep	ott	NOV	Dec	
Hot water usage in litres per day for each mont	Apr h Vd,m = facto	May or from Tabl	Jun le 1c x (43)	Jul 86.05	Aug	Sep	97 52	101 34	105 17	
Hot water usage in litres per day for each mont 105.17 101.34 97.52	Apr h Vd,m = facto 93.70	May or from Tabl 89.87	Jun le 1c x (43) 86.05	Jul 86.05	89.87	Sep 93.70	97.52 Σ(44)1	101.34 12 =	105.17 1147.29	(44)
Hot water usage in litres per day for each moni- 105.17 101.34 $97.52Energy content of hot water used = 4.18 \times Vd.n$	Apr h Vd,m = facto 93.70	May or from Tabl 89.87	Jun le 1c x (43) 86.05	Jul 86.05 ables 1b.	Aug 89.87	Sep 93.70	97.52 Σ(44)1	101.34 12 =	105.17 1147.29	(44)
Hot water usage in litres per day for each mont 105.17 101.34 $97.52Energy content of hot water used = 4.18 \times Vd,m155.96$ 136.40 140.76	Apr h Vd,m = facto 93.70 n x nm x Tm/36	May or from Tabl 89.87 500 kWh/m 117.75	Jun le 1c x (43) 86.05 onth (see Ta	Jul 86.05 ables 1b, 94.15	Aug 89.87 1c 1d)	Sep 93.70	97.52 Σ(44)1	101.34 12 = 139.09	105.17 1147.29	(44)
Hot water usage in litres per day for each mont 105.17 101.34 $97.52Energy content of hot water used = 4.18 \times Vd,n155.96$ 136.40 140.76	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72	May or from Tabl 89.87 500 kWh/m 117.75	Jun le 1c x (43) 86.05 onth (see Ta 101.61	Jul 86.05 ables 1b, 94.15	Aug 89.87 1c 1d) 108.04	Sep 93.70 109.33	97.52 Σ(44)1 127.42 Σ(45)1	101.34 12 = 139.09 12 =	105.17 1147.29 151.04	(44)
Hot water usage in litres per day for each monitorial for the formula 105.17 101.34 97.52 Energy content of hot water used = $4.18 \times Vd$, m 155.96 136.40 140.76 Distribution loss $0.15 \times (45)$ m	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72	May or from Tabl 89.87 500 kWh/m 117.75	Jun le 1c x (43) 86.05 onth (see Ta 101.61	Jul 86.05 ables 1b, 94.15	Aug 89.87 1c 1d) 108.04	Sep 93.70 109.33	97.52 Σ(44)1 127.42 Σ(45)1	101.34 12 = 139.09 12 =	105.17 1147.29 151.04 1504.28	(44) (45)
Hot water usage in litres per day for each mont 105.17 101.34 $97.52Energy content of hot water used = 4.18 \times Vd,m155.96$ 136.40 $140.76Distribution loss 0.15 \times (45)m23.39$ 20.46 21.11	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41	May or from Tabl 89.87 500 kWh/m 117.75	Jun le 1c x (43) 86.05 onth (see Ta 101.61	Jul 86.05 ables 1b, 94.15	Aug 89.87 1c 1d) 108.04 16.21	Sep 93.70 109.33	97.52 Σ(44)1 127.42 Σ(45)1 19.11	101.34 12 = 139.09 12 = 20.86	105.17 1147.29 151.04 1504.28 22.66	(44) (45) (46)
Hot water usage in litres per day for each montant 105.17 101.34 $97.52Energy content of hot water used = 4.18 \times Vd,m155.96$ 136.40 $140.76Distribution loss 0.15 \times (45)m23.39$ 20.46 $21.11Storage volume (litres) including any solar or W$	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41 WHRS storage	May or from Tabl 89.87 500 kWh/mi 117.75 17.66 e within sam	Jun le 1c x (43) 86.05 onth (see Ta 101.61 15.24	Jul 86.05 ables 1b, 94.15 14.12	Aug 89.87 1c 1d) 108.04 16.21	Sep 93.70 109.33 16.40	97.52 Σ(44)1 127.42 Σ(45)1 19.11	101.34 12 = 139.09 12 = 20.86	105.17 1147.29 151.04 1504.28 22.66 110.00	(44) (45) (46) (47)
Hot water usage in litres per day for each mont 105.17 101.34 $97.52Energy content of hot water used = 4.18 \times Vd,n155.96$ 136.40 $140.76Distribution loss 0.15 \times (45)m23.39$ 20.46 $21.11Storage volume (litres) including any solar or WWater storage loss:$	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41 WHRS storage	May or from Tabl 89.87 500 kWh/mi 117.75 17.66 within sam	Jun le 1c x (43) 86.05 00000000000000000000000000000000000	Jul 86.05 ables 1b, 94.15 14.12	Aug 89.87 1c 1d) 108.04 16.21	Sep 93.70 109.33 16.40	97.52 Σ(44)1 127.42 Σ(45)1 19.11	101.34 12 = 139.09 12 = 20.86	105.17 1147.29 151.04 1504.28 22.66 110.00	(44) (45) (46) (47)
Hot water usage in litres per day for each montain 105.17 101.34 $97.52Energy content of hot water used = 4.18 \times Vd, n155.96$ 136.40 $140.76Distribution loss 0.15 \times (45)m23.39$ 20.46 $21.11Storage volume (litres) including any solar or WWater storage loss:b) Manufacturer's declared loss factor is not kr$	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41 WHRS storage own	May or from Tabl 89.87 500 kWh/m 117.75 17.66 e within sam	Jun le 1c x (43) 86.05 0nth (see Ta 101.61 15.24 ne vessel	Jul 86.05 ables 1b, 94.15 14.12	Aug 89.87 1c 1d) 108.04 16.21	Sep 93.70 109.33 16.40	97.52 Σ(44)1 127.42 Σ(45)1 19.11	101.34 12 = 139.09 12 = 20.86	105.17 1147.29 151.04 1504.28 22.66 110.00	(44) (45) (46) (47)
Hot water usage in litres per day for each mont 105.17 101.34 $97.52Energy content of hot water used = 4.18 \times Vd,m155.96$ 136.40 $140.76Distribution loss 0.15 \times (45)m23.39$ 20.46 $21.11Storage volume (litres) including any solar or WWater storage loss:b) Manufacturer's declared loss factor is not krHot water storage loss factor from Table 2 ($	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41 WHRS storage own kWh/litre/day)	May or from Tabl 89.87 500 kWh/mi 117.75 17.66 within sam	Jun le 1c x (43) 86.05 00000000000000000000000000000000000	Jul 86.05 ables 1b, 94.15 14.12	Aug 89.87 1c 1d) 108.04 16.21	Sep 93.70 109.33 16.40	97.52 Σ(44)1 127.42 Σ(45)1 19.11	101.34 12 = 139.09 12 = 20.86	105.17 1147.29 151.04 1504.28 22.66 110.00 0.02	(44) (45) (46) (47) (51)
Hot water usage in litres per day for each montain 105.17 101.34 $97.52Energy content of hot water used = 4.18 \times Vd,m155.96$ 136.40 $140.76Distribution loss 0.15 \times (45)m23.39$ 20.46 $21.11Storage volume (litres) including any solar or WWater storage loss:b) Manufacturer's declared loss factor is not krHot water storage loss factor from Table 2 (Volume factor from Table 2a$	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41 WHRS storage own kWh/litre/day)	May or from Tabl 89.87 500 kWh/mo 117.75 17.66 e within same	Jun le 1c x (43) 86.05 0nth (see Ta 101.61 15.24 ne vessel	Jul 86.05 ables 1b, 94.15 14.12	Aug 89.87 1c 1d) 108.04 16.21	Sep 93.70 109.33 16.40	97.52 Σ(44)1 127.42 Σ(45)1 19.11	101.34 12 = 139.09 12 = 20.86	105.17 1147.29 151.04 1504.28 22.66 110.00 0.02 1.03	(44) (45) (46) (47) (51) (52)
Hot water usage in litres per day for each montant 105.17 101.34 $97.52Energy content of hot water used = 4.18 \times Vd,m155.96$ 136.40 $140.76Distribution loss 0.15 \times (45)m23.39$ 20.46 $21.11Storage volume (litres) including any solar or WWater storage loss:b) Manufacturer's declared loss factor is not krHot water storage loss factor from Table 2 (Volume factor from Table 2aTemperature factor from Table 2b$	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41 WHRS storage own kWh/litre/day)	May or from Tabl 89.87 500 kWh/mi 117.75 17.66 e within same	Jun le 1c x (43) 86.05 00000000000000000000000000000000000	Jul 86.05 ables 1b, 94.15 14.12	Aug 89.87 1c 1d) 108.04 16.21	Sep 93.70 109.33 16.40	97.52 Σ(44)1 127.42 Σ(45)1 19.11	101.34 12 = 139.09 12 = 20.86	105.17 1147.29 151.04 1504.28 22.66 110.00 0.02 1.03 0.60	 (44) (45) (46) (47) (51) (52) (53)
Hot water usage in litres per day for each mont 105.17 101.34 $97.52Energy content of hot water used = 4.18 \times Vd,m155.96$ 136.40 $140.76Distribution loss 0.15 \times (45)m23.39$ 20.46 $21.11Storage volume (litres) including any solar or WWater storage loss:b) Manufacturer's declared loss factor is not krHot water storage loss factor from Table 2 (Volume factor from Table 2aTemperature factor from Table 2bEnergy lost from water storage (kWh/day)$	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41 WHRS storage own kWh/litre/day) 47) x (51) x (52	May or from Tabl 89.87 500 kWh/m 117.75 17.66 17.66 within sam	Jun le 1c x (43) 86.05 onth (see Ta 101.61 15.24 ne vessel	Jul 86.05 ables 1b, 94.15 14.12	Aug 89.87 1c 1d) 108.04 16.21	Sep 93.70 109.33 16.40	97.52 Σ(44)1 127.42 Σ(45)1 19.11	101.34 12 = 139.09 12 = 20.86	105.17 1147.29 151.04 1504.28 22.66 110.00 0.02 1.03 0.60 1.03	 (44) (45) (46) (47) (51) (52) (53) (54)
JainFebIvialHot water usage in litres per day for each monit105.17101.3497.52Energy content of hot water used = 4.18 x Vd,n155.96136.40140.76Distribution loss0.15 x (45)m23.3920.4621.11Storage volume (litres) including any solar or WWater storage loss:b) Manufacturer's declared loss factor is not krHot water storage loss factor from Table 2 (Volume factor from Table 2a Temperature factor from Table 2b Energy lost from water storage (kWh/day)Enter (50) or (54) in (55)	Apr h Vd,m = facto 93.70 h x nm x Tm/36 122.72 18.41 WHRS storage own kWh/litre/day) 47) x (51) x (52	May or from Tabl 89.87 500 kWh/m 117.75 17.66 2 within sam	Jun le 1c x (43) 86.05 0nth (see Ta 101.61 15.24 he vessel	Jul 86.05 ables 1b, 94.15 14.12	Aug 89.87 1c 1d) 108.04 16.21	Sep 93.70 109.33 16.40	97.52 Σ(44)1 127.42 Σ(45)1 19.11	101.34 12 = 139.09 12 = 20.86	105.17 1147.29 151.04 1504.28 22.66 110.00 0.02 1.03 0.60 1.03 1.03	 (44) (45) (46) (47) (51) (52) (53) (54) (55)
Hot water usage in litres per day for each mont 105.17 101.34 97.52 Energy content of hot water used = 4.18 x Vd,n 155.96 136.40 140.76 Distribution loss 0.15 x (45)m 23.39 20.46 21.11 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 (Volume factor from Table 2a Temperature factor from Table 2b Energy lost from water storage (kWh/day) = Enter (50) or (54) in (55) Water storage loss calculated for each month	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41 WHRS storage own kWh/litre/day) 47) x (51) x (52 55) x (41)m	May or from Tabl 89.87 500 kWh/m 117.75 17.66 within sam	Jun le 1c x (43) 86.05 onth (see Ta 101.61 15.24 ne vessel	Jul 86.05 ables 1b, 94.15 14.12	Aug 89.87 1c 1d) 108.04 16.21	Sep 93.70 109.33 16.40	97.52 Σ(44)1 127.42 Σ(45)1 19.11	101.34 12 =	105.17 1147.29 151.04 1504.28 22.66 110.00 0.02 1.03 0.60 1.03 1.03	 (44) (45) (46) (47) (51) (52) (53) (54) (55)
Hot water usage in litres per day for each mont 105.17 101.34 97.52 Energy content of hot water used = 4.18 x Vd,n 155.96 136.40 140.76 Distribution loss 0.15 x (45)m 23.39 20.46 21.11 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 (Volume factor from Table 2a Temperature factor from Table 2b Energy lost from water storage (kWh/day) Enter (50) or (54) in (55) Water storage loss calculated for each month 32.01 28.92 32.01	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41 WHRS storage own kWh/litre/day) 47) x (51) x (52 55) x (41)m 30.98	May or from Tabl 89.87 500 kWh/mo 117.75 17.66 within sam 2) x (53) 32.01	Jun le 1c x (43) 86.05 onth (see Ta 101.61 15.24 ne vessel 30.98	Jul 86.05 ables 1b, 94.15 14.12 32.01	Aug 89.87 1c 1d) 108.04 16.21 32.01	Sep 93.70 109.33 16.40 30.98	97.52 Σ(44)1 127.42 Σ(45)1 19.11 32.01	101.34 12 = 139.09 12 = 20.86	105.17 1147.29 151.04 1504.28 22.66 110.00 0.02 1.03 0.60 1.03 1.03 32.01	 (44) (45) (46) (47) (51) (52) (53) (54) (55) (56)
JainFebIvialHot water usage in litres per day for each mont 105.17 101.34 97.52 Energy content of hot water used = $4.18 \times Vd$,n 155.96 136.40 140.76 Distribution loss $0.15 \times (45)m$ 23.39 20.46 21.11 Storage volume (litres) including any solar or WWater storage loss:b) Manufacturer's declared loss factor is not krHot water storage loss factor from Table 2aTemperature factor from Table 2aTemperature factor from Table 2bEnergy lost from water storage (kWh/day)Enter (50) or (54) in (55)Water storage loss calculated for each month 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 32.01	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41 'WHRS storage own kWh/litre/day) 47) x (51) x (52 55) x (41)m 30.98 r dedicated WV	May or from Tabl 89.87 500 kWh/mi 117.75 17.66 e within sam 2) x (53) 32.01 WHRS (56)n	Jun le 1c x (43) 86.05 00000000000000000000000000000000000	Jul 86.05 ables 1b, 94.15 14.12 14.12 32.01 s] ÷ (47),	Aug 89.87 1c 1d) 108.04 16.21 32.01 else (56)	Sep 93.70 109.33 16.40 30.98	97.52 Σ(44)1 127.42 Σ(45)1 19.11 32.01	101.34 12 =	105.17 1147.29 151.04 1504.28 22.66 110.00 0.02 1.03 0.60 1.03 1.03 1.03 32.01	 (44) (45) (46) (47) (51) (52) (53) (54) (55) (56)
Hot water usage in litres per day for each mont 105.17 101.34 97.52 Energy content of hot water used = 4.18 x Vd,n 155.96 136.40 140.76 Distribution loss 0.15 x (45)m 23.39 20.46 21.11 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 (Volume factor from Table 2a Temperature factor from Table 2b Energy lost from water storage (kWh/day) Enter (50) or (54) in (55) Water storage loss calculated for each month 32.01 28.92 32.01 If the vessel contains dedicated solar storage of 32.01 28.92 32.01	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41 WHRS storage own kWh/litre/day) 47) x (51) x (52 55) x (41)m 30.98 r dedicated WV 30.98	May or from Tabl 89.87 500 kWh/mo 117.75 17.66 within sam 2) x (53) 32.01 WHRS (56)n 32.01	Jun le 1c x (43) 86.05 onth (see Ta 101.61 15.24 ne vessel 30.98 n x [(47) - Vs 30.98	Jul 86.05 ables 1b, 94.15 14.12 14.12 32.01 s] ÷ (47), 32.01	Aug 89.87 1c 1d) 108.04 16.21 16.21 32.01 else (56) 32.01	Sep 93.70 109.33 16.40 30.98	97.52 Σ(44)1 127.42 Σ(45)1 19.11 19.11 32.01	101.34 12 = 139.09 12 = 20.86 20.86 30.98 30.98	105.17 1147.29 151.04 1504.28 22.66 110.00 0.02 1.03 0.60 1.03 32.01	 (44) (45) (46) (47) (51) (52) (53) (54) (55) (56) (57)

Primary circuit lo	ss for each	month fro	m Table 3										
	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
Combi loss for ea	ach month f	from Table	3a, 3b or 3	с									
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
Total heat requir	ed for wate	er heating o	calculated f	or each mo	nth 0.85 x	: (45)m + (4	6)m + (57)r	n + (59)m +	· (61)m				
	211.24	186.33	196.03	176.21	173.03	155.10	149.43	163.32	162.83	182.70	192.58	206.32	(62)
Solar DHW input	calculated	using Appe	endix 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 wat	er heater fo	or each mo	onth (kWh/i	month) (62	!)m + (63)n	n							
	211.24	186.33	196.03	176.21	173.03	155.10	149.43	163.32	162.83	182.70	192.58	206.32	
										∑(64)1	.12 = 2	155.12	(64)
Heat gains from	water heati	ing (kWh/n	nonth) 0.25	5 × [0.85 × ((45)m + (61	L)m] + 0.8 ×	[(46)m + (57)m + (59)	m]				
	96.08	85.30	91.02	83.60	83.37	76.58	75.53	80.15	79.15	86.59	89.04	94.44	(65)
5 Internal gain	e .												
J. Internal gain.	lan	Eeb	Mar	Apr	May	lun	tul.	Δυσ	Sen	Oct	Nov	Dec	
Metabolic gains	Jan (Table 5)	reb	Ividi	Арі	iviay	Jun	Jui	Aug	Seh	00	NOV	Dec	
wietabolic gains		120.20	120.29	120.29	120.20	120.29	120.29	120.20	120.20	120.20	120.29	120.20	(66)
Lighting gains (ca	lculated in	Annendix		129.20	129.20	123.20	129.20	129.20	129.20	129.20	129.20	129.20] (00)
LIGHTING BUILD (CC	20.85	18 52	15.06		8 52	7 10	7 77	10.11	12.56	17.22	20.10	21 / 2	(67)
Annliance gains (calculated	in Annendi	ix Lequatio	n 13 or 1	3a) also si	ee Table 5	1.11	10.11	15.50	17.22	20.10	21.45] (07)
Appliance Bailio (222.85	236.28	230.16	217 14	200 71	185.27	17/ 05	172 52	178.64	101.65	208.09	222 52	(68)
Cooking gains (ca	alculated in	Annendix	equation	115 or 115	a) also see	Table 5	174.95	172.52	178.04	191.05	208.09	223.33] (00)
COOKING Barris (CC	35.02	25.02	25.02	25.02	25 92	25.02	25.02	35.03	35.03	35.03	25.02	25.02	(60)
Pump and fan ga	ins (Table 5	55.55 (a)	55.55	55.55	33.33	33.33	33.33	55.55	35.55	55.55	55.55	55.55] (03)
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
Losses e g evano	pration (Tab	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00] (70)
200000 0.8. 01000	-103 42	-103 42	-103.42	-103 42	-103 42	-103 42	-103.42	-103.42	-103.42	-103 42	-103 42	-103 42	(71)
Water heating ga	ains (Table !	5)	105.12	103.12	103.12	100.12	103.12	103.12	103.12	103.12	103.12	103.12] (/ =/
	129 14	126.93	122 34	116 11	112.06	106 36	101 52	107 72	109 93	116 38	123 67	126 94	(72)
Total internal gai	ins (66)m +	· (67)m + (6	58)m + (69)i	m + (70)m ·	+ (71)m + (72)m	101.01	10777	200.00	110.00	120107] (' =/
	445.62	443.51	429.35	406.44	383.08	, 360.60	346.02	352,13	363,91	387.04	413.64	433.68	(73)
	113102	110.01	123.33	100.11	303.00	300.00	510.02	332.13	303.51	307.01	115.01	133.00] (, 3)
6. Solar gains													
			Access f	actor	Area	Sol	ar flux		g Sfia data	FF	1	Gains	
			Table	bu	m-	v	//m-	or Ta	able 6b	or Table	6c	vv	
North			0.7	7 x [2.09	x 1	0.63 x	0.9 x 0).40 x	0.80		4.93	(74)
NorthEast			0.7	7 X	21.08	x 1	1.28 x	0.9 x 0).40 x	0.80		52.74	(75)
Solar gains in wa	tts Σ(74)m	(82)m] (/
Ū	57.67	116.78	209.44	343.38	461.64	492.31	460.48	366.97	254.94	142.42	72.45	47.18	(83)
Total gains - inte	rnal and so	lar (73)m +	· (83)m					1			1		1, ,
	503.29	560.29	638.79	749.82	844.72	852.92	806.50	719.10	618.86	529.46	486.09	480.86	(84)
			1			•		1			1		
7. Mean interna	al temperat	ture (heati	ng season)										
Temperature dur	ring heating	g periods ir	n the living a	area from T	able 9, Th1	L(°C)						21.00	(85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor	for gains fo	or living are	ea n1,m (se	e Table 9a)		1		1			1		1
	1.00	1.00	0.99	0.93	0.77	0.56	0.41	0.48	0.78	0.97	1.00	1.00	(86)

SAP version 9.92

Mean internal te	mp of livin	g area T1 (s	teps 3 to 7	in Table 9c	:)								
	20.14	20.26	20.48	20.76	20.95	20.99	21.00	21.00	20.96	20.70	20.36	20.11	(87)
Temperature du	ring heating	g periods in	the rest of	dwelling fr	rom Table	9, Th2(°C)							
	20.20	20.20	20.20	20.20	20.20	20.20	20.20	20.20	20.20	20.20	20.20	20.20	(88)
Utilisation factor	for gains f	or rest of d	welling n2,	n									
	1.00	0.99	0.98	0.91	0.72	0.49	0.34	0.40	0.71	0.96	0.99	1.00	(89)
Mean internal te	mperature	in the rest	of dwelling	T2 (follow	steps 3 to	7 in Table 9	e)	•	•				
	19.04	19.21	19.53	19.92	20.15	20.20	20.20	20.20	20.17	19.84	19.36	18.99	(90)
Living area fracti	on	I			1	-1		1	Li,	ving area ÷	(4) =	0.31	(91)
Mean internal te	emperature	for the wh	ole dwellin	g fLA x T1 +	-(1 - fLA) x	T2				0 * **	.,		(-)
	19.38	19.53	19.82	20.18	20.40	20.44	20.45	20.45	20.41	20.11	19.67	19.34	(92)
Apply adjustmen	t to the me	an internal	temperati	ure from Ta	ble 4e wh	ere appropr	iate						(5-)
supply adjustifier		10.52	10.92	20.19	20.40	20.44	20.45	20.45	20.41	20.11	10.67	10.24	(02)
	19.30	19.55	19.82	20.18	20.40	20.44	20.43	20.45	20.41	20.11	19.07	15.54	(55)
8. Space heatin	g requirem	ient											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor	for gains, i	ηm											
	1.00	0.99	0.98	0.91	0.73	0.51	0.36	0.42	0.73	0.96	0.99	1.00	(94)
Useful gains, nm	Gm, W (94	l)m x (84)m			1	-1							
0 / 1	501.71	556.53	625.13	683.57	620.17	436.57	289.26	303.79	451.09	506.73	482.65	479.72	(95)
Monthly average	external to	emperature	from Tabl	e U1	020127		100.10	1 000110	102100	000110	102.00		(55)
	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	r mean inte	4.90	visture Im	0.90	v [(93)m	(96)ml	10.00	10.40	14.10	10.00	7.10	4.20	(90)
	1125 20		1002 57	940 11		420 74	200 E2	204 52	475.00	715 47	046.24	1120.47	(07)
Space beating re	auiromont	k\\/b/mon	1002.37	[(07)m]	[0.054.45]	435.74	289.33	304.33	475.00	/15.4/	940.24	1139.47	(97)
Space neating re			200.01	110.10			0.00	0.00	0.00	155.24	222 70	400.05	
	471.38	366.20	280.81	119.19	25.51	0.00	0.00	0.00	0.00	155.31	12	490.85	(00)
									∑(98	8)15, 10	12 =	2243.04	(98)
Space heating re	quirement	kWh/m²/ye	ear							(98)	÷ (4)	25.72	(99)
9b. Energy requ	uirements -	communit	y heating s	cheme									
Fraction of space	e heat from	secondary	/suppleme	ntary syster	m (table 1	1)				'0' if r	ione	0.00	(301)
Fraction of space	heat from	community	vsvstem	, -,		,				1 - (3()1) =	1.00	(302)
Fraction of com	nunity heat	from boile	rs							- (·-,	1.00	(303a)
Fraction of total	snace heat	from comp	unity boile	orc						(302) x (303	3a) =	1.00	(304a)
Factor for contro	and charg	ing method	t (Table 4c)	3)) for com	munity sn	ace heating				(302) x (303	~~,	1.00	(305)
Factor for chargi	ng method	(Table Ac(3)) for comr	nunity wat	er heating							1.00	(3052)
Distribution loss	factor (Tab	(10012 for		booting sy	etom							1.00	(206)
Distribution loss		ile 120/1010	Community	neating sy	stem							1.05	(300)
Constant in the second													
Space neating										1			(0.0)
Annual space ne	ating requi	rement							243.04				(98)
Space heat from	boilers							(98	3) x (304a) x	x (305) x (30)6) =	2355.19	(307a)
Water heating										7			
Annual water he	ating requi	rement						2	155.12				(64)
Water heat from	boilers							(64)	x (303a) x	(305a) x (30)6) =	2262.87	(310a)
Electricity used f	or heat dist	tribution					0.01	1 × [(307a)	(307e) + (3	310a)(310	e)] =	46.18	(313)
Electricity for pu	mps, fans a	ind electric	keep-hot (Table 4f)						_			
mechanical v	entilation f	ans - balanc	ed, extract	or positive	e input fro	m outside			55.33				(330a)

Total electricity for the above, kWh/year

Electricity for lighting (Appendix L)

Total delivered energy for all uses

		_
	55.33	(331)
	368.18	(332)
(307) + (309) + (310) + (312) + (315) + (331) + (332)(337b) =	5041.57	(338)

		Fuel		Fuel price		Fuel	
		kWh/year				cost £/year	_
Space heating from boilers		2355.19	х	4.24	x 0.01 =	99.86	(340a)
Water heating from boilers		2262.87	x	4.24	x 0.01 =	95.95	(342a)
Pumps and fans		55.33	x	13.19	x 0.01 =	7.30	(349)
Electricity for lighting		368.18	х	13.19	x 0.01 =	48.56	(350)
Additional standing charges					[120.00	(351)
Total energy cost				(340a)(342e) +	(345)(354) = [371.67	(355)
11b. SAP rating - community	heating scheme						
Energy cost deflator (Table 12)					[0.42	(356)
Energy cost factor (ECF)					[1.18	(357)
SAP value						83.53]
SAP rating (section 13)					[84	(358)
SAP band					[В]
12b. CO ₂ emissions - commun	nity heating scheme						
		Energy		Emission factor		Emissions	
		kWh/year				(kg/year)	
Emissions from other sources (space heating)						
Efficiency of boilers		94.00					
							(367a)
CO2 emissions from boilers	[(307a)+(310a)] x 100 ÷ (367a) =	4912.83	x	0.216	= [1061.17	(367a)] (367)
CO2 emissions from boilers Electrical energy for communit	[(307a)+(310a)] x 100 ÷ (367a) = y heat distribution	4912.83 46.18	x x	0.216	= [1061.17 23.97	(367a) (367) (372)
CO2 emissions from boilers Electrical energy for communit Total CO2 associated with com	[(307a)+(310a)] x 100 ÷ (367a) = y heat distribution munity systems	4912.83 46.18	x x	0.216	= [= [1061.17 23.97 1085.14	(367a) (367) (372) (373)
CO2 emissions from boilers Electrical energy for communit Total CO2 associated with com Total CO2 associated with space	[(307a)+(310a)] x 100 ÷ (367a) = y heat distribution munity systems re and water heating	4912.83 46.18	x x	0.216	= [= [1061.17 23.97 1085.14 1085.14	(367a) (367) (372) (373) (376)
CO2 emissions from boilers Electrical energy for communit Total CO2 associated with com Total CO2 associated with space Pumps and fans	[(307a)+(310a)] x 100 ÷ (367a) = y heat distribution munity systems se and water heating	4912.83 46.18 55.33	x x x	0.216 0.52 0.52	= [= [= [1061.17 23.97 1085.14 1085.14 28.71	(367a) (367) (372) (373) (376) (378)
CO2 emissions from boilers Electrical energy for communit Total CO2 associated with com Total CO2 associated with space Pumps and fans Electricity for lighting	[(307a)+(310a)] x 100 ÷ (367a) = y heat distribution munity systems re and water heating	4912.83 46.18 55.33 368.18	x x x x	0.216 0.52 0.52 0.52	= [= [= [= [1061.17 23.97 1085.14 1085.14 28.71 191.09	(367a)] (367)] (372)] (373)] (376)] (378)] (379)
CO2 emissions from boilers Electrical energy for communit Total CO2 associated with com Total CO2 associated with space Pumps and fans Electricity for lighting Total CO ₂ , kg/year	[(307a)+(310a)] x 100 ÷ (367a) = y heat distribution munity systems are and water heating	4912.83 46.18 55.33 368.18	x x x x x	0.216 0.52 0.52 0.52	= [= [= [= [(376)(382) = [1061.17 23.97 1085.14 1085.14 28.71 191.09 1304.94	(367a) (367) (372) (373) (376) (378) (379) (383)
CO2 emissions from boilers Electrical energy for communit Total CO2 associated with com Total CO2 associated with space Pumps and fans Electricity for lighting Total CO ₂ , kg/year Dwelling CO ₂ emission rate	[(307a)+(310a)] x 100 ÷ (367a) = y heat distribution munity systems re and water heating	4912.83 46.18 55.33 368.18	x x x x	0.216 0.52 0.52 0.52	= [= [= [(376)(382) = [(383) ÷ (4) = [1061.17 23.97 1085.14 1085.14 28.71 191.09 1304.94 14.96	(367a) (367) (372) (373) (376) (378) (378) (379) (383) (384)
CO2 emissions from boilers Electrical energy for communit Total CO2 associated with com Total CO2 associated with space Pumps and fans Electricity for lighting Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value	[(307a)+(310a)] x 100 ÷ (367a) = y heat distribution munity systems re and water heating	4912.83 46.18 55.33 368.18	x x x x	0.216 0.52 0.52 0.52	= [= [= [(376)(382) = [(383) ÷ (4) = [1061.17 23.97 1085.14 1085.14 28.71 191.09 1304.94 14.96 86.77	(367a) (367) (372) (373) (376) (378) (378) (379) (383) (384)
CO2 emissions from boilers Electrical energy for communit Total CO2 associated with com Total CO2 associated with space Pumps and fans Electricity for lighting Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14)	[(307a)+(310a)] x 100 ÷ (367a) = y heat distribution munity systems and water heating	4912.83 46.18 55.33 368.18	x x x x	0.216 0.52 0.52 0.52	= [= [= [(376)(382) = [(383) ÷ (4) = [1061.17 23.97 1085.14 1085.14 28.71 191.09 1304.94 14.96 86.77 87	(367a) (367) (372) (373) (376) (378) (378) (379) (383) (384) (385)
CO2 emissions from boilers Electrical energy for communit Total CO2 associated with com Total CO2 associated with space Pumps and fans Electricity for lighting Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14) El band	[(307a)+(310a)] x 100 ÷ (367a) = y heat distribution munity systems are and water heating	4912.83 46.18 55.33 368.18	x x x x	0.216 0.52 0.52 0.52	= [= [= [(376)(382) = [(383) ÷ (4) = [1061.17 23.97 1085.14 1085.14 28.71 191.09 1304.94 14.96 86.77 87 B	(367a) (367) (372) (373) (376) (378) (379) (383) (384) (385)
CO2 emissions from boilers Electrical energy for communit Total CO2 associated with com Total CO2 associated with space Pumps and fans Electricity for lighting Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14) El band 13b. Primary energy - commu	[(307a)+(310a)] x 100 ÷ (367a) = y heat distribution munity systems re and water heating	4912.83 46.18 55.33 368.18	x x x x	0.216 0.52 0.52 0.52	= [= [= [(376)(382) = [(383) ÷ (4) = [[1061.17 23.97 1085.14 1085.14 28.71 191.09 1304.94 14.96 86.77 87 B	(367a) (367) (372) (373) (376) (378) (379) (383) (384) (385)

Primary energy from other sources (space heating)						
Efficiency of boilers	94.00					(367a)
Primary energy from boilers [(307a)+(310a)] x 100 ÷ (367a) = 4912.83	х	1.22	=	5993.65	(367)
Electrical energy for community heat distribution	46.18	x	3.07	=	141.77	(372)
Total primary energy associated with community systems					6135.43	(373)
Total primary energy associated with space and water heating					6135.43	(376)
Pumps and fans	55.33	x	3.07	=	169.85	(378)
Electricity for lighting	368.18	x	3.07	=	1130.31	(379)
Primary energy kWh/year					7435.59	(383)


Assessor name		Miss Jayr	na Parmar						Assessor nur	nber	6549		
Client									Last modified	d	23/11	/2016	
Address		A-L04-60	A Centric (Close, Lond	on, N8								
1. Overall dwellin	ng dimen	sions											
					ļ	Area (m²)		ľ	Average storey height (m)	1	Vo	lume (m³)	
Lowest occupied						49.39] (1a) x	Ē	2.50	(2a) =		123.48	(3a)
Total floor area		(1a)	+ (1b) + (1e	c) + (1d)(1n) =	49.39	(4)						
Dwelling volume									(3a) + (3b) + (3	3c) + (3d)(3	3n) =	123.48	(5)
2. Ventilation rat	e									_			
											m	³ per hour	
Number of chimne	eys							Γ	0	x 40 =	:	0	(6a)
Number of open fl	ues							Ē	0	x 20 =	: [0	(6b)
Number of intermi	ittent fan	S						Ē	0	x 10 =	:	0	(7a)
Number of passive	e vents							Γ	0	x 10 =	:	0	(7b)
Number of flueless	s gas fires	5							0	x 40 =	:	0	(7c)
											Air o	hanges pei hour	r
Infiltration due to	chimneys	s, flues, fan	s, PSVs		(6a) + (6b) + (7	7a) + (7b) + ((7c) = 🗌	0	÷ (5) =	-	0.00	(8)
If a pressurisation	test has l	been carrie	d out or is ii	ntended, p	roceed to	(17), otherv	vise continu	le from	(9) to (16)				
Air permeability va	alue, q50,	expressed	in cubic me	etres per h	our per sq	uare metre	of envelop	e area				4.00	(17)
If based on air peri	meability	value, the	n (18) = [(17	7) ÷ 20] + (8	3), otherw	ise (18) = (1	.6)					0.20	(18)
Number of sides of	n which t	he dwelling	g is sheltere	ed								3	(19)
Shelter factor									1	- [0.075 x (1	9)] =	0.78	(20)
Infiltration rate inc	corporati	ng shelter f	actor							(18) x (2	20) =	0.16	(21)
Infiltration rate mo	odified fo	r monthly v	wind speed	:									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Au	g Sep	Oct	Nov	Dec	
Monthly average v	vind spee	ed from Tab	ole U2				_			_			_
	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	0 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	3 1.00	1.08	1.13	1.18	(22a)
Adjusted infiltratio	on rate (a	llowing for	shelter and	l wind fact	or) (21) x (22a)m				-			-
	0.20	0.19	0.19	0.17	0.17	0.15	0.15	0.14	4 0.16	0.17	0.17	0.18	(22b)
Calculate effective	air chan	ge rate for	the applical	ble case:									-
If mechanical v	entilatior	n: air chang	e rate throu	ugh system	I							0.50	_ (23a)
If balanced with	h heat reo	covery: effi	ciency in %	allowing fo	or in-use fa	actor from	Table 4h					N/A	(23c)
c) whole house	extract v	entilation o	or positive i	nput venti	lation fron	n outside	1	1	- 1		1		٦.
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0 0.50	0.50	0.50	0.50	(24c)
Effective air chang	e rate - e	nter (24a) o	or (24b) or ((24c) or (24	1d) in (25)		1	1	- 1		1		٦.
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(25)



3. Heat losses and heat loss parameter								
Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m²K	A x U W/	К к-valu kJ/m²	е, Ахк, К kJ/К	
Window			12.36	x 1.24	= 15.27		(2	27)
External wall			6.99	x 0.18	= 1.26		(2	29a)
Party wall			53.62	x 0.00	= 0.00		(3	32)
Total area of external elements ΣA , m ²			19.35				(3	31)
Fabric heat loss, $W/K = \sum(A \times U)$					(26)	(30) + (32) =	= 16.53 (3	33)
Heat capacity Cm = Σ(A x κ)				(28).	(30) + (32) +	(32a)(32e) =	= N/A (S	34)
Thermal mass parameter (TMP) in kJ/m²K							250.00 (3	35)
Thermal bridges: $\Sigma(L \times \Psi)$ calculated using App	endix K						4.11 (3	36)
Total fabric heat loss						(33) + (36) =	= 20.64 (3	37)
Jan Feb Mar	Apr	May	Jun .	Jul Aug	Sep	Oct	Nov Dec	
Ventilation heat loss calculated monthly 0.33	(25)m x (5)							
20.37 20.37 20.37	20.37	20.37	20.37 20	0.37 20.37	20.37	20.37 2	0.37 20.37 (3	38)
Heat transfer coefficient, W/K $(37)m + (38)m$								
41.01 41.01 41.01	41.01	41.01	41.01 43	1.01 41.01	41.01	41.01 4	1.01 41.01	
					Average = ∑(39)112/12 :	= 41.01 (3	39)
Heat loss parameter (HLP), W/m ² K (39)m \div (4)								
0.83 0.83 0.83	0.83	0.83	0.83 0	0.83 0.83	0.83	0.83	0.83 0.83	
					Average = ∑(40)112/12 =	= 0.83 (4	40)
Number of days in month (Table 1a)								
31.00 28.00 31.00	30.00	31.00	30.00 3	1.00 31.00	30.00	31.00 3	0.00 31.00 (4	40)
4. Water heating energy requirement								
Assumed occupancy, N							1.67 (4	42)
Assumed occupancy, N Annual average hot water usage in litres per da	iy Vd,average =	(25 x N) + 3	36				1.67 (4 73.91 (4	42) 43)
Assumed occupancy, N Annual average hot water usage in litres per da Jan Feb Mar	y Vd,average = Apr	(25 x N) + 3 May	36 Jun	Jul Aug	Sep	Oct	1.67 (4 73.91 (4 Nov Dec	42) 43)
Assumed occupancy, N Annual average hot water usage in litres per da Jan Feb Mar Hot water usage in litres per day for each mon	y Vd,average = Apr th Vd,m = factor	(25 x N) + 3 May r from Tabl	36 Jun e 1c x (43)	Jul Aug	Sep	Oct	1.67 (2 73.91 (2 Nov Dec	42) 43)
Assumed occupancy, N Annual average hot water usage in litres per da Jan Feb Mar Hot water usage in litres per day for each mon 81.31 78.35 75.39	iy Vd,average = Apr th Vd,m = factor 72.44	(25 x N) + 3 May r from Tabl 69.48	36 Jun . e 1c x (43) 66.52 66	Jul Aug 6.52 69.48	Sep 72.44	Oct 75.39 7	1.67 (4 73.91 (4 Nov Dec 8.35 81.31	42) 43)
Assumed occupancy, N Annual average hot water usage in litres per da Jan Feb Mar Hot water usage in litres per day for each mon 81.31 78.35 75.39	y Vd,average = Apr th Vd,m = factor 72.44	(25 x N) + : May r from Tabl 69.48	36 Jun . e 1c x (43) 66.52 60	Jul Aug 6.52 69.48	Sep 72.44	Oct 75.39 7 Σ(44)112 =	1.67 (4 73.91 (4 Nov Dec 8.35 81.31 = 886.96 (4	42) 43) 44)
Assumed occupancy, N Annual average hot water usage in litres per da Jan Feb Mar Hot water usage in litres per day for each mon 81.31 78.35 75.39 Energy content of hot water used = 4.18 x Vd,r	ny Vd,average = Apr th Vd,m = factor 72.44	(25 x N) + : May r from Tabl 69.48 00 kWh/ma	36 Jun . e 1c x (43) 66.52 60 onth (see Tabl	Jul Aug 6.52 69.48 es 1b, 1c 1d)	Sep 72.44	Oct 75.39 7 Σ(44)112 =	1.67 (2 73.91 (2 Nov Dec 8.35 81.31 = 886.96 (2	42) 43) 44)
Assumed occupancy, N Annual average hot water usage in litres per da Jan Feb Mar Hot water usage in litres per day for each mon 81.31 78.35 75.39 Energy content of hot water used = 4.18 x Vd,r 120.57 105.45 108.8	IV Vd,average = Apr th Vd,m = factor 72.44 n x nm x Tm/360 2 94.87	(25 x N) + : May r from Tabl 69.48 00 kWh/mo 91.03	36 Jun e 1c x (43) 66.52 60 onth (see Tabl 78.55 72	Jul Aug 6.52 69.48 les 1b, 1c 1d) 2.79 2.79 83.53	Sep 72.44 84.53	Oct 75.39 7 ∑(44)112 = 98.51 10	$ \begin{array}{c c} 1.67 & (4) \\ \hline 73.91 & (4) \\ Nov & Dec \\ \hline 8.35 & 81.31 \\ = & 886.96 & (4) \\ 07.53 & 116.77 \\ \end{array} $	42) 43) 44)
Assumed occupancy, N Annual average hot water usage in litres per da Jan Feb Mar Hot water usage in litres per day for each mon $\boxed{81.31}$ 78.35 75.39 Energy content of hot water used = 4.18 x Vd,r $\boxed{120.57}$ 105.45 108.8	y Vd,average = Apr th Vd,m = factor 72.44 n x nm x Tm/360 2 94.87	(25 x N) + : May r from Tabl 69.48 00 kWh/mo 91.03	36 Jun . e 1c x (43) 66.52 60 onth (see Tabl 78.55 72	Jul Aug 6.52 69.48 les 1b, 1c 1d) 2.79 83.53	Sep 72.44 84.53	Oct 75.39 ζ(44)112 98.51 10 ζ(45)112	$ \begin{array}{c c} 1.67 & (2) \\ \hline 73.91 & (2) \\ \hline 8.35 & 81.31 \\ \hline 8.35 & 81.31 \\ \hline 8.886.96 & (2) \\ \hline 07.53 & 116.77 \\ \hline 1162.95 & (2) \\ \hline \end{array} $	42) 43) 44) 45)
Assumed occupancy, N Annual average hot water usage in litres per day I an Feb Mar Hot water usage in litres per day for each mon $\boxed{81.31}$ 78.35 75.39 Energy content of hot water used = 4.18 x Vd,r $\boxed{120.57}$ 105.45 108.83 Distribution loss 0.15 x (45)m	y Vd,average = Apr th Vd,m = factor 72.44 n x nm x Tm/360 94.87	(25 x N) + : May r from Tabl 69.48 00 kWh/mo 91.03	36 Jun . e 1c x (43) 66.52 66 onth (see Tabl 78.55 72	Jul Aug 6.52 69.48 les 1b, 1c 1d) 2.79 83.53	Sep 72.44 84.53	Oct 75.39 7 Σ(44)112 98.51 1 Σ(45)112	$ \begin{array}{c c} 1.67 & (4) \\ \hline 73.91 & (4) \\ \hline Nov & Dec \\ \hline 8.35 & 81.31 \\ \hline = & 886.96 & (4) \\ \hline 07.53 & 116.77 \\ \hline = & 1162.95 & (4) \\ \hline \end{array} $	42) 43) 44) 45)
Assumed occupancy, N Annual average hot water usage in litres per day I an Feb Mar Hot water usage in litres per day for each mon $\boxed{81.31}$ 78.35 75.39 Energy content of hot water used = 4.18 x Vd,r $\boxed{120.57}$ 105.45 108.82 Distribution loss 0.15 x (45)m $\boxed{18.09}$ 15.82 16.32	y Vd,average = Apr th Vd,m = factor 72.44 n x nm x Tm/360 94.87 14.23	(25 x N) + : May r from Tabl 69.48 00 kWh/mc 91.03 13.65	36 Jun e 1c x (43) 66.52 60 onth (see Tabl 78.55 72 11.78 10	Jul Aug 6.52 69.48 es 1b, 1c 1d) 2.79 83.53	Sep 72.44 84.53 12.68	Oct 7 75.39 7 Σ(44)112 1 98.51 1 Σ(45)112 1 14.78 1	$ \begin{array}{c c} 1.67 & (2) \\ \hline 73.91 & (2) \\ \hline Nov & Dec \\ \hline 8.35 & 81.31 \\ \hline 8.35 & 81.31 \\ \hline 8.35 & 81.31 \\ \hline \hline 8.35 & 116.77 \\ \hline \hline 1162.95 & (2) \\ \hline 6.13 & 17.52 & (2) \\ \hline \end{array} $	42) 43) 44) 45) 46)
Assumed occupancy, N Annual average hot water usage in litres per day I an Feb Mar Hot water usage in litres per day for each mon $\boxed{81.31}$ 78.35 75.39 Energy content of hot water used = 4.18 x Vd,r $\boxed{120.57}$ 105.45 108.82 Distribution loss 0.15 x (45)m $\boxed{18.09}$ 15.82 16.32 Storage volume (litres) including any solar or V	y Vd,average = Apr th Vd,m = factor 72.44 n x nm x Tm/360 94.87 14.23 /WHRS storage	(25 x N) + : May r from Tabl 69.48 00 kWh/mo 91.03 13.65 within sam	36 Jun e 1c x (43) 66.52 60 onth (see Tabl 78.55 72 11.78 10 e vessel	Jul Aug 6.52 69.48 es 1b, 1c 1d) 2.79 2.79 83.53 0.92 12.53	Sep 72.44 84.53 12.68	Oct 75.39 7 Σ(44)112 98.51 1 Σ(45)112 14.78	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	 42) 43) 44) 45) 46) 47)
Assumed occupancy, N Annual average hot water usage in litres per day I an Feb Mar Hot water usage in litres per day for each mon $\boxed{81.31}$ 78.35 75.39 Energy content of hot water used = 4.18 x Vd,r $\boxed{120.57}$ 105.45 108.8 Distribution loss $0.15 \times (45)m$ $\boxed{18.09}$ 15.82 16.32 Storage volume (litres) including any solar or W Water storage loss:	y Vd,average = Apr th Vd,m = factor 72.44 n x nm x Tm/360 94.87 14.23 /WHRS storage	(25 x N) + : May r from Tabl 69.48 00 kWh/me 91.03 13.65 within sam	36 Jun e 1c x (43) 66.52 60 onth (see Tabl 78.55 7: 11.78 10 ne vessel	Jul Aug 6.52 69.48 les 1b, 1c 1d) 2.79 2.79 83.53 0.92 12.53	Sep 72.44 84.53 12.68	Oct 75.39 7 Σ(44)112 98.51 1 Σ(45)112 14.78	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	42) 43) 44) 45) 46) 47)
Assumed occupancy, N Annual average hot water usage in litres per day Hot water usage in litres per day for each mon $\boxed{81.31}$ 78.35 75.39 Energy content of hot water used = $4.18 \times Vd$,r $\boxed{120.57}$ 105.45 108.82 Distribution loss $0.15 \times (45)m$ $\boxed{18.09}$ 15.82 16.32 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr	y Vd,average = Apr th Vd,m = factor 72.44 n x nm x Tm/360 94.87 14.23 /WHRS storage nown	(25 x N) + 3 May r from Tabl 69.48 00 kWh/ma 91.03 13.65 within sam	36 Jun e 1c x (43) 66.52 60 onth (see Tabl 78.55 72 11.78 10 e vessel	Jul Aug 6.52 69.48 es 1b, 1c 1d) 2.79 2.79 83.53 0.92 12.53	Sep 72.44 84.53 12.68	Oct 75.39 ζ(44)112 98.51 1 ζ(45)112 14.78	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	42) 43) 44) 45) 46) 47)
Assumed occupancy, N Annual average hot water usage in litres per day I an Feb Mar Hot water usage in litres per day for each mon $\boxed{81.31}$ 78.35 75.39 Energy content of hot water used = 4.18 x Vd,r $\boxed{120.57}$ 105.45 108.82 Distribution loss 0.15 x (45)m $\boxed{18.09}$ 15.82 16.32 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 (y Vd,average = Apr th Vd,m = factor 72.44 n x nm x Tm/360 94.87 14.23 /WHRS storage hown kWh/litre/day)	(25 x N) + : May r from Tabl 69.48 00 kWh/mo 91.03 13.65 within sam	36 Jun e 1c x (43) 66.52 66 onth (see Tabl 78.55 72 11.78 10 ne vessel	Jul Aug 6.52 69.48 les 1b, 1c 1d) 2.79 2.79 83.53 0.92 12.53	Sep 72.44 84.53 12.68	Oct 7 75.39 7 Σ(44)112 7 98.51 1 Σ(45)112 1 14.78 1	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	 42) 43) 44) 45) 46) 47) 51)
Assumed occupancy, N Annual average hot water usage in litres per day Hot water usage in litres per day for each mon 81.31 78.35 75.39 Energy content of hot water used = $4.18 \times Vd$,r 120.57 105.45 108.82 Distribution loss $0.15 \times (45)m$ 18.09 15.82 16.32 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 (Volume factor from Table 2a	y Vd,average = Apr th Vd,m = factor 72.44 n x nm x Tm/360 94.87 14.23 /WHRS storage hown kWh/litre/day)	(25 x N) + 3 May r from Tabl 69.48 00 kWh/ma 91.03 13.65 within sam	36 Jun e 1c x (43) 66.52 60 onth (see Tabl 78.55 72 11.78 10 e vessel	Jul Aug 6.52 69.48 es 1b, 1c 1d) 2.79 2.79 83.53 0.92 12.53	Sep 72.44 84.53 12.68	Oct 7 75.39 7 Σ(44)112 7 98.51 1 Σ(45)112 1 14.78 1	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	 42) 43) 44) 45) 46) 47) 51) 52)
Assumed occupancy, N Annual average hot water usage in litres per day Jan Feb Mar Hot water usage in litres per day for each mon 81.31 78.35 75.39 Energy content of hot water used = 4.18 x Vd,r 120.57 105.45 108.82 Distribution loss 0.15 x (45)m 18.09 15.82 16.32 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 Volume factor from Table 2a Temperature factor from Table 2b	y Vd,average = Apr th Vd,m = factor 72.44 n x nm x Tm/360 94.87 14.23 /WHRS storage hown kWh/litre/day)	(25 x N) + : May r from Tabl 69.48 00 kWh/mo 91.03 13.65 within sam	36 Jun e 1c x (43) 66.52 66 onth (see Tabl 78.55 72 11.78 10 e vessel	Jul Aug 6.52 69.48 les 1b, 1c 1d) 2.79 2.79 83.53 0.92 12.53	Sep 72.44 84.53 12.68	Oct 75.39 7 Σ(44)112 98.51 1 Σ(45)112 14.78	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	 42) 43) 44) 45) 46) 47) 51) 52) 53)
Assumed occupancy, N Annual average hot water usage in litres per day Hot water usage in litres per day for each mon 81.31 78.35 75.39 Energy content of hot water used = $4.18 \times Vd$,r 120.57 105.45 108.8 Distribution loss $0.15 \times (45)m$ 18.09 15.82 16.32 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 Volume factor from Table 2 Energy lost from water storage (kWh/day)	y Vd,average = Apr th Vd,m = factor 72.44 n x nm x Tm/360 94.87 14.23 /WHRS storage hown kWh/litre/day) (47) x (51) x (52	(25 x N) + : May r from Tabl 69.48 00 kWh/ma 91.03 13.65 within sam	36 Jun e 1c x (43) 66.52 60 onth (see Tabl 78.55 7: 11.78 10 ne vessel	Jul Aug 6.52 69.48 les 1b, 1c 1d) 2.79 2.79 83.53 0.92 12.53	Sep 72.44 84.53 12.68	Oct 75.39 7 Σ(44)112 1 98.51 1 Σ(45)112 1 14.78 1	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	 42) 43) 44) 45) 46) 47) 51) 52) 53) 54)
Assumed occupancy, N Annual average hot water usage in litres per day I an Feb Mar Hot water usage in litres per day for each mon 81.31 78.35 75.39 Energy content of hot water used = 4.18 x Vd,r 120.57 105.45 108.82 Distribution loss 0.15 x (45)m 18.09 15.82 16.32 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 (Volume factor from Table 2a Temperature factor from Table 2b Energy lost from water storage (kWh/day) Enter (50) or (54) in (55)	y Vd,average = Apr th Vd,m = factor 72.44 n x nm x Tm/360 94.87 14.23 /WHRS storage town kWh/litre/day) (47) x (51) x (52	(25 x N) + : May r from Tabl 69.48 00 kWh/ma 91.03 13.65 within sam	36 Jun e 1c x (43) 66.52 60 onth (see Tabl 78.55 72 11.78 10 e vessel 11.78 10	Jul Aug 6.52 69.48 les 1b, 1c 1d) 2.79 2.79 83.53 0.92 12.53	Sep 72.44 84.53 12.68	Oct 75.39 7 Σ(44)112 1 98.51 1 Σ(45)112 1 14.78 1	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	 42) 43) 44) 45) 46) 47) 51) 52) 53) 54) 55)
Assumed occupancy, N Annual average hot water usage in litres per day Hot water usage in litres per day for each mon 81.31 78.35 75.39 Energy content of hot water used = $4.18 \times Vd$,r 120.57 105.45 108.8 Distribution loss 0.15 x (45)m 18.09 15.82 16.32 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 Volume factor from Table 2a Temperature factor from Table 2b Energy lost from water storage (kWh/day) Enter (50) or (54) in (55) Water storage loss calculated for each month	y Vd,average = Apr th Vd,m = factor 72.44 n x nm x Tm/360 94.87 14.23 /WHRS storage hown kWh/litre/day) (47) x (51) x (52 (55) x (41)m	(25 x N) + : May r from Tabl 69.48 00 kWh/me 91.03 13.65 within sam	36 Jun e 1c x (43) 66.52 60 onth (see Tabl 78.55 72 11.78 10 e vessel 11.78 10	Jul Aug 6.52 69.48 les 1b, 1c 1d) 2.79 2.79 83.53 0.92 12.53	Sep 72.44 84.53 12.68	Oct 75.39 7 Σ(44)112 1 98.51 1 Σ(45)112 1 14.78 1	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	 42) 43) 44) 45) 46) 47) 51) 52) 53) 54) 55)
Assumed occupancy, N Annual average hot water usage in litres per day I an Feb Mar Hot water usage in litres per day for each mon 81.31 78.35 75.39 Energy content of hot water used = $4.18 \times Vd$,r 120.57 105.45 108.82 Distribution loss $0.15 \times (45)m$ 18.09 15.82 16.32 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 (Volume factor from Table 2a Temperature factor from Table 2b Energy lost from water storage (kWh/day) Enter (50) or (54) in (55) Water storage loss calculated for each month 32.01 28.92 32.01	Apr Apr th Vd,m = factor 72.44 14.23 94.87 14.23 /WHRS storage town kWh/litre/day) (47) x (51) x (52 (55) x (41)m 30.98	(25 x N) + : May r from Tabl 69.48 00 kWh/ma 91.03 13.65 within sam within sam 2) x (53)	36 Jun	Jul Aug 6.52 69.48 es 1b, 1c 1d) 2.79 83.53 0.92 12.53 0.92 32.01	Sep 72.44 84.53 12.68 30.98	Oct 7 75.39 7 Σ(44)112 1 98.51 1 Σ(45)112 1 14.78 1 32.01 3	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	 42) 43) 44) 45) 46) 47) 51) 52) 53) 54) 55) 56)
Assumed occupancy, N Annual average hot water usage in litres per day I an Feb Mar Hot water usage in litres per day for each mon 81.31 78.35 75.39 Energy content of hot water used = 4.18 x Vd,r 120.57 105.45 108.83 Distribution loss 0.15 x (45)m 18.09 15.82 16.32 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 (Volume factor from Table 2a Temperature factor from Table 2b Energy lost from water storage (kWh/day) Enter (50) or (54) in (55) Water storage loss calculated for each month 32.01 28.92 32.01 If the vessel contains dedicated solar storage of	Apr Apr th Vd,m = factor 72.44 n x nm x Tm/360 94.87 14.23 /WHRS storage hown kWh/litre/day) (47) x (51) x (52) (55) x (41)m 30.98 r dedicated WW	(25 x N) + : May r from Tabl 69.48 00 kWh/mo 91.03 13.65 within sam t) x (53) 32.01 VHRS (56)m	36 Jun e 1c x (43) 66.52 60 onth (see Tabl 78.55 72 11.78 10 e vessel 11.78 30.98 32 n x [(47) - Vs] =	Jul Aug 6.52 69.48 les 1b, 1c 1d) 2.79 83.53 0.92 12.53 0.92 12.53 2.01 32.01 ÷ (47), else (56)	Sep 72.44 84.53 12.68 30.98	Oct 7 75.39 7 Σ(44)112 1 98.51 1 Σ(45)112 1 14.78 1 32.01 3	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	 42) 43) 44) 45) 46) 47) 51) 52) 53) 54) 55) 56)

$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Primary circuit	oss for each	month fro	m Table 3										
Contbillos for each month from Table 3a, 3b or 3c 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0		23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26 (59)
$ \begin{array}{ $	Combi loss for e	ach month	from Table	3a, 3b or 3	с									
Total hear required for water heating calculated for each month 0.8.8 x (d5)m (46)m (16)m (15)m + (15)m (16)m (15)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 (6	61)
$ \begin{array}{ $	Total heat requi	red for wat	er heating o	calculated f	or each mo	onth 0.85 x	(45)m + (4	6)m + (57)r	n + (59)m +	- (61)m				
Solar DHW input calculated using Appendix G or Appendix H 0.00 0.		175.85	155.38	164.10	148.36	146.31	132.05	128.07	138.81	138.02	153.78	161.02	172.05 (6	62)
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	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 (6	63)
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Output from wa	iter heater f	or each mo	onth (kWh/i	month) (62	2)m + (63)n	n							
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		175.85	155.38	164.10	148.36	146.31	132.05	128.07	138.81	138.02	153.78	161.02	172.05	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $				•							<u>Σ(64)1</u>	12 = 1	.813.79 (6	64)
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Heat gains from	water heat	ing (kWh/n	nonth) 0.2	5 × [0.85 ×	(45)m + (61	L)m] + 0.8 ×	[(46)m + (5	57)m + (59)	m]				
S. Internal gains Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Metabolic gains (Table 5) 83.61 66.83 66.69 66.71 111.33 113.63 31.36		84.31	75.01	80.40	74.34	74.49	68.91	68.42	71.99	70.90	76.98	78.55	83.05 (6	65)
S. Internal gains Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Retabolic gains (Table 5) 83.61													· · · · · · · · · · · · · · · · · · ·	
jan řeb Mar Áya May jun jun Aug Sep Oct Nov Dec Matability (Table 5) 83.61	5. Internal gair	าร												
Metabolic gains (Table 5) B3.61		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Metabolic gains	(Table 5)												
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 $ \begin{array}{c c c c c c c c c c c c c c c c c c c $		83.61	83.61	83.61	83.61	83.61	83.61	83.61	83.61	83.61	83.61	83.61	83.61 (6	66)
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	Lighting gains (c	alculated in	Appendix	L, equation	L9 or L9a),	also see Ta	able 5							
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 145.65 147.16 143.35 135.24 125.01 115.39 108.96 107.45 111.26 119.37 129.60 139.22 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 31.36<		12.98	11.53	9.38	7.10	5.31	4.48	4.84	6.29	8.45	10.73	12.52	13.35 (6	67)
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Appliance gains	(calculated	in Appendi	x L, equatio	on L13 or L1	L3a), also s	ee Table 5							
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 $\begin{array}{ c c c c c c c c c c c c c c c c c c c$		145.65	147.16	143.35	135.24	125.01	115.39	108.96	107.45	111.26	119.37	129.60	139.22 (6	68)
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	Cooking gains (c	alculated in	Appendix	L, equation	L15 or L15	a), also see	e Table 5							
Pump and fan gains (Table 5a) 0.00 0.00		31.36	31.36	31.36	31.36	31.36	31.36	31.36	31.36	31.36	31.36	31.36	31.36 (6	69)
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Pump and fan g	ains (Table !	5a)	•		•						•		
Losses e.g. evaporation (Table 5) $\begin{array}{c ccccccccccccccccccccccccccccccccccc$		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 (70)
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Losses e.g. evap	oration (Tal	ole 5)										· ·	
Water heating gains (Table 5) $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		-66.89	-66.89	-66.89	-66.89	-66.89	-66.89	-66.89	-66.89	-66.89	-66.89	-66.89	-66.89 (71)
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Water heating g	ains (Table	5)										,	,
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		113 32	111 62	108.07	103 25	100 12	95 71	91 97	96 77	98 47	103 46	109.09	111.62 (72)
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Total internal ga	ains (66)m -	+ (67)m + (f	58)m + (69)	m + (70)m ·	+ (71)m + (72)m	51.57	50.77	50.17	100.10	105.05	111.02	,
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		320.04	318 39	308.88	293.68	278 52	263.67	253.86	258 59	266.26	281.64	299.30	312.27 (73)
6. Solar gains Access factor Table 6d Area m ² Solar flux W/m ² g specific data or Table 6b FF specific data or Table 6c Gains W SouthWest 0.77 x 12.36 x 36.79 $v.0.9$ x 0.40 x 0.80 = 100.85 (79) Solar gains in watts $\Sigma(74)$ m(82)m 100.85 171.79 235.04 291.23 326.20 323.84 312.22 286.13 254.50 189.86 120.80 86.31 (83) Total gains - internal and solar (73)m + (83)m 420.89 490.18 543.93 584.91 604.72 587.51 566.08 544.72 520.77 471.50 420.09 398.58 (84) Temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1(°C) 21.00 (85) Jan Feb May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains for living area n1, m (see Table 9a) 0.98 0.96 0.90 0.79 0.62 0.45 0.32 0.35 0.54		520.04	518.55	508.88	235.08	278.52	203.07	255.80	238.33	200.20	201.04	299.30	512.27	73)
Access factor Table 6d Area m ² Solar flux W/m ² g specific data or Table 6b FF specific data or Table 6c Gains W SouthWest 0.77 x 12.36 x 36.79 x 0.9 x 0.40 x 0.80 = 100.85 (79) SouthWest 0.77 x 12.36 x 36.79 $x 0.9$ x 0.40 x 0.80 = 100.85 (79) Solar gains in watts $\Sigma(74)$ m(82)m 100.85 171.79 235.04 291.23 326.20 323.84 312.22 286.13 254.50 189.86 120.80 86.31 (83) Total gains - internal and solar (73)m + (83)m 420.89 490.18 543.93 584.91 604.72 587.51 566.08 544.72 520.77 471.50 420.09 398.58 (84) Temperature during heating periods in the living area from Table 9, Th1(°C) 21.00 (85) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains for living area 11 (steps 3 to 7 in Table 9c)	6. Solar gains													
Table 6d m² W/m² specific data or Table 6b specific data or Table 6c W SouthWest 0.77 x 12.36 x 36.79 $x 0.9 \times 0.40$ x 0.80 = 100.85 (79) Solar gains in watts $\Sigma(74)$ m(82)m 100.85 171.79 235.04 291.23 326.20 323.84 312.22 286.13 254.50 189.86 120.80 86.31 (83) Total gains - internal and solar (73)m + (83)m 420.89 490.18 543.93 584.91 604.72 587.51 566.08 544.72 520.77 471.50 420.09 398.58 (84) Temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1(°C) 21.00 (85) Question factor for gains for living area n1,m (see Table 9a) Utilisation factor for gains for living area n1,m (see Table 9a) 0.96 0.90 0.79 0.62 0.45 0.32 0.54 0.82 0.96 0.99 (86)				Access f	actor	Area	Sola	ar flux		g	FF		Gains	
SouthWest 0.77 x 12.36 x 36.79 x 0.9 x 0.80 = 100.85 (79) Solar gains in watts ∑(74)m(82)m 100.85 171.79 235.04 291.23 326.20 323.84 312.22 286.13 254.50 189.86 120.80 86.31 (83) Total gains - internal and solar (73)m + (83)m 420.89 490.18 543.93 584.91 604.72 587.51 566.08 544.72 520.77 471.50 420.09 398.58 (84) Temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1(°C) 21.00 (85) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains for living area n1,m (see Table 9a) 0.98 0.96 0.90 0.79 0.62 0.45 0.32 0.35 0.54 0.82 0.96 0.99 (86)				Table	6d	m²	N	//m²	spec or T	ific data able 6b	specific c	lata 60	W	
Solutivest 0.77 x 12.36 x 36.79 x 0.9 x 0.9 x 0.40 x 0.80 = 100.85 (79) Solar gains in watts $\Sigma(74)$ m(82)m 100.85 171.79 235.04 291.23 326.20 323.84 312.22 286.13 254.50 189.86 120.80 86.31 (83) Total gains - internal and solar (73)m + (83)m 420.89 490.18 543.93 584.91 604.72 587.51 566.08 544.72 520.77 471.50 420.09 398.58 (84) 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1(°C) Temperature during heating periods in the living area from Table 9, Th1(°C) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains for living area $1,m$ (see Table 9a) 0.98 0.96 0.90 0.79 0.62 0.45 0.32 0.35 0.54 0.82 0.96 0.99 (86) Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)	C					12.26		6 70					400.05	70)
Solar gains in watts 2(74)m(82)m 100.85 171.79 235.04 291.23 326.20 323.84 312.22 286.13 254.50 189.86 120.80 86.31 (83) Total gains - internal and solar (73)m + (83)m 420.89 490.18 543.93 584.91 604.72 587.51 566.08 544.72 520.77 471.50 420.09 398.58 (84) Temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1(°C) 21.00 (85) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains for living area n1,m (see Table 9a) 0.98 0.96 0.90 0.79 0.62 0.45 0.32 0.35 0.54 0.82 0.96 0.99 (86)	SouthWest		(02)	0.7	/X	12.36	X 3	6.79 x	0.9 x).40 x	0.80	=	100.85	79)
100.85 171.79 235.04 291.23 326.20 323.84 312.22 286.13 254.50 189.86 120.80 86.31 (83) Total gains - internal and solar (73)m + (83)m 420.89 490.18 543.93 584.91 604.72 587.51 566.08 544.72 520.77 471.50 420.09 398.58 (84) 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1(°C) 21.00 (85) Jan Feb May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains for living area n1,m (see Table 9a) 0.98 0.96 0.90 0.79 0.62 0.45 0.32 0.35 0.54 0.82 0.99 (86) Mean internal temp of living area T1 (steps 3 to 7 in Table 9r)	Solar gains in Wa	atts ∑(74)m	(82)m				L							
Total gains - internal and solar (73)m + (83)m 420.89 490.18 543.93 584.91 604.72 587.51 566.08 544.72 520.77 471.50 420.09 398.58 (84) 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1(°C) 21.00 (85) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains for living area n1,m (see Table 9a) 0.98 0.96 0.90 0.79 0.62 0.45 0.32 0.35 0.54 0.82 0.96 0.99 (86)		100.85	171.79	235.04	291.23	326.20	323.84	312.22	286.13	254.50	189.86	120.80	86.31 (8	83)
420.89 490.18 543.93 584.91 604.72 587.51 566.08 544.72 520.77 471.50 420.09 398.58 (84) 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1(°C) 21.00 (85) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains for living area n1,m (see Table 9a) O.98 0.96 0.90 0.79 0.62 0.45 0.32 0.35 0.54 0.82 0.96 0.99 (86) Mean internal temp of living area T1 (steps 3 to 7 in Table 9c) (86)	Total gains - inte	ernal and so	lar (73)m +	· (83)m			I							
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains for living area n1,m (see Table 9a) 0.98 0.96 0.90 0.79 0.62 0.45 0.32 0.35 0.54 0.82 0.96 0.99 (86)		420.89	490.18	543.93	584.91	604.72	587.51	566.08	544.72	520.77	471.50	420.09	398.58 (8	84)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains for living area n1,m (see Table 9a) 0.98 0.96 0.90 0.79 0.62 0.45 0.32 0.35 0.54 0.82 0.96 0.99 (86)	7. Mean intern	al t <u>empera</u>	ture <u>(heati</u>	ng s <u>eason)</u>										
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains for living area n1,m (see Table 9a) 0.98 0.96 0.90 0.79 0.62 0.45 0.32 0.35 0.54 0.82 0.96 0.99 (86) Mean internal temp of living area T1 (steps 3 to 7 in Table 9c) 0.62 0.45 0.32 0.35 0.54 0.82 0.96 0.99 (86)	Temperature du	uring heating	g periods in	the living :	area from T	able 9. Th1	1(°C)						21.00 (5	85)
Utilisation factor for gains for living area n1,m (see Table 9a) 0.98 0.96 0.90 0.79 0.62 0.45 0.32 0.35 0.54 0.82 0.96 0.99 (86) Mean internal temp of living area T1 (steps 3 to 7 in Table 9c) 0.62 0.45 0.32 0.35 0.54 0.82 0.96 0.99 (86)		Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1
0.98 0.96 0.90 0.79 0.62 0.45 0.32 0.35 0.54 0.82 0.96 0.99 (86) Mean internal temp of living area T1 (steps 3 to 7 in Table 9c) 0.62 0.45 0.32 0.35 0.54 0.82 0.96 0.99 (86)	Utilisation facto	r for gains f	or living ar	ea n1.m (se	e Table 9a)	- ,					- ••			
Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)		0.02			0.70	0.62	0.45	0.32	0.35	0.54	0.82	0 96	0.99 /	86)
	Mean internal to	emp of livin	g area T1 //	tens 3 to 7	in Table Or	- <u>0.02</u>	1 0.75	0.52	0.55	0.54	0.02	0.50		501

Temperature du	20.45	20.62	20.79	20.93	20.99	21.00	21.00	21.00	21.00	20.92	20.66	20.40	(87)
	ing heating	periods in	the rest of	dwelling fr	rom Table 9	9, Th2(°C)							
	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	(88)
Utilisation factor	for gains for	or rest of d	welling n2,	n						-			
	0.98	0.95	0.88	0.75	0.57	0.39	0.26	0.29	0.48	0.78	0.95	0.98	(89)
Mean internal te	mperature	in the rest	of dwelling	T2 (follow	steps 3 to	7 in Table 9	c)					-	
	19.51	19.74	19.98	20.15	20.21	20.23	20.23	20.23	20.22	20.15	19.81	19.44	(90)
Living area fraction	on								Liv	ving area ÷	(4) =	0.52	(91)
Mean internal te	mperature	for the wh	ole dwellin	g fLA x T1 +	-(1 - fLA) x T	2							
	20.00	20.19	20.40	20.55	20.61	20.62	20.63	20.63	20.62	20.55	20.25	19.94	(92)
Apply adjustmen	t to the me	an internal	temperatu	ire from Ta	ble 4e whe	re appropri	iate						
	20.00	20.19	20.40	20.55	20.61	20.62	20.63	20.63	20.62	20.55	20.25	19.94	(93)
8. Space heatin	g requirem	ent											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor	for gains, r	lm						1					
	0.98	0.95	0.89	0.77	0.60	0.42	0.29	0.32	0.51	0.80	0.95	0.98	(94)
Useful gains, ŋm	Gm, W (94)m x (84)m								1			
	411.61	465.14	482.70	448.34	360.14	246.61	165.07	173.24	265.84	376.06	398.96	392.01	(95)
Monthly average	external te	emperature	e from Tabl	e U1						1		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	(96)
Heat loss rate for	r mean inte	rnal tempe	rature, Lm	, W [(39)m	x [(93)m -	(96)m]				1			
	643.86	627.26	570.06	477.89	365.54	247.09	165.11	173.31	267.48	407.91	539.43	645.52	(97)
Space heating re	quirement,	kWh/mon	th 0.024 x	[(97)m - (9	5)m] x (41)r	n					-		
	172.79	108.95	64.99	21.27	4.02	0.00	0.00	0.00	0.00	23.70	101.14	188.62	
									∑(98	8)15, 10	.12 =	685.46	(98)
Space heating re	quirement	kWh/m²/ye	ear							(98)	÷ (4)	13.88	(99)
9b. Energy requ													
	irements -	communit	y heating s	cheme									
Fraction of space	irements - heat from	communit secondary,	y heating s /suppleme	cheme ntary syster	m (table 11)				'0' if ı	none	0.00	(301)
Fraction of space Fraction of space	irements - heat from heat from	communit secondary, community	y heating s /supplemer y system	cheme ntary syster	m (table 11)				'0' if r 1 - (30	none 01) =	0.00	(301) (302)
Fraction of space Fraction of space Fraction of comm	irements - heat from heat from hunity heat	communit secondary, community from boile	y heating s /supplemen y system rs	cheme ntary syster	m (table 11)				'0' if r 1 - (30	none D1) =	0.00 1.00 1.00	(301) (302) (303a)
Fraction of space Fraction of space Fraction of comm Fraction of total	irements - heat from heat from hunity heat space heat	communit secondary, community from boile from comm	y heating s /supplemen y system rs nunity boile	cheme htary syster ers	m (table 11)				'0' if ı 1 - (30 (302) x (303	none D1) = Ga) =	0.00 1.00 1.00 1.00	(301) (302) (303a) (304a)
Fraction of space Fraction of space Fraction of comm Fraction of total Factor for contro	irements - heat from heat from hunity heat space heat I and charg	communit secondary, community from boile from comm ing methoo	y heating s /supplemen y system rs nunity boile d (Table 4c(cheme ntary syster ers 3)) for com	m (table 11 Imunity spa) ace heating				'0' if ı 1 - (3((302) x (303	none D1) = Ba) =	0.00 1.00 1.00 1.00 1.00	(301) (302) (303a) (304a) (305)
Fraction of space Fraction of space Fraction of comm Fraction of total Factor for contro Factor for chargin	irements - heat from heat from hunity heat space heat I and charg ng method	communit secondary, community from boile from comm ing methoo (Table 4c(3	y heating s /supplemen y system rs nunity boile d (Table 4c(s)) for comr	cheme htary syster ers 3)) for com nunity wate	m (table 11 nmunity spa er heating) ace heating				'0' if ı 1 - (30 (302) x (303	none D1) = Ba) =	0.00 1.00 1.00 1.00 1.00 1.00	(301) (302) (303a) (304a) (305) (305a)
Fraction of space Fraction of space Fraction of comm Fraction of total Factor for contro Factor for chargin Distribution loss	irements - heat from heat from hunity heat space heat I and charg ng method factor (Tab	communit secondary, community from boile from comm ing method (Table 4c(3 le 12c) for o	y heating s /supplemen y system rs nunity boile d (Table 4c(i)) for comr community	cheme ntary system ers 3)) for com nunity wate heating sy	m (table 11 Imunity spa er heating stem) ace heating				'0' if ı 1 - (3((302) x (30)	none D1) = Ba) = 	0.00 1.00 1.00 1.00 1.00 1.00 1.05	(301) (302) (303a) (304a) (305) (305a) (306)
Fraction of space Fraction of space Fraction of comm Fraction of total Factor for contro Factor for chargin Distribution loss	irements - heat from heat from hunity heat space heat I and charg ng method factor (Tab	communit secondary, community from boile from comm ing method (Table 4c(3 le 12c) for d	y heating s /supplemen y system rs nunity boile d (Table 4c(i)) for comr community	cheme htary syster ers 3)) for com hunity wate heating sy	m (table 11 nmunity spa er heating stem) ace heating				'0' if ı 1 - (30 (302) x (30	none D1) = Ba) = 	0.00 1.00 1.00 1.00 1.00 1.00 1.05	(301) (302) (303a) (304a) (305) (305a) (306)
Fraction of space Fraction of space Fraction of comm Fraction of total Factor for contro Factor for chargin Distribution loss Space heating	irements - heat from heat from nunity heat space heat I and charg ng method factor (Tab	communit secondary, community from boile from comm ing methoo (Table 4c(3 le 12c) for o	y heating s /supplemen y system rs nunity boile d (Table 4c(2)) for comr community	cheme ntary syster ers 3)) for com nunity wate heating sy	m (table 11 nmunity spa er heating stem) ace heating				'0' if ı 1 - (3((302) x (30)	none D1) = Ba) = 	0.00 1.00 1.00 1.00 1.00 1.00 1.05	(301) (302) (303a) (304a) (305) (305a) (306)
Fraction of space Fraction of space Fraction of comm Fraction of total Factor for contro Factor for chargin Distribution loss Space heating Annual space heat	irements - heat from heat from hunity heat space heat I and charg ng method factor (Tab	communit secondary, community from boile from comm ing method (Table 4c(3 le 12c) for o ement	y heating s /supplemen y system rs nunity boile d (Table 4c((Table 4c(community	cheme htary syster ers 3)) for com nunity wate heating sy	m (table 11 nmunity spa er heating stem) ace heating			685.46	'0' if ı 1 - (3((302) x (30)	none D1) = Ba) = 	0.00 1.00 1.00 1.00 1.00 1.00 1.05	(301) (302) (303a) (304a) (305) (305a) (306)
Fraction of space Fraction of space Fraction of comm Fraction of total Factor for contro Factor for chargin Distribution loss Space heating Annual space heat	irements - heat from heat from hunity heat space heat I and charg ng method factor (Tab ating requir boilers	communit secondary, community from boile from comm ing methoo (Table 4c(3 le 12c) for o ement	y heating s /supplemen y system rs nunity boile d (Table 4c(community	cheme ntary syster ers 3)) for com nunity wate heating sy	m (table 11 nmunity spa er heating stem) ace heating			585.46 3) x (304a) ;	'0' if ı 1 - (3((302) x (30) (305) x (30	none D1) = Ba) = D6) =	0.00 1.00 1.00 1.00 1.00 1.05 719.74	(301) (302) (303a) (304a) (305) (305a) (306) (98) (98) (307a)
Fraction of space Fraction of space Fraction of comm Fraction of total Factor for contro Factor for chargin Distribution loss Space heating Annual space heat Space heat from	irements - heat from heat from hunity heat space heat I and charg ng method factor (Tab ating requir boilers	communit secondary, community from boile from comm ing method (Table 4c(3 le 12c) for o ement	y heating s /supplemen y system rs nunity boile d (Table 4c(community	cheme htary system ers 3)) for com nunity wate heating sy	m (table 11 omunity spa er heating stem) ace heating		(98	585.46 3) x (304a) x	'0' if ı 1 - (3((302) x (30) (305) x (30)	none D1) = 3a) = D6) =	0.00 1.00 1.00 1.00 1.00 1.00 1.05 719.74	(301) (302) (303a) (304a) (305) (305a) (306) (98) (307a)
Fraction of space Fraction of space Fraction of comm Fraction of total Factor for contro Factor for chargin Distribution loss Space heating Annual space heat Space heat from Water heating	irements - heat from heat from hunity heat space heat I and charg ng method factor (Tab ating requir boilers	communit secondary, community from boile from comm ing methoo (Table 4c(3 le 12c) for o ement	y heating s /supplemen y system rs nunity boile d (Table 4c(community) for comr	cheme ntary syster ers 3)) for com nunity wate heating sy	m (table 11 nmunity spa er heating stem) ace heating		(98	585.46 3) x (304a) x	'0' if ı 1 - (3((302) x (30) (305) x (30	none D1) = Ba) = D6) =	0.00 1.00 1.00 1.00 1.00 1.05 719.74	(301) (302) (303a) (304a) (305a) (305a) (306) (98) (307a)
Fraction of space Fraction of space Fraction of comm Fraction of total Factor for contro Factor for chargin Distribution loss Space heating Annual space heat Space heat from Water heating Annual water heat	irements - heat from heat from hunity heat space heat I and charg ng method factor (Tab ating requir boilers	communit secondary, community from boile from comm ing methoo (Table 4c(3 le 12c) for o ement	y heating s /supplemen y system rs nunity boile d (Table 4c(community	cheme ntary system ers 3)) for com nunity wate heating sy	m (table 11 nmunity spa er heating stem) ace heating		(98	585.46 3) x (304a) x 813.79	'0' if ı 1 - (3((302) x (30) (305) x (3()	none ()1) = ()3a) = () () ()6) =	0.00 1.00 1.00 1.00 1.00 1.00 1.05 719.74	(301) (302) (303a) (304a) (305) (305a) (306) (98) (307a)
Fraction of space Fraction of space Fraction of comm Fraction of total Factor for contro Factor for chargin Distribution loss Space heating Annual space heat Space heat from Water heat from	irements - heat from heat from hunity heat space heat I and charg ng method factor (Tab ating requir boilers	communit secondary, community from boile from comm ing method (Table 4c(3 le 12c) for o ement	y heating s /supplemen y system rs nunity boile d (Table 4c(i)) for comr community	cheme ntary system ers 3)) for com nunity wate heating sy	m (table 11 nmunity spa er heating stem) ace heating		(98 (98 [] (64)	585.46 3) x (304a) x 813.79 x (303a) x	'0' if 1 1 - (30 (302) x (30)) x (305) x (30] (305a) x (30	none D1) = Ba) = D6) = D6) =	0.00 1.00 1.00 1.00 1.00 1.00 1.05 719.74	(301) (302) (303a) (304a) (305a) (305a) (306a) (98) (307a)
Fraction of space Fraction of space Fraction of comm Fraction of total Factor for contro Factor for chargin Distribution loss Space heating Annual space hea Space heat from Water heating Annual water hea Water heat from	irements - heat from heat from hunity heat space heat I and charg ng method factor (Tab ating requir boilers ating requir boilers or heat dist	communit secondary, community from boile from comm ing methoo (Table 4c(3 le 12c) for o ement	y heating s /supplemen y system rs nunity boile d (Table 4c(community) for comr community	cheme ntary system ers 3)) for com nunity wate heating sy	m (table 11 nmunity spa er heating stem) ace heating	0.01	(98 (98 [1] (64) . × [(307a)	585.46 3) x (304a) x 813.79 x (303a) x .(307e) + (3	'0' if ı 1 - (3((302) x (30) (305) x (3(305a) x (3(310a)(310)	none ()1) = ()3a) = ()3a) = ()4b ()5b) = ()5b ()5b) = ()5b ()5b) = ()5b ()5b) = ()5b) = ()5b) = ()5b) = ()5b)	0.00 1.00 1.00 1.00 1.00 1.00 1.05 719.74 1904.48 26.24	(301) (302) (303a) (304a) (305) (305a) (306) (98) (307a) (64) (310a) (313)
Fraction of space Fraction of space Fraction of comm Fraction of total Factor for contro Factor for chargin Distribution loss Space heating Annual space heat Space heat from Water heating Annual water heat Water heat from Electricity used for	irements - heat from heat from hunity heat space heat I and charg ng method factor (Tab ating requir boilers ating requir boilers or heat dist mps, fans a	communit secondary, community from boile from comm ing method (Table 4c(3 le 12c) for o ement ement rement ribution nd electric	y heating s /supplemen y system rs nunity boile d (Table 4c(i)) for comr community	cheme htary syster 275 3)) for com nunity wate heating sy Fable 4f)	m (table 11 nmunity spa er heating stem) ace heating	0.01	(98 (98 (1) (64) × [(307a)	585.46 3) x (304a) x 813.79 x (303a) x .(307e) + (3	'0' if ı 1 - (3((302) x (303 (305) x (30) (305a) x (30 310a)(310	none D1) = 3a) = () D6) = e)] =	0.00 1.00 1.00 1.00 1.00 1.00 1.05 719.74 1904.48 26.24	(301) (302) (303a) (305) (305a) (306) (98) (307a) (64) (310a) (313)
Fraction of space Fraction of space Fraction of comm Fraction of total Factor for contro Factor for chargin Distribution loss Space heating Annual space heat Space heat from Water heating Annual water heat Water heat from Electricity used for Electricity for put mechanical ve	irements - heat from heat from hunity heat space heat I and charg ng method factor (Tab ating requir boilers ating requir boilers or heat dist mps, fans a entilation fa	communit secondary, community from boile from comm ing method (Table 4c(3 le 12c) for o ement ement rement ribution nd electric ans - baland	y heating s /supplemen y system rs nunity boile d (Table 4c(community community keep-hot ('	cheme ntary system and system and for com nunity wate heating sy heating sy Fable 4f) c or positive	m (table 11 nmunity spa er heating stem) ace heating	0.01	(98 (98 (1 (64) × [(307a)	585.46 3) x (304a) x 813.79 x (303a) x .(307e) + (3 33.29	'0' if i 1 - (3((302) x (30) (305) x (3() (305a) x (3(310a)(310	none [] ()1) = [] ()3a) = [] ()3a) = [] ()4b ()5b) = [] ()5b ()5b) = [] ()5b ()5b) = [] ()5b ()5b) = [] ()5b) = [_] ()5b) = [_] ()5b) = [_] ()5b) = [_] ()5b) = [_] ()5b) = [_]	0.00 1.00 1.00 1.00 1.00 1.00 1.05 719.74 1904.48 26.24	(301) (302) (303a) (304a) (305) (305a) (305a) (306) (306) (307a) (64) (310a) (310a) (313)

Electricity for lighting (Appendix L)

Total delivered energy for all uses

(307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) =

(332) 2886.82 (338)

229.32

10b. Fuel costs - community heating scheme						
	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from boilers	719.74	x	4.24	x 0.01 =	30.52	(340a)
Water heating from boilers	1904.48	x	4.24	x 0.01 =	80.75	(342a)
Pumps and fans	33.29	x	13.19	x 0.01 =	4.39	(349)
Electricity for lighting	229.32	x	13.19	x 0.01 =	30.25	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)(342e) +	(345)(354) =	265.90	(355)
11b. SAP rating - community heating scheme						
Energy cost deflator (Table 12)					0.42	(356)
Energy cost factor (ECF)					1.18	(357)
SAP value					83.49	
SAP rating (section 13)					83	(358)
SAP band					В	
12b. CO ₂ emissions - community heating scheme						
	Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from other sources (space heating)						
Efficiency of boilers	94.00					(367a)
CO2 emissions from boilers [(307a)+(310a)] x 100 ÷ (367a) =	2791.72	x	0.216	=	603.01	(367)
Electrical energy for community heat distribution	26.24	x	0.52	=	13.62	(372)
Total CO2 associated with community systems					616.63	(373)
Total CO2 associated with space and water heating					616.63	(376)
Pumps and fans	33.29	x	0.52	=	17.28	(378)
Electricity for lighting	229.32	x	0.52	=	119.01	(379)
Total CO ₂ , kg/year				(376)(382) =	752.92	(383)
Dwelling CO ₂ emission rate				(383) ÷ (4) =	15.24	(384)
El value					89.31	
El rating (section 14)					89	(385)
El band					В	
13b. Primary energy - community heating scheme						
	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary energy from other sources (space heating)						
Efficiency of boilers	94.00					(367a)
Primary energy from boilers [(307a)+(310a)] x 100 ÷ (367a) =	2791.72	x	1.22	=	3405.90	(367)
Electrical energy for community heat distribution	26.24	x	3.07	=	80.56	(372)
Total primary energy associated with community systems					3486.46	(373)
Total primary energy associated with space and water heating					3486.46	(376)
Pumps and fans	33.29	x	3.07	=	102.20	(378)
Electricity for lighting	229.32	x	3.07	=	704.00	(379)
Primary energy kWh/year	_				4292.66	(383)
Dwelling primary energy rate kWh/m2/year					86.91	(384)



Assessor name		Miss Jayr	na Parmar						Assessor nur	nber	6549		
Client									ast modified	d	23/11,	/2016	
Address		A-L06-73	A Centric (Close, Lond	on, N8								
1. Overall dwellin	g dimens	sions											
					А	rea (m²)		Av	erage storey height (m)	i	Vo	lume (m³)	
Lowest occupied						72.32	<mark>](1a)</mark> x		2.50	(2a) =		180.80	(3a)
Total floor area		(1a)	+ (1b) + (1	c) + (1d)(1n) =	72.32	(4)						
Dwelling volume								(3	a) + (3b) + (3	3c) + (3d)(3	sn) =	180.80	(5)
2. Ventilation rate	e									_			
											m³	per hour	
Number of chimner	vc								0	×40 =		0	(62)
Number of open fl	y5								0] (6b)
Number of intermi	ttont fan	c							0] (00)] (7a)
Number of passivo	vonte	3							0	10 - 10 - 10 - 10 - 10 - 10 - 10 - 10] (78)
Number of fluoloss	and fires								0] (7c)
Number of fideless	gas mes	•							0	X40 -	Airc	banges ne	_ (/C) r
												hour	
Infiltration due to o	chimneys	, flues, fans	s, PSVs		(6a)	+ (6b) + (7	a) + (7b) + (7c) =	0	÷ (5) =	:	0.00	(8)
If a pressurisation	test has b	been carried	d out or is i	ntended, pi	roceed to (17), otherw	ise continu/	e from (9,) to (16)				
Air permeability va	lue, q50,	expressed	in cubic m	etres per h	our per squ	uare metre	of envelope	e area				4.00	(17)
If based on air perr	neability	value, ther	n (18) = [(17	7) ÷ 20] + (8	3), otherwi	se (18) = (1	6)					0.20	(18)
Number of sides or	n which t	he dwelling	g is sheltere	ed								2	(19)
Shelter factor									1	- [0.075 x (1	9)] =	0.85	(20)
Infiltration rate inc	orporatir	ng shelter fa	actor							(18) x (2	20) =	0.17	(21)
Infiltration rate mo	dified fo	r monthly v	wind speed	:									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average w	vind spee	d from Tab	le U2										
	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22)m	÷4												
	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
Adjusted infiltratio	n rate (al	llowing for	shelter and	I wind facto	or) (21) x (2	22a)m							_
	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.20	(22b)
Calculate effective	air chang	ge rate for t	the applica	ble case:									_
If mechanical ve	entilation	1: air chang	e rate throu	ugh system								0.50	(23a)
If balanced with	heat red	covery: effi	ciency in %	allowing fo	or in-use fa	ctor from T	able 4h					N/A	(23c)
c) whole house	extract v	entilation o	or positive i	input venti	lation from	outside	1	1					-
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(24c)
Effective air change	e rate - e	nter (24a) o	or (24b) or	(24c) or (24	ld) in (25)			1					-
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(25)



3. Heat losses a	and heat lo	ss paramet	er:										
Element			а	Gross rea, m²	Openings m ²	Net A,	area m²	U-value W/m²K	A x U W	//К к-v kJ	/alue, /m².K	Ахк, kJ/K	
Window						21	.34 x	1.24	= 26.37	7			(27)
External wall						11	.81 x	0.18	= 2.13				(29a
Party wall						51	.97 x	0.00	= 0.00				(32)
Roof						72	.32 x	0.16	= 11.57	7			(30)
Total area of ext	ternal eleme	ents ∑A, m²	2			105	5.47						(31)
Fabric heat loss,	W/K = ∑(A	× U)							(2	6)(30) + (32) =	40.07	(33)
Heat capacity Cr	m = ∑(А x к)							(28).	(30) + (32)	+ (32a)(3	2e) =	N/A	(34)
Thermal mass p	arameter (T	MP) in kJ/r	m²K									250.00	(35)
Thermal bridges	: Σ(L x Ψ) ca	alculated us	sing Appen	dix K								4.81	(36)
Total fabric heat	tloss									(33) + (36) =	44.88	(37)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat	loss calcula	ited month	ily 0.33 x (2	25)m x (5)	-								
	29.83	29.83	29.83	29.83	29.83	29.83	29.83	29.83	29.83	29.83	29.83	29.83	(38)
Heat transfer co	efficient, W	' ′/K (37)m⊣	+ (38)m		1			1					
	74.71	74.71	74.71	74.71	74.71	74.71	74.71	74.71	74.71	74.71	74.71	74.71	7
		1			I				Average =	Σ(39)112	/12 =	74.71	_] (39)
Heat loss param	eter (HLP),	W/m²K (39	9)m ÷ (4)						0	,			
	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	7
									Average =	$\Sigma(40)112$	/12 =	1.03	_] (40)
Number of days	in month (1	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)
			1		I I						1		
4. Water heati	ng energy r	equiremen	t										
Assumed occupa	ancy, N											2.30	(42)
Annual average	hot water u	sage in litr	es per day	Vd,average	= (25 x N) +	36						88.85	(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)						
	97.74	94.18	90.63	87.07	83.52	79.97	79.97	83.52	87.07	90.63	94.18	97.74	
										∑(44)1	.12 =	1066.22	(44)
Energy content	of hot wate	r used = 4.:	18 x Vd,m x	nm x Tm/3	3600 kWh/m	onth (see	Tables 1b	o, 1c 1d)					
	144.94	126.77	130.81	114.04	109.43	94.43	87.50	100.41	101.61	118.41	129.26	140.37	
										∑(45)1	.12 =	1397.98	(45)
Distribution loss	0.15 x (45)	m											
	21.74	19.01	19.62	17.11	16.41	14.16	13.13	15.06	15.24	17.76	19.39	21.06	(46)
Storage volume	(litres) inclu	iding any s	olar or WW	/HRS storag	ge within sam	ne vessel						110.00	(47)
Water storage lo													
water storage it	55.												
b) Manufacture	r's declared	loss factor	is not know	wn									
b) Manufacture Hot water sto	r's declared orage loss fa	loss factor actor from	is not knov Table 2 (kV	wn Vh/litre/da	y)							0.02	(51)
b) Manufacturei Hot water sto Volume facto	r's declared orage loss fa or from Tabl	loss factor actor from le 2a	is not knov Table 2 (kV	wn Vh/litre/da	y)							0.02	(51) (52)
b) Manufacturei Hot water sto Volume facto Temperature	r's declared orage loss fa or from Table factor fron	loss factor actor from le 2a n Table 2b	is not knov Table 2 (kV	vn Vh/litre/da	y)							0.02 1.03 0.60	(51) (52) (53)
b) Manufacturer Hot water sto Volume facto Temperature Energy lost fi	r's declared orage loss fa or from Table factor fron rom water s	loss factor actor from le 2a n Table 2b torage (kW	is not knov Table 2 (kV /h/day) (47	wn Vh/litre/da 7) x (51) x (5	y) 52) x (53)							0.02 1.03 0.60 1.03	(51) (52) (53) (54)
b) Manufacturer Hot water sto Volume facto Temperature Energy lost fi Enter (50) or (54	r's declared orage loss fa or from Tabl e factor fron rom water s I) in (55)	loss factor actor from le 2a n Table 2b torage (kW	is not knov Table 2 (kV /h/day) (47	vn Vh/litre/da 7) x (51) x (!	y) 52) x (53)							0.02 1.03 0.60 1.03 1.03	(51) (52) (53) (54) (55)
b) Manufacturer Hot water sto Volume facto Temperature Energy lost fi Enter (50) or (54 Water storage lo	r's declared orage loss fa or from Tabl e factor fron rom water s I) in (55) oss calculate	loss factor actor from le 2a n Table 2b torage (kW ed for each	is not knov Table 2 (kV /h/day) (47 month (55	vn Vh/litre/da 7) x (51) x (! 5) x (41)m	y) 52) x (53)							0.02 1.03 0.60 1.03 1.03) (51) (52) (53) (54) (55)
b) Manufacturen Hot water sto Volume facto Temperature Energy lost fi Enter (50) or (54 Water storage lo	r's declared orage loss fa or from Table factor fron rom water s l) in (55) oss calculate	loss factor actor from le 2a n Table 2b torage (kW ed for each 28.92	is not know Table 2 (kV /h/day) (47 month (55 32.01	vn Vh/litre/da 7) x (51) x (5 5) x (41)m 30.98	y) 52) x (53) <u>32.01</u>	30.98	32.01	32.01	30.98	32.01	30.98	0.02 1.03 0.60 1.03 1.03 32.01) (51) (52) (53) (54) (55) (56)

	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)
Primary circuit le	oss for each	month fro	m Table 3										
	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
Combi loss for e	ach month	from Table	3a, 3b or 3	C		•			•				
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
Total heat requi	red for wate	er heating o	alculated for	or each mo	nth 0.85 x	(45)m + (4	6)m + (57)n	n + (59)m +	⊦ (61)m			·	
	200.22	176.69	186.09	167.54	164.70	147.92	142.78	155.69	155.10	173.69	182.75	195.64	(62)
Solar DHW inpu	t calculated	using Appe	endix G or A	opendix 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	nth (kWh/r	nonth) (62	2 m + (63) m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.00)
		176.60	196.00	167 54	164 70	147.02	1/2 79	155 60	155 10	172.60	102.75	105.64	
	200.22	170.09	180.09	107.54	104.70	147.92	142.70	133.09	155.10	5(64)1	102.75	049.92	
lloat gains from	water beat	ing (WMb/n	oonth) 0.25		(4E) m + (61	\ml + 0.9 v	[(46) - (1	7)		2(64)1	12 =	048.82	,64)
Heat gains from	water neat			00.74		.)m] + 0.8 ×	[(40)11 + (3	57)m + (59)		02.50	05 77		
	92.41	82.09	87.72	80.71	80.61	74.19	73.32	//.61	76.58	83.59	85.77	90.89	,65)
5. Internal gair	ıs												
	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains	(Table 5)				,								
Sector Banno	115.06	115.06	115.06	115.06	115.06	115.06	115.06	115.06	115.06	115.06	115.06	115.06	(66)
Lighting gains (c	alculated in	Annendix	equation	115.00		hle 5	115.00	115.00	115.00	115.00	115.00	115.00	.00)
						6 22	6 74	0 76	11 75	14.02	17.40	19 57	(67)
Appliance gains	(calculated	in Annondi		9.00	7.59	0.25	0.74	0.70	11.75	14.92	17.42	10.57	.07)
Appliance gains							454.64	4 4 9 5 9	454.00	166.00	400.00		(60)
	202.65	204.75	199.45	188.17	173.93	160.55	151.61	149.50	154.80	166.08	180.32	193.71	,68)
COOKING gains (C	alculated in	Appendix	L, equation	L15 or L15	a), also see	Table 5							
	34.51	34.51	34.51	34.51	34.51	34.51	34.51	34.51	34.51	34.51	34.51	34.51	(69)
Pump and fan ga	ains (Table S	5a)											
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
Losses e.g. evap	oration (Tal	ole 5)											
	-92.04	-92.04	-92.04	-92.04	-92.04	-92.04	-92.04	-92.04	-92.04	-92.04	-92.04	-92.04	(71)
Water heating g	ains (Table	5)											
	124.21	122.16	117.90	112.10	108.34	103.04	98.54	104.31	106.36	112.36	119.13	122.17	(72)
Total internal ga	iins (66)m +	- (67)m + (6	8)m + (69)r	m + (70)m ·	+ (71)m + (7	72)m							
	402.45	400.48	387.92	367.67	347.18	327.34	314.40	320.09	330.43	350.88	374.39	391.96	(73)
C. Color action													
6. Solar gains						6-1			_			C alina	
			Access T Table	actor 6d	Area m²	- 501 W	ar flux //m²	spec	g ific data	specific d	lata	Gains	
								or T	able 6b	or Table	6c		
SouthWest			0.77	7 x	21.34	x 3	6.79 x	0.9 x 🚺	0.40 x	0.80	=	174.12	(79)
Solar gains in wa	atts ∑(74)m	(82)m											
	174.12	296.59	405.81	502.82	563.20	559.13	539.06	494.01	439.41	327.80	208.56	149.01	(83)
Total gains - inte	ernal and so	lar (73)m +	(83)m			I						·	
0 - 10	576.57	697.07	793.73	870.49	910.38	886.47	853.46	814.10	769.84	678.68	582.95	540.97	(84)
				0.0.10			000.10			0.0.00			1
7. Mean intern	al tempera	ture (heati	ng season)										
Temperature du	iring heating	g periods in	the living a	irea from T	able 9, Th1	.(°C)						21.00	(85)
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains f	or living are	ea n1,m (see	e Table 9a)									
	0.99	0.98	0.94	0.86	0.71	0.53	0.38	0.42	0.64	0.90	0.98	0.99	(86)
					-								

Mean internal te	emp of livin	g area T1 (s	steps 3 to 7	in Table 90	c)								
	20.10	20.31	20.56	20.80	20.94	20.99	21.00	21.00	20.97	20.78	20.38	20.05	(87)
Temperature du	ring heating	g periods in	i the rest of	dwelling f	rom Table	9, Th2(°C)							
	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	(88)
Utilisation factor	r for gains f	or rest of d	welling n2,	m									
	0.99	0.97	0.93	0.83	0.66	0.46	0.30	0.33	0.57	0.86	0.97	0.99	(89)
Mean internal te	emperature	in the rest	of dwelling	g T2 (follow	, steps 3 to	o 7 in Table 9	Эс)	•				•	
	18.88	19.17	19.52	19.83	20.00	20.05	20.06	20.05	20.04	19.82	19.28	18.80	(90)
Living area fracti	ion	1	11		1			1	Ľ	ving area ÷	(4) =	0.28	(91)
Mean internal te	emperature	for the wh	ole dwellin	g fLA x T1 +	+(1 - fLA) x	: T2							(/
	10.22	10 /0	10.81	20.10	20.27	20.31	20.32	20.32	20.30	20.09	10.50	10.15	(02)
Apply adjustmen	13.22	19.49	19.01		20.27		20.32	20.32	20.30	20.09	19.39	19.15	(92)
Apply aujustiller											10 -0	1 10 17	
	19.22	19.49	19.81	20.10	20.27	20.31	20.32	20.32	20.30	20.09	19.59	19.15	(93)
8. Space heatin	ng requirem	ent											
	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor	r for gains	nm		r.									
		0.07	0.02	0.02	0.67	0.48	0.22	0.26	0.50	0.86	0.07	0.00	(04)
Usoful gains nm	$\begin{bmatrix} 0.33 \\ 0.33 \end{bmatrix}$	0.97	0.92	0.85	0.07	0.48	0.33	0.30	0.39	0.80	0.97	0.99	(94)
Oserui gairis, ijiri			722.44	724.26	600.00	422 70	077.54	202.12	454.25	500.05		525.00	(05)
	568.96	674.14	733.11	/21.30	609.30	422.79	277.51	292.12	451.35	586.05	565.51	535.68	(95)
Monthly average	e external t	emperature	e from Table	e U1			1		1	1			I
	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,	<i>,</i> W [(39)m	1 x [(93)m	- (96)m]							
	1114.76	1090.08	994.43	837.06	639.95	426.85	277.91	292.81	463.18	708.87	932.96	1116.77	(97)
Space heating re	equirement,	, kWh/mon	th 0.024 x	[(97)m - (9	5)m] x (41	.)m							
	406.07	279.51	194.42	83.30	22.81	0.00	0.00	0.00	0.00	91.38	264.56	432.33	
									∑(9)	8)15, 10	12 =	1774.40	(98)
Space heating re	equirement	kWh/m²/y	ear							(98)	÷ (4)	24.54	(99)
01 5	• •												
96. Energy requ	uirements -	communit	y neating s	cneme									
Fraction of space	e heat from	secondary	/supplemer	ntary syste	m (table 1	.1)				'0' if r	none	0.00	(301)
Fraction of space	e heat from	communit	y system							1 - (30	01) =	1.00	(302)
Fraction of comr	munity heat	from boile	ers									1.00	(303a)
Fraction of total	space heat	from comr	nunity boile	ers						(302) x (303	3a) =	1.00	(304a)
Factor for contro	ol and charg	ging metho	d (Table 4c((3)) for com	nmunity sp	bace heating	5					1.00	(305)
Factor for chargi	ing method	(Table 4c(3	3)) for comr	nunity wat	er heating	5						1.00	(305a)
Distribution loss	factor (Tab	le 12c) for	community	heating sy	vstem							1.05	(306)
Space heating													
Annual space he	ating requi	rement						1	1774.40]			(98)
Space heat from	boilers							(98	8) x (304a) :	- x (305) x (30	06) = 🔤	1863.12	(307a)
Water heating													
Annual water he	ating requi	rement							2048-82	1			(64)
Water heat from	hoilers							(64)) x (2022) v	J (305a) v (20)6) =	2151 26	(3102)
Electricity used f	for heat did	tribution					0.07	,+•0) 1 x [/2075]	$(307a) \pm 0$	$(3030) \times (300)$	a)] =	10 11	(312)
Electricity for co	ion neat uist		koon hat /	Table 4f			0.0.	r ∨ [(207a).	(3078) + (3	5108](510	c)] - [40.14	(212)
Lieuticity for pu	inips, idils ä		reep-not (i avie 41)				Г — —	45.00	1			(225.)
mechanical v	entilation f	ans - Dalano	Leu, extract	or positive	e input fro	un outside			45.88				(330a)

Total electricity for the above, kWh/year

Electricity for lighting (Appendix L) Total delivered energy for all uses

(307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) =

 45.88
 (331)

 319.06
 (332)

 4379.32
 (338)

10b. Fuel costs - community heating scheme						
	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from boilers	1863.12	x	4.24	x 0.01 =	79.00	(340a)
Water heating from boilers	2151.26	x	4.24	x 0.01 =	91.21] (342a)
Pumps and fans	45.88	x	13.19	x 0.01 =	6.05	(349)
Electricity for lighting	319.06	x	13.19	x 0.01 =	42.08	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)(342e) +	· (345)(354) =	338.35	(355)
11b. SAP rating - community heating scheme						
Energy cost deflator (Table 12)					0.42	(356)
Energy cost factor (ECF)					1.21	(357)
SAP value					83.10]
SAP rating (section 13)					83	(358)
SAP band					В]
12b. CO ₂ emissions - community heating scheme						
	Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from other sources (space heating)						
Efficiency of boilers	94.00					(367a)
CO2 emissions from boilers [(307a)+(310a)] x 100 ÷ (367a) = [4270.62	x	0.216	=	922.45	(367)
Electrical energy for community heat distribution	40.14	x	0.52	=	20.83	(372)
Total CO2 associated with community systems					943.29	(373)
Total CO2 associated with space and water heating					943.29	(376)
Pumps and fans	45.88	×	0.52	=	23.81	(378)
Electricity for lighting	319.06	x	0.52	=	165.59	(379)
Total CO ₂ , kg/year				(376)(382) =	1132.69	(383)
Dwelling CO ₂ emission rate				(383) ÷ (4) =	15.66	(384)
El value					87.06	
El rating (section 14)					87	(385)
El band					В	
13b. Primary energy - community heating scheme						
	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary energy from other sources (space heating)						
Efficiency of boilers	94.00					(367a)
Primary energy from boilers [(307a)+(310a)] x 100 ÷ (367a) = [4270.62	x	1.22	=	5210.16	(367)
Electrical energy for community heat distribution	40.14	x	3.07	=	123.24	(372)
Total primary energy associated with community systems					5333.40	(373)
Total primary energy associated with space and water heating					5333.40	(376)
Pumps and fans	45.88	x	3.07	=	140.85	(378)
Electricity for lighting	319.06	x	3.07	=	979.51	(379)
Primary energy kWh/year					6453.76	(383)



Assessor name		Miss Jayr	na Parmar					А	ssessor nur	nber	6549		
Client								L	ast modifie	d	23/11	/2016	
Address		A-L04-65	A Centric (Close, Lond	on, N8								
1. Overall dwellin	ng dimens	sions											
					А	rea (m²)		Ave h	erage storey eight (m)	I	Vo	lume (m³)	
Lowest occupied						77.30	<mark>](1a)</mark> x		2.50	(2a) =		193.25	(3a)
Total floor area		(1a)	+ (1b) + (1e	c) + (1d)(1n) =	77.30	(4)						
Dwelling volume							-	(3a	ı) + (3b) + (3	3c) + (3d)(3	3n) =	193.25	(5)
2 Montilation rat										_			
2. Ventilation rat	e												
										_	m	' per hour	_
Number of chimne	eys								0	x 40 =	:	0	(6a)
Number of open fl	lues								0	x 20 =	:	0	(6b)
Number of interm	ittent fan	s							0	x 10 =		0	(7a)
Number of passive	e vents								0	x 10 =	:	0	(7b)
Number of flueles	s gas fires	;							0	 x 40 =		0	(7c)
										_	Air o	hanges pe hour	r
Infiltration due to	chimneys	, flues, fans	s, PSVs		(6a)	+ (6b) + (7	a) + (7b) + (7c) =	0	÷ (5) =		0.00	(8)
If a pressurisation	test has b	been carried	d out or is ii	ntended, pi	roceed to (17), otherw	vise continu	e from (9)	to (16)				
, Air permeability va	alue, q50,	expressed	in cubic me	etres per h	our per sau	uare metre	of envelope	e area	. ,			4.00	(17)
If based on air per	meability	value. ther	n (18) = [(17	7) ÷ 20] + (8). otherwi	se (18) = (1	6)					0.20	(18)
Number of sides o	n which t	he dwelling	is sheltere	d d	,,	() (-	-,					3	(19)
Shelter factor			,						1	- [0 075 x (1	9)] =	0.78	(20)
Infiltration rate in	ornoratir	ng shelter f	actor						-	(18) x (2	20) =	0.16	(21)
Infiltration rate m	odified fo	r monthly y								(10) × (2		0.10	_ (21)
	lan	Eob	Mar	Anr	May	lun	1.1	Aug	Son	Oct	Nov	Dec	
Monthly average		d from Tab		Abi	ividy	Jun	Jui	Aug	Sch	000	NOV	Dec	
			4.00	4.40	4.20	2.80	2.90	2.70	4.00	4.20	4.50	4.70	(22)
Wind factor (22)m	5.10	5.00	4.90	4.40	4.50	5.60	5.80	5.70	4.00	4.50	4.50	4.70	_ (22)
	1.20	4.25	1.22	1.10	1.00	0.05	0.05	0.02	1.00	1.00	1.12	1.10	7 (22-)
	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)
	on rate (al	liowing for	shelter and		Dr) (21) X (2		0.15			0.17	<u> </u>	0.10	
	0.20	0.19	0.19	0.17	0.17	0.15	0.15	0.14	0.16	0.17	0.17	0.18	(22b)
Calculate effective	e air chang	ge rate for t	the applical	ole case:									-
If mechanical v	entilation	: air chang	e rate throu	ugh system								0.50	_ (23a)
If balanced wit	h heat reo	covery: effi	ciency in %	allowing fo	or in-use fa	ctor from T	able 4h					N/A	(23c)
c) whole house	extract v	entilation o	or positive i	nput venti	ation from	outside							_
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(24c)
Effective air chang	ge rate - e	nter (24a) o	or (24b) or	(24c) or (24	ld) in (25)								
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(25)



5. Heat losses and heat loss parameter							
Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/	/Κ κ-value kJ/m².I	, Ахк, К kJ/К
Window			14.12	x 1.24	= 17.45		(27)
External wall			13.75	x 0.18	= 2.48		(29a)
Party wall			60.09	x 0.00	= 0.00		(32)
Total area of external elements ΣA , m ²			27.87				(31)
Fabric heat loss, $W/K = \sum (A \times U)$					(26)(30) + (32) =	19.92 (33)
Heat capacity Cm = Σ(A x κ)				(28)	(30) + (32) +	(32a)(32e) =	N/A (34)
Thermal mass parameter (TMP) in kJ/m²K							250.00 (35)
Thermal bridges: $\Sigma(L \times \Psi)$ calculated using App	endix K						4.23 (36)
Total fabric heat loss						(33) + (36) =	24.15 (37)
Jan Feb Mar	Apr	May	Jun	Jul Aug	Sep	Oct N	lov Dec
Ventilation heat loss calculated monthly 0.33	(25)m x (5)						
31.89 31.89 31.89	31.89	31.89	31.89 3	1.89 31.89	31.89	31.89 32	1.89 31.89 <mark>(38)</mark>
Heat transfer coefficient, W/K $(37)m + (38)m$							
56.04 56.04 56.04	56.04	56.04	56.04 5	6.04 56.04	56.04	56.04 56	5.04 56.04
					Average = ∑	(39)112/12 =	56.04 (39)
Heat loss parameter (HLP), W/m ² K (39)m \div (4)							
0.72 0.72 0.72	0.72	0.72	0.72 0	0.72 0.72	0.72	0.72 0	.72 0.72
					Average = ∑	(40)112/12 =	0.72 (40)
Number of days in month (Table 1a)							
31.00 28.00 31.00	30.00	31.00	30.00 3	1.00 31.00	30.00	31.00 30	0.00 31.00 (40)
4. Water heating energy requirement							
Assumed occupancy, N							2.41 (42)
Assumed occupancy, N Annual average hot water usage in litres per da	ay Vd,average = ((25 x N) + 3	36				2.41 (42) 91.43 (43)
Assumed occupancy, N Annual average hot water usage in litres per da Jan Feb Mar	ay Vd,average = (Apr	(25 x N) + 3 May	36 Jun	Jul Aug	Sep	Oct N	2.41 (42) 91.43 (43) lov Dec
Assumed occupancy, N Annual average hot water usage in litres per da Jan Feb Mar Hot water usage in litres per day for each mon	ay Vd,average = (Apr th Vd,m = factor	(25 x N) + 3 May from Table	36 Jun e 1c x (43)	Jul Aug	Sep	Oct N	2.41 (42) 91.43 (43) lov Dec
Assumed occupancy, N Annual average hot water usage in litres per da Jan Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26	ay Vd,average = (Apr th Vd,m = factor 89.60	(25 x N) + 3 May from Table 85.94	36 Jun e 1c x (43) 82.29 8	Jul Aug 2.29 85.94	Sep 89.60	Oct N 93.26 96	2.41 (42) 91.43 (43) lov Dec
Assumed occupancy, N Annual average hot water usage in litres per da Jan Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26	ay Vd,average = (Apr th Vd,m = factor 89.60	(25 x N) + 3 May from Table 85.94	36 Jun e 1c x (43) 82.29 8	Jul Aug 2.29 85.94	Sep 89.60	Oct Ν 93.26 96 Σ(44)112 =	2.41 (42) 91.43 (43) lov Dec 5.91 100.57 1097.15 (44)
Assumed occupancy, N Annual average hot water usage in litres per da Jan Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26 Energy content of hot water used = 4.18 x Vd,r	ay Vd,average = (Apr th Vd,m = factor 89.60 n x nm x Tm/360	(25 x N) + 3 May from Table 85.94	36 Jun e 1c x (43) 82.29 8 onth (see Tabl	Jul Aug 2.29 85.94 les 1b, 1c 1d)	Sep 89.60	Oct Ν 93.26 96 Σ(44)112 =	2.41 (42) 91.43 (43) lov Dec 5.91 100.57 1097.15 (44)
Assumed occupancy, N Annual average hot water usage in litres per day Jan Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26 Energy content of hot water used = 4.18 x Vd,r 149.14 130.44 134.6	ay Vd,average = (Apr th Vd,m = factor 89.60 n x nm x Tm/360 1 117.35	(25 x N) + 3 May from Table 85.94 00 kWh/mo 112.60	36 Jun e 1c x (43) 82.29 8 onth (see Tabl 97.17 9	Jul Aug 2.29 85.94 les 1b, 1c 1d) 0.04 103.32	Sep 89.60	Oct N 93.26 96 ∑(44)112 = 121.85 13	2.41 (42) 91.43 (43) lov Dec 5.91 100.57 1097.15 (44) 3.01 144.44
Assumed occupancy, N Annual average hot water usage in litres per day Jan Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26 Energy content of hot water used = 4.18 x Vd,r 149.14 130.44 134.6	ay Vd,average = (Apr th Vd,m = factor 89.60 n x nm x Tm/360 1 117.35	(25 x N) + 3 May from Table 85.94 00 kWh/mc 112.60	36 Jun e 1c x (43) 82.29 8 onth (see Tabl 97.17 9	Jul Aug 2.29 85.94 les 1b, 1c 1d) 0.04	Sep 89.60	Oct N 93.26 96 $\Sigma(44)112 =$ 13 121.85 13 $\Sigma(45)112 =$ 13	2.41 (42) 91.43 (43) lov Dec 5.91 100.57 1097.15 (44) 3.01 144.44 1438.53 (45)
Assumed occupancy, N Annual average hot water usage in litres per day I an Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26 Energy content of hot water used = $4.18 \times Vd$,r 149.14 130.44 134.6 Distribution loss 0.15 x (45)m	ay Vd,average = (Apr th Vd,m = factor 89.60 n x nm x Tm/360 1 117.35	(25 x N) + 3 May from Table 85.94 00 kWh/mo 112.60	36 Jun e 1c x (43) 82.29 8 onth (see Tabl 97.17 9	Jul Aug 2.29 85.94 les 1b, 1c 1d) 0.04	Sep 89.60	Oct Ν 93.26 96 Σ(44)112 = 121.85 13 Σ(45)112 =	2.41 (42) 91.43 (43) lov Dec 5.91 100.57 1097.15 (44) 3.01 144.44 1438.53 (45)
Assumed occupancy, N Annual average hot water usage in litres per day I an Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26 Energy content of hot water used = $4.18 \times Vd$,r 149.14 130.44 134.6 Distribution loss 0.15 x (45)m 22.37 19.57 20.19	ay Vd,average = (Apr th Vd,m = factor 89.60 n x nm x Tm/360 1 117.35 :	(25 x N) + 3 May from Table 85.94 00 kWh/mc 112.60 16.89	36 Jun e 1c x (43) 82.29 82.29 8 onth (see Table 97.17 9 14.58 1	Jul Aug 2.29 85.94 les 1b, 1c 1d) 0.04 0.04 103.32 3.51 15.50	Sep 89.60 104.56 15.68	Oct N 93.26 96 $\Sigma(44)112 =$ 13 121.85 13 $\Sigma(45)112 =$ 13 18.28 19	$\begin{array}{c c} 2.41 & (42) \\ \hline 91.43 & (43) \\ \hline 000 & Dec \\ \hline 5.91 & 100.57 \\ \hline 1097.15 & (44) \\ \hline 3.01 & 144.44 \\ \hline 1438.53 & (45) \\ \hline 0.95 & 21.67 & (46) \\ \hline \end{array}$
Assumed occupancy, N Annual average hot water usage in litres per day I an Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26 Energy content of hot water used = $4.18 \times Vd$,r 149.14 130.44 134.6 Distribution loss $0.15 \times (45)m$ 22.37 19.57 20.19 Storage volume (litres) including any solar or W	ay Vd,average = (Apr th Vd,m = factor 89.60 n x nm x Tm/360 1 117.35 17.60 /WHRS storage v	(25 x N) + 3 May from Table 85.94 00 kWh/mo 112.60 16.89 within sam	36 Jun e 1c x (43) 82.29 8 onth (see Tabl 97.17 9 14.58 1 e vessel	Jul Aug 2.29 85.94 les 1b, 1c 1d) 0.04 0.04 103.32 3.51 15.50	Sep 89.60 104.56 15.68	Oct N 93.26 96 $\Sigma(44)112 =$ 13 121.85 13 $\Sigma(45)112 =$ 13 18.28 19	$\begin{array}{c c} 2.41 & (42) \\ \hline 91.43 & (43) \\ \hline 000 & Dec \\ \hline 5.91 & 100.57 \\ \hline 1097.15 & (44) \\ \hline 3.01 & 144.44 \\ \hline 1438.53 & (45) \\ \hline 0.95 & 21.67 & (46) \\ \hline 110.00 & (47) \\ \hline \end{array}$
Assumed occupancy, N Annual average hot water usage in litres per day I an Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26 Energy content of hot water used = $4.18 \times Vd$,r 149.14 130.44 134.6 Distribution loss $0.15 \times (45)m$ 22.37 19.57 20.19 Storage volume (litres) including any solar or W Water storage loss:	ay Vd,average = (Apr th Vd,m = factor 89.60 n x nm x Tm/360 1 117.35 1 17.60 /WHRS storage v	(25 x N) + 3 May from Table 85.94 00 kWh/mo 112.60 16.89 within sam	36 Jun e 1c x (43) 82.29 82.29 8 onth (see Table 97.17 9 14.58 1 e vessel	Jul Aug 2.29 85.94 les 1b, 1c 1d) 0.04 0.04 103.32 3.51 15.50	Sep 89.60 104.56 15.68	Oct N 93.26 96 $\Sigma(44)112 =$ 13 121.85 13 $\Sigma(45)112 =$ 18.28	$\begin{array}{c c} 2.41 & (42) \\ \hline 91.43 & (43) \\ \hline 00 & Dec \\ \hline 5.91 & 100.57 \\ \hline 1097.15 & (44) \\ \hline 3.01 & 144.44 \\ \hline 1438.53 & (45) \\ \hline 0.95 & 21.67 & (46) \\ \hline 110.00 & (47) \\ \hline \end{array}$
Assumed occupancy, N Annual average hot water usage in litres per day I an Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26 Energy content of hot water used = $4.18 \times Vd$,r 149.14 130.44 134.6 Distribution loss 0.15 x (45)m 22.37 19.57 20.19 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kn	ay Vd,average = (Apr th Vd,m = factor 89.60 n x nm x Tm/360 1 117.35 17.60 /WHRS storage v hown	(25 x N) + 3 May from Table 85.94 00 kWh/mc 112.60 16.89 within sam	36 Jun e 1c x (43) 82.29 8 onth (see Tabl 97.17 9 14.58 1 e vessel	Jul Aug 2.29 85.94 les 1b, 1c 1d) 0.04 0.04 103.32 3.51 15.50	Sep 89.60 104.56 15.68	Oct N 93.26 96 $\Sigma(44)112 =$ 13 121.85 13 $\Sigma(45)112 =$ 18.28	2.41 (42) 91.43 (43) lov Dec 5.91 100.57 1097.15 (44) 3.01 144.44 1438.53 (45) 9.95 21.67 (46) 110.00 (47)
Assumed occupancy, N Annual average hot water usage in litres per day Jan Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26 Energy content of hot water used = $4.18 \times Vd$,r 149.14 130.44 134.6 Distribution loss $0.15 \times (45)m$ 22.37 19.57 20.19 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 (ay Vd,average = (Apr th Vd,m = factor 89.60 n x nm x Tm/360 1 117.35 1 117.35 1 17.60 WHRS storage v hown kWh/litre/day)	(25 x N) + 3 May from Table 85.94 00 kWh/mo 112.60 16.89 within sam	36 Jun e 1c x (43) 82.29 82.29 8 onth (see Table 97.17 9 14.58 1 e vessel	Jul Aug 2.29 85.94 les 1b, 1c 1d) 0.04 0.04 103.32 3.51 15.50	Sep 89.60 104.56 15.68	Oct N 93.26 96 $\Sigma(44)112 =$ 13 121.85 13 $\Sigma(45)112 =$ 13 18.28 19	$\begin{array}{c c} 2.41 & (42) \\ \hline 91.43 & (43) \\ \hline 0v & Dec \\ \hline 5.91 & 100.57 \\ \hline 1097.15 & (44) \\ \hline 3.01 & 144.44 \\ \hline 1438.53 & (45) \\ \hline 0.95 & 21.67 & (46) \\ \hline 110.00 & (47) \\ \hline 0.02 & (51) \\ \hline \end{array}$
Assumed occupancy, N Annual average hot water usage in litres per day Jan Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26 Energy content of hot water used = 4.18 x Vd,r 149.14 130.44 134.6 Distribution loss 0.15 x (45)m 22.37 19.57 20.19 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 (Volume factor from Table 2a	ay Vd,average = (Apr th Vd,m = factor 89.60 n x nm x Tm/360 1 117.35 1 17.60 /WHRS storage w hown kWh/litre/day)	(25 x N) + 3 May from Table 85.94 00 kWh/mc 112.60 16.89 within sam	36 Jun e 1c x (43) 82.29 82.29 83 onth (see Tabl 97.17 91 14.58 11 e vessel	Jul Aug 2.29 85.94 les 1b, 1c 1d) 0.04 0.04 103.32 3.51 15.50	Sep 89.60 104.56 15.68	Oct N 93.26 96 $\Sigma(44)112 =$ 13 121.85 13 $\Sigma(45)112 =$ 18.28	$\begin{array}{c c} 2.41 & (42) \\ \hline 91.43 & (43) \\ \hline 0v & Dec \\ \hline 5.91 & 100.57 \\ \hline 1097.15 & (44) \\ \hline 3.01 & 144.44 \\ \hline 1438.53 & (45) \\ \hline 0.95 & 21.67 & (46) \\ \hline 110.00 & (47) \\ \hline \hline 0.02 & (51) \\ \hline 1.03 & (52) \\ \hline \end{array}$
Assumed occupancy, N Annual average hot water usage in litres per day Jan Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26 Energy content of hot water used = 4.18 x Vd,r 149.14 130.44 134.6 Distribution loss 0.15 x (45)m 22.37 19.57 20.19 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 Volume factor from Table 2a Temperature factor from Table 2b	ay Vd,average = (Apr th Vd,m = factor 89.60 n x nm x Tm/360 1 117.35 17.60 WHRS storage v hown kWh/litre/day)	(25 x N) + 3 May from Table 85.94 00 kWh/mo 112.60 16.89 within sam	36 Jun e 1c x (43) 82.29 82.29 8 onth (see Table 97.17 9 14.58 1 e vessel	Jul Aug 2.29 85.94 les 1b, 1c 1d) 0.04 0.04 103.32 3.51 15.50	Sep 89.60 104.56 15.68	Oct N 93.26 96 $\Sigma(44)112 =$ 13 121.85 13 $\Sigma(45)112 =$ 13 18.28 19	$\begin{array}{c c} 2.41 & (42) \\ \hline 91.43 & (43) \\ \hline 0v & Dec \\ \hline 5.91 & 100.57 \\ \hline 1097.15 & (44) \\ \hline 3.01 & 144.44 \\ \hline 1438.53 & (45) \\ \hline 0.95 & 21.67 & (46) \\ \hline 110.00 & (47) \\ \hline 0.02 & (51) \\ \hline 1.03 & (52) \\ \hline 0.60 & (53) \\ \hline \end{array}$
Assumed occupancy, N Annual average hot water usage in litres per day Jan Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26 Energy content of hot water used = $4.18 \times Vd$,r 149.14 130.44 134.6 Distribution loss $0.15 \times (45)m$ 22.37 19.57 20.19 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 20 Volume factor from Table 22 Temperature factor from Table 2b Energy lost from water storage (kWh/day)	ay Vd,average = (Apr th Vd,m = factor 89.60 n x nm x Tm/360 1 117.35 1 117.35 1 17.60 /WHRS storage v hown kWh/litre/day) (47) x (51) x (52)	(25 x N) + 3 May from Table 85.94 00 kWh/mo 112.60 16.89 within sam	36 Jun e 1c x (43) 82.29 82.29 83 onth (see Table 97.17 94 14.58 13 e vessel	Jul Aug 2.29 85.94 les 1b, 1c 1d) 0.04 0.04 103.32 3.51 15.50	Sep 89.60 104.56 15.68	Oct N 93.26 96 $\Sigma(44)112 =$ 13 121.85 13 $\Sigma(45)112 =$ 18.28	$\begin{array}{c c} 2.41 & (42) \\ \hline 91.43 & (43) \\ \hline 0v & Dec \\ \hline 5.91 & 100.57 \\ \hline 1097.15 & (44) \\ \hline 3.01 & 144.44 \\ \hline 1438.53 & (45) \\ \hline 0.95 & 21.67 & (46) \\ \hline 110.00 & (47) \\ \hline 0.02 & (51) \\ \hline 1.03 & (52) \\ \hline 0.60 & (53) \\ \hline 1.03 & (54) \\ \hline \end{array}$
Assumed occupancy, N Annual average hot water usage in litres per day Jan Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26 Energy content of hot water used = 4.18 x Vd,r 149.14 130.44 134.6 Distribution loss 0.15 x (45)m 22.37 19.57 20.19 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 (Volume factor from Table 2a Temperature factor from Table 2b Energy lost from water storage (kWh/day) Enter (50) or (54) in (55)	Apr Apr th Vd,m = factor 89.60 n x nm x Tm/360 1 117.35 17.60 WHRS storage w hown kWh/litre/day) (47) x (51) x (52)	(25 x N) + 3 May from Table 85.94 00 kWh/mo 112.60 16.89 within sam	36 Jun e 1c x (43) 82.29 82.29 8 onth (see Table) 97.17 9 14.58 1 e vessel	Jul Aug 2.29 85.94 les 1b, 1c 1d) 0.04 0.04 103.32 3.51 15.50	Sep 89.60 104.56 15.68	Oct Ν 93.26 96 Σ(44)112 = 121.85 13 Σ(45)112 = 18.28 19	$\begin{array}{c c} 2.41 & (42) \\ \hline 91.43 & (43) \\ \hline 0v & Dec \\ \hline 5.91 & 100.57 \\ \hline 1097.15 & (44) \\ \hline 3.01 & 144.44 \\ \hline 1438.53 & (45) \\ \hline 0.95 & 21.67 & (46) \\ \hline 110.00 & (47) \\ \hline 0.02 & (51) \\ \hline 1.03 & (52) \\ \hline 0.60 & (53) \\ \hline 1.03 & (54) \\ \hline 1.03 & (55) \\ \hline \end{array}$
Assumed occupancy, N Annual average hot water usage in litres per day Jan Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26 Energy content of hot water used = 4.18 x Vd,r 149.14 130.44 134.6 Distribution loss 0.15 x (45)m 22.37 19.57 20.19 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 (Volume factor from Table 2a Temperature factor from Table 2b Energy lost from water storage (kWh/day) Enter (50) or (54) in (55) Water storage loss calculated for each month	ay Vd,average = (Apr th Vd,m = factor 89.60 n x nm x Tm/360 1 117.35 1 117.35 1 17.60 /WHRS storage v hown kWh/litre/day) (47) x (51) x (52) (55) x (41)m	(25 x N) + 3 May from Table 85.94 00 kWh/mo 112.60 16.89 within sam	36 Jun e 1c x (43) 82.29 82.29 8 onth (see Table 97.17 9 14.58 1 e vessel	Jul Aug 2.29 85.94 les 1b, 1c 1d) 0.04 0.04 103.32 3.51 15.50	Sep 89.60 104.56 15.68	Oct N 93.26 96 $\Sigma(44)112 =$ 13 121.85 13 $\Sigma(45)112 =$ 18 18.28 19	$\begin{array}{c c} 2.41 & (42) \\ \hline 91.43 & (43) \\ \hline 0v & Dec \\ \hline 5.91 & 100.57 \\ \hline 1097.15 & (44) \\ \hline 3.01 & 144.44 \\ \hline 1438.53 & (45) \\ \hline 0.95 & 21.67 & (46) \\ \hline 110.00 & (47) \\ \hline 0.02 & (51) \\ \hline 1.03 & (52) \\ \hline 0.60 & (53) \\ \hline 1.03 & (54) \\ \hline 1.03 & (55) \\ \hline \end{array}$
Assumed occupancy, N Annual average hot water usage in litres per day I an Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26 Energy content of hot water used = $4.18 \times Vd$,r 149.14 130.44 134.6 Distribution loss $0.15 \times (45)m$ 22.37 19.57 20.19 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 20 Volume factor from Table 20 Temperature factor from Table 20 Energy lost from water storage (kWh/day) Enter (50) or (54) in (55) Water storage loss calculated for each month 32.01 28.92 32.01	ay Vd,average = (Apr th Vd,m = factor 89.60 n x nm x Tm/360 1 117.35 1 117.35 1 17.60 /WHRS storage w hown kWh/litre/day) (47) x (51) x (52) (55) x (41)m 30.98	(25 x N) + 3 May from Table 85.94 00 kWh/mo 112.60 16.89 within sam) x (53) 32.01	36 Jun e 1c x (43) 82.29 8. onth (see Table 97.17 9. 14.58 1. e vessel 30.98 3.	Jul Aug 2.29 85.94 les 1b, 1c 1d) 0.04 0.04 103.32 3.51 15.50 2.01 32.01	Sep 89.60 104.56 15.68 30.98	Oct N 93.26 96 $\Sigma(44)112 =$ 13 121.85 13 $\Sigma(45)112 =$ 13 18.28 19 18.28 19 32.01 30	$\begin{array}{c c c c c c c c c c c c c c c c c c c $
Assumed occupancy, N Annual average hot water usage in litres per day Jan Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26 Energy content of hot water used = $4.18 \times Vd$,r 149.14 130.44 134.6 Distribution loss $0.15 \times (45)m$ 22.37 19.57 20.19 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 Volume factor from Table 2a Temperature factor from Table 2b Energy lost from water storage (kWh/day) Enter (50) or (54) in (55) Water storage loss calculated for each month 32.01 28.92 32.01 If the vessel contains dedicated solar storage of	Apr Apr th Vd,m = factor 89.60 n x nm x Tm/360 1 117.35 117.60 WHRS storage v hown kWh/litre/day) (47) x (51) x (52) (55) x (41)m 30.98 r dedicated WW	(25 x N) + 3 May from Table 85.94 00 kWh/mo 112.60 16.89 within sam) x (53) 32.01 /HRS (56)m	36 Jun 81 82.29 8 97.17 9 14.58 1 e vessel 1 30.98 3 30.98 3 x [(47) - Vs] -	Jul Aug 2.29 85.94 2.29 85.94 des 1b, 1c 1d) 0.04 0.04 103.32 3.51 15.50 2.01 32.01 ÷ (47), else (56)	Sep 89.60 104.56 15.68 30.98	Oct N 93.26 96 $\Sigma(44)112 =$ 13 121.85 13 $\Sigma(45)112 =$ 13 18.28 19 18.28 19 32.01 30	$\begin{array}{c c c c c c c c c c c c c c c c c c c $

Primary circuit l	oss for each	n month fro	om Table 3										
	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
Combi loss for e	each month	from Table	e 3a, 3b or 3	с									
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
Total heat requi	ired for wat	er heating	calculated f	or each mo	onth 0.85 x	: (45)m + (4	6)m + (57)ı	m + (59)m +	- (61)m				
	204.42	180.37	189.88	170.85	167.88	150.66	145.32	158.60	158.05	177.13	186.50	199.72	(62)
Solar DHW inpu	t calculated	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 wa	ter heater f	for each me	onth (kWh/i	month) (62	2)m + (63)n	n		•					_
	204.42	180.37	189.88	170.85	167.88	150.66	145.32	158.60	158.05	177.13	186.50	199.72	1
			1				1			Σ(64)1	.12 = 2	.089.37] (64)
Heat gains from	water heat	ing (kWh/r	nonth) 0.2	5 × [0.85 ×	(45)m + (61	L)m] + 0.8 >	< [(46)m + (57)m + (59)	m]	2.			, , L
Ū	93,81	83.31	, 88,98	81.81	81.66	75.10	74.16	78.58	77.56	84.74	87.02	92.25] (65)
	55.61	00.01	00.50	01.01	01.00	, 5.10	,	1 10.50	77.50	01.71	07.02	52.25] (00)
5. Internal gain	ns												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains	(Table 5)												
	120.48	120.48	120.48	120.48	120.48	120.48	120.48	120.48	120.48	120.48	120.48	120.48	(66)
Lighting gains (c	alculated ir	Appendix	L, equation	L9 or L9a),	also see Ta	able 5							
	19.11	16.98	13.81	10.45	7.81	6.60	7.13	9.26	12.43	15.79	18.43	19.64	(67)
Appliance gains	(calculated	in Append	ix L, equatio	on L13 or L1	13a), also s	ee Table 5							
	213.71	215.92	210.33	198.44	183.42	169.31	159.88	157.66	163.25	175.14	190.16	204.28	(68)
Cooking gains (c	calculated in	n Appendix	L, equation	L15 or L15	a), also see	Table 5							-
	35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05	(69)
Pump and fan g	ains (Table	5a)											_
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00] (70)
Losses e.g. evap	oration (Ta	ble 5)	1							I], ,
	-96.39	-96.39	-96.39	-96.39	-96.39	-96.39	-96.39	-96.39	-96.39	-96.39	-96.39	-96.39	7(71)
Water heating g	gains (Table	5)				1		1], ,
	126.09	123.98	119.59	113.63	109.76	104.31	99.68	105.61	107.72	113.89	120.86	123.99	7(72)
Total internal ga	ains (66)m ·	+ (67)m + (68)m + (69)	m + (70)m ·	+ (71)m + (72)m] (. –/
	418.05	416.02	402.88	381.67	360 14	, 339.36	325.83	331.68	342 55	363 97	388 59	407.05] (73)
	110.05	110.02	102.00	301.07	300.11	333.30	323.03	331.00	312.33	303.37		107.05] (, 5)
6. Solar gains													
			Access f	actor	Area	So	lar flux		g	FF		Gains	
			lable	6d	m-	v	V/m²	spec or T	ific data able 6b	specific of or Table	lata 6c	w	
NorthFact			0.7	7	14.12		1 20		<u>) 40</u>	0.80		25.22	7 (75)
Solar gains in w	atte 5(71)m	(97)m	0.7	/ × L	14.12		1.20 X	0.9 X	J.40 X	0.80	= [55.55] (75)
		71.01	120 57	212 70	200.02	204.04	205.20	227.41	157.00	07.00	44.45	20.05] (02)
Total asing int.	35.33	/1.91	129.57	212.79	286.03	304.94	285.26	227.41	157.88	87.89	44.45	28.85] (83)
Total gains - Inte		nar (73)m ⊣	+ (83)m										7 (2.4)
	453.38	487.94	532.45	594.45	646.17	644.29	611.09	559.09	500.43	451.86	433.05	435.90] (84)
7. Mean interr	nal tempera	ture (heati	ing season)	· ·									
Temperature du	uring heatin	g periods i	n the living a	area from T	able 9. Th	L(°C)						21.00	(85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	or for gains f	or living ar	ea n1,m (se	• e Table 9a)				Ŭ	•				
	1.00	1.00	0.98	0.93	0.77	0.55	0.40	0.46	0.74	0.96	0.99	1.00	(86)
Mean internal t	emp of livin	g area T1 (steps 3 to 7	in Table 90	 ;)		1	1					, - ∘,
					•								

Temperature during heating periods in the rest of dwelling from Table 9, Th2(C) 20.32 20.33 20.33 19.99 19.72 19.21 19.21 49.21 49.21 49.21 20.32 20.32 20.32 20.32 20.33 20.33 19.99 19.72 19.21 49.21 49.21 49.21 49.21 49.21 49.21 49.21 49.21 49.21 49.21 49.21 49.21	
20.32 20.33 19.99 19.72 19.72 19.74 19.76 19.88 20.10 20.37 20.52 20.55 20.55 20.55 20.53 20.33 19.99 19.72 (92) Apply adjustment to the mean internal temperature from Table 4e where appropriate 19.76 19.88 20.10 20.37 20.55 20.55 20.55 20.55 20.55 20.55	
Utilisation factor for gains for rest of dwelling n2,m 1.00 0.99 0.98 0.91 0.72 0.50 0.34 0.39 0.68 0.99 1.00 (99) Mean internal temperature in the rot of dwelling 12 (follow steps 31 of in Table 9:0) 19.46 19.55 19.63 20.13 20.22 20.32 20.32 20.33 10.99 19.72 19.42 (90) Waan internal temperature for the whole dwelling fLA X T1 +(1) - fLA) x T2 19.76 19.88 20.10 20.37 20.52 20.55 20.55 20.55 20.33 19.99 19.72 (92) Apply adjustment to the mean internal temperature from Table 4e where appropriate 19.76 19.88 20.10 20.37 20.52 20.55 20.55 20.55 20.33 19.99 19.72 (92) Apply adjustment to the mean internal temperature from Table 4e where appropriate 19.76 19.88 20.10 20.37 20.52 20.55 20.55 20.55 20.33 19.99 19.72 (92) Listication factor for gains, m 1.00 0.99 0.98 0.91 0.74 0.52 0.36 0.42 0.70	
1.00 0.99 0.98 0.91 0.72 0.50 0.34 0.39 0.68 0.95 0.99 1.00 (89) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) Living area fracio Living area fracio Living area fracio Living area fracio <td colspan<="" td=""></td>	
Mean internal temperature in the rest of dwelling 12 (follow steps 3 to 7 in Table 9c) 19.46 19.59 19.83 20.13 20.22 20.32 20.32 20.30 20.09 19.72 19.47 (91) Mean internal temperature for the whole dwelling 12 x 11 + (1 - (LA) x T2 19.76 19.88 20.10 20.37 20.52 20.55 20.55 20.53 20.33 19.99 19.72 (92) Apply adjustment to the mean internal temperature from Table 4e where appropriate 19.76 19.88 20.10 20.37 20.52 0.55 20.55 20.53 20.33 19.99 19.72 (92) Apply adjustment to the mean internal temperature from Table 4e where appropriate 19.76 19.88 20.10 20.37 20.52 0.55 20.53 20.33 19.99 19.72 (92) Space heating requirement 19.76 19.88 20.10 20.74 0.52 0.55 20.53 20.33 19.99 19.72 (92) Used up and Apply adjustment to the mean internal temperature from Table 42 10.0 0.99 0.91 0.74 0.52 0.36 0.42 0.70 7.21 4.20	
19.46 19.59 19.83 20.13 20.29 20.32 20.32 20.30 20.09 19.72 19.42 (90) Living area fraction Living area fraction Living area f (A) = 0.34 (91) Mean internal temperature for the whole dwelling fLAx T1 + (1. / LA) × T2 19.76 19.88 20.10 20.37 20.52 20.55 20.53 20.33 19.99 19.72 (92) Apply adjustment to the mean internal temperature from Table 4e where appropriate 19.76 19.88 20.10 20.37 20.52 20.55 20.53 20.33 19.99 19.72 (93) S. Space heating requirement Internal temperature from Table 4e where appropriate Utilisation factor for gains, m Internal temperature from Table 4 Nov Dec Utilisation factor for gains, m 1.00 0.99 0.58 0.91 0.74 0.52 0.36 0.42 0.70 0.95 0.99 1.00 (94) Useful gains, mGm, W (94)m x (84)m Internal temperature from Table 4 Internal temperature from Table 4 (91) 1.00 (92) (92) (92) 65.0 8.90 1.1.70	
Living area fraction Uning area fraction Living area fraction Mean internal temperature for the whole dwelling fLA x T1 + (1 - fLA) x T2 19.76 19.88 20.10 20.37 20.52 20.55 20.55 20.55 20.55 20.53 20.33 19.99 19.72 (3) Apply adjustment to the mean internal temperature from Table de where appropriate Living area, fLA Separate heating requirement, Wal/mathefine Aggin Ka K1 (100 0.99 0.98 0.91 0.74 0.52 0.55 0.05 0.05 0.05 0.05 0.05 0.05	
Mean internal temperature for the whole dwelling fLA x T1 + (1 - fLA) x T2 19.76 19.88 20.10 20.32 20.52 20.55 20.53 20.33 19.99 19.72 (92) Apply adjustment to the mean internal temperature from Table 4e where appropriate 19.76 19.88 20.10 20.37 20.52 20.55 20.55 20.53 20.33 19.99 19.72 (93) 3. Space heating requirement 19.76 19.88 0.91 0.74 0.52 0.36 0.42 0.70 0.95 0.99 1.00 (94) Useful gains, mGM W(94)m 64.75 429.04 434.58 (95) Monthly average external temperature from Table U1 14.60 16.60 16.40 14.10 10.60 7.10 4.20 (96) Heat loss rate for mean internal temperature, Im, W (193)m x	
19.76 19.88 20.10 20.37 20.52 20.55 20.55 20.53 20.33 19.99 19.72 (92) Apply adjustment to the mean internal temperature from Table 4e where appropriate 19.76 19.88 20.10 20.37 20.52 20.55 20.55 20.53 20.33 19.99 19.72 (93) 8. Space heating requirement Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains, qm 1.00 0.99 0.98 0.91 0.74 0.52 0.36 0.42 0.70 0.95 0.99 1.00 (94) Useful gains, qmGm, W (94)m x (84)m 451.57 484.18 520.49 542.18 476.17 331.94 221.13 232.19 350.86 427.51 429.04 434.58 (95) Monthy average external temperature, tm, W ([39]m x ([39]m - (96)m] 865.52 839.33 761.92 444.08 333.17 221.20 232.40 360.40 545.36 722.62 869.93 (97) Space heating requirement, WWh/mM/m /m (25)m) x (41)m	
Apply adjustment to the mean internal temperature from Table 4e where appropriate 19.76 19.88 20.10 20.37 20.52 20.55 20.55 20.53 20.33 19.99 19.72 (93) Space heating requirement Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains, nm 1.00 0.99 0.98 0.91 0.74 0.52 0.36 0.42 0.70 0.95 0.99 1.00 (94) Useful gains, nm 451.57 484.18 520.49 542.18 476.17 331.94 221.13 232.19 350.86 427.51 429.04 434.58 (95) Monthly average external temperature from Table UI 4.30 4.90 65.50 8.90 1.70 1.4.60 1.6.40 1.4.10 1.0.60 7.10 4.20 (96) State for mean internal temperature from Table UI 5.50 8.93 3.1.7 221.20 232.40 360.40 545.36<	
19.76 19.88 20.10 20.37 20.52 20.55 20.53 20.33 19.99 19.72 (93) 8. Space heating requirement Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains, nm 1.00 0.99 0.98 0.91 0.74 0.52 0.36 0.42 0.70 0.95 0.99 1.00 (94) Useful gains, npmGm, W (94)m x (84)m 476.17 331.94 221.13 232.19 350.86 427.51 429.04 434.58 (95) Monthly average external temperature from Table U1 4.30 4.90 6.50 8.90 11.70 14.60 16.60 16.40 14.10 10.60 7.10 4.20 (96) Heat loss rate for mean internal temperature, Inv, W ((39)m (93)m (93)m (93)m (93)m (93)m (93)m (93)m (94)m (94)m (93)m (94)m (93)m (94)m (93)m (94)m (93)m (94)m (93)m (93)m (96)m 50 50.62 859.33 761.92 642.55 494.08 333.17 221.20 232.40 360.40 545.36 722.62 869.93 (97) Space heating requirement, Wuh/mon	
S. Space heating requirements Space heating requirement Nav Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains, nm 1.00 0.99 0.98 0.91 0.74 0.52 0.36 0.42 0.70 0.95 0.99 1.00 (94) Useful gains, nmGm, W (94)m x (84)m 451.57 484.18 520.49 542.18 476.17 331.94 221.13 232.19 350.86 427.51 429.04 434.58 (95) Monthly average external temperature from Table U1 43.0 4.90 6.50 8.90 1.70 1.4.60 16.60 16.40 14.10 10.60 7.10 4.20 (96) Heat loss rate for mean intermenal temperature, Lm, W (139)m x (193)m (96)m 866.52 839.33 761.92 642.55 494.08 333.17 221.20 232.40 360.40 545.36 722.62 869.93 (97) Space heating requirement, kWh/month 0.024 x (197)m - (95)m] x (41)m 308.73 238.66 <t< td=""></t<>	
B. Space heating requirement Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains, m 1.00 0.99 0.98 0.91 0.74 0.52 0.36 0.42 0.70 0.95 0.99 1.00 (94) Useful gains, mGm, W (94)m x (84)m 431.57 484.18 520.49 542.18 476.17 331.94 221.13 232.19 350.86 427.51 429.04 434.58 (95) Monthly average external temperature from Table U1 4.30 4.90 6.50 82.01 11.70 14.60 16.60 16.40 14.10 10.60 7.10 4.20 (96) Heat loss rate for mean internal temperature, tm, W (139)m x (193)m (96)m] 86.52 839.33 761.92 642.55 494.08 333.17 221.20 232.40 360.40 545.36 722.62 869.93 (97) Space heating requirement, kWh/month 0.024 x(197)m - (95)m] x (41)m 1.03 1.00	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains, nm 1.00 0.99 0.98 0.91 0.74 0.52 0.36 0.42 0.70 0.95 0.99 1.00 (94) Useful gains, nmGn, W (94)m x (84)m 451.57 484.18 520.49 542.18 476.17 331.94 221.13 232.19 350.86 427.51 429.04 434.58 (95) Monthly average external temperature from Table U1 4.30 4.90 6.50 8.90 11.70 14.60 16.60 16.40 14.10 10.60 7.10 4.20 (96) Heat loss rate for mean internal temperature, Lm, W ((39)m x ((93)m x (93)m (96)m) 866.52 89.33 761.92 642.55 494.08 333.17 221.20 232.40 360.40 545.35 722.62 869.93 (97) Space heating requirement, kWh/month 0.024 x ([97)m - (95)m) x (41)m 10.02 (308.73 238.66 177.62	
Utilisation factor for gains, nm 1.00 0.99 0.98 0.91 0.74 0.52 0.36 0.42 0.70 0.95 0.99 1.00 (94) Useful gains, nmGm, W (94)m x (84)m 451.57 484.18 520.49 542.18 476.17 331.94 221.13 232.19 350.86 427.51 429.04 434.58 (95) Monthly average external temperature from Table U1 4.30 4.90 6.50 8.90 11.70 14.60 16.60 16.40 14.10 10.60 7.10 4.20 (96) Heat loss rate for mean internal temperature, Lm, W [(39)m × [(93)m - (96)m] 866.52 839.33 761.92 642.55 494.08 333.17 221.20 232.40 360.40 545.36 722.62 869.93 (97) Space heating requirement, kWh/month 0.024 x (97)m - (95)m) x (41)m 308.73 238.66 179.62 72.26 13.33 0.00 0.00 0.00 87.67 211.38 323.90 Space heating requirement kWh/m²/year (98) ± (4) 18.57 (99) 9 9 9 9 1.00 (302) 1.33	
1.00 0.99 0.98 0.91 0.74 0.52 0.36 0.42 0.70 0.95 0.99 1.00 (94) Useful gains, nmGm, W (94)m x (84)m 451.57 484.18 520.49 542.18 476.17 331.94 221.13 232.19 350.86 427.51 429.04 434.58 (95) Monthly average external temperature from Table U1 4.30 6.50 8.90 11.70 14.60 16.60 16.40 14.10 10.60 7.10 4.20 (96) Heat loss rate for mean internal temperature, Lm, W ([39]m x [(93)m - (96)m] 866.52 839.33 761.92 642.55 494.08 333.17 221.20 232.40 360.40 545.36 722.62 869.93 (97) Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m 50 50.00 0.00 0.00 87.67 211.38 323.90 2(98) ± (4) 18.57 (98) Space heating requirement kWh/m²/year (98) ± (4) 18.57 (99) 9b 1.00 (302) (303) 1.00 (302) 1.00	
Useful gains, nmGin, W (94)m x (84)m 451.57 484.18 50.49 542.18 476.17 331.94 221.13 232.19 350.86 427.51 429.04 434.58 (95) Monthly average external temperature from Table U1 4.30 4.90 6.50 8.90 11.70 14.60 16.60 16.40 14.10 10.60 7.10 4.20 (96) Heat loss rate for mean intermal temperature, In, W [(39)m x ([93)m - (96)m] 665.52 839.33 761.92 642.55 494.08 333.17 221.20 232.40 360.40 545.36 722.62 869.93 (97) Space heating requirement, kWh/month 0.024 x (197)m - (95)m] x (41)m 308.73 238.66 179.62 72.26 13.33 0.00 0.00 0.00 87.67 211.38 323.90 Space heating requirement kWh/m²/year (98) + (4) 18.57 (99) 9b. Energy requirements - community heating scheme 1.00 (302) (301) 1.430.1 1.60 (302) (303) (304) (302) x (303a) = 1.00 (302) x (303a) [302 x (304) x (303) [302 x (304)	
451.57 484.18 50.49 542.18 476.17 331.94 221.13 232.19 350.86 427.51 429.04 434.58 (95) Monthly average external temperature from Table U1 4.30 4.90 6.50 8.90 11.70 14.60 16.40 14.10 10.60 7.10 4.20 (96) Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m] 866.52 839.33 761.92 642.55 494.08 333.17 221.20 232.40 360.40 545.36 722.62 869.93 (97) Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m 0.00 0.00 0.00 87.67 211.38 323.90 2(98) ± (4) 18.57 (99) 9) £(98) ± (4) 18.57 (99) 9) £(98) ± (4) 18.57 (99) 9) £(98) ± (4) 18.57 (99) 9) £(13.13) 1.00 (302) x (303a) = 1.00 (302) x (304a) = (302) x (304a) = (304a)	
Monthly average external temperature from Table U1	
4.30 4.90 6.50 8.90 11.70 14.60 16.60 16.40 14.10 10.60 7.10 4.20 (96) Heat loss rate for mean internal temperature, Lm, W [(33)m x [(93)m - (96)m] 866.52 839.33 761.92 642.55 494.08 333.17 221.20 232.40 360.40 545.36 722.62 869.93 (97) Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m Space heating requirement kWh/m²/year (98) \div (4) 18.57 (98) Space heat from secondary/supplementary system (table 11) '0' if none 0.00 (301) Fraction of space heat from community boilers Space heat from community boilers Factor for control and charging method (Table 4c(3)) for community space heating 1.00 (302) (303a) 1.00 (304a) Space heating requirement 1.02 (306) Space heat from community water heating 1.00	
Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m] 866.52 839.33 761.92 642.55 494.08 333.17 221.20 232.40 360.40 545.36 722.62 869.93 (97) Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m 308.73 238.66 179.62 72.26 13.33 0.00 0.00 0.00 87.67 211.38 323.90 Space heating requirement, kWh/m ² /year (98) \pm (4) 18.57 (99) 99) 99. 90. 10.00 0.00 (301) 1.00 (302) 1.00 (302) 1.00 1.00 1.00 1.00 (303)	
866.52 839.33 761.92 642.55 494.08 333.17 221.20 232.40 360.40 545.36 722.62 869.93 (97) Space heating requirement, kWh/month $0.024 \times [(97)m - (95)m] \times (41)m$ 308.73 238.66 179.62 72.26 13.33 0.00 0.00 0.00 0.00 87.67 211.38 323.90 Space heating requirement, kWh/m ² /year (98) \div (4) 18.57 (99) 99 99. 99. $98.9 \div$ (4) 18.57 (99) 9b. Energy requirements - community heating scheme (98) \div (4) 18.57 (99) 99. 91. Fraction of space heat from secondary/supplementary system (table 11) '0' if none 0.00 (301) Fraction of space heat from community system 1 - (301) = 1.00 (302) Fraction of total space heat from community solers (302) x (303a) = 1.00 (304a) Fractor of total space heat from community boilers (302) x (303a) = 1.00 (305a) Fractor of charging method (Table 4c(3)) for community space heating 1.00 (305a) 1.05 (306) Space heating 1.00 (305a)	
Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m 308.73 238.66 179.62 72.26 13.33 0.00 0.00 0.00 87.67 211.38 323.90 Space heating requirement kWh/m²/year (98) \pm (4) 18.57 (99) 9b. Energy requirements - community heating scheme (98) \pm (4) 18.57 (99) 9b. Energy requirements - community heating scheme 0' if none 0.00 (301) Fraction of space heat from secondary/supplementary system (table 11) '0' if none 0.00 (302) Fraction of space heat from community system 1 - (301) = 1.00 (302) Fraction of community heat from boilers (302) x (303a) = 1.00 (304a) Factor for control and charging method (Table 4c(3)) for community space heating 1.00 (305) Factor for charging method (Table 4c(3)) for community water heating 1.00 (305a) Distribution loss factor (Table 12c) for community heating system 1.05 (306) Space heating (98) x (304a) x (305) x (306) = 1507.33 (307a) Water heating (98) x (304a) x (305) x (306) = 1507.33 (307a)	
308.73238.66179.6272.2613.330.000.000.0087.67211.38323.90 $[98]$ Space heating requirement kWh/m²/year(98) ± (4)18.57(99)9b. Energy requirements - community heating schemeFraction of space heat from secondary/supplementary system (table 11)'0' if none0.00(301)Fraction of space heat from community system1.00(302)Fraction of community heat from boilersFraction of total space heat from community boilersFraction of control and charging method (Table 4c(3)) for community space heating1.00GastaDistribution loss factor (Table 12c) for community heating system1435.55(98) x (304a) x (305) x (306) =Interview dotsGastaGastaGastaGastaGastaGastaGastaGastaG	
Space heating requirement kWh/m ² /year (98) \div (4) 18.57 (99) 9b. Energy requirements - community heating scheme Fraction of space heat from secondary/supplementary system (table 11) Fraction of space heat from community system Fraction of community heat from boilers Fraction of total space heat from community boilers Fractor for control and charging method (Table 4c(3)) for community space heating Factor for charging method (Table 4c(3)) for community water heating Factor for charging method (Table 4c(3)) for community water heating Distribution loss factor (Table 12c) for community heating system Space heating requirement Space heat from boilers Space h	
Space heating requirement kWh/m²/year (98) ÷ (4) 18.57 (99) 9b. Energy requirements - community heating scheme Fraction of space heat from secondary/supplementary system (table 11) '0' if none 0.00 (301) Fraction of space heat from community system 1 - (301) = 1.00 (302) Fraction of community heat from boilers 1.00 (303a) Fraction of total space heat from community boilers (302) x (303a) = 1.00 (304a) Factor for control and charging method (Table 4c(3)) for community space heating 1.00 (305a) Factor for charging method (Table 4c(3)) for community water heating 1.00 (305a) Distribution loss factor (Table 12c) for community heating system 1.05 (306) Space heating 1.05 (306) Space heat from boilers (98) x (304a) x (305) x (306) = 1507.33 (307a) Water heating 1435.55 (98)	
9b. Energy requirements - community heating scheme Fraction of space heat from secondary/supplementary system (table 11) Fraction of space heat from community system 1 - (301) = Fraction of community heat from boilers Fraction of total space heat from community boilers Fractor for control and charging method (Table 4c(3)) for community space heating Factor for charging method (Table 4c(3)) for community water heating Distribution loss factor (Table 12c) for community heating system Space heating Annual space heat from boilers Space heat from boilers Space heating Manual space heating requirement (98) x (304a) x (305) x (306) = (307a)	
Fraction of space heat from secondary/supplementary system (table 11) '0' if none 0.00 (301) Fraction of space heat from community system 1 - (301) = 1.00 (302) Fraction of community heat from boilers 1.00 (303a) Fraction of total space heat from community boilers (302) x (303a) = 1.00 (304a) Fractor for control and charging method (Table 4c(3)) for community space heating 1.00 (305a) Factor for charging method (Table 4c(3)) for community water heating 1.00 (305a) Distribution loss factor (Table 12c) for community heating system 1.05 (306) Space heating 1435.55 (98) Space heat from boilers (98) x (304a) x (305) x (306) = 1507.33 (307a)	
Fraction of space heat from community system 1 - (301) = 1.00 (302) Fraction of community heat from boilers 1.00 (303a) Fraction of total space heat from community boilers (302) x (303a) = 1.00 (304a) Fraction of total space heat from community boilers (302) x (303a) = 1.00 (304a) Fraction of total space heat from community boilers (302) x (303a) = 1.00 (304a) Factor for control and charging method (Table 4c(3)) for community space heating 1.00 (305a) Factor for charging method (Table 4c(3)) for community water heating 1.00 (305a) Distribution loss factor (Table 12c) for community heating system 1.05 (306) Space heating 1.05 (306) (305) Space heating requirement 1435.55 (98) (98) x (304a) x (305) x (306) = 1507.33 (307a) Water heating (98) x (304a) x (305) x (306) = 1507.33 (307a)	
Fraction of community heat from boilers 1.00 (303a) Fraction of total space heat from community boilers (302) x (303a) = 1.00 (304a) Factor for control and charging method (Table 4c(3)) for community space heating 1.00 (305) Factor for charging method (Table 4c(3)) for community water heating 1.00 (305a) Distribution loss factor (Table 12c) for community heating system 1.05 (306) Space heating 1.05 (306) Space heating 1435.55 (98) Space heat from boilers (98) x (304a) x (305) x (306) = 1507.33 (307a)	
Fraction of total space heat from community boilers (302) x (303a) = 1.00 (304a) Factor for control and charging method (Table 4c(3)) for community space heating 1.00 (305) Factor for charging method (Table 4c(3)) for community water heating 1.00 (305a) Distribution loss factor (Table 12c) for community heating system 1.05 (306) Space heating Annual space heating requirement Space heat from boilers (98) x (304a) x (305) x (306) = 1507.33 (307a) Water heating	
Factor for control and charging method (Table 4c(3)) for community space heating 1.00 (305) Factor for charging method (Table 4c(3)) for community water heating 1.00 (305a) Distribution loss factor (Table 12c) for community heating system 1.05 (306) Space heating Annual space heating requirement Space heat from boilers Water heating Water heating	
Factor for charging method (Table 4c(3)) for community water heating 1.00 (305a) Distribution loss factor (Table 12c) for community heating system 1.05 (306) Space heating Annual space heating requirement 1435.55 (98) Space heat from boilers (98) x (304a) x (305) x (306) = 1507.33 (307a) Water heating	
Distribution loss factor (Table 12c) for community heating system Space heating Annual space heating requirement 1435.55 (98) Space heat from boilers (98) x (304a) x (305) x (306) = 1507.33 (307a)	
Space heating Annual space heating requirement 1435.55 (98) Space heat from boilers (98) x (304a) x (305) x (306) = 1507.33 Water heating	
Space heating Annual space heating requirement 1435.55 (98) Space heat from boilers (98) x (304a) x (305) x (306) = 1507.33 (307a) Water heating	
Annual space heating requirement 1435.55 (98) Space heat from boilers (98) x (304a) x (305) x (306) = 1507.33 (307a) Water heating Vater heating (98) x (304a) x (305) x (306) = 1507.33 (307a)	
Space heat from boilers (98) x (304a) x (305) x (306) = 1507.33 (307a) Water heating	
Water heating	
Water heating	
Annual water heating requirement 2089.37 (64)	
Water heat from boilers (64) x (303a) x (305a) x (306) = 2193.84 (310a)	
Electricity used for heat distribution $0.01 \times [(307a)(307e) + (310a)(310e)] = 37.01$ (313)	
Electricity for pumps, fans and electric keep-hot (Table 4f)	
mechanical ventilation fans - balanced, extract or positive input from outside 52.10 (330a)	

Electricity for lighting (Appendix L)

Total delivered energy for all uses

(307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) = 4090.81

(332)

337.53

10b. Fuel costs - community heating scheme						
	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from boilers	1507.33	x	4.24	x 0.01 =	63.91	(340a)
Water heating from boilers	2193.84	x	4.24	x 0.01 =	93.02	(342a)
Pumps and fans	52.10	x	13.19	x 0.01 =	6.87	(349)
Electricity for lighting	337.53	x	13.19	x 0.01 =	44.52	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)(342e) +	(345)(354) =	328.32	(355)
11b. SAP rating - community heating scheme						
Energy cost deflator (Table 12)					0.42	(356)
Energy cost factor (ECF)					1.13	(357)
SAP value					84.27]
SAP rating (section 13)					84	(358)
SAP band					В]
12b. CO ₂ emissions - community heating scheme						
	Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from other sources (space heating)						
Efficiency of boilers	94.00					(367a)
CO2 emissions from boilers [(307a)+(310a)] x 100 ÷ (367a) =	3937.41	x	0.216	=	850.48	(367)
Electrical energy for community heat distribution	37.01	x	0.52	=	19.21	(372)
Total CO2 associated with community systems					869.69	(373)
Total CO2 associated with space and water heating					869.69	(376)
Pumps and fans	52.10	x	0.52	=	27.04	(378)
Electricity for lighting	337.53	x	0.52	=	175.18	(379)
Total CO ₂ , kg/year				(376)(382) =	1071.91	(383)
Dwelling CO ₂ emission rate				(383) ÷ (4) =	13.87	(384)
El value					88.26]
El rating (section 14)					88	(385)
El band					В]
13b. Primary energy - community heating scheme						
	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary energy from other sources (space heating)						
Efficiency of boilers	94.00					(367a)
Primary energy from boilers [(307a)+(310a)] x 100 ÷ (367a) =	3937.41	x	1.22	=	4803.65	(367)
Electrical energy for community heat distribution	37.01	x	3.07	=	113.63	(372)
Total primary energy associated with community systems					4917.27	(373)
Total primary energy associated with space and water heating					4917.27	(376)
Pumps and fans	52.10	x	3.07	=	159.96	(378)
Electricity for lighting	337.53	x	3.07	=	1036.22	(379)
Primary energy kWh/year					6113.45	(383)
Dwelling primary energy rate kWh/m2/year					79.09	(384)



Assessor name		Miss Jayr	na Parmar				ŀ	Assessor nur	6549	6549			
Client								L	ast modified	d	23/11	/2016	
Address		B-L00-05	B Centric C	Close, Lond	on, N8								
1. Overall dwellir	ng dimens	sions											
					A	area (m²)		Av	erage storey neight (m)	I	Vo	lume (m³)	
Lowest occupied						63.47	<mark>(1a)</mark> x		2.50	(2a) =		158.68	(3a)
Total floor area		(1a)	+ (1b) + (1e	c) + (1d)(1n) =	63.47	(4)						
Dwelling volume								(3	a) + (3b) + (3	3c) + (3d)(3	sn) =	158.68	(5)
2. Ventilation rat	e									_			
											m³	per hour	
Number of chimne	evs								0	x 40 =		0	(6a)
Number of open fl	ues								0	 x 20 =		0	(6b)
Number of intermi	ittent fan	S							0	 x 10 =		0	(7a)
Number of passive	e vents								0	 x 10 =		0	(7b)
Number of flueless	s gas fires	;							0	x 40 =		0	(7c)
											Air c	hanges pei hour	r
Infiltration due to	chimneys	, flues, fans	s, PSVs		(6a)) + (6b) + (7	a) + (7b) + (7c) =	0	÷ (5) =	:	0.00	(8)
If a pressurisation	test has b	been carried	d out or is ii	ntended, p	roceed to (17), otherw	vise continu	e from (9)) to (16)				
Air permeability va	alue, q50,	expressed	in cubic me	etres per h	our per squ	uare metre	of envelope	e area				4.00	(17)
If based on air peri	meability	value, ther	n (18) = [(17	7) ÷ 20] + (8	3), otherwi	se (18) = (1	6)					0.20	(18)
Number of sides of	n which t	he dwelling	g is sheltere	d								3	(19)
Shelter factor									1	- [0.075 x (1	9)] =	0.78	(20)
Infiltration rate inc	corporatir	ng shelter fa	actor							(18) x (2	20) =	0.16	(21)
Infiltration rate mo	odified fo	r monthly v	wind speed	:									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average v	vind spee	d from Tab	le U2			-							-
	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22)m	÷4					1		L					٦
	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 infiltratio	on rate (al	llowing for	shelter and	wind facto	or) (21) x (4	22a)m	0.45	0.14	0.10	0.47	0.47	0.10	
	0.20	0.19	0.19		0.17	0.15	0.15	0.14	0.16	0.17	0.17	0.18	_ (220)
If mechanical w	ontilation	y air chang	e rate throu	ugh system								0.50	(222)
If balanced with	h heat red	overv: effi	ciency in %	allowing fo	or in-use fa	ctor from T	able 4h					N/A	(23c)
c) whole house	extract v	entilation of	or positive i	nput venti	lation from	n outside					L] (200)
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(24c)
Effective air chang	e rate - e	nter (24a) o	or (24b) or	(24c) or (24	ld) in (25)		-				-		_, · · /
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(25)



3. Heat losses a	and heat lo	ss paramet	er										
Element			а	Gross irea, m ²	Openings m ²	Net A	t area , m²	U-value W/m²K	A x U V	V/K ĸ-' kJ	value, /m².K	Ахк, kJ/K	
Window						12	2.76 x	1.24	= 15.7	7			(27)
Door						2	.32 x	1.80	= 4.18	;			(26)
Ground floor						63	3.47 x	0.20	= 12.6	9			(28a)
External wall						7	.89 x	0.18	= 1.42	!			(29a)
Party wall						57	7.47 x	0.00	= 0.00)			(32)
Total area of ext	ernal elem	ents ∑A, m²	1			86	5.44						(31)
Fabric heat loss,	W/K = ∑(A	× U)							(2	6)(30) + (32) =	34.06	(33)
Heat capacity Cr	n = ∑(А x к)	1						(28)	(30) + (32)	+ (32a)(3	2e) =	N/A	(34)
Thermal mass pa	arameter (1	「MP) in kJ/n	n²K									250.00	(35)
Thermal bridges	: Σ(L x Ψ) c	alculated us	sing Appen	dix K								5.06	(36)
Total fabric heat	loss									(33) + (36) =	39.11	(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)									
	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	(38)
Heat transfer co	efficient, W	//K (37)m +	- (38)m										
	65.30	65.30	65.30	65.30	65.30	65.30	65.30	65.30	65.30	65.30	65.30	65.30	
									Average =	∑(39)112	/12 =	65.30	(39)
Heat loss param	eter (HLP),	W/m²K (39	9)m ÷ (4)										
	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03]
									Average =	∑(40)112	/12 =	1.03	(40)
Number of days	in month (Table 1a)											
	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)
4 14/-1 h 1 ¹		· · · · · · · · · · · · · · · · · · ·											
4. water neath	ng energy r	requiremen	τ									• • • •	
Assumed occupa	ancy, N					26						2.08	(42)
Annual average	not water t	Ech	es per day	vo,average	$e = (25 \times N) +$	30	1.1	A	For	Oct		83.55 Dec	_ (43)
Hot water usage	Jan	rep	Ividi	Api	ividy		2)	Aug	Seh	001	NOV	Dec	
not water usage			05 22			75 10	75 10	70 51	01 00	05.33	00 50	01.00	٦
	91.90	06.50	85.22	81.88	78.54	75.19	75.19	78.54	81.88	5(44)1	12 -	1002 50	
Enormy contont (of hot wate	rusod = 4.1	8 x Vd m y	nm v Tm/	2600 kWb/m	onth (cor	n Tablas 1h	1c 1d)		2(44)1	12 =	1002.59	_ (44)
Lifergy content of	126.20	110.20	122.00	107.24		00 70			05.54	111 25	121 55	121.00	7
	150.29	119.20	125.00	107.24	102.90	00.79	02.20	94.42	95.54	5(AE)1	12 -	1214 55	
Distribution loss	$0.15 \times (45)$	Im								2(45)1	12 –	1514.55	_ (45)
Distribution 1033	20.44	17.88	18.45	16.09	15 / 2	12 27	12.34	14.16	1/ 22	16 70	18.22	10.80	7(46)
Storage volume	(litres) inclu	uding any s	10.45	/HRS stora	ge within san		12.54	14.10	14.55	10.70	10.25	110.00	
Water storage lo		uunig arry so			ge within san	110 103301						110.00](47)
h) Manufacturer	's declared	loss factor	is not know	wn									
Hot water sto	orage loss f	actor from	Table 2 (k)	Nh/litre/da	av)							0.02	7 (51)
Volume facto	or from Tab			vii) iiti c/ uu	·y)							1.03] (51)] (52)
Temperature	factor from	n Table 2h										0.60] (52)] (53)
Energy lost fr	om water		(h/dav) (1	7) x (51) v (52) x (52)							1.03] (57)
Enter (50) or (54) in (55)		, uuy) (4	,,,()+)^(<i>52 N</i> (33)							1.03] (55)
Water storage lo	oss calculat	ed for each	month (5	5) x (41)m							Ĺ	1.05	
	32 01	28.92	32 01	30.98	32 01	30 98	32 01	32.01	30 98	32.01	30 98	32.01	(56)
	52.01	20.52	32.01	50.50	32.01	50.50	52.01	52.01	50.90	52.01	50.50	52.01	

If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56) 32.01 28.92 32.01 30.98 32.01 30.98 32.01 32.01 30.98 32.01 30.98 32.01 (57)Primary circuit loss for each month from Table 3 23.26 21.01 23.26 22.51 23.26 22.51 23.26 23.26 22.51 23.26 22.51 23.26 (59)Combi loss for each month from Table 3a, 3b or 3c 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 (61)Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m 175.04 187.27 191.57 169.13 178.28 160.73 158.17 142.29 137.56 149.69 149.04 166.63 (62)Solar DHW input calculated using Appendix G or Appendix H 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 (63)Output from water heater for each month (kWh/month) (62)m + (63)m 149.04 191.57 169.13 178.28 160.73 158.17 142.29 137.56 149.69 166.63 175.04 187.27 1965.39 ∑(64)1...12 = (64)Heat gains from water heating (kWh/month) 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m] 89.54 79.58 85.12 78.45 78.43 72.32 71.58 75.62 74.56 81.24 83.21 88.11 (65) 5. Internal gains Feb Jan Mar Apr May Jun Jul Aug Sep Oct Nov Dec Metabolic gains (Table 5) 103.89 103.89 103.89 103.89 103.89 103.89 103.89 103.89 103.89 103.89 103.89 103.89 (66)Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 16.19 14.38 11.69 8.85 6.62 5.59 6.04 7.85 10.53 13.37 15.61 16.64 (67)Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 181.61 183.49 178.74 168.63 155.87 135.86 133.98 138.73 148.84 161.60 173.59 143.88 (68)Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 33.39 33.39 33.39 33.39 33.39 33.39 33.39 33.39 33.39 33.39 33.39 33.39 (69)Pump and fan gains (Table 5a) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 (70)Losses e.g. evaporation (Table 5) -83.11 -83.11 -83.11 -83.11 -83.11 -83.11 -83.11 -83.11 -83.11 -83.11 -83.11 -83.11 (71) Water heating gains (Table 5) 120.35 118.42 114.41 108.96 105.42 100.44 96.21 103.56 109.20 115.57 101.63 118.43 (72) Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m 372.31 370.46 359.01 340.61 322.08 304.07 292.28 297.63 306.99 325.58 346.94 362.83 (73) 6. Solar gains Access factor Solar flux FF Gains Area g Table 6d m² W/m² specific data specific data w or Table 6b or Table 6c 0.77 12.76 11.28 0.40 31.93 NorthEast x 0.9 x 0.80 (75) х х _ Solar gains in watts ∑(74)m...(82)m 64.99 117.09 192.29 258.48 275.56 257.79 205.51 142.67 40.17 26.07 31.93 79.42 (83)Total gains - internal and solar (73)m + (83)m 532.91 (84) 404.24 435.44 476.10 580.56 579.64 550.06 503.14 449.66 405.00 387.12 388.90 7. Mean internal temperature (heating season) 21.00 (85) Temperature during heating periods in the living area from Table 9, Th1(°C) Feb Mar Jul Oct Nov Dec Jan Apr May Jun Aug Sep Utilisation factor for gains for living area n1,m (see Table 9a)

	1.00	1.00	0.99	0.96	0.86	0.68	0.52	0.58	0.85	0.98	0.99	1.00	(86)
Mean internal to	emp of livin	g area T1 (s	steps 3 to 7	in Table 9c	:)								
	19.96	20.07	20.28	20.58	20.84	20.97	20.99	20.99	20.89	20.57	20.21	19.93	(87)
Temperature du	iring heating	g periods in	the rest of	f dwelling fi	rom Table 9	9, Th2(°C)	•		•	•	•		-
	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	(88)
Utilisation facto	r for gains f	or rest of d	welling n2,	m	1			I			I], ,
	1.00	0 99	0.98	0.94	0.82	0.60	0.41	0.47	0.78	0.96	0.99	1.00	(89)
Mean internal to	emperature	in the rest	of dwelling	T2 (follow	stens 3 to	7 in Table 9))	0.47	0.70	0.50	0.55	1.00] (03)
		10 02			10.00		20.06	20.05	10.07	10 56	10.04	19.62	(00)
Li in a cura fue at	10.07	10.02	19.14	19.50	19.90	20.04	20.00	20.05	19.97	19.50	(4)	10.02] (90)
Living area fract	ion	for the state	- I	- (1 4 74	(4 (1 A)				Lr	ving area ÷	(4) =	0.54] (91)
Mean internal to	emperature	for the wh	ole dwellin	g fLA x 11 +	-(1 - fLA) x	12							1
	19.36	19.49	19.75	20.11	20.41	20.54	20.56	20.56	20.47	20.10	19.67	19.32	(92)
Apply adjustme	nt to the me	ean interna	l temperati	ure from Ta	ble 4e whe	ere appropr	iate						-
	19.36	19.49	19.75	20.11	20.41	20.54	20.56	20.56	20.47	20.10	19.67	19.32	(93)
8. Space heatin	ng requirem	ent											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains	- 			inay		5 di	,	ocp			200	
o this ation racto	1 00	0.00	0.00	0.05	0.94	0.64	0.47	0.52	0.91	0.06	0.00	1.00	(04)
	1.00	0.99	0.98	0.95	0.84	0.04	0.47	0.53	0.81	0.96	0.99	1.00	(94)
Oserui gains, nr	1Gm, w (94)m x (84)m	 									L	1 ()
	402.44	432.24	467.92	503.91	486.03	372.52	256.46	267.17	364.79	390.63	383.81	387.50] (95)
Monthly average	e external t	emperature	e from Tabl	e U1									-
	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate fo	or mean inte	ernal tempe	erature, Lm	, W [(39)m	x [(93)m -	(96)m]							
	983.65	952.79	865.23	731.82	568.56	387.68	258.64	271.44	415.85	620.40	820.56	987.59	(97)
Space heating re	equirement,	kWh/mon	th 0.024 x	[(97)m - (9	5)m] x (41)	m							
	432.42	349.81	295.60	164.09	61.40	0.00	0.00	0.00	0.00	170.95	314.46	446.47]
									Σ(98	3)15, 10	.12 = 2	2235.19	(98)
Space heating re	equirement	kWh/m²/y	ear							(98)	÷ (4)	35.22	(99)
		-	_]
9b. Energy req	uirements -	communit	y heating s	cheme									
Fraction of spac	e heat from	secondary	/suppleme	ntary syste	m (table 11	.)				'0' if r	none	0.00	(301)
Fraction of spac	e heat from	communit	y system							1 - (30	01) =	1.00	(302)
Fraction of com	munity heat	from boile	ers									1.00	(303a)
Fraction of total	space heat	from comr	nunity boile	ers						(302) x (303	3a) =	1.00	(304a)
Factor for contro	ol and charg	ging metho	d (Table 4c	(3)) for com	munity spa	ace heating						1.00	(305)
Factor for charg	ing method	(Table 4c(3	3)) for comr	nunity wat	er heating							1.00	(305a)
Distribution loss	factor (Tab	le 12c) for	community	, heating sy	stem							1.05	(306)
2.00.0000000000000000000000000000000000					otenn							2.00] (888)
Space beating													
	oting roqui	comont							225 10	1			(00)
Annual space ne	ating requi	ement						<u>/</u> 00	255.19) , (205) (2(246.05	(90)
Space neat from	1 Dollers							(98	s) x (304a) x	(305) X (30	J6) = <u>2</u>	2346.95] (307a)
Water heating								·		1			
Annual water he	eating requi	rement							965.39	J			(64) 7
Water heat fron	n boilers							(64)	x (303a) x	(305a) x (30	06) = 2	2063.66	(310a)
Electricity used	for heat dist	ribution					0.01	L × [(307a)	.(307e) + (3	310a)(310	e)] =	44.11	(313)
Electricity for pu	umps, fans a	nd electric	keep-hot (Table 4f)									

mechanical ventilation fans - balanced, extract or positive input from outside

42.78

(330a)

Total electricity for the above, kWh/year Electricity for lighting (Appendix L)

Total delivered energy for all uses

	42.78	(331)
	285.93	(332)
(307) + (309) + (310) + (312) + (315) + (331) + (332)(337b) =	4739.32	(338)

10b. Fuel costs - community neating scheme						
	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from boilers	2346.95	х	4.24	x 0.01 =	99.51	(340a)
Water heating from boilers	2063.66	х	4.24	x 0.01 =	87.50	(342a)
Pumps and fans	42.78	х	13.19	x 0.01 =	5.64	(349)
Electricity for lighting	285.93	х	13.19	x 0.01 =	37.71	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)(342e) +	+ (345)(354) =	350.37	(355)
11b. SAP rating - community heating scheme						
Energy cost deflator (Table 12)					0.42	(356)
Energy cost factor (ECF)					1.36	(357)
SAP value					81.07	
SAP rating (section 13)					81	(358)
SAP band					В	

12b. CO₂ emissions - community heating scheme

		Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from other sources	(space heating)						
Efficiency of boilers		94.00					(367a)
CO2 emissions from boilers	[(307a)+(310a)] x 100 ÷ (367a) =	4692.14	x	0.216	=	1013.50	(367)
Electrical energy for communit	ty heat distribution	44.11	x	0.52	=	22.89	(372)
Total CO2 associated with com	imunity systems					1036.39	(373)
Total CO2 associated with space	ce and water heating					1036.39	(376)
Pumps and fans		42.78	x	0.52	=	22.20	(378)
Electricity for lighting		285.93	x	0.52	=	148.40	(379)
Total CO₂, kg/year					(376)(382) =	1206.99	(383)
Dwelling CO₂ emission rate					(383) ÷ (4) =	19.02	(384)
El value						85.09]
El rating (section 14)						85	(385)
El band						В]
13b. Primary energy - comm	unity heating scheme						-
		Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary energy from other sou	irces (space heating)						
Efficiency of boilers		94.00					(367a)
Primary energy from boilers	[(307a)+(310a)] x 100 ÷ (367a) =	4692.14	x	1.22	=	5724.42	(367)
Electrical energy for communit	ty heat distribution	44.11	х	3.07	=	135.41	(372)
Total primary energy associate	ed with community systems					5859.82	(373)
Total primary energy associate	ed with space and water heating					5859.82	(376)
Pumps and fans		42.78	x	3.07	=	131.34	(378)

877.79

(379)

х

3.07

=

285.93

Primary energy kWh/year

Dwelling primary energy rate kWh/m2/year

6868.95	(383)
108.22	(384)



Assessor name		Miss Jayr	na Parmar					Assessor nur	nber	6549	6549		
Client									Last modifie	d	23/11	/2016	
Address		B-L00-02	B Centric (Close, Lond	on, N8								
1. Overall dwellin	g dimens	sions											
					A	Area (m²)		Av	erage storey height (m)	1	Vo	lume (m³)	
Lowest occupied						95.27	(1a) x		2.50	(2a) =		238.18	(3a)
Total floor area		(1a)	+ (1b) + (1	c) + (1d)(1n) =	95.27	(4)						
Dwelling volume								(3	a) + (3b) + (3	3c) + (3d)(3	3n) =	238.18	(5)
2. Ventilation rate	e												
											m	³ per hour	
Number of chimne	vs								0	x 40 =		0	(6a)
Number of open flu	ues								0	x 20 =	: [0	(6b)
Number of intermi	ttent fan	s							0	x 10 =	: [0] (7a)
Number of passive	vents								0	x 10 =	: [0] (7b)
Number of flueless	gas fires								0	x 40 =	: [0] (7c)
	0										Air o	hanges per	r
Infiltration due to o	chimnevs	. flues. fan	s. PSVs		(6a) + (6b) + (7	'a) + (7b) + ((7c) =	0	÷ (5) =	-	0.00	(8)
If a pressurisation	test has k	, been carried	d out or is i	ntended, p	roceed to ((17), otherw	vise continu	e from (9) to (16)		L		
Air permeability va	lue, q50,	expressed	in cubic m	etres per h	our per sq	uare metre	of envelop	e area				4.00	(17)
If based on air perr	neability	value, ther	n (18) = [(17	7) ÷ 20] + (8	3), otherwi	ise (18) = (1	.6)					0.20	(18)
Number of sides or	n which t	he dwelling	g is sheltere	ed								2	(19)
Shelter factor									1	- [0.075 x (1	9)] =	0.85	(20)
Infiltration rate inc	orporatir	ng shelter f	actor							(18) x (2	20) =	0.17	(21)
Infiltration rate mo	dified fo	r monthly v	wind speed	:									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average w	vind spee	d from Tab	ole U2										
	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22)m	÷4												
	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
Adjusted infiltratio	n rate (al	llowing for	shelter and	l wind facto	or) (21) x (2	22a)m							
	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.20	(22b)
Calculate effective	air chang	ge rate for t	the applica	ble case:									_
If mechanical ve	entilation	air chang	e rate thro	ugh system								0.50	(23a)
If balanced with	n heat reo	covery: effi	ciency in %	allowing fo	or in-use fa	actor from T	Table 4h					N/A	(23c)
c) whole house	extract v	entilation o	or positive i	input venti	lation from	n outside							_
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(24c)
Effective air change	e rate - e	nter (24a) o	or (24b) or	(24c) or (24	1d) in (25)			<u> </u>					_
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(25)



3. Heat losses	and heat lo	ss paramet	er										
Element			а	Gross rea, m²	Openings m ²	Net a A, I	area m²	U-value W/m²K	A x U W/	′К к-\ kJ,	/alue, /m².K	Ахк, kJ/K	
Window						27.	95 x	1.24	= 34.54				(27)
Ground floor						95.	27 x	0.20	= 19.05				(28a)
External wall						25.	22 x	0.18	= 4.54				(29a)
Party wall						63.	29 x	0.00	= 0.00				(32)
Total area of ext	ternal elem	ents ∑A, m²				148	.44						(31)
Fabric heat loss,	, W/K = ∑(A	× U)							(26)(30) + (3	32) =	58.13	(33)
Heat capacity C	m = ∑(А x к)							(28)	.(30) + (32) +	(32a)(3	2e) =	N/A	(34)
Thermal mass p	arameter (T	MP) in kJ/n	n²K									250.00	(35)
Thermal bridges	s: Σ(L x Ψ) ca	alculated us	sing Append	dix K								10.27	(36)
Total fabric heat	t loss									(33) + (3	36) =	68.41	(37)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat	t loss calcula	ited month	ly 0.33 x (2	25)m x (5)									
	39.30	39.30	39.30	39.30	39.30	39.30	39.30	39.30	39.30	39.30	39.30	39.30	(38)
Heat transfer co	oefficient, W	//K (37)m +	- (38)m										
	107.70	107.70	107.70	107.70	107.70	107.70	107.70	107.70	107.70	107.70	107.70	107.70	
	ator (UUD)	M/m21/ /20							Average = ∑	(39)112/	/12 =	107.70] (39)
Heat loss param	leter (HLP),	W/m-K (35	9)m ÷ (4)	4.42	1.12	1.12	1.42	1 1 12		1.12	4.42		7
	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	
Number of days	in month (Table 1a)							Average = \sum	(40)112/	12 =	1.13] (40)
Number of days			21.00	20.00	21.00	20.00	21.00	21.00	20.00	21.00	20.00	21.00	
	51.00	28.00	51.00	30.00	51.00	30.00	31.00	31.00	30.00	51.00	50.00	51.00] (40)
4. Water heati	ng energy r	equiremen	t										
Assumed occup	ancy, N											2.69	(42)
Annual average	hot water u	isage in litre	es per day V	/d,average	= (25 x N) +	36						98.12	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage	e in litres pe	r day for ea	ich month	Vd,m = fact	or from Tab	le 1c x (43)							_
	107.93	104.00	100.08	96.15	92.23	88.30	88.30	92.23	96.15	100.08	104.00	107.93	
				- 10				4 4 1)		∑(44)1	.12 =	1177.40	(44)
Energy content	of hot wate	r used = 4.1	18 x Vd,m x	nm x 1m/3	600 kWh/m	onth (see	lables 1b	, 1c 1d)					Г
	160.05	139.98	144.45	125.94	120.84	104.27	96.63	110.88	112.20	130.76	142.74	155.00	
Distribution loss	s 0.15 x (45))m								∑(45)1	.12 =	1543.75	_ (45)
	24.01	21.00	21.67	18.89	18.13	15.64	14.49	16.63	16.83	19.61	21.41	23.25	(46)
Storage volume	(litres) inclu	uding any so	olar or WW	HRS storag	e within sam	ne vessel						110.00	(47)
Water storage lo	oss:												_
b) Manufacture	r's declared	loss factor	is not knov	vn									_
Hot water st	orage loss f	actor from	Table 2 (kW	/h/litre/day	()							0.02	(51)
Volume facto	or from Tab	le 2a										1.03	(52)
Temperature	e factor fron	n Table 2b										0.60	(53)
Energy lost f	rom water s	torage (kW	'h/day) (47	') x (51) x (5	52) x (53)							1.03	(54)
Enter (50) or (54	4) in (55)											1.03	(55)
Water storage lo	oss calculate	ed for each	month (55	5) x (41)m									_
	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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

	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01 (57)
Primary circuit l	oss for each	month fro	m Table 3										
	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26 (59)
Combi loss for e	ach month	from Table	3a. 3b or 3	с								, <u> </u>	,
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		61)
Total heat requi	red for wat	ar heating (o.oo	or each mo	0.00	$(45)m \pm (4)$	$5)m \pm (57)n$	n ± (59)m ±	(61)m	0.00	0.00	0.00	01)
iotal field requi					170.10		151.00			100.04	100.22	210.20	(2)
	215.33	189.91	199.73	1/9.43	176.12	157.77	151.90	166.16	165.70	186.04	196.23	210.28	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	nth (kWh/r	month) (62	2)m + (63)m	1							
	215.33	189.91	199.73	179.43	176.12	157.77	151.90	166.16	165.70	186.04	196.23	210.28	
										∑(64)1	12 = 2	194.59 (64)
Heat gains from	water heat	ing (kWh/m	nonth) 0.25	5 × [0.85 × ((45)m + (61)m] + 0.8 ×	[(46)m + (5	57)m + (59))m]				
	97.44	86.49	92.25	84.67	84.40	77.47	76.35	81.09	80.10	87.70	90.26	95.76 (65)
								·					
5. Internal gair	15												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains	(Table 5)												
	134.56	134.56	134.56	134.56	134.56	134.56	134.56	134.56	134.56	134.56	134.56	134.56 (66)
Lighting gains (c	alculated in	Appendix I	, equation	L9 or L9a),	also see Ta	ible 5							
	22.15	19.67	16.00	12.11	9.05	7.64	8.26	10.74	14.41	18.30	21.35	22.76 (67)
Appliance gains	(calculated	in Appendi	x L, equatio	on L13 or L1	.3a), also se	ee Table 5							
	248.45	251.02	244.53	230.70	213.24	196.83	185.87	183.29	189.79	203.62	221.08	237.48 (68)
Cooking gains (c	alculated in	Appendix	L, equation	L15 or L15	a), also see	Table 5						, .	
	36.46	36.46	36.46	36.46	36.46	36.46	36.46	36.46	36.46	36.46	36.46	36.46 (69)
Pump and fan g	ains (Table	5a)	00110	00110	00110	00110		00110	00110	00110	00110	(,
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		70)
	oration (Tak	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 (/0]
LUSSES E.g. Evap			107.05	107.05	107.05	107.05	107.05	107.05	107.05	107.05	407.05	407.05	74)
	-107.65	-107.65	-107.65	-107.65	-107.65	-107.65	-107.65	-107.65	-107.65	-107.65	-107.65	-107.65 (/1)
Water heating g	ains (Table	5)								I		·	
	130.97	128.70	123.99	117.60	113.44	107.59	102.62	108.99	111.25	117.88	125.35	128.71 (72)
Total internal ga	ains (66)m +	+ (67)m + (6	8)m + (69)ı	m + (70)m +	+ (71)m + (7	72)m							
	464.93	462.77	447.89	423.77	399.10	375.43	360.12	366.38	378.82	403.16	431.15	452.33 (73)
6 Solar gains													
0. 30101 gams			Accors f	actor	Aroa	Sol	or flux		~			Cainc	
			Table	6d	m ²	- 3014 W	//m²	spec	в ific data	specific d	ata	W	
								or T	able 6b	or Table	6c		
SouthWest			0.7	7 X	27.95	x 3	6.79 x	0.9 x 0	0.40 x	0.80	=	228.06 (79)
Solar gains in wa	atts ∑(74)m	(82)m				_							
	228.06	388.46	531.51	658.57	737.65	732.32	706.03	647.03	575.51	429.33	273.16	195.17 (83)
Total gains - inte	ernal and so	lar (73)m +	(83)m					I					
	692.99	851.23	979.40	1082.34	1136 75	1107 75	1066 15	1013/12	95/1 33	832 /19	70/ 31	647 50 (84)
	052.55	0.01.20	5,5.40	1002.34	1130.75	1107.75	1000.13	1010.72	554.55	552.45	, 04.91		<i>.</i> ,
7. Mean intern	al tempera	ture (heatii	ng season)										
Temperature du	iring heating	g periods in	the living a	area from T	able 9, Th1	.(°C)						21.00	85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains f	or living are	ea n1,m (se	e Table 9a)									
	1.00	0.99	0.96	0.90	0.78	0.60	0.44	0.48	0.72	0.93	0.99	1.00 (86)
					, .		2		···-				- 1

Mean internal te	emp of livin	g area T1 (s	steps 3 to 7	in Table 90	c)								
	19.90	20.12	20.39	20.68	20.89	20.98	21.00	20.99	20.94	20.66	20.21	19.85	(87)
Temperature du	ring heatin	g periods in	the rest of	f dwelling f	rom Table	9, Th2(°C)							
	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	(88)
Utilisation factor	r for gains f	or rest of d	welling n2,	m									
	0.99	0.98	0.95	0.87	0.72	0.51	0.34	0.38	0.63	0.91	0.98	1.00	(89)
Mean internal te	emperature	in the rest	of dwelling	g T2 (follow	steps 3 to	7 in Table 9	ic)						
	18.53	18.83	19.22	19.62	19.87	19.96	19.97	19.97	19.93	19.60	18.97	18.45	(90)
Living area fracti	ion								Li	ving area ÷	(4) =	0.41	(91)
Mean internal te	emperature	for the wh	ole dwellin	g fLA x T1 +	+(1 - fLA) x	Т2							
	19.09	19.36	19.70	20.05	20.29	20.38	20.39	20.39	20.35	20.04	19.48	19.02	(92)
Apply adjustmer	nt to the me	ean internal	l temperatu	ure from Ta	able 4e wh	ere appropr	iate						
	19.09	19.36	19.70	20.05	20.29	20.38	20.39	20.39	20.35	20.04	19.48	19.02	(93)
													-
8. Space heatin	ng requirem	hent											
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor	r for gains,	ηm 							1				
	0.99	0.98	0.95	0.88	0.74	0.55	0.38	0.42	0.67	0.91	0.98	0.99	(94)
Useful gains, ηm	1Gm, W (94	‡)m x (84)m	1			-							
	687.32	832.99	928.54	948.36	840.67	607.37	406.68	426.80	634.95	755.09	691.18	643.60	(95)
Monthly average	e external t	emperature	e from Tabl	e U1									
	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate fo	or mean inte	ernal tempe	erature, Lm,	, W [(39)m	ı x [(93)m -	(96)m]							
	1593.14	1557.39	1421.86	1201.18	924.90	622.24	408.58	429.95	672.92	1016.46	1333.21	1596.45	(97)
Space heating re	equirement	, kWh/mon	th 0.024 x	[(97)m - (9	5)m] x (41))m							
	673.93	486.79	367.03	182.03	62.67	0.00	0.00	0.00	0.00	194.46	462.26	708.92	
									∑(98	8)15, 10	12 =	3138.08	(98)
Space heating re	equirement	kWh/m²/ye	ear							(98)	÷ (4)	32.94	(99)
9b. Energy reg	uirements ·	- communit	v heating s	cheme									
Fraction of space	e heat from) secondary	/suppleme	ntary syste	m (table 1)	1)				'0' if r	none	0.00	(301)
Fraction of space	e heat from	ı communit	v system							1 - (30)1) =	1.00	(302)
Fraction of com	munity heat	t from boile	ers							- (00		1.00	(303a)
Fraction of total	space heat	from comr	nunity boile	ers						(302) x (303	3a) =	1.00	(304a)
Factor for contro	of and charg	ging method	d (Table 4c((3)) for com	nmunity sn	ace heating				(002) // (000		1 00	(305)
Factor for chargi	ing method	(Table 4c(?	(fuble for 3)) for comr	munity wat	er heating							1.00	(305a)
Distribution loss	factor (Tak	(100) (100)	community	heating sy	stem							1.05	(306)
Distribution 1033		// 120/101	community	incating sy	stem							1.05	(500)
Snace heating													
	ating requi	rement							2138.08	1			(98)
Snace heat from	boilers	rement						(0)	(30/2)	J v (205) v (2()e) - 📑	2201 00	(3072)
Space near nom	Doners							(50	5) x (5048) /	x (505) x (50		5294.99	(3078)
Water heating													
Annual water be	ating requi	irement							210/ 50	1			(64)
Water heat from	hoilers	rement						(64)	(303a) x] (305a) v (3()6) = <u> </u>	230/1 32	(3102)
Electricity used f	for heat die	tribution					0 01	(04) x [(207 <u>2</u>)	(307a) ± (2	$(3030) \times (300)$	e)] =	55 99	(312)
Electricity for pu	imns fans a	and electric	keen-hot (*	Table 4f)			0.01	⊾ ^ [(307a)	(3078) + (3	5108](510	-/] - [JJ.JJ	(212)
mechanical.	unps, ialis a		necp-not (or positive	n innut fra	moutrida		[60.44	1			(220-)
mechanical V	enulation T	ans - Dalano	leu, extract	t or positive	= input froi	noutside			00.44	L			(SUCC)

Total electricity for the above, kWh/year

Electricity for lighting (Appendix L)

Total delivered energy for all uses

	-
60.44	(331)
391.16	(332)
6050.91	(338)

10b. Fuel costs - community heating scheme						
	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from boilers	3294.99	x	4.24	x 0.01 =	139.71] (340a)
Water heating from boilers	2304.32	x	4.24	x 0.01 =	97.70	(342a)
Pumps and fans	60.44	x	13.19	x 0.01 =	7.97	(349)
Electricity for lighting	391.16	x	13.19	x 0.01 =	51.59	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)(342e) +	- (345)(354) =	416.98] (355)
11b. SAP rating - community heating scheme						
Energy cost deflator (Table 12)					0.42	(356)
Energy cost factor (ECF)					1.25	(357)
SAP value					82.58	
SAP rating (section 13)					83	(358)
SAP band					В]
12b. CO ₂ emissions - community heating scheme						
	Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from other sources (space heating)						
Efficiency of boilers	94.00					(367a)
CO2 emissions from boilers [(307a)+(310a)] x 100 ÷ (367a) =	5956.71	x	0.216	=	1286.65	(367)
Electrical energy for community heat distribution	55.99	x	0.52	=	29.06	(372)
Total CO2 associated with community systems					1315.71	(373)
Total CO2 associated with space and water heating					1315.71	(376)
Pumps and fans	60.44	x	0.52	=	31.37	(378)
Electricity for lighting	391.16	x	0.52	=	203.01	(379)
Total CO ₂ , kg/year				(376)(382) =	1550.09	(383)
Dwelling CO ₂ emission rate				(383) ÷ (4) =	16.27	(384)
El value					85.19	1
El rating (section 14)					85	(385)
El band					В]
13b. Primary energy - community heating scheme						
	Energy kWh/year		Primary factor		Primary energy (kWh/year)	r
Primary energy from other sources (space heating)						
Efficiency of boilers	94.00					(367a)
Primary energy from boilers [(307a)+(310a)] x 100 ÷ (367a) =	5956.71	x	1.22	=	7267.19	(367)
Electrical energy for community heat distribution	55.99	x	3.07	=	171.90	(372)
Total primary energy associated with community systems					7439.09	(373)
Total primary energy associated with space and water heating					7439.09	(376)
Pumps and fans	60.44	x	3.07	=	185.55	(378)

(307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) =

Pumps and fans Electricity for lighting

Primary energy kWh/year

1200.87

8825.50

(379)

(383)

391.16

3.07

=

х



Assessor name		Miss Jayr	na Parmar						Assessor nur	nber	6549		
Client									Last modifie	d	23/11	/2016	
Address		B-L04-26	B Centric C	Close, Lond	on, N8								
1. Overall dwellin	ng dimen	sions											
					A	area (m²)		Av	erage storey height (m)	1	Vo	lume (m³)	
Lowest occupied						49.68	<mark>](1a)</mark> x		2.50	(2a) =		124.20	(3a)
Total floor area		(1a)	+ (1b) + (1e	c) + (1d)(1n) =	49.68	(4)						
Dwelling volume								(3	a) + (3b) + (3	3c) + (3d)(3	3n) =	124.20	(5)
2. Ventilation rat	te												
											mª	³ per hour	
Number of chimne	evs								0	x 40 =		0	(6a)
Number of open f	lues								0	x 20 =	. [0	(6b)
Number of interm	ittent fan	s							0	x 10 =	: [0] (02)
Number of passive	e vents								0	x 10 =	:	0] (7b)
Number of flueles	s gas fires								0	x 40 =	:	0	(7c)
	0 840 11 00										Air c	hanges pe	r (, , ,
												hour	
Infiltration due to	chimneys	, flues, fans	s, PSVs		(6a)) + (6b) + (7	a) + (7b) + (7c) =	0	÷ (5) =	-	0.00	(8)
If a pressurisation	test has b	been carried	d out or is ii	ntended, pi	roceed to (17), otherv	vise continu	e from (9) to (16)				
Air permeability va	alue, q50,	expressed	in cubic me	etres per h	our per sq	uare metre	of envelope	e area				4.00	(17)
If based on air per	meability	value, ther	n (18) = [(17	7) ÷ 20] + (8	3), otherwi	se (18) = (1	6)					0.20	(18)
Number of sides o	on which t	he dwelling	g is sheltere	d								2	(19)
Shelter factor									1	- [0.075 x (1	9)] =	0.85	(20)
Infiltration rate inc	corporatir	ng shelter fa	actor							(18) x (2	20) =	0.17	(21)
Infiltration rate me	odified fo	r monthly v	wind speed	:									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average	wind spee	d from Tab	ole U2				-			-		-	-
	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22)m	1 ÷ 4	-				-1	1			1	r	1	-
L	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 infiltratio	on rate (al	llowing for	shelter and	l wind facto	or) (21) x (2	22a)m							٦
	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.20	(22b)
Calculate effective	e air chang	ge rate for t	the applical	ble case:									٦
If mechanical v	entilation	i: air chang	e rate throu	ugh system								0.50	_ (23a)
If balanced wit	h heat red	covery: effi	ciency in %	allowing fo	or in-use fa	ictor from T	able 4h					N/A	(23c)
c) whole house	e extract v	entilation of	or positive i	nput venti	lation from	i outside	1						
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	_ (24c)
Effective air chang	ge rate - e	nter (24a) (or (24b) or ((24c) or (24	id) in (25)		1			I		1	
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(25)



		ss paramet	ler										
Element			а	Gross rea, m²	Openings m ²	Net a A, n	rea n²	U-value W/m²K	AxUV	//К к k	-value, J/m².K	Ахк, kJ/K	
Window						15.1	L5 x	1.24	= 18.72	2			(27)
External wall						11.1	L7 X	0.18	= 2.01				(2 9a
Party wall						44.1	L5 x	0.00	= 0.00				(32)
Roof						49.6	58 x	0.16	= 7.95				(30)
Total area of ext	ernal eleme	ents ∑A, m²	2			76.0	00						(31)
Fabric heat loss,	W/K = ∑(A	× U)							(2	6)(30) +	(32) =	28.68	(33)
Heat capacity Cn	n = ∑(А x к)							(28).	(30) + (32)	+ (32a)(32e) =	N/A	(34)
Thermal mass pa	arameter (T	MP) in kJ/r	m²K									250.00	(35)
Thermal bridges	: Σ(L x Ψ) ca	alculated us	sing Appen	dix K								4.30	(36)
Total fabric heat	loss		0 11							(33) +	(36) =	32.98	(37)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat	loss calcula	ited month	nly 0.33 x (2	25)m x (5)									
	20.49	20.49	20.49	20.49	20.49	20.49	20.49	20.49	20.49	20.49	20.49	20.49	(38)
Heat transfer co	efficient, W	/K (37)m +	+ (38)m										
	53.48	53.48	53.48	53.48	53.48	53.48	53.48	53.48	53.48	53.48	53.48	53.48	7
	00110	00110	00110	00110	00110	00110		1 00110	Average =	$\Sigma(39)112$	2/12 =	53.48	 (39)
Heat loss param	eter (HLP). '	W/m²K (39	9)m ÷ (4)							2(00)22	_,		_ (00)
	1.08	1.08	1.08	1.08	1.08	1.08	1 08	1.08	1.08	1.08	1.08	1.08	7
	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	Average -	$5(40)1 1^{-1}$	2/12 -	1.00	
Number of days	in month (T	Table 1a)							Average -	2(40)11		1.00] (40)
Number of duys	21.00	28.00	21.00	20.00	21.00	20.00	21.00	21.00	20.00	21.00	20.00	21.00	
	51.00	20.00	31.00	30.00		11.1.1.1				JT.00			
					51.00	00.00	51.00	51.00	00.00		50.00	01.00	_ (40)
4. Water heating	ng energy r	equiremen	it		31.00		51.00	51.00	1 00.00	1	30.00		_ (+0)
4. Water heatin Assumed occupa	ng energy ro ancy, N	equiremen	ıt		51.00		51.00					1.68	(40)
4. Water heatin Assumed occupa Annual average	n <mark>g energy r</mark> o ancy, N hot water u	equiremen sage in litr	it es per day '	Vd,average	= (25 x N) +	36	51.00	51.00				1.68 74.12	_ (42) _ (42) _ (43)
4. Water heatin Assumed occupa Annual average	ng energy ro ancy, N hot water u Jan	equiremen sage in litr Feb	it es per day ' Mar	Vd,average Apr	= (25 x N) + May	36 Jun	Jul	Aug	Sep	Oct		1.68 74.12 Dec	_ (42) _ (42) _ (43)
4. Water heatin Assumed occupa Annual average Hot water usage	ng energy ro ancy, N hot water u Jan e in litres pe	equiremen sage in litr Feb r day for ea	es per day ' Mar ach month	Vd,average Apr Vd,m = fact	= (25 x N) + May cor from Tabl	36 Jun le 1c x (43)	Jul	Aug	Sep	Oct	Nov	1.68 74.12 Dec	_ (42) _ (43)
4. Water heatin Assumed occupa Annual average Hot water usage	ng energy ro ancy, N hot water u Jan in litres pe 81.53	equiremen Isage in litr Feb r day for ea 78.56	es per day ' Mar ach month 75.60	Vd,average Apr Vd,m = fact 72.63	= (25 x N) + May tor from Tabl	36 Jun 66.70	Jul 66.70	Aug 69.67	Sep 72.63	Oct 75.60	Nov	1.68 74.12 Dec 81.53] (42)] (43)
4. Water heatin Assumed occupa Annual average Hot water usage	ng energy ro ancy, N hot water u Jan : in litres pe 81.53	equiremen sage in litr Feb r day for ea 78.56	nt es per day ' Mar ach month 75.60	Vd,average Apr Vd,m = fact 72.63	= (25 x N) + May tor from Tabl	36 Jun le 1c x (43) 66.70	Jul 66.70	Aug 69.67	Sep 72.63	Oct 75.60 Σ(44)1	Nov	1.68 74.12 Dec 81.53 889.39	_ (42) _ (42) _ (43) _ (44)
4. Water heatin Assumed occupa Annual average Hot water usage Energy content o	ng energy ro ancy, N hot water u Jan in litres pe 81.53	equiremen Isage in litr Feb r day for ea 78.56 r used = 4.:	es per day ' Mar ach month 75.60 18 x Vd,m x	Vd,average Apr Vd,m = fact 72.63	= (25 x N) + May for from Tabl 69.67 8600 kWh/m	36 Jun le 1c x (43) 66.70	Jul 66.70	Aug 69.67	Sep 72.63	Oct 75.60 Σ(44)1	Nov	1.68 74.12 Dec 81.53 889.39] (42)] (43)] (44)
4. Water heatin Assumed occupa Annual average Hot water usage Energy content o	ng energy ro ancy, N hot water u Jan in litres pe 81.53 of hot water 120.90	equiremen sage in litr Feb r day for ea 78.56 r used = 4.1 105.74	nt es per day ' Mar ach month 75.60 18 x Vd,m x 109.12	Vd,average Apr Vd,m = fact 72.63 nm x Tm/3 95.13	= (25 x N) + May tor from Tabl 69.67 3600 kWh/m 91.28	36 Jun le 1c x (43) 66.70 onth (see T 78.77	Jul 66.70 -ables 1b 72.99	Aug 69.67 , 1c 1d) 83.76	Sep 72.63	Oct 75.60 Σ(44)1 98.78	Nov 78.56 12 = [1.68 74.12 Dec 81.53 889.39 2 117.09] (42)] (43)] (44)
4. Water heatin Assumed occupa Annual average Hot water usage Energy content o	ng energy ro ancy, N hot water u Jan in litres pe 81.53 of hot water 120.90	equiremen sage in litr Feb r day for ea 78.56 r used = 4.1 105.74	it es per day ' Mar ach month 75.60 18 x Vd,m x 109.12	Vd,average Apr Vd,m = fact 72.63 nm x Tm/3 95.13	= (25 x N) + May tor from Tabl 69.67 3600 kWh/m 91.28	36 Jun le 1c x (43) 66.70 onth (see T 78.77	Jul 66.70 Fables 1b 72.99	Aug 69.67 , 1c 1d) 83.76	Sep 72.63 84.76	Oct 75.60 Σ(44)1 98.78 Σ(45)1	Nov 78.56 12 = 107.82 12 =	1.68 74.12 Dec 81.53 889.39 2 117.09 1166.14] (42)] (42)] (43)] (44)] (45)
4. Water heatin Assumed occupa Annual average Hot water usage Energy content of Distribution loss	ng energy re ancy, N hot water u Jan in litres pe 81.53 of hot water 120.90 0.15 x (45)	equiremen isage in litr Feb r day for ea 78.56 r used = 4.1 105.74	nt es per day ' Mar ach month 75.60 18 x Vd,m x 109.12	Vd,average Apr Vd,m = fact 72.63 nm x Tm/3 95.13	= (25 x N) + May tor from Tabl 69.67 3600 kWh/m 91.28	36 Jun le 1c x (43) 66.70 onth (see T 78.77	Jul 66.70 ⁻ ables 1b 72.99	Aug 69.67 , 1c 1d) 83.76	Sep 72.63 84.76	Oct 75.60 Σ(44)1 98.78 Σ(45)1	Nov 78.56 12 = 107.82 12 =	1.68 74.12 Dec 81.53 889.39 2 117.09 1166.14] (42)] (43)] (44)] (45)
4. Water heatin Assumed occupa Annual average Hot water usage Energy content of Distribution loss	ng energy ro ancy, N hot water u Jan in litres pe 81.53 of hot water 120.90 0.15 x (45) 18.14	equiremen sage in litr Feb r day for ea 78.56 r used = 4.1 105.74 m	it es per day ' Mar ach month 75.60 18 x Vd,m x 109.12 16.37	Vd,average Apr Vd,m = fact 72.63 nm x Tm/3 95.13	= (25 x N) + May tor from Tabl 69.67 3600 kWh/m 91.28 13.69	36 Jun le 1c x (43) 66.70 onth (see T 78.77	Jul 66.70 Fables 1b 72.99	Aug 69.67 , 1c 1d) 83.76	Sep 72.63 84.76	Oct 75.60 Σ(44)1 98.78 Σ(45)1 14.82	Nov 78.56 12 = 107.82 12 =	1.68 74.12 Dec 81.53 889.39 2 117.09 1166.14 17.56	(42) (42) (43) (44) (44) (45)
4. Water heatin Assumed occupa Annual average Hot water usage Energy content of Distribution loss Storage volume	ng energy re ancy, N hot water u Jan e in litres pe 81.53 of hot water 120.90 0.15 x (45) 18.14 (litres) inclu	equiremen sage in litr Feb r day for ea 78.56 r used = 4.1 105.74 m 15.86 uding any s	it es per day ' Mar ach month 75.60 18 x Vd,m x 109.12 16.37 olar or WW	Vd,average Apr Vd,m = fact 72.63 nm x Tm/3 95.13 14.27 (HRS storag	= (25 x N) + May tor from Tabl 69.67 3600 kWh/m 91.28 13.69 ge within sam	36 Jun le 1c x (43) 66.70 onth (see T 78.77 11.82 ne vessel	Jul 66.70 ⁻ ables 1b 72.99 10.95	Aug 69.67 , 1c 1d) 83.76 12.56	Sep 72.63 84.76	Oct 75.60 Σ(44)1 98.78 Σ(45)1 14.82	Nov 78.56 12 = 107.82 12 = 16.17	1.68 74.12 Dec 81.53 889.39 2 117.09 1166.14 17.56 110.00	(42) (43) (43) (44) (45) (45) (46) (47)
4. Water heatin Assumed occupa Annual average Hot water usage Energy content of Distribution loss Storage volume Water storage lo	ng energy ro ancy, N hot water u Jan in litres pe 81.53 of hot water 120.90 0.15 x (45) 18.14 (litres) incluoss:	equiremen sage in litr Feb r day for ea 78.56 r used = 4.3 105.74 m 15.86 uding any s	nt es per day ' Mar ach month 75.60 18 x Vd,m x 109.12 16.37 olar or WW	Vd,average Apr Vd,m = fact 72.63 nm x Tm/3 95.13 14.27 /HRS storag	= (25 x N) + May tor from Tabl 69.67 3600 kWh/m 91.28 13.69 se within sam	36 Jun le 1c x (43) 66.70 onth (see T 78.77 11.82 ne vessel	Jul 66.70 72.99 10.95	Aug 69.67 , 1c 1d) 83.76 12.56	Sep 72.63 84.76 12.71	Oct 75.60 Σ(44)1 98.78 Σ(45)1 14.82	Nov Nov 78.56 12 = 107.82 12 = 16.17	1.68 74.12 Dec 81.53 889.39 1166.14 17.56 110.00] (42)] (42)] (43)] (44)] (44)] (45)] (46)] (47)
4. Water heatin Assumed occupa Annual average Hot water usage Energy content of Distribution loss Storage volume Water storage lo b) Manufacturer	ng energy ro ancy, N hot water u Jan e in litres pe 81.53 of hot water 120.90 0.15 x (45) 18.14 (litres) inclu oss: 's declared	equiremen sage in litr Feb r day for ea 78.56 r used = 4.1 105.74 m 15.86 uding any s loss factor	it es per day ' Mar ach month 75.60 18 x Vd,m x 109.12 16.37 olar or WW	Vd,average Apr Vd,m = fact 72.63 nm x Tm/3 95.13 14.27 /HRS storag	= (25 x N) + May tor from Tabl 69.67 3600 kWh/m 91.28 13.69 te within sam	36 Jun le 1c x (43) 66.70 onth (see T 78.77 11.82 ne vessel	Jul 66.70 - ables 1b 72.99 10.95	Aug 69.67 , 1c 1d) 83.76 12.56	Sep 72.63 84.76	Oct 75.60 Σ(44)1 98.78 Σ(45)1 14.82	Nov 78.56 12 = 107.82 12 = 16.17	1.68 74.12 Dec 81.53 889.39 1166.14 17.56 110.00	(42) (43) (43) (44) (45) (45) (46) (47)
 4. Water heatin Assumed occupa Annual average Hot water usage Energy content of Distribution loss Storage volume Water storage lo Manufacturer Hot water stor 	ng energy ro ancy, N hot water u Jan in litres pe 81.53 of hot water 120.90 0.15 x (45) 18.14 (litres) inclu oss: 's declared orage loss fa	equiremen sage in litr Feb r day for ea 78.56 r used = 4.: 105.74 m 15.86 uding any s loss factor actor from	it es per day ' Mar ach month 75.60 18 x Vd,m x 109.12 16.37 olar or WW 'is not know Table 2 (ky	Vd,average Apr Vd,m = fact 72.63 nm x Tm/3 95.13 14.27 /HRS storag vn	= (25 x N) + May tor from Tabl 69.67 3600 kWh/m 91.28 13.69 te within sam	36 Jun le 1c x (43) 66.70 0nth (see T 78.77 11.82 ne vessel	Jul 66.70 72.99 10.95	Aug 69.67 , 1c 1d) 83.76 12.56	Sep 72.63 84.76 12.71	Oct 75.60 Σ(44)1 98.78 Σ(45)1 14.82	Nov Nov 78.56 12 = 107.82 12 =	1.68 74.12 Dec 81.53 889.39 1166.14 17.56 110.00	(42) (42) (43) (43) (44) (44) (45) (45) (46) (47)
 4. Water heatin Assumed occupa Annual average Hot water usage Energy content of Distribution loss Storage volume Water storage lo Manufacturer Hot water stor 	ng energy ro ancy, N hot water u Jan in litres pe 81.53 of hot water 120.90 0.15 x (45) 18.14 (litres) inclu oss: r's declared orage loss fator	equiremen sage in litr Feb r day for ea 78.56 r used = 4.: 105.74 um 15.86 uding any s loss factor actor from	it es per day ' Mar ach month 75.60 18 x Vd,m x 109.12 16.37 olar or WW is not know Table 2 (kV	Vd,average Apr Vd,m = fact 72.63 nm x Tm/3 95.13 95.13 14.27 /HRS storag vn Vh/litre/day	= (25 x N) + May tor from Tabl 69.67 3600 kWh/m 91.28 13.69 te within sam	36 Jun le 1c x (43) 66.70 onth (see T 78.77 11.82 ne vessel	Jul 66.70 ⁻ ables 1b 72.99 10.95	Aug 69.67 , 1c 1d) 83.76	Sep 72.63 84.76	Oct 75.60 Σ(44)1 98.78 Σ(45)1 14.82	Nov 78.56 12 =	1.68 74.12 Dec 81.53 889.39 1166.14 17.56 110.00 0.02 1.03	(42) (43) (43) (44) (44) (45) (45) (46) (47) (51) (52)
 4. Water heatin Assumed occupa Annual average Hot water usage Energy content of Distribution loss Storage volume Water storage lo Manufacturer Hot water stor Volume factor Temperature 	ng energy ro ancy, N hot water u Jan in litres pe 81.53 of hot water 120.90 0.15 x (45) 18.14 (litres) inclu oss: r's declared or age loss fa or from Table	equiremen sage in litr Feb r day for ea 78.56 r used = 4.: 105.74 m 15.86 uding any s loss factor actor from le 2a n Table 2b	it es per day ' Mar ach month 75.60 18 x Vd,m x 109.12 16.37 olar or WW ' is not know Table 2 (kV	Vd,average Apr Vd,m = fact 72.63 nm x Tm/3 95.13 14.27 /HRS storag vn Vh/litre/day	= (25 x N) + May tor from Tabl 69.67 3600 kWh/m 91.28 13.69 te within sam	36 Jun le 1c x (43) 66.70 onth (see T 78.77 11.82 ne vessel	Jul 66.70 72.99 10.95	Aug 69.67 , 1c 1d) 83.76 12.56	Sep 72.63 84.76	Oct 75.60 Σ(44)1 98.78 Σ(45)1 14.82	Nov Nov 78.56 12 = 107.82 12 = 16.17	1.68 74.12 Dec 81.53 889.39 1166.14 1166.14 110.00 0.02 1.03 0.60	(42) (42) (43) (43) (44) (44) (45) (45) (46) (47) (51) (52) (53)
 4. Water heatin Assumed occupa Annual average Hot water usage Energy content of Distribution loss Storage volume Water storage lo b) Manufacturer Hot water storage lo b) Manufacturer Hot water storage lo Colume factor Temperature Energy lost fr 	ng energy ro ancy, N hot water u Jan in litres pe 81.53 of hot water 120.90 0.15 x (45) 18.14 (litres) inclu oss: r's declared or age loss fa or from Table factor from com water s	equiremen sage in litr Feb r day for ea 78.56 r used = 4.: 105.74 m 15.86 uding any s loss factor actor from le 2a n Table 2b torage (kW	it es per day ' Mar ach month 75.60 18 x Vd,m x 109.12 16.37 olar or WW 'is not know Table 2 (kV	Vd,average Apr Vd,m = fact 72.63 nm x Tm/3 95.13 14.27 /HRS storag vn Vh/litre/day	= (25 x N) + May for from Tabl 69.67 3600 kWh/m 91.28 13.69 ge within sam y)	36 Jun le 1c x (43) 66.70 onth (see T 78.77 11.82 ne vessel	Jul 66.70 ⁻ ables 1b 72.99 10.95	Aug 69.67 , 1c 1d) 83.76 12.56	Sep 72.63 84.76 12.71	Oct 75.60 Σ(44)1 98.78 Σ(45)1 14.82	Nov 78.56 12 = [] 107.82 12 = [] 16.17	1.68 74.12 Dec 81.53 889.39 117.09 1166.14 17.56 110.00 0.02 1.03 0.60 1.03	(42) (43) (43) (43) (44) (44) (44) (45) (45) (45) (47) (51) (52) (52) (53) (54)
 4. Water heatin Assumed occupa Annual average Hot water usage Energy content of Distribution loss Storage volume Water storage lo b) Manufacturer Hot water storage lo b) Manufacturer Hot water storage lo c) Manufacturer Energy lost fr 	ng energy re ancy, N hot water u Jan in litres pe 81.53 of hot water 120.90 0.15 x (45) 18.14 (litres) inclu oss: r's declared orage loss fa or from Table factor from rom water s of in (55)	equiremen sage in litr Feb r day for ea 78.56 r used = 4.: 105.74 105.74 m 15.86 uding any s loss factor actor from le 2a n Table 2b torage (kW	It es per day ' Mar ach month 75.60 18 x Vd,m x 109.12 16.37 olar or WW ' is not know Table 2 (kV Vh/day) (47	Vd,average Apr Vd,m = fact 72.63 nm x Tm/3 95.13 14.27 /HRS storag vn Vh/litre/day	= (25 x N) + May tor from Tabl 69.67 3600 kWh/m 91.28 13.69 te within sam y) 52) x (53)	36 Jun le 1c x (43) 66.70 onth (see T 78.77 11.82 ne vessel	Jul 66.70 72.99 10.95	Aug 69.67 , 1c 1d) 83.76 12.56	Sep 72.63 84.76	Oct 75.60 Σ(44)1 98.78 Σ(45)1 14.82	Nov Nov 	1.68 74.12 Dec 81.53 889.39 1166.14 1166.14 110.00 110.00 10.02 1.03 0.60 1.03	(42) (42) (43) (43) (44) (44) (45) (44) (45) (46) (47) (51) (52) (53) (53) (55)
 4. Water heatin Assumed occupa Annual average Hot water usage Energy content of Distribution loss Storage volume Water storage loss b) Manufacturer Hot water storage Volume factor Temperature Energy lost fr Enter (50) or (54 	ng energy ro ancy, N hot water u Jan in litres pe 81.53 of hot water 120.90 0.15 x (45) 18.14 (litres) inclu oss: r's declared or age loss fa or from Tabl factor from rom water s c) in (55)	equiremen sage in litr Feb r day for ea 78.56 r used = 4.: 105.74 m 15.86 uding any s loss factor actor from le 2a n Table 2b torage (kW	it es per day ' Mar ach month 75.60 18 x Vd,m x 109.12 16.37 olar or WW 'is not know Table 2 (kV /h/day) (47	Vd,average Apr Vd,m = fact 72.63 nm x Tm/3 95.13 14.27 /HRS storag vn Vh/litre/day /) x (51) x (5 5) x (41)m	= (25 x N) + May for from Tabl 69.67 3600 kWh/m 91.28 13.69 re within sam y) 52) x (53)	36 Jun le 1c x (43) 66.70 onth (see T 78.77 11.82 ne vessel	Jul 66.70 ⁻ ables 1b 72.99 10.95	Aug 69.67 , 1c 1d) 83.76	Sep 72.63 84.76 12.71	Oct 75.60 Σ(44)1 98.78 Σ(45)1 14.82	Nov 78.56 12 = 107.82 12 = 16.17	1.68 74.12 Dec 81.53 889.39 117.09 1166.14 110.00 110.00 0.02 1.03 0.60 1.03 1.03	(42) (43) (43) (43) (44) (44) (44) (45) (45) (46) (47) (51) (52) (53) (53) (54) (55)
 4. Water heatin Assumed occupa Annual average Hot water usage Energy content of Distribution loss Storage volume Water storage lo b) Manufacturer Hot water storage lo b) Manufacturer Energy lost fr Enter (50) or (54 Water storage lo 	ng energy re ancy, N hot water u Jan in litres pe 81.53 of hot water 120.90 0.15 x (45) 18.14 (litres) inclu oss: r's declared or age loss fa or from Table factor from rom water s a) in (55) oss calculate	equiremen sage in litr Feb r day for ea 78.56 r used = 4.1 105.74 105.74 m 15.86 uding any s loss factor actor from le 2a n Table 2b torage (kW ed for each 28.92	It es per day ' Mar ach month 75.60 18 x Vd,m x 109.12 16.37 olar or WW 16.37 olar or WW 'is not know Table 2 (kV /h/day) (47 month (55)	Vd,average Apr Vd,m = fact 72.63 nm x Tm/3 95.13 14.27 /HRS storag vn Vh/litre/day 7) x (51) x (5 5) x (41)m 30.98	= (25 x N) + May tor from Tabl 69.67 3600 kWh/m 91.28 13.69 te within sam y) 52) x (53) 32.01	36 Jun le 1c x (43) 66.70 0nth (see T 78.77 11.82 ne vessel	Jul 66.70 72.99 10.95	Aug 69.67 , 1c 1d) 83.76 12.56	Sep 72.63 84.76 12.71	Oct 75.60 Σ(44)1 98.78 Σ(45)1 14.82 32.01	Nov 78.56 12 = [107.82 12 = [16.17	1.68 74.12 Dec 81.53 889.39 1166.14 1166.14 110.00 0.02 1.03 0.60 1.03 1.03	(42) (43) (43) (43) (44) (44) (45) (44) (47) (51) (52) (53) (53) (55)

	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01 (57)
Primary circuit lo	oss for each	month fror	n Table 3					1			I	
	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26 (59)
Combi loss for e	ach month t	from Table	3a, 3b or 3	с								
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 (61)
Total heat requi	red for wate	er heating c	alculated f	or each mo	onth 0.85 x	(45)m + (40	6)m + (57)r	n + (59)m +	- (61)m			
	176.18	155.67	164.39	148.62	146.56	132.26	128.27	139.03	138.25	154.05	161.32	172.37 (62)
Solar DHW input	calculated	using Appe	ndix G or A	ppendix H				1			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 (63)
Output from wa	ter heater f	or each moi	nth (kWh/r	month) (62	2)m + (63)m	1					1	
	176.18	155.67	164.39	148.62	146.56	132.26	128.27	139.03	138.25	154.05	161.32	172.37
		I IIII								Σ(64)1	12 = 1	.816.98 (64)
Heat gains from	water heat	ing (kWh/m	onth) 0.25	5 × [0.85 ×	(45)m + (61	.)m] + 0.8 ×	[(46)m + (5	57)m + (59)	m]	2(-)		
Ū	84.42	75.10	80.50	- 74.43	74.57	68.99	68.49	72.07	70.98	77.06	78.65	83.15 (65)
5. Internal gain	s										_	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabolic gains	(Table 5)											
	84.03	84.03	84.03	84.03	84.03	84.03	84.03	84.03	84.03	84.03	84.03	84.03 (66)
Lighting gains (ca	alculated in	Appendix L	, equation	L9 or L9a),	also see Ta	ible 5						
	13.05	11.59	9.43	7.14	5.34	4.50	4.87	6.33	8.49	10.78	12.58	13.41 (67)
Appliance gains	(calculated	in Appendix	(L, equatio	on L13 or L1	L3a), also se	ee Table 5						
	146.40	147.92	144.09	135.94	125.66	115.99	109.53	108.01	111.84	119.99	130.27	139.94 (68)
Cooking gains (c	alculated in	Appendix L	, equation	L15 or L15	a), also see	Table 5						
	31.40	31.40	31.40	31.40	31.40	31.40	31.40	31.40	31.40	31.40	31.40	31.40 (69)
Pump and fan ga	ains (Table 5	5a)										
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 (70)
Losses e.g. evap	oration (Tab	ole 5)										
	-67.23	-67.23	-67.23	-67.23	-67.23	-67.23	-67.23	-67.23	-67.23	-67.23	-67.23	-67.23 (71)
Water heating g	ains (Table	5)										
	113.47	111.76	108.20	103.37	100.23	95.81	92.06	96.87	98.58	103.58	109.23	111.77 (72)
Total internal ga	ins (66)m +	- (67)m + (6	8)m + (69)ı	m + (70)m	+ (71)m + (7	72)m		•		•		
	321.14	319.48	309.93	294.66	279.43	264.51	254.66	259.41	267.12	282.56	300.30	313.33 (73)
								4	1	1	1	
6. Solar gains						_						
			Access f	actor	Area	Sola	ar flux //m²		g ific data	FF coocific o	lata	Gains
			Table	bu		v	//111	or T	able 6b	or Table	6C	vv
North			0.7	7 X	2 09	x □ 1	0.63 x	09x (n 40 x	0.80	=	4 93 (74)
NorthFast			0.7		13.06		1 28 x	0.9 x ($\frac{1}{1}$			32.68 (75)
Solar gains in wa	atts 5(74)m	(82)m	0.7		15.00		1.20		<u>, , , , , , , , , , , , , , , , , , , </u>	0.00		(75)
Solar Ballis III We	37.61	75.93	125.8/	222 52	200 18	210 12	208.46	227.80	165.27	92.50	47.20	30.79 (83)
Total gains - inte	ornal and so	73.95 ar (73)m +	(83)m	222.52	299.10	519.12	298.40	237.80	105.27	92.30	47.20	(83)
				F17 10	F79.62	F92 62	FF2 12	407.21	422.20	275.06	247.40	244.12 (94)
	358.74	395.42	445.78	517.18	578.02	583.03	553.12	497.21	432.39	375.00	347.49	344.13 (84)
7. Mean intern	al tempera	ture (heatin	ng season)									
Temperature du	ring heating	g periods in	the living a	area from T	able 9, Th1	(°C)						21.00 (85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor	r for gains fo	or living are	a n1,m (se	e Table 9a)								

	1.00	0.99	0.98	0.92	0.77	0.57	0.42	0.49	0.77	0.96	0.99	1.00	(86)
Mean internal to	emp of livin	g area T1 (s	steps 3 to 7	in Table 9c	:)								
	19.97	20.10	20.35	20.67	20.90	20.98	21.00	20.99	20.93	20.62	20.24	19.94	(87)
Temperature du	iring heating	g periods ir	the rest of	f dwelling fi	rom Table 9	9, Th2(°C)		•	•	•		•	-
	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	(88)
Utilisation facto	r for gains f	or rest of d	welling n2,	m	I		1	1			1	ļ] , ,
	0.99	0 99	0.97	0.89	0.71	0.49	0.33	0.39	0.69	0.94	0.99	0.99	(89)
Mean internal to	emperature	in the rest	of dwelling	T2 (follow	stens 3 to	7 in Table 9	- 0.55 Ac)	0.55	0.05	0.54	0.55	0.55] (03)
		10.05			10.02	20.01		20.02	10.07	10.50	10.04	19.61	(00)
Li in a cura fue at	10.00	10.05	19.20	19.05	19.95	20.01	20.02	20.02	19.97	19.59	(4)	10.01] (90)] (94)
Living area fract	ion	6	- I	- (1 4 74	(4 (1 A)	.			LIV	ving area ÷	(4) =	0.47] (91)
wean internal to	emperature	for the wh			-(I - TLA) X	12					10.00		
	19.28	19.44	19.75	20.13	20.39	20.47	20.48	20.48	20.42	20.08	19.61	19.24	(92)
Apply adjustme	nt to the me	ean interna	l temperati	ure from Ta	ble 4e whe	ere appropr	iate					1	1
	19.28	19.44	19.75	20.13	20.39	20.47	20.48	20.48	20.42	20.08	19.61	19.24	(93)
8. Space heatin	ng requirem	ent											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Litilisation facto	r for gains	nm											
o this ation facto		0.00	0.07	0.00	0.74	0.52	0.27	0.44	0.72	0.04	0.08	0.00	(04)
Useful gains an	0.99	0.99	0.97	0.90	0.74	0.53	0.37	0.44	0.72	0.94	0.98	0.99	[(94)
Oserui gains, nii		F) III X (84) III											1 (0-1)
	355.92	389.95	430.78	463.92	426.52	308.41	206.88	216.62	312.70	351.82	342.22	341.93	(95)
Monthly average	e external t	emperature	e from Tabl	e U1									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	(96)
Heat loss rate fo	or mean inte	ernal tempe	erature, Lm	, W [(39)m	x [(93)m -	(96)m]							_
	801.18	777.60	708.31	600.66	464.76	313.94	207.60	218.19	338.10	506.92	668.85	804.05	(97)
Space heating re	equirement,	, kWh/mon	th 0.024 x	[(97)m - (9	5)m] x (41)	m							
	331.27	260.50	206.48	98.46	28.45	0.00	0.00	0.00	0.00	115.39	235.18	343.82]
									∑(98	3)15, 10	.12 = 1	619.54	(98)
Space heating re	equirement	kWh/m²/y	ear							(98)	÷ (4)	32.60	(99)
9b. Energy req	uirements -	communit	y heating s	cheme									
Fraction of spac	e heat from	secondary	/suppleme	ntary system	m (table 11	L)				'0' if ı	none	0.00	(301)
Fraction of spac	e heat from	communit	y system							1 - (30	01) =	1.00	(302)
Fraction of com	munity heat	from boile	ers									1.00	(303a)
Fraction of total	space heat	from comr	nunity boil	ers						(302) x (303	3a) =	1.00	(304a)
Factor for contro	ol and charg	ging metho	d (Table 4c	(3)) for com	munity spa	ace heating						1.00	(305)
Factor for charg	ing method	(Table 4c(3	3)) for com	nunity wat	er heating							1.00	(305a)
Distribution loss	factor (Tab	le 12c) for	community	heating sy	stem							1.05	(306)
													-
Space heating													
Annual space he	eating requi	rement						1	619.54	1			(98)
Space heat from	hoilers							(98	(304a)	, (305) x (3(06) = 1	700 52	(307a)
epace neut non								(90	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	. (505) X (50] (3070)
Matau haatina													
water neating	otin	romt							916.09	1			
Annual water he	eating requi	rement) (205 \ (5)		007.00	(04)
water heat fron	n Dollers							(64)	x (303a) x	(305a) x (30	נ = (סט	907.83] (310a)
Electricity used	tor heat dist	tribution					0.01	. × [(307a)	.(307e) + (3	310a)(310	e)] = [36.08	(313)
Electricity for pu	umps, fans a	ind electric	keep-hot (Table 4f)									

mechanical ventilation fans - balanced, extract or positive input from outside

33.49

(330a)

Total electricity for the above, kWh/year Electricity for lighting (Appendix L)

Total delivered energy for all uses

	33.49	(331)
	230.50	(332)
(307) + (309) + (310) + (312) + (315) + (331) + (332)(337b) =	3872.33	(338)

10b Euel costs

100. The costs - community nearing scheme						
	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from boilers	1700.52	x	4.24	x 0.01 =	72.10	(340a)
Water heating from boilers	1907.83	x	4.24	x 0.01 =	80.89	(342a)
Pumps and fans	33.49	х	13.19	x 0.01 =	4.42	(349)
Electricity for lighting	230.50	x	13.19	x 0.01 =	30.40	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)(342e) -	+ (345)(354) =	307.81	(355)
11b. SAP rating - community heating scheme						
Energy cost deflator (Table 12)					0.42	(356)
Energy cost factor (ECF)					1.37	(357)
SAP value					80.95	
SAP rating (section 13)					81	(358)
SAP band					В	7

12b. CO₂ emissions - community heating scheme

		Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from other sources	(space heating)						
Efficiency of boilers		94.00					(367a)
CO2 emissions from boilers	[(307a)+(310a)] x 100 ÷ (367a) =	3838.66	x	0.216	=	829.15	(367)
Electrical energy for communit	ty heat distribution	36.08	x	0.52	=	18.73	(372)
Total CO2 associated with com	imunity systems					847.88	(373)
Total CO2 associated with space	ce and water heating					847.88	(376)
Pumps and fans		33.49	x	0.52	=	17.38	(378)
Electricity for lighting		230.50	x	0.52	=	119.63	(379)
Total CO ₂ , kg/year					(376)(382) =	984.89	(383)
Dwelling CO ₂ emission rate					(383) ÷ (4) =	19.82	(384)
El value						86.06]
El rating (section 14)						86	(385)
El band						В]
13b. Primary energy - comm	unity heating scheme						
		Energy kWh/year		Primary factor		Primary energy (kWh/year)	,
Primary energy from other sou	urces (space heating)						
Efficiency of boilers		94.00					(367a)
Primary energy from boilers	[(307a)+(310a)] x 100 ÷ (367a) =	3838.66	x	1.22	=	4683.17	(367)
Electrical energy for communit	ty heat distribution	36.08	x	3.07	=	110.78	(372)
Total primary energy associate	ed with community systems					4793.95	(373)
Total primary energy associate	ed with space and water heating					4793.95	(376)

Total primary energy associated with space and water heating

Pumps and fans

Electricity for lighting

102.80

707.64

(378)

(379)

х

х

33.49

230.50

3.07

3.07

=

=

Primary energy kWh/year

Dwelling primary energy rate kWh/m2/year

5604.39	(383)
112.81	(384)



Assessor name		Miss Jayna Parmar							Assessor nur	6549	6549			
Client									Last modified	t	23/11,	/2016		
Address		A-L00-28	A Centric (Close, Lond	on, N8									
1. Overall dwellin	ng dimens	sions												
					ļ	Area (m²)			Average storey height (m)			Volume (m³)		
Lowest occupied						73.69	<mark>(1a)</mark> x	Ē	2.50] (2a) =		184.23	(3a)	
Total floor area		(1a)	+ (1b) + (1d	c) + (1d)(1n) =	73.69	(4)							
Dwelling volume								(3a) + (3b) + (3	3c) + (3d)(3	sn) =	184.23	(5)	
2. Ventilation rat	e													
											m³	' per hour		
Number of chimne	ys								0	x 40 =		0	(6a)	
Number of open flues							0	x 20 =		0	(6b)			
Number of intermittent fans								0	x 10 =		0	(7a)		
Number of passive vents							0	x 10 =		0	(7b)			
Number of flueless gas fires 0 x 40 =									0	(7c)				
											Air c	hanges pei hour	r	
Infiltration due to	chimneys	, flues, fans	s, PSVs		(6a) + (6b) + (7	a) + (7b) + (7c) =	0	÷ (5) =		0.00	(8)	
If a pressurisation	test has b	een carried	d out or is ii	ntended, pi	roceed to	(17), otherv	vise continu	e from (9) to (16)					
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope are							e area				4.00	(17)		
If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, otherwise $(18) = (16)$											0.20	(18)		
Number of sides on which the dwelling is sheltered												2	(19)	
Shelter factor									1 - [0.075 x (19)]			0.85	(20)	
Infiltration rate incorporating shelter factor									(18) x (2	20) =	0.17	(21)		
Infiltration rate mo	odified for	r monthly v	vind speed	:										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average w	vind spee	d from Tab	le U2				_			_			_	
	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)	
Wind factor (22)m	÷4					-1	-						-	
	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 infiltratio	on rate (al	lowing for	shelter and	wind facto	or) (21) x (22a)m	1	1					-	
	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.20	(22b)	
Calculate effective	air chang	ge rate for t	he applical	ole case:									-	
If mechanical ventilation: air change rate through system												0.50] (23a)	
If balanced with	n heat rec	covery: effic	ciency in %	allowing fo	or in-use fa	actor from T	able 4h					N/A	_ (23c)	
c) whole house	extract v	entilation o	or positive i	nput venti	lation from	n outside				0	•			
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	_ (24c)	
Effective air chang	e rate - er	nter (24a) o	or (24b) or (24c) or (22	ia) in (25)	0.50	0.50	0	0.50	0.50	0.50	0.50	7 (2-)	
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(25)	


3. Heat losses a	and heat lo	ss paramet	er.										
Element			а	Gross rea, m²	Openings m ²	Net a A, r	n²	U-value W/m²K	A x U W	//К к-\ kJ,	value, /m².K	Ахк, kJ/K	
Window						23.0	06 x	1.24	= 28.50)			(27)
Ground floor						73.	59 x	0.20	= 14.74	 ↓ _]			(28a
External wall						20.9	99 x	0.18	= 3.78				(29a
Party wall						56.2	27 x	0.00	= 0.00				(32)
Total area of ext	ternal eleme	ents ∑A, m²	2			117.	74						(31)
Fabric heat loss,	W/K = ∑(A	× U)							(2	5)(30) + (32) =	47.01	(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/r	m²K									250.00] (35)
Thermal bridges	s: Σ(L x Ψ) ca	alculated us	sing Appen	dix K								8.56] (36)
Total fabric heat	t loss									(33) + (3	36) =	55.58] (37)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat	loss calcula	ted month	ıly 0.33 x (2	25)m x (5)									
	30.40	30.40	30.40	30.40	30.40	30.40	30.40	30.40	30.40	30.40	30.40	30.40	(38)
Heat transfer co	efficient, W	' //K (37)m⊣	+ (38)m						•				_ · ·
	85.97	85.97	85.97	85.97	85.97	85.97	85.97	85.97	85.97	85.97	85.97	85.97	٦
		I							Average = 5	(39)112/	/12 =	85.97	_] (39)
Heat loss param	eter (HLP),	W/m²K (39	9)m ÷ (4)							, , ,			_ · ·
	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	٦
		1							Average = 3	5(40)112/	/12 =	1.17	_] (40)
Number of days	in month (1	Fable 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)
	<u> </u>	1	•	•								-	
4. Water heati	ng energy r	equiremen	it										
Assumed occupa	ancy, N											2.33	(42)
Annual average	hot water u	isage in litr	es per day '	Vd,average	= (25 x N) +	36						89.59	(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 Tabl	e 1c x (43)			_				_
	98.55	94.97	91.38	87.80	84.22	80.63	80.63	84.22	87.80	91.38	94.97	98.55	
										∑(44)1	.12 =	1075.10	(44)
Energy content	of hot wate	r used = 4.:	18 x Vd,m x	nm x Tm/3	3600 kWh/m	onth (see T	Tables 1b	o, 1c 1d)					
	146.15	127.82	131.90	114.99	110.34	95.21	88.23	101.25	102.45	119.40	130.34	141.54]
										∑(45)1	.12 =	1409.62] (45)
Distribution loss	6 0.15 x (45))m											
	21.92	19.17	19.79	17.25	16.55	14.28	13.23	15.19	15.37	17.91	19.55	21.23	(46)
Storage volume	(litres) inclu	uding any s	olar or WW	/HRS storag	ge within sam	ne vessel						110.00	(47)
Water storage lo	oss:												
b) Manufacture	r's declared	loss factor	is not know	wn									
Hot water sto	orage loss fa	actor from	Table 2 (kV	Vh/litre/da	y)							0.02	(51)
Volume facto	or from Tab	le 2a										1.03	(52)
Temperature	e factor fron	n Table 2b										0.60	(53)
													_
Energy lost fi	rom water s	storage (kW	/h/day) (47	7) x (51) x (5	52) x (53)							1.03	(54)
Energy lost fi Enter (50) or (54	rom water s 1) in (55)	storage (kW	/h/day) (47	7) x (51) x (5	52) x (53)							1.03 1.03	_ (54)] (55)
Energy lost fi Enter (50) or (54 Water storage lo	rom water s 1) in (55) oss calculate	torage (kW	/h/day) (47 month (55	7) x (51) x (5 5) x (41)m	52) x (53)							1.03 1.03	_ (54) _ (55)
Energy lost fi Enter (50) or (54 Water storage lo	rom water s 4) in (55) oss calculate 32.01	ed for each 28.92	/h/day) (47 month (55 32.01	7) x (51) x (5 5) x (41)m 30.98	52) x (53) 32.01	30.98	32.01	32.01	30.98	32.01	30.98	1.03 1.03 32.01] (54)] (55)] (56)

	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)
Primary circuit	oss for each	month fro	m Table 3										
	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
Combi loss for e	ach month	from Table	3a. 3b or 3	с	1			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	(61)
Total boat roqui	rod for wat	or heating	colculated f	or oach mo	0.00	$(45)m \pm (4)$	$6)m \pm (57)$	1 + (50)m	↓ (61)m	0.00	0.00	0.00	(01)
iotal field requi										474.00	402.02	100.01	(ca)
	201.42	1/7.75	187.18	168.49	165.62	148.71	143.51	156.52	155.95	174.68	183.83	196.81	(62)
Solar DHW inpu	t calculated	using Appe	endix G or A	ppendix H		1	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	(63)
Output from wa	iter heater f	or each mo	onth (kWh/r	nonth) (62	2)m + (63)n	1							
	201.42	177.75	187.18	168.49	165.62	148.71	143.51	156.52	155.95	174.68	183.83	196.81	
										∑(64)1	12 = 2	060.46	(64)
Heat gains from	water heat	ing (kWh/n	nonth) 0.25	5 × [0.85 × ((45)m + (61	l)m] + 0.8 ×	: [(46)m + (57)m + (59)m]				
	92.82	82.44	88.08	81.03	80.91	74.45	73.56	77.89	76.86	83.92	86.13	91.28	(65)
		1											
5. Internal gair	าร												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains	(Table 5)												
	116.61	116.61	116.61	116.61	116.61	116.61	116.61	116.61	116.61	116.61	116.61	116.61	(66)
Lighting gains (c	alculated in	Appendix	L, equation	L9 or L9a),	also see Ta	able 5						ı	
0 00 (18 34	16 29	13 25	10.03	7 50	6 33	6 84	8 89	11 93	15 15	17.68	18.85	(67)
Appliance gains	(calculated	in Annendi		n 13 or 1	13a) also s	ee Table 5	0.01	0.05	11.55	13.13	17.00	10.05	(07)
Appliance gains				101.05			152.02	151 70	157.17	100.00	102.00	100.07	(60)
	205.75	207.89	202.51	191.05	176.59	T-163.00	153.93	151.79	157.17	168.63	183.08	196.67	(68)
COOKING gains (C	calculated in	Appendix	L, equation	L15 or L15	a), also see	e Table 5						,	
	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	(69)
Pump and fan g	ains (Table !	5a)											
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
Losses e.g. evap	oration (Tal	ole 5)											
	-93.29	-93.29	-93.29	-93.29	-93.29	-93.29	-93.29	-93.29	-93.29	-93.29	-93.29	-93.29	(71)
Water heating g	ains (Table	5)											
	124.75	122.68	118.38	112.54	108.75	103.41	98.87	104.69	106.75	112.80	119.63	122.69	(72)
Total internal ga	ains (66)m +	+ (67)m + (6	58)m + (69)r	n + (70)m ·	+ (71)m + (72)m		•					
-	406.83	404.85	392.13	371.61	350.83	330.73	317.62	323.35	333.84	354.56	378.38	396.20	(73)
								1					()
6. Solar gains													
			Access f	actor	Area	Sol	ar flux		g	FF		Gains	
			Table	6d	m²	v	V/m²	spec	ific data	specific d	lata 	W	
SouthWest			0.77	7 X	23.06	x 3	6.79 x	0.9 x	0.40 x	0.80	=	188.16	(79)
Solar gains in wa	atts ∑(74)m	(82)m											
	188.16	320.50	438.52	543.35	608.60	604.19	582.51	533.83	474.83	354.22	225.37	161.02	(83)
Total gains - inte	ernal and so	lar (73)m +	(83)m										
	594.99	725.34	830.65	914.96	959.42	934.92	900.13	857.18	808.67	708.78	603.75	557.22	(84)
7. Mean intern	al tempera	ture (heati	ng season)										
Temperature du	uring heating	g periods ir	the living a	rea from T	able 9, Th	L(°C)						21.00	(85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains f	or living are	ea n1,m (se	e Table 9a)									
	0.99	0.98	0.95	0.88	0.75	0.57	0.42	0.46	0.68	0.91	0.98	0.99	(86)
	L				•			ı]	

Mean internal te	emp of livin	g area T1 (steps 3 to 7	in Table 90	c)								
	19.93	20.14	20.42	20.70	20.90	20.98	21.00	20.99	20.95	20.69	20.24	19.87	(87)
Temperature du	ring heating	g periods ir	າ the rest of	dwelling f	rom Table	9, Th2(°C)							
	19.95	19.95	19.95	19.95	19.95	19.95	19.95	19.95	19.95	19.95	19.95	19.95	(88)
Utilisation factor	r for gains f	or rest of d	welling n2,r	n	•			•	•	•		-	-
	0.99	0.97	0.94	0.85	0.69	0.48	0.32	0.35	0.60	0.88	0.98	0.99	(89)
Mean internal te	emperature	in the rest	of dwelling	T2 (follow	v steps 3 to	o 7 in Table	9c)	1		1		-1], ,
	18 54	18.85	19.24	19.62	19.86	19.93	19.95	19 94	19.91	19.61	18 99	18 46] (90)
Living area fracti	ion	10.05	13.21	19:02	19.00	13.33	10.00	10.01	15.51	ving area ÷ /	(4) -	0.30] (01)
Mean internal te	omperature	for the wh	ole dwellin	τflΛνT1 μ	⊾(1 _ fl ∧) v	· T2				vilig alea . ((4)	0.39	
Wear internal te				20.04		20.24	20.25	20.25	20.21	20.02	10.47	10.00	
A sealed a discator of	19.07	19.35	19.70	20.04	20.20	20.34	20.35	20.35	20.31	20.03	19.47	19.00] (92)
Apply adjustmer	it to the me	an Interna	i temperatu	Ire from Ta	able 4e wh	ere approp	riate			1	-		٦
	19.07	19.35	19.70	20.04	20.26	20.34	20.35	20.35	20.31	20.03	19.47	19.00] (93)
8. Space heatin	ng requirem	ient											
·	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Litilisation factor	r for gains	nm			,			18	сср			200	
Othisation factor				0.05	0.71	0.52	0.20	0.20	0.62		0.07	0.00	
	0.99	0.97	0.93	0.85	0.71	0.52	0.36	0.39	0.63	0.88	0.97	0.99] (94)
Usetul gains, nm	iGm, w (94	/)m x (84)m	1 TT			1	1			1 1			٦
	587.60	703.64	774.67	778.47	677.95	483.23	321.16	337.44	508.79	625.80	587.52	552.01] (95)
Monthly average	e external t	emperatur	e from Table	e U1			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	(96)
Heat loss rate fo	r mean inte	ernal tempe	erature, Lm,	W [(39)m	n x [(93)m	- (96)m]							_
	1270.16	1242.46	1134.56	957.62	735.62	493.16	322.42	339.50	533.98	810.37	1063.42	1272.48	(97)
Space heating re	equirement,	, kWh/mor	ith 0.024 x	[(97)m - (9	5)m] x (41	.)m							
	507.82	362.08	267.76	128.99	42.91	0.00	0.00	0.00	0.00	137.32	342.65	536.03	
									Σ(9	8)15, 10	12 =	2325.56	(98)
Space heating re	equirement	kWh/m²/y	ear							(98) -	÷ (4)	31.56	(99)
			_										
9b. Energy requ	uirements -	communit	ty heating s	cheme									<u></u>
Fraction of space	e heat from	secondary	/supplemer	ntary syste	m (table 1	.1)				'0' if n	ione	0.00] (301)
Fraction of space	e heat from	communit	y system:							1 - (30)1) =	1.00	(302)
Fraction of comr	munity heat	: from boile	ers									0.25	(303a)
Fraction of comr	munity heat	: from CHP										0.75	(303b)
Fraction of total	space heat	from com	munity CHP							(302) x (303	3a) =	0.75	(304a)
Fraction of total	space heat	from com	munity boile	ers						(302) x (303	3b) =	0.25	(304b)
Factor for contro	ol and charg	ging metho	d (Table 4c(3)) for com	nmunity sp	bace heating	5					1.00	(305)
Factor for chargi	ing method	(Table 4c(3)) for comn	nunity wat	er heating	5						1.00	(305a)
Distribution loss	factor (Tab	le 12c) for	community	heating sy	vstem							1.05	(306)
													-
Space heating													
Annual space he	ating requi	rement							2325.56	1			(98)
Space heat from	СНР							(9)	8) x (304a)	⊐ x (305) x (30)6) =	1831 38	(307a)
Space heat from	boilers							(0)	$(30.10) \times (30.10)$	v (205) v (20)e) – [610.46	(307b)
Space near nom	5011013							(9)	57 × (3040)	, 100) X (00)		010.40] (2010)
Wator besting													
Annual water	ating as a f	romert						· · ·	2060 46	Г			(CA)
Annual water he	ating requi	rement										4.000.00	(04)
water heat from	1 СНР							(64) x (303a) x	(305a) x (30	JD) = [1622.62] (310a)

Water heat from boilers			(64) x (303b) x (305a) x (306) =	540.87	(310b)
Electricity used for heat distribution		0.01 × [(307a)(307e) + (3	10a)(310e)] =	46.05	(313)
Electricity for pumps, fans and electric keep-hot (Table 4f)						
mechanical ventilation fans - balanced, extract or positive input	t from outside		49.67			(330a)
Total electricity for the above, kWh/year					49.67	(331)
Electricity for lighting (Appendix L)					323.94	(332)
Total delivered energy for all uses	(307) + (309) +	(310) + (312)) + (315) + (331) + ((332)(337b) =	4978.94	(338)
100. Fuel costs - community neating scheme	Freed		E. A. Martin		Freed	
	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from CHP	1831.38	х	2.97	x 0.01 =	54.39	(340a)
Space heating from boilers	610.46	x	4.24	x 0.01 =	25.88	(340b)
Water heating from CHP	1622.62	x	2.97	x 0.01 =	48.19	(342a)
Water heating from boilers	540.87	x	4.24	x 0.01 =	22.93	(342b)
Pumps and fans	49.67	x	13.19	x 0.01 =	6.55	(349)
Electricity for lighting	323.94	x	13.19	x 0.01 =	42.73	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)(342e) +	· (345)(354) =	320.68	(355)
11b. SAP rating - community heating scheme						
Energy cost deflator (Table 12)					0.42	(356)
Energy cost factor (ECF)					1.13	(357)
SAP value					84.17	7
SAP rating (section 13)					84	(358)
					L	
SAP band					В	
SAP band					В]
SAP band 12b. CO ₂ emissions - community heating scheme					В]
SAP band 12b. CO ₂ emissions - community heating scheme	Energy kWh/year		Emission factor		B Emissions (kg/year)]
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating)	Energy kWh/year		Emission factor		B Emissions (kg/year)]
SAP band 12b. CO₂ emissions - community heating scheme <i>Emissions from community CHP (space and water heating)</i> Power efficiency of CHP unit	Energy kWh/year 28.09		Emission factor		B Emissions (kg/year)	(361)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit	Energy kWh/year 28.09 66.01		Emission factor		B Emissions (kg/year)	(361) (362)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [Energy kWh/year 28.09 66.01 2774.3769	x	Emission factor		B Emissions (kg/year) 599.2654	(361) (362)] (363)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity [Energy kWh/year 28.09 66.01 2774.3769 -779.3100	X X	Emission factor	=	B Emissions (kg/year) 599.2654 -404.4619	(361) (362)] (363)] (364)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP	Energy kWh/year 28.09 66.01 2774.3769 -779.3100 2458.1194	X X X X	Emission factor 0.2160 0.5190 0.2160	= = =	B Emissions (kg/year) 599.2654 -404.4619 530.9538	(361) (362)] (363)] (364)] (365)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity	Energy kWh/year 28.09 66.01 2774.3769 -779.3100 2458.1194 -690.4747	X X X X X	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5	= = = =	B Emissions (kg/year) 599.2654 -404.4619 530.9538 -358.3564	(361) (362) (363) (364) (365) (366)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating)	Energy kWh/year 28.09 66.01 2774.3769 -779.3100 2458.1194 -690.4747	X X X X X	Emission factor 0.2160 0.5190 0.2160 0.5190	= = = =	B Emissions (kg/year) 599.2654 -404.4619 530.9538 -358.3564	(361) (362)] (363)] (364)] (365)] (366)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers	Energy kWh/year 28.09 66.01 2774.3769 -779.3100 2458.1194 -690.4747 94.00	x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190	= = = =	B Emissions (kg/year) 599.2654 -404.4619 530.9538 -358.3564	(361) (362) (363) (364) (365) (366) (367b)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Energy kWh/year 28.09 66.01 2774.3769 -779.3100 2458.1194 -690.4747 94.00 1224.82	x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.2160 0.2160 0.5190	= = =	B Emissions (kg/year) 599.2654 -404.4619 530.9538 -358.3564 264.56	(361) (362) (363) (364) (365) (366) (367b) (368)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution	Energy kWh/year 28.09 66.01 2774.3769 -779.3100 2458.1194 -690.4747 94.00 1224.82 46.05	x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.52	= = = =	B Emissions (kg/year) 599.2654 -404.4619 530.9538 -358.3564 264.56 23.90	(361) (362) (363) (364) (365) (366) (367b) (368) (372)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution [Total CO2 associated with community systems	Energy kWh/year 28.09 66.01 2774.3769 -779.3100 2458.1194 -690.4747 94.00 1224.82 46.05	x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5190 0.5190		B Emissions (kg/year) 599.2654 -404.4619 530.9538 -358.3564 264.56 23.90 655.86	(361) (362) (363) (364) (365) (366) (367b) (368) (372) (373)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating	Energy kWh/year 28.09 66.01 2774.3769 -779.3100 2458.1194 -690.4747 94.00 1224.82 46.05	x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.52 0.52 0.52 0.52 0.52 0.52 0.52 0.5	= = = =	B Emissions (kg/year) 599.2654 -404.4619 530.9538 -358.3564 264.56 23.90 655.86 655.86	(361) (362) (363) (364) (365) (366) (367b) (368) (372) (373) (376)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans	Energy kWh/year 28.09 66.01 2774.3769 -779.3100 2458.1194 -690.4747 94.00 1224.82 46.05	x x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.2160 0.5190		B Emissions (kg/year) 599.2654 -404.4619 530.9538 -358.3564 264.56 23.90 655.86 655.86 25.78	(361) (362) (363) (364) (365) (366) (366) (368) (372) (373) (373) (376)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting	Energy kWh/year 28.09 66.01 2774.3769 -779.3100 2458.1194 -690.4747 94.00 1224.82 46.05 49.67 323.94	x x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5190 0.5190 0.5190 0.5190		B Emissions (kg/year) 599.2654 -404.4619 530.9538 -358.3564 25.78 264.56 23.90 655.86 655.86 25.78 168.13	(361) (362) (363) (364) (365) (366) (367b) (368) (372) (373) (373) (378) (379)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting Total CO ₂ , kg/year	Energy kWh/year 28.09 66.01 2774.3769 -779.3100 2458.1194 -690.4747 94.00 1224.82 46.05 46.05	x x x x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5190 0.5190 0.52 0.52 0.52	= = = = = = (376)(382) =	B Emissions (kg/year) 599.2654 -404.4619 530.9538 -358.3564 264.56 23.90 655.86 655.86 25.78 168.13 849.77	(361) (362) (363) (364) (365) (366) (366) (368) (372) (373) (373) (376) (378) (379) (383)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP [less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting Total CO ₂ , kg/year Dwelling CO ₂ emission rate	Energy kWh/year 28.09 66.01 2774.3769 -779.3100 2458.1194 -690.4747 94.00 1224.82 46.05 49.67 323.94	x x x x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5190 0.5190 0.5190	= = = = = (376)(382) = (383) ÷ (4) =	B Emissions (kg/year) 599.2654 -404.4619 530.9538 -358.3564 25.78 264.56 23.90 655.86 25.78 168.13 849.77 11.53	(361) (362) (363) (364) (365) (365) (366) (367b) (368) (372) (373) (373) (373) (378) (378) (379) (383)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with 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 28.09 66.01 2774.3769 -779.3100 2458.1194 -690.4747 94.00 1224.82 46.05 49.67 323.94	x x x x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.2160 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190	= = = = = (376)(382) = (383) ÷ (4) =	B Emissions (kg/year) 599.2654 -404.4619 530.9538 -358.3564 264.56 23.90 655.86 655.86 25.78 168.13 849.77 11.53 90.41	(361) (362) (363) (364) (365) (366) (366) (368) (372) (373) (373) (373) (378) (379) (383) (384)
SAP band 12b. CO₂ emissions - community heating scheme <i>Emissions from community CHP (space and water heating)</i> Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers CO2 emissions from boilers [307b)+(310b)] × 100 ÷ (367b) = Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with 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 28.09 66.01 2774.3769 -779.3100 2458.1194 -690.4747 94.00 1224.82 46.05 49.67 323.94	x x x x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5190 0.5190 0.5190 0.5190	= = = = = (376)(382) = (383) ÷ (4) =	B Emissions (kg/year) 599.2654 -404.4619 530.9538 -358.3564 25.78 264.56 23.90 655.86 25.78 168.13 849.77 11.53 90.41 90	 (361) (362) (363) (364) (365) (365) (366) (368) (372) (373) (373) (376) (378) (379) (383) (384) (385)

13b. Primary energy - community heating scheme						
	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary Energy from community CHP (space and water heatir	ng)					
Power efficiency of CHP unit	28.09					(361)
Heat efficiency of CHP unit	66.01					(362)
Space heating from CHP $(307a) \times 100 \div (362)$	2) = 2774.38	x	1.22	=	3384.74	(363)
less credit energy for electricity	-779.31	x	3.07	=	-2392.48	(364)
Water heated by CHP	2458.12	x	1.22	=	2998.91	(365)
less credit energy for electricity	-690.47	x	3.07	=	-2119.76	(366)
Primary energy from other sources (space heating)						
Efficiency of boilers	94.00					(367b)
Primary energy from boilers [(307b)+(310b)] x 100 ÷ (367b)	b) = 1224.82	x	1.22	=	1494.28	(368)
Electrical energy for community heat distribution	46.05	×	3.07	=	141.38	(372)
Total primary energy associated with community systems					3507.07	(373)
Total primary energy associated with space and water heating	g				3507.07	(376)
Pumps and fans	49.67	×	3.07	=	152.49	(378)
Electricity for lighting	323.94	x	3.07	=	994.50	(379)
Primary energy kWh/year					4654.06	(383)
Dwelling primary energy rate kWh/m2/year					63.16	(384)



Assessor name	Miss Jay	na Parmar						Assessor nun	nber	6549		
Client								Last modified	ł	23/11	/2016	
Address	A-L03-19	A Centric	Close, Lond	on, N8								
			-									
1. Overall dwelling di	mensions											
				Α	vrea (m²)		ľ	Average storey height (m)	,	Vo	lume (m³)	
Lowest occupied					87.58	<mark>(1a)</mark> x	Ē	2.50] (2a) =		218.95	(3a)
Total floor area	(1a) + (1b) + (1	c) + (1d)(1n) =	87.58	(4)						
Dwelling volume								(3a) + (3b) + (3	sc) + (3d)(3	8n) =	218.95] (5)
2. Ventilation rate									_			
										m³	³ per hour	
Number of chimneys							Г	0	x 40 =		0] (6a)
Number of open flues							Ē	0	x 20 =	: [] (6b)
Number of intermitten	t fans						Ē	0	x 10 =	: [0] (7a)
Number of passive ven	ts							0	x 10 =	: [0] (7b)
Number of flueless gas	fires						Ē	0	x 40 =	: [0] (7c)
C C									_	Air c	hanges per hour	r
Infiltration due to chim	neys, flues, far	s, PSVs		(6a) + (6b) + (7	a) + (7b) + (7c) = 🗌	0		. [0.00	(8)
If a pressurisation test	has been carrie	d out or is i	ntended, pi	roceed to ((17), otherw	/ise continu	e from	(9) to (16)				
Air permeability value,	q50, expressed	l in cubic m	etres per h	our per sq	uare metre	of envelope	e area				4.00	(17)
If based on air permeal	oility value, the	n (18) = [(1	7) ÷ 20] + (8	3), otherwi	se (18) = (1	6)					0.20	(18)
Number of sides on wh	ich the dwellin	g is sheltere	ed								2	(19)
Shelter factor								1	- [0.075 x (1	9)] =	0.85	(20)
Infiltration rate incorpo	orating shelter	factor							(18) x (2	20) =	0.17	(21)
Infiltration rate modifie	ed for monthly	wind speed	:									
Jai	n Feb	Mar	Apr	May	Jun	Jul	Au	g Sep	Oct	Nov	Dec	
Monthly average wind	speed from Tal	ble U2										
5.1	0 5.00	4.90	4.40	4.30	3.80	3.80	3.7	0 4.00	4.30	4.50	4.70	(22)
Wind factor (22)m \div 4												
1.2	8 1.25	1.23	1.10	1.08	0.95	0.95	0.93	3 1.00	1.08	1.13	1.18] (22a)
Adjusted infiltration rat	e (allowing for	shelter and	d wind facto	or) (21) x (2	22a)m							_
0.2	2 0.21	0.21	0.19	0.18	0.16	0.16	0.1	6 0.17	0.18	0.19	0.20	(22b)
Calculate effective air c	hange rate for	the applica	ble case:									_
If mechanical ventila	ation: air chang	ge rate thro	ugh system								0.50	(23a)
If balanced with hea	at recovery: eff	iciency in %	allowing fo	or in-use fa	ictor from T	able 4h					N/A	(23c)
c) whole house extr	act ventilation	or positive	input venti	lation fron	n outside				.			_
0.5	0 0.50	0.50	0.50	0.50	0.50	0.50	0.50	0 0.50	0.50	0.50	0.50	(24c)
Effective air change rat	e - enter (24a)	or (24b) or	(24c) or (24	ld) in (25)	-				-			_
0.5	0 0.50	0.50	0.50	0.50	0.50	0.50	0.5	0.50	0.50	0.50	0.50	(25)



3. Heat losses a	and heat los	ss paramet	er										
Element			а	Gross rea, m²	Openings m ²	Net a A, m	rea 1²	U-value W/m²K	A x U W	//К к-ч kJ	value, /m².K	Ахк, kJ/K	
Window						29.4	5 x	1.24	= 36.39)			(27)
External wall						21.9	7 x	0.18	= 3.95				(29a
Party wall						57.0	5 x	0.00	= 0.00				(32)
Roof						87.5	8 x	0.16	= 14.01				(30)
Total area of ext	ternal eleme	ents ∑A, m²	2			139.0	00						(31)
Fabric heat loss,	W/K = ∑(A	× U)							(2	6)(30) + (32) =	54.36	(33)
Heat capacity Cr	m = ∑(А x к)							(28)	.(30) + (32)	+ (32a)(3	2e) =	N/A	(34)
Thermal mass p	arameter (T	MP) in kJ/r	n²K									250.00	(35)
Thermal bridges	:: Σ(L x Ψ) ca	lculated us	sing Appen	dix K								7.51	(36)
Total fabric heat	t loss		0 11							(33) + (36) =	61.87	(37)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat	loss calcula	ted month	ly 0.33 x (2	25)m x (5)	-			_					
	36.13	36.13	36.13	36.13	36.13	36.13	36.13	36.13	36.13	36.13	36.13	36.13	(38)
Heat transfer co	efficient. W	/K (37)m +	+ (38)m										_ (,
	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	7
	50.00	50.00	50.00	50.00	50.00	50.00	30.00		Average = '	$\Sigma(39)112$	/12 =	98.00	 (39)
Heat loss param	eter (HLP). '	W/m²K (30	9)m ÷ (4)						, werage	2(33)112		50.00	
	1 12	1 12	1 12	1 1 2	1 12	1 1 2	1 1 2	1 12	1 1 2	1 1 2	1 12	1 1 2	7
	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12		(40)1 12	/12 -	1 1 2	
Number of days	in month (T	able 1a)							Average -	2(40)112,	12 -	1.12	_ (40)
Number of days		28.00	21.00	20.00	21.00	20.00	21.00	21.00	20.00	21.00	20.00	21.00	
	51.00	28.00	51.00	30.00	51.00	30.00	51.00	31.00	30.00	51.00	50.00	51.00	_ (40)
4. Water heati	ng energy r	equiremen	t										
Assumed occupa	ancy, N											2.59	(42)
Annual average	hot water u	sage in litre	es per day '	Vd,average	= (25 x N) +	36						95.74	(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 Tabl	le 1c x (43)							
	105.31	101.48	97.65	93.82	89.99	86.17	86.17	89.99	93.82	97.65	101.48	105.31	
										<u>Σ</u> (44)1	.12 =	1148.87	(44)
Energy content	of hot wate	r used = 4.2	18 x Vd,m x	nm x Tm/3	3600 kWh/m	onth (see T	ables 1b), 1c 1d)					
	156.18	136.59	140.95	122.89	117.91	101.75	94.28	108.19	109.49	127.59	139.28	151.25	
										Σ(45)1	.12 =	1506.35	 (45)
Distribution loss	0.15 x (45)	m								2(-7			
	23.43	20.49	21.14	18.43	17.69	15.26	14.14	16.23	16.42	19.14	20.89	22.69	(46)
Storage volume	(litres) inclu	iding any s	olar or WW	HRS storag	re within sam	ne vessel	1	10.23	10.12	13.11		110.00] (10)] (47)
Water storage lo					,						L	110100	
h) Manufacture	r's declared	loss factor	is not know	wn									
Hot water st	orage loss fr	ector from	Table 2 (k)	/h/litre/day	v)							0.02	7 (51)
Volumo facto	or from Tabl			vily intrey day	y)							1.02] (51)] (52)
	factor from	e za										0.60	_ (52) _ (52)
Enorgy lost f			(b (day) (4-	7) / [1) / [- 2) y (F 2)							1.02	_ (55) _ (54)
	ioni water s	torage (KM	myuay) (47	7 (T C) X (S	JZJ X (JJ)							1.03	(54) (55)
Enter (50) or (54	+) III (55)	d for c	month /Fr) v (41)								1.03	_ (55)
water storage lo	Jss calculate	eu for each	month (55	5) X (41)M									
	22.01	20.02	22.01	20.00	22.04	20.00	22.01	22.21	20.00	22.01	20.05	22.24	7
-			•										
	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01 (57)	
Primary circuit l	oss for each	month fro	m Table 3										
	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26 (59)	
Combi loss for e	ach month	from Table	3a, 3b or 3	с				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 (61)	
Total heat requi	red for wate	er heating o	alculated f	or each mo	nth 0.85 x	(45)m + (40	6)m + (57)r	n + (59)m +	- (61)m				
·	211 45	186 52	196 23	176 38	173 19	155 24	149 56	163.47	162.98	182 87	192 77	206 53 (62)	
Solar DHW innu	t calculated	using Anne	endix G or A	Annendix H	175.15	155.21	115.50	105.17	102.50	102.07	192.77		
Solar Britt Inpu					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 (63)	
Output from wa	tor bostor f	or oach me	0.00	(67)	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 (03)	
				176.29	172.10	155.24	140 56	162.47	162.08	102.07	102 77	206 52	
	211.45	180.52	190.23	1/0.38	173.19	155.24	149.50	103.47	102.98	5(64)4	192.77	200.53	
11							[/46]			<u>∑</u> (64)1	12 = 2	(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)	imj				
	96.15	85.36	91.09	83.65	83.43	76.63	75.57	80.20	79.20	86.65	89.11	94.51 (65)	
5. Internal gair	ıs												
Ŭ	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains	(Table 5)												
Sector Sector	129 56	129 56	129 56	129 56	129 56	129 56	129 56	129 56	129 56	129 56	129 56	129 56 (66)	
Lighting gains (c	alculated in	Annendix	equation	129.90	also see Ta	129.90	129.50	129.50	129.90	129.50	129.90	129.50 (00)	
				11 42			7.90	10.14	12.60	17.27	20.16	21.40 (67)	
Appliance gains	20.91	10.57		11.45		7.22	7.80	10.14	15.00	17.27	20.10	21.49 (07)	
Appliance gains										100.00			
	234.55	236.99	230.85	217.80	201.31	185.82	175.47	173.04	179.17	192.23	208.71	224.21 (68)	
Cooking gains (c	alculated in	Appendix	L, equation	L15 or L15	a), also see	Table 5							
	35.96	35.96	35.96	35.96	35.96	35.96	35.96	35.96	35.96	35.96	35.96	35.96 (69)	
Pump and fan g	ains (Table S	5a)	[I		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 (70)	
Losses e.g. evap	oration (Tal	ole 5)											
	-103.65	-103.65	-103.65	-103.65	-103.65	-103.65	-103.65	-103.65	-103.65	-103.65	-103.65	-103.65 (71)	
Water heating g	ains (Table	5)											
	129.23	127.02	122.43	116.19	112.13	106.43	101.57	107.79	110.00	116.46	123.76	127.03 (72)	
Total internal ga	ains (66)m +	+ (67)m + (6	58)m + (69)ı	m + (70)m -	+ (71)m + (7	72)m							
	446.57	444.45	430.26	407.29	383.86	361.33	346.71	352.83	364.64	387.83	414.50	434.60 (73)	
C. Calan asian													
6. Solar gains													
			Access f Table	actor 6d	Area m²	Sola W	ar flux //m²	spec	g ific data	FF specific d	ata	Gains	
								or T	able 6b	or Table	6c		
SouthWest			0.7	7 X	29.45	x 3	6.79 x	0.9 x 0	0.40 x	0.80	=	240.29 (79)	
Solar gains in wa	atts ∑(74)m	(82)m											
-	240.29	409.31	560.04	693.91	777.24	771.62	743.92	681.76	606.40	452.37	287.82	205.64 (83)	
Total gains - inte	ernal and so	lar (73)m +	(83)m										
	686.86	853.76	990.29	1101 20	1161 10	1132.95	1090 64	103/ 59	971.04	840.21	702 32	640.24 (84)	
	000.00	000.70	550.25	1101.20	1101.10	1152.55	1050.04	1004.00	571.04	070.21	, 52.52		
7. Mean intern	al tempera	ture (heati	ng season)										
Temperature du	iring heating	g periods in	the living a	area from T	able 9, Th1	.(°C)						21.00 (85)	
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains f	or living are	ea n1,m (se	e Table 9a)									
	0.99	0.98	0.95	0.87	0.72	0.54	0.39	0.43	0.66	0.91	0.98	1.00 (86)	

Mean internal te	emp of livin	ig area T1 (s	steps 3 to 7	in Table 90	c)								
	19.97	20.20	20.48	20.75	20.92	20.99	21.00	21.00	20.96	20.72	20.28	19.91	(87)
Temperature du	iring heatin	g periods ir	n the rest of	dwelling f	rom Table	9 <i>,</i> Th2(°C)							
	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	(88)
Utilisation facto	r for gains f	for rest of d	lwelling n2,	m									
	0.99	0.97	0.93	0.83	0.66	0.46	0.30	0.34	0.58	0.87	0.98	0.99	(89)
Mean internal te	emperature	in the rest	t of dwelling	g T2 (follow	, steps 3 to	7 in Table 9	Əc)						_
	18.63	18.96	19.35	19.72	19.92	19.98	19.98	19.98	19.96	19.69	19.08	18.55	(90)
Living area fract	ion	4	4		I		1	1	Li	ving area ÷	(4) =	0.34	(91)
Mean internal te	emperature	or the wh	ole dwellin	g fl A x T1 +	⊦(1 - fl A) x	Т2			_		(.)] (0 -)
	19.09	19.39	19.74	20.07	20.26	20.32	20.33	20.33	20.30	20.04	19/19	19.01	(92)
Apply adjustmer	15.05		15.74	re from Ta	20.20	ere appropr	ioto	20.33	20.30	20.04	19.49	19.01] (32)
								20.22	20.20	20.04	10.40	10.01	
	19.09	19.39	19.74	20.07	20.26	20.32	20.33	20.33	20.30	20.04	19.49	19.01] (93)
8. Space heatir	ng requiren	nent											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor	r for gains,	ηm		-	-			-					
	0.99	0.97	0.93	0.83	0.68	0.49	0.33	0.37	0.60	0.87	0.97	0.99	(94)
Useful gains, nm	1Gm. W (94	4)m x (84)r	1 0.00	0.00	0.00	0.15	0.00		0.00	0.07	0.07] (0 .)
obertar game, rin	678.99	827.66	018.02	010 02	788.21	553.04	364.84	383 72	586.13	73/ 03	683.88	63/ 87] (05)
Monthly avorage	o ovtornal t			0.111	788.21	555.04	504.84	505.72	580.15	734.95	085.88	034.87] (93)
					44.70	14.60	16.60	16.40	14.40	10.00	7.40	1.20	
11	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 to	or mean into	arnal tempe	erature, Lm,	, w [(39)m	1 x [(93)m ·	- (96)mj				I] ()
	1449.54	1419.78	1297.51	1094.66	838.95	560.78	365.73	385.24	607.84	925.51	1213.90	1451.82] (97)
Space heating re	equirement	, kWh/mon	1th 0.024 x	[(97)m - (9	5)mJ x (41)m							7
	573.29	397.91	282.34	126.46	37.75	0.00	0.00	0.00	0.00	141.79	381.62	607.81	
									∑(9)	8)15, 10	.12 = 2	2548.97] (98) _
Space heating re	equirement	kWh/m²/y	ear							(98)	÷ (4)	29.10	(99)
9b. Energy req	uirements	- communi	ty heating s	cheme									
Eraction of space	e heat from	secondary	/sunnleme	ntary syste	m (table 1	1)				יח' if ו		0.00	(301)
Fraction of space	e heat from		ty supplement	intary syste		1)				1 (2)		1.00	
Fraction of some		t from boil	ly system							1 - (50	JI) – [0.25	(302)
			215									0.25] (3034)] (3036)
	munity nea									(222) (222		0.75	(3030)
Fraction of total	space neat	: from comi	munity CHP							(302) x (30	3a) =	0.75] (304a)
Fraction of total	space heat	: from com	munity boile	ers						(302) x (303	3b) =	0.25] (304b)
Factor for contro	ol and char	ging metho	d (Table 4c	(3)) for com	nmunity sp	bace heating						1.00] (305) -
Factor for charg	ing method	i (Table 4c(3)) for comr	nunity wat	er heating							1.00	(305a)
Distribution loss	factor (Tak	ble 12c) for	community	heating sy	vstem							1.05	(306)
Space heating													
Annual space he	eating requi	rement						2	548.97				(98)
Space heat from	СНР							(98	3) x (304a)	x (305) x (30	06) = 2	2007.31	(307a)
Space heat from	boilers							(98	3) x (304b)	x (305) x (30	06) =	669.10	(307b)
Water heating													
Annual water he	eating requi	irement						2	157.19]			(64)
Water heat from	n CHP							(64)	x (303a) x	(305a) x (30	06) = 1	1698.79	(310a)

Water heat from boilers			(64) x (303b) x (305a) x (306) =	566.26] (310b)
Electricity used for heat distribution		0.01 × [(307a)(307e) + (3	10a)(310e)] =	49.41	(313)
Electricity for pumps, fans and electric keep-hot (Table 4f)						
mechanical ventilation fans - balanced, extract or positive input	t from outside		55.56			(330a)
Total electricity for the above, kWh/year					55.56	(331)
Electricity for lighting (Appendix L)					369.29	(332)
Total delivered energy for all uses	(307) + (309) +	(310) + (312)) + (315) + (331) + ((332)(337b) =	5366.32	(338)
40h Euslands annunity hasting ashares						-
100. Fuel costs - community neating scheme	Freed		E. A. Marine		Freed	
	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from CHP	2007.31	х	2.97	x 0.01 =	59.62] (340a)
Space heating from boilers	669.10	x	4.24	x 0.01 =	28.37] (340b)
Water heating from CHP	1698.79	x	2.97	x 0.01 =	50.45	(342a)
Water heating from boilers	566.26	x	4.24	x 0.01 =	24.01] (342b)
Pumps and fans	55.56	x	13.19	x 0.01 =	7.33	(349)
Electricity for lighting	369.29	x	13.19	x 0.01 =	48.71	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)(342e) +	(345)(354) =	338.49	(355)
11b. SAP rating - community heating scheme						
Energy cost deflator (Table 12)					0.42	(356)
Energy cost factor (ECF)					1.07	(357)
SAP value					85.04	1
SAP rating (section 13)					85	_] (358)
					<u>ــــــــــــــــــــــــــــــــــــ</u>	_ · ·
SAP band					В	7
SAP band					В]
SAP band 12b. CO ₂ emissions - community heating scheme					В	
SAP band 12b. CO ₂ emissions - community heating scheme	Energy kWh/year		Emission factor		B Emissions (kg/year)]
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating)	Energy kWh/year		Emission factor		B Emissions (kg/year)	
SAP band 12b. CO₂ emissions - community heating scheme <i>Emissions from community CHP (space and water heating)</i> Power efficiency of CHP unit	Energy kWh/year 28.09		Emission factor		B Emissions (kg/year)	(361)
SAP band 12b. CO ₂ emissions - community heating scheme <i>Emissions from community CHP (space and water heating)</i> Power efficiency of CHP unit	Energy kWh/year 28.09 66.01		Emission factor		B Emissions (kg/year)	(361) (362)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [Energy kWh/year 28.09 66.01 3040.9017	x	Emission factor		B Emissions (kg/year) 656.8348	(361) (362)] (363)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity [Energy kWh/year 28.09 66.01 3040.9017 -854.1757	X X	Emission factor	=	B Emissions (kg/year) 656.8348 -443.3172	(361) (362)] (363)] (364)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP	Energy kWh/year 28.09 66.01 3040.9017 -854.1757 2573.5136	x x x x	Emission factor 0.2160 0.5190 0.2160	= = =	B Emissions (kg/year) 656.8348 -443.3172 555.8789	(361) (362)] (363)] (364)] (365)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity	Energy kWh/year 28.09 66.01 3040.9017 -854.1757 2573.5136 -722.8884	× × × × ×	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5	= = = =	B Emissions (kg/year) 656.8348 -443.3172 555.8789 -375.1791	(361) (362)] (363)] (364)] (365)] (366)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating)	Energy kWh/year 28.09 66.01 3040.9017 -854.1757 2573.5136 -722.8884	x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190	= = = =	B Emissions (kg/year) 656.8348 -443.3172 555.8789 -375.1791	(361) (362)] (363)] (364)] (365)] (366)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers	Energy kWh/year 28.09 66.01 3040.9017 -854.1757 2573.5136 -722.8884 94.00	x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5	= = = =	B Emissions (kg/year) 656.8348 -443.3172 555.8789 -375.1791	(361) (362)] (363)] (364)] (365)] (366) (367b)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Energy kWh/year 28.09 66.01 3040.9017 -854.1757 2573.5136 -722.8884 94.00 1314.22	x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.2160 0.5190	= = = =	B Emissions (kg/year) 656.8348 -443.3172 555.8789 -375.1791 283.87	(361) (362)] (363)] (364)] (365)] (366) (367b)] (368)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution	Energy kWh/year 28.09 66.01 3040.9017 -854.1757 2573.5136 -722.8884 94.00 1314.22 49.41	x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.52	= = = =	B Emissions (kg/year) 656.8348 -443.3172 555.8789 -375.1791 283.87 25.65	(361) (362)] (363)] (364)] (365)] (366) (367b)] (368)] (372)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution [Total CO2 associated with community systems	Energy kWh/year 28.09 66.01 3040.9017 -854.1757 2573.5136 -722.8884 94.00 1314.22 49.41	x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5190 0.5190		B Emissions (kg/year) 656.8348 -443.3172 555.8789 -375.1791 283.87 25.65 703.74	(361) (362)] (363)] (364)] (365)] (366) (367b)] (368)] (372)] (373)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating	Energy kWh/year 28.09 66.01 3040.9017 -854.1757 2573.5136 -722.8884 94.00 1314.22 49.41	x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.2160 0.5190		B Emissions (kg/year) 656.8348 -443.3172 555.8789 -375.1791 283.87 25.65 703.74 703.74	(361) (362)] (363)] (364)] (365)] (366) (367b)] (368)] (372)] (373)] (376)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans	Energy kWh/year 28.09 66.01 3040.9017 -854.1757 2573.5136 -722.8884 94.00 1314.22 49.41	x x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.2160 0.5190 0.5190		В Emissions (kg/year) 656.8348 -443.3172 555.8789 -375.1791 283.87 25.65 703.74 703.74 28.84	(361) (362)] (363)] (364)] (365)] (366) (366)] (368)] (372)] (373)] (376)] (378)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting	Energy kWh/year 28.09 66.01 3040.9017 -854.1757 2573.5136 -722.8884 94.00 1314.22 49.41 55.56 369.29	x x x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190		B Emissions (kg/year) 656.8348 -443.3172 555.8789 -375.1791 283.87 25.65 703.74 703.74 28.84 191.66	(361) (362)] (363)] (364)] (365)] (365)] (366) (367b)] (368)] (372)] (373)] (376)] (378)] (379)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting Total CO ₂ , kg/year	Energy kWh/year 28.09 66.01 3040.9017 -854.1757 2573.5136 -722.8884 94.00 1314.22 49.41 55.56 369.29	x x x x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.2160 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190	= = = = = = (376)(382) =	B Emissions (kg/year) 656.8348 -443.3172 555.8789 -375.1791 283.87 25.65 703.74 28.84 191.66 924.23	(361) (362)] (363)] (364)] (365)] (366) (366)] (368)] (372)] (373)] (376)] (378)] (379)] (383)
SAP band 12b. CO2 emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [307b)+(310b)] × 100 ÷ (367b) = Electrical energy for community heat distribution Total CO2 associated with space and water heating Pumps and fans Electricity for lighting Total CO2, kg/year Dwelling CO2 emission rate	Energy kWh/year 28.09 66.01 3040.9017 -854.1757 2573.5136 -722.8884 94.00 1314.22 49.41 55.56 369.29	x x x x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5190 0.5190 0.5190	= = = = = (376)(382) = (383) ÷ (4) =	B Emissions (kg/year) 656.8348 -443.3172 555.8789 -375.1791 283.87 25.65 703.74 28.84 191.66 924.23 10.55	(361) (362)] (363)] (364)] (365)] (365)] (366)] (368)] (372)] (373)] (373)] (378)] (378)] (379)] (383)] (384)
SAP band 12b. CO2 emissions - community heating scheme <i>Emissions from community CHP (space and water heating)</i> Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers CO2 emissions from boilers CO2 emissions from boilers CO2 emissions from boilers CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting Total CO2, kg/year Dwelling CO2 emission rate El value	Energy kWh/year 28.09 66.01 3040.9017 -854.1757 2573.5136 -722.8884 94.00 1314.22 49.41 55.56 369.29	x x x x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.2160 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190	= = = = = = (376)(382) = (383) ÷ (4) =	B Emissions (kg/year) 656.8348 -443.3172 555.8789 -375.1791 283.87 25.65 703.74 28.84 191.66 924.23 10.55 90.66	(361) (362)] (363)] (364)] (365)] (366)] (366)] (368)] (372)] (373)] (373)] (376)] (378)] (379)] (383)] (384)]
SAP band 12b. CO2 emissions - community heating scheme <i>Emissions from community CHP (space and water heating)</i> Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [307b)+(310b)] × 100 ÷ (367b) = Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with 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 28.09 66.01 3040.9017 -854.1757 2573.5136 -722.8884 94.00 1314.22 49.41 55.56 369.29	x x x x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5190 0.5190 0.5190 0.5190	= = = = = (376)(382) = (383) ÷ (4) =	B Emissions (kg/year) 656.8348 -443.3172 555.8789 -375.1791 283.87 25.65 703.74 28.84 191.66 924.23 10.55 90.66 91	(361) (362) (363) (364) (365) (365) (366) (367b) (368) (372) (373) (373) (373) (373) (378) (378) (378) (379) (383) (384) (384)

13b. Primary energy - community heating scheme						
	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary Energy from community CHP (space and water heating)						
Power efficiency of CHP unit	28.09					(361)
Heat efficiency of CHP unit	66.01					(362)
Space heating from CHP $(307a) \times 100 \div (362) \Rightarrow$	= 3040.90	x	1.22	=	3709.90	(363)
less credit energy for electricity	-854.18	x	3.07	=	-2622.32	(364)
Water heated by CHP	2573.51	х	1.22	=	3139.69	(365)
less credit energy for electricity	-722.89	x	3.07	=	-2219.27	(366)
Primary energy from other sources (space heating)						
Efficiency of boilers	94.00					(367b)
Primary energy from boilers [(307b)+(310b)] x 100 ÷ (367b) =	= 1314.22	x	1.22	=	1603.35	(368)
Electrical energy for community heat distribution	49.41	x	3.07	=	151.70	(372)
Total primary energy associated with community systems					3763.05	(373)
Total primary energy associated with space and water heating					3763.05	(376)
Pumps and fans	55.56	x	3.07	=	170.57	(378)
Electricity for lighting	369.29	x	3.07	=	1133.72	(379)
Primary energy kWh/year					5067.34	(383)
Dwelling primary energy rate kWh/m2/year					57.86	(384)



Assessor name		Miss Jayr	na Parmar						Assessor nur	nber	6549		
Client									Last modified	Ł	23/11,	/2016	
Address		A-L03-48	A Centric (Close, Lond	on, N8								
				-									
1. Overall dwellir	ng dimens	sions											
					A	area (m²)		ľ	Average storey height (m)	1	Vo	lume (m³)	
Lowest occupied						87.21	(1a) x	Г	2.50	(2a) =		218.03	(3a)
Total floor area		(1a)	+ (1b) + (1	c) + (1d)(1n) =	87.21	(4)						
Dwelling volume									(3a) + (3b) + (3	3c) + (3d)(3	sn) =	218.03	(5)
2 Vontilation rat										_			
2. Ventilation rat	.e											nor hour	
								F		٦		per nour	٦
Number of chimne	eys								0	」 x 40 = ⊐		0	_ (6a)
Number of open fl	ues								0	x 20 =		0	_ (6b)
Number of intermi	ittent fan	S							0	」 x 10 =		0	_ (7a)
Number of passive	e vents								0	x 10 =		0	_ (7b) ¬
Number of flueless	s gas fires	5						L	0	x 40 =		0	_ (7c)
											Air c	hanges per hour	r
Infiltration due to	chimnevs	s. flues. fan:	s. PSVs		(6a)) + (6b) + (7	a) + (7b) + (7c) = [0	÷ (5) =		0.00	(8)
If a pressurisation	test has k	been carrie	d out or is i	ntended, p	roceed to (17), otherw	ise continu	e from	(9) to (16)		L		
, Air permeability va	alue, q50,	expressed	in cubic m	etres per h	our per squ	uare metre	of envelope	e area	., .,			4.00	(17)
If based on air per	meability	value, the	n (18) = [(17	7) ÷ 20] + (8	3), otherwi	se (18) = (1	6)					0.20	(18)
Number of sides o	, n which t	he dwelling	g is sheltere	ed		. , .						2	(19)
Shelter factor			5						1	- [0.075 x (1	9)] =	0.85	(20)
Infiltration rate inc	corporatir	ng shelter f	actor							(18) x (2	20) =	0.17	(21)
Infiltration rate mo	odified fo	r monthly v	wind speed	:									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Au	g Sep	Oct	Nov	Dec	
Monthly average v	wind spee	d from Tab	ole U2										
	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.7	0 4.00	4.30	4.50	4.70	(22)
Wind factor (22)m	÷4						•	•	·				_
Γ	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.9	3 1.00	1.08	1.13	1.18	(22a)
Adjusted infiltratio	on rate (al	llowing for	shelter and	wind facto	or) (21) x (2	22a)m		•	•			-	
Γ	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.1	6 0.17	0.18	0.19	0.20	(22b)
Calculate effective	air chan	ge rate for	the applica	ble case:									_
If mechanical v	entilation	n: air chang	e rate throu	ugh system								0.50	(23a)
If balanced witl	h heat reo	covery: effi	ciency in %	allowing fo	or in-use fa	ctor from T	able 4h					N/A	(23c)
c) whole house	extract v	entilation o	or positive i	input venti	lation from	n outside							
Γ	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.5	0 0.50	0.50	0.50	0.50	(24c)
Effective air chang	e rate - e	nter (24a) o	or (24b) or	(24c) or (24	4d) in (25)								
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.5	0 0.50	0.50	0.50	0.50	(25)



Element	Gross area, m ²	Openings m ²	Net ar A, m	rea I ²	U-value W/m²K	A x U W,	/Κ κ-ν: kJ/	alue, 'm².K	Ахк, kJ/K	
Window			23.1	7 x	1.24	= 28.63				(27)
External wall			23.1	0 x	0.18	= 4.16				(29a)
Party wall			63.5	2 x	0.00	= 0.00				(32)
Total area of external elements ΣA , m ²			46.2	7						(31)
Fabric heat loss, $W/K = \Sigma(A \times U)$						(26)(30) + (3	2) =	32.79	(33)
Heat capacity Cm = Σ(A x κ)					(28)	(30) + (32) +	(32a)(32	e) =	N/A	(34)
Thermal mass parameter (TMP) in kJ/m²K									250.00	(35)
Thermal bridges: $\Sigma(L \times \Psi)$ calculated using App	endix K								6.50	(36)
Total fabric heat loss							(33) + (3	6) =	39.29	(37)
Jan Feb Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly 0.33 >	(25)m x (5)									
35.97 35.97 35.97	35.97	35.97	35.97	35.97	35.97	35.97	35.97	35.97	35.97	(38)
Heat transfer coefficient, W/K (37)m + (38)m										
75.26 75.26 75.26	75.26	75.26	75.26	75.26	75.26	75.26	75.26	75.26	75.26	
						Average = ∑	(39)112/	12 =	75.26	(39)
Heat loss parameter (HLP), W/m ² K (39)m \div (4)										
0.86 0.86 0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	
						Average = ∑	(40)112/	12 =	0.86	(40)
Number of days in month (Table 1a)										
31.00 28.00 31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)
4. Water heating energy requirement									2.50	(42)
Assumed occupancy, N	v Vd avorago -	- (25 y NI) + 1	26						2.59	(42)
	y vu,average –	- (23 x N) +	30		Aug		Oct	Nov	 	(43)
IAU FEO IVIAU	Δnr	May	lun	Int		Sen		14114	LIEC	
Hot water usage in litres per day for each mon	Apr h Vd.m = facto	May or from Tabl	Jun le 1c x (43)	Jul	Aug	Sep	oll	NOV	Dec	
Hot water usage in litres per day for each mont	Apr h Vd,m = facto	May or from Tabl	Jun le 1c x (43)	Jul 86.05	Aug	Sep	97 52	101 34	105 17	
Hot water usage in litres per day for each mont 105.17 101.34 97.52	Apr h Vd,m = facto 93.70	May or from Tabl 89.87	Jun le 1c x (43) 86.05	Jul 86.05	89.87	Sep 93.70	97.52 Σ(44)1	101.34 12 =	105.17 1147.29	(44)
Hot water usage in litres per day for each moni- 105.17 101.34 $97.52Energy content of hot water used = 4.18 \times Vd.n$	Apr h Vd,m = facto 93.70	May or from Tabl 89.87	Jun le 1c x (43) 86.05	Jul 86.05 ables 1b.	Aug 89.87	Sep 93.70	97.52 Σ(44)1	101.34 12 =	105.17 1147.29	(44)
Hot water usage in litres per day for each mont 105.17 101.34 $97.52Energy content of hot water used = 4.18 \times Vd,m155.96$ 136.40 140.76	Apr h Vd,m = facto 93.70 n x nm x Tm/36	May or from Tabl 89.87 500 kWh/m 117.75	Jun le 1c x (43) 86.05 onth (see Ta	Jul 86.05 ables 1b, 94.15	Aug 89.87 1c 1d)	Sep 93.70	97.52 Σ(44)1	101.34 12 = 139.09	105.17 1147.29	(44)
Hot water usage in litres per day for each mont 105.17 101.34 $97.52Energy content of hot water used = 4.18 \times Vd,n155.96$ 136.40 140.76	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72	May or from Tabl 89.87 500 kWh/m 117.75	Jun le 1c x (43) 86.05 onth (see Ta 101.61	Jul 86.05 ables 1b, 94.15	Aug 89.87 1c 1d) 108.04	Sep 93.70 109.33	97.52 Σ(44)1 127.42 Σ(45)1	101.34 12 = 139.09 12 =	105.17 1147.29 151.04	(44)
Hot water usage in litres per day for each moning 105.17 101.34 $97.52Energy content of hot water used = 4.18 \times Vd, m155.96$ 136.40 $140.76Distribution loss 0.15 \times (45)m$	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72	May or from Tabl 89.87 500 kWh/m 117.75	Jun le 1c x (43) 86.05 onth (see Ta 101.61	Jul 86.05 ables 1b, 94.15	Aug 89.87 1c 1d) 108.04	Sep 93.70 109.33	97.52 Σ(44)1 127.42 Σ(45)1	101.34 12 = 139.09 12 =	105.17 1147.29 151.04 1504.28	(44) (45)
Hot water usage in litres per day for each mont 105.17 101.34 $97.52Energy content of hot water used = 4.18 \times Vd,m155.96$ 136.40 $140.76Distribution loss 0.15 \times (45)m23.39$ 20.46 21.11	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41	May or from Tabl 89.87 500 kWh/m 117.75	Jun le 1c x (43) 86.05 onth (see Ta 101.61	Jul 86.05 ables 1b, 94.15	Aug 89.87 1c 1d) 108.04 16.21	Sep 93.70 109.33	97.52 Σ(44)1 127.42 Σ(45)1 19.11	101.34 12 = 139.09 12 = 20.86	105.17 1147.29 151.04 1504.28 22.66	(44) (45) (46)
Hot water usage in litres per day for each montant 105.17 101.34 $97.52Energy content of hot water used = 4.18 \times Vd,m155.96$ 136.40 $140.76Distribution loss 0.15 \times (45)m23.39$ 20.46 $21.11Storage volume (litres) including any solar or W$	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41 WHRS storage	May or from Tabl 89.87 500 kWh/m 117.75 17.66 within sam	Jun le 1c x (43) 86.05 onth (see Ta 101.61 15.24	Jul 86.05 ables 1b, 94.15 14.12	Aug 89.87 1c 1d) 108.04 16.21	Sep 93.70 109.33 16.40	97.52 Σ(44)1 127.42 Σ(45)1 19.11	101.34 12 = 139.09 12 = 20.86	105.17 1147.29 151.04 1504.28 22.66 110.00	(44) (45) (46) (47)
Hot water usage in litres per day for each mont 105.17 101.34 $97.52Energy content of hot water used = 4.18 \times Vd,n155.96$ 136.40 $140.76Distribution loss 0.15 \times (45)m23.39$ 20.46 $21.11Storage volume (litres) including any solar or WWater storage loss:$	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41 WHRS storage	May or from Tabl 89.87 500 kWh/mi 117.75 17.66 within sam	Jun le 1c x (43) 86.05 00000000000000000000000000000000000	Jul 86.05 ables 1b, 94.15 14.12	Aug 89.87 1c 1d) 108.04 16.21	Sep 93.70 109.33 16.40	97.52 Σ(44)1 127.42 Σ(45)1 19.11	101.34 12 = 139.09 12 = 20.86	105.17 1147.29 151.04 1504.28 22.66 110.00	(44) (45) (46) (47)
Hot water usage in litres per day for each montain 105.17 101.34 $97.52Energy content of hot water used = 4.18 \times Vd, n155.96$ 136.40 $140.76Distribution loss 0.15 \times (45)m23.39$ 20.46 $21.11Storage volume (litres) including any solar or WWater storage loss:b) Manufacturer's declared loss factor is not kr$	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41 WHRS storage own	May or from Tabl 89.87 500 kWh/m 117.75 17.66 e within sam	Jun le 1c x (43) 86.05 0nth (see Ta 101.61 15.24 ne vessel	Jul 86.05 ables 1b, 94.15 14.12	Aug 89.87 1c 1d) 108.04 16.21	Sep 93.70 109.33 16.40	97.52 Σ(44)1 127.42 Σ(45)1 19.11	101.34 12 = 139.09 12 = 20.86	105.17 1147.29 151.04 1504.28 22.66 110.00	(44) (45) (46) (47)
Hot water usage in litres per day for each mont 105.17 101.34 $97.52Energy content of hot water used = 4.18 \times Vd,m155.96$ 136.40 $140.76Distribution loss 0.15 \times (45)m23.39$ 20.46 $21.11Storage volume (litres) including any solar or WWater storage loss:b) Manufacturer's declared loss factor is not krHot water storage loss factor from Table 2 ($	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41 WHRS storage own kWh/litre/day)	May or from Tabl 89.87 500 kWh/mi 117.75 17.66 within sam	Jun le 1c x (43) 86.05 00000000000000000000000000000000000	Jul 86.05 ables 1b, 94.15 14.12	Aug 89.87 1c 1d) 108.04 16.21	Sep 93.70 109.33 16.40	97.52 Σ(44)1 127.42 Σ(45)1 19.11	101.34 12 = 139.09 12 = 20.86	105.17 1147.29 151.04 1504.28 22.66 110.00 0.02	(44) (45) (46) (47) (51)
Hot water usage in litres per day for each mont 105.17 101.34 $97.52Energy content of hot water used = 4.18 \times Vd,m155.96$ 136.40 $140.76Distribution loss 0.15 \times (45)m23.39$ 20.46 $21.11Storage volume (litres) including any solar or WWater storage loss:b) Manufacturer's declared loss factor is not krHot water storage loss factor from Table 2 (Volume factor from Table 2a$	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41 WHRS storage own kWh/litre/day)	May or from Tabl 89.87 500 kWh/mo 117.75 17.66 e within sam	Jun le 1c x (43) 86.05 0nth (see Ta 101.61 15.24 ne vessel	Jul 86.05 ables 1b, 94.15 14.12	Aug 89.87 1c 1d) 108.04 16.21	Sep 93.70 109.33 16.40	97.52 Σ(44)1 127.42 Σ(45)1 19.11	101.34 12 = 139.09 12 = 20.86	105.17 1147.29 151.04 1504.28 22.66 110.00 0.02 1.03	(44) (45) (46) (47) (51) (52)
Hot water usage in litres per day for each montant in the image in litres per day for each montant in the image in litres per day for each montant in the image	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41 WHRS storage own kWh/litre/day)	May or from Tabl 89.87 500 kWh/mi 117.75 17.66 e within same	Jun le 1c x (43) 86.05 00000000000000000000000000000000000	Jul 86.05 ables 1b, 94.15 14.12	Aug 89.87 1c 1d) 108.04 16.21	Sep 93.70 109.33 16.40	97.52 Σ(44)1 127.42 Σ(45)1 19.11	101.34 12 = 139.09 12 = 20.86	105.17 1147.29 151.04 1504.28 22.66 110.00 0.02 1.03 0.60	 (44) (45) (46) (47) (51) (52) (53)
Hot water usage in litres per day for each mont 105.17 101.34 97.52 Energy content of hot water used = 4.18 x Vd,n 155.96 136.40 140.76 Distribution loss 0.15 x (45)m 23.39 20.46 21.11 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 (Volume factor from Table 2a Temperature factor from Table 2b Energy lost from water storage (kWh/day)	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41 WHRS storage own kWh/litre/day) 47) x (51) x (52	May or from Tabl 89.87 500 kWh/m 117.75 17.66 17.66 within sam	Jun le 1c x (43) 86.05 onth (see Ta 101.61 15.24 ne vessel	Jul 86.05 ables 1b, 94.15 14.12	Aug 89.87 1c 1d) 108.04 16.21	Sep 93.70 109.33 16.40	97.52 Σ(44)1 127.42 Σ(45)1 19.11	101.34 12 = 139.09 12 = 20.86	105.17 1147.29 151.04 1504.28 22.66 110.00 0.02 1.03 0.60 1.03	 (44) (45) (46) (47) (51) (52) (53) (54)
JainFebIvialHot water usage in litres per day for each monit105.17101.3497.52Energy content of hot water used = 4.18 x Vd,n155.96136.40140.76Distribution loss0.15 x (45)m23.3920.4621.11Storage volume (litres) including any solar or WWater storage loss:b) Manufacturer's declared loss factor is not krHot water storage loss factor from Table 2 (Volume factor from Table 2a Temperature factor from Table 2b Energy lost from water storage (kWh/day)Enter (50) or (54) in (55)	Apr h Vd,m = facto 93.70 h x nm x Tm/36 122.72 18.41 WHRS storage own kWh/litre/day) 47) x (51) x (52	May or from Tabl 89.87 500 kWh/m 117.75 17.66 2 within sam	Jun le 1c x (43) 86.05 0nth (see Ta 101.61 15.24 he vessel	Jul 86.05 ables 1b, 94.15 14.12	Aug 89.87 1c 1d) 108.04 16.21	Sep 93.70 109.33 16.40	97.52 Σ(44)1 127.42 Σ(45)1 19.11	101.34 12 = 139.09 12 = 20.86	105.17 1147.29 151.04 1504.28 22.66 110.00 0.02 1.03 0.60 1.03 1.03	 (44) (45) (46) (47) (51) (52) (53) (54) (55)
Hot water usage in litres per day for each mont 105.17 101.34 97.52 Energy content of hot water used = 4.18 x Vd,n 155.96 136.40 140.76 Distribution loss 0.15 x (45)m 23.39 20.46 21.11 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 (Volume factor from Table 2a Temperature factor from Table 2b Energy lost from water storage (kWh/day) = Enter (50) or (54) in (55) Water storage loss calculated for each month	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41 WHRS storage own kWh/litre/day) 47) x (51) x (52 55) x (41)m	May or from Tabl 89.87 500 kWh/m 117.75 17.66 within sam	Jun le 1c x (43) 86.05 onth (see Ta 101.61 15.24 ne vessel	Jul 86.05 ables 1b, 94.15 14.12	Aug 89.87 1c 1d) 108.04 16.21	Sep 93.70 109.33 16.40	97.52 Σ(44)1 127.42 Σ(45)1 19.11	101.34 12 =	105.17 1147.29 151.04 1504.28 22.66 110.00 0.02 1.03 0.60 1.03 1.03	 (44) (45) (46) (47) (51) (52) (53) (54) (55)
JainFebIvialHot water usage in litres per day for each monit 105.17 101.34 97.52 Energy content of hot water used = $4.18 \times Vd$,n 155.96 136.40 140.76 Distribution loss $0.15 \times (45)m$ 23.39 20.46 21.11 Storage volume (litres) including any solar or WWater storage loss:b) Manufacturer's declared loss factor is not krHot water storage loss factor from Table 2aTemperature factor from Table 2aTemperature factor from Table 2bEnergy lost from water storage (kWh/day)Enter (50) or (54) in (55)Water storage loss calculated for each month 32.01 28.92 32.01	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41 WHRS storage own kWh/litre/day) 47) x (51) x (52 55) x (41)m 30.98	May or from Tabl 89.87 500 kWh/mo 117.75 17.66 within sam 2) x (53) 32.01	Jun le 1c x (43) 86.05 onth (see Ta 101.61 15.24 ne vessel 30.98	Jul 86.05 ables 1b, 94.15 14.12 32.01	Aug 89.87 1c 1d) 108.04 16.21 32.01	Sep 93.70 109.33 16.40 30.98	97.52 Σ(44)1 127.42 Σ(45)1 19.11 32.01	101.34 12 = 139.09 12 = 20.86	105.17 1147.29 151.04 1504.28 22.66 110.00 0.02 1.03 0.60 1.03 1.03 32.01	 (44) (45) (46) (47) (51) (52) (53) (54) (55) (56)
JainFebIvialHot water usage in litres per day for each mont 105.17 101.34 97.52 Energy content of hot water used = $4.18 \times Vd$, n 155.96 136.40 140.76 Distribution loss $0.15 \times (45)m$ 23.39 20.46 21.11 Storage volume (litres) including any solar or WWater storage loss:b) Manufacturer's declared loss factor is not krHot water storage loss factor from Table 2aTemperature factor from Table 2aTemperature factor from Table 2bEnergy lost from water storage (kWh/day)Enter (50) or (54) in (55)Water storage loss calculated for each month 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 32.01	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41 'WHRS storage own kWh/litre/day) 47) x (51) x (52 55) x (41)m 30.98 r dedicated WV	May or from Tabl 89.87 500 kWh/mi 117.75 17.66 e within sam 2) x (53) 32.01 WHRS (56)n	Jun le 1c x (43) 86.05 00000000000000000000000000000000000	Jul 86.05 ables 1b, 94.15 14.12 14.12 32.01 s] ÷ (47),	Aug 89.87 1c 1d) 108.04 16.21 32.01 else (56)	Sep 93.70 109.33 16.40 30.98	97.52 Σ(44)1 127.42 Σ(45)1 19.11 32.01	101.34 12 = 139.09 12 = 20.86 30.98	105.17 1147.29 151.04 1504.28 22.66 110.00 0.02 1.03 0.60 1.03 1.03 1.03 32.01	 (44) (45) (46) (47) (51) (52) (53) (54) (55) (56)
Hot water usage in litres per day for each mont 105.17 101.34 97.52 Energy content of hot water used = 4.18 x Vd,n 155.96 136.40 140.76 Distribution loss 0.15 x (45)m 23.39 20.46 21.11 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 (Volume factor from Table 2a Temperature factor from Table 2b Energy lost from water storage (kWh/day) Enter (50) or (54) in (55) Water storage loss calculated for each month 32.01 28.92 32.01 If the vessel contains dedicated solar storage of 32.01 28.92 32.01	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41 WHRS storage own kWh/litre/day) 47) x (51) x (52 55) x (41)m 30.98 r dedicated WV 30.98	May or from Tabl 89.87 500 kWh/mo 117.75 17.66 within sam 2) x (53) 32.01 WHRS (56)n 32.01	Jun le 1c x (43) 86.05 onth (see Ta 101.61 15.24 ne vessel 30.98 n x [(47) - Vs 30.98	Jul 86.05 ables 1b, 94.15 14.12 14.12 32.01 s] ÷ (47), 32.01	Aug 89.87 1c 1d) 108.04 16.21 16.21 32.01 else (56) 32.01	Sep 93.70 109.33 16.40 30.98	97.52 Σ(44)1 127.42 Σ(45)1 19.11 19.11 32.01	101.34 12 = 139.09 12 = 20.86 20.86 30.98 30.98	105.17 1147.29 151.04 1504.28 22.66 110.00 0.02 1.03 0.60 1.03 32.01	 (44) (45) (46) (47) (51) (52) (53) (54) (55) (56) (57)

Primary circuit lo	oss for each	month fro	m Table 3										
	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
Combi loss for ea	ach month f	from Table	3a, 3b or 3	с									
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
Total heat requi	red for wate	er heating	calculated f	or each mo	onth 0.85 x	: (45)m + (4	6)m + (57)r	n + (59)m +	· (61)m				
	211.24	186.33	196.03	176.21	173.03	155.10	149.43	163.32	162.83	182.70	192.58	206.32	(62)
Solar DHW input	t calculated	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 wat	ter heater f	or each mo	onth (kWh/i	month) (62	2)m + (63)n	n							
	211.24	186.33	196.03	176.21	173.03	155.10	149.43	163.32	162.83	182.70	192.58	206.32]
										∑(64)1	.12 = 2	155.12	(64)
Heat gains from	water heat	ing (kWh/r	nonth) 0.25	5 × [0.85 × ((45)m + (61 	L)m] + 0.8 ×	[(46)m + (5	57)m + (59)	m]				-
	96.08	85.30	91.02	83.60	83.37	76.58	75.53	80.15	79.15	86.59	89.04	94.44	(65)
5. Internal gain	IS												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains	(Table 5)				•			Ū	•				
-	129.28	129.28	129.28	129.28	129.28	129.28	129.28	129.28	129.28	129.28	129.28	129.28	(66)
Lighting gains (ca	alculated in	Appendix	L, equation	L9 or L9a),	also see Ta	able 5				Į	1		
	20.85	18.52	15.06	11.40	8.52	7.19	7.77	10.11	13.56	17.22	20.10	21.43	(67)
Appliance gains	(calculated	in Append	ix L, equatic	on L13 or L1	13a), also s	ee Table 5							
	233.85	236.28	230.16	217.14	200.71	185.27	174.95	172.52	178.64	191.65	208.09	223.53	(68)
Cooking gains (c	alculated in	Appendix	L, equation	L15 or L15	a), also see	Table 5							
	35.93	35.93	35.93	35.93	35.93	35.93	35.93	35.93	35.93	35.93	35.93	35.93	(69)
Pump and fan ga	ains (Table 5	5a)								-			
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
Losses e.g. evap	oration (Tab	ole 5)											
	-103.42	-103.42	-103.42	-103.42	-103.42	-103.42	-103.42	-103.42	-103.42	-103.42	-103.42	-103.42	(71)
Water heating g	ains (Table !	5)											
	129.14	126.93	122.34	116.11	112.06	106.36	101.52	107.72	109.93	116.38	123.67	126.94	(72)
Total internal ga	ins (66)m +	· (67)m + (6	68)m + (69)ı	m + (70)m ·	+ (71)m + (72)m							
	445.62	443.51	429.35	406.44	383.08	360.60	346.02	352.13	363.91	387.04	413.64	433.68	(73)
6 Solar gains													
or oor an Samo			Access f	actor	Area	Sola	ar flux		g	FF		Gains	
			Table	6d	m²	N	//m²	speci	ific data	specific o	lata	W	
								or Ta	able 6b	or Table	6C		_
North			0.7	7 X	2.09	x1	0.63 x	0.9 x 0	0.40 x	0.80	=	4.93	(74)
NorthEast			0.7	7X	21.08	x 1	1.28 x	0.9 x 0).40 x	0.80	=	52.74	(75)
Solar gains in wa	atts ∑(74)m	(82)m				1							-
	57.67	116.78	209.44	343.38	461.64	492.31	460.48	366.97	254.94	142.42	72.45	47.18	(83)
Total gains - inte	ernal and so	lar (73)m +	- (83)m		1	1		I	1	r	1	1	1
	503.29	560.29	638.79	749.82	844.72	852.92	806.50	719.10	618.86	529.46	486.09	480.86	(84)
7. Mean intern	al temperat	ture (heati	ng season)										
Temperature du	ring heating	g periods ir	n the living a	area from T	able 9, Th	L(°C)						21.00	(85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor	r for gains fo	or living ar	ea n1,m (se	e Table 9a)									
	1.00	1.00	0.99	0.93	0.77	0.56	0.41	0.48	0.78	0.97	1.00	1.00	(86)

SAP version 9.92

Mean internal te	emp of livin	g area T1 (steps 3 to 7	in Table 90	c)								
	20.14	20.26	20.48	20.76	20.95	20.99	21.00	21.00	20.96	20.70	20.36	20.11	(87)
Temperature du	iring heatin	g periods i	n the rest of	dwelling f	rom Table	e 9, Th2(°C)							
	20.20	20.20	20.20	20.20	20.20	20.20	20.20	20.20	20.20	20.20	20.20	20.20	(88)
Utilisation facto	r for gains f	or rest of c	welling n2,	m									
	1.00	0.99	0.98	0.91	0.72	0.49	0.34	0.40	0.71	0.96	0.99	1.00	(89)
Mean internal te	emperature	in the res	t of dwelling	g T2 (follow	steps 3 to	o 7 in Table	9c)	•	•		•		-
	19.04	19.21	19.53	19.92	20.15	20.20	20.20	20.20	20.17	19.84	19.36	18.99	(90)
Living area fract	ion	4	4	I		-	1	1	Li	ving area ÷	(4) =	0.31	(91)
Mean internal te	emperature	e for the wi	hole dwellin	g fLA x T1 +	+(1 - fLA) >	(T2				0 * **			
	19 38	19 53	19.82	20.18	20.40	20.44	20.45	20.45	20.41	20.11	19.67	19 34	(92)
Annly adjustme	nt to the m	ean intern:	al temperatu	re from Ta	hle 4e wh	ere approp	riate	20.15	20.11	20.11	19.07	13.51] (32)
	10.29	10.52	10.92	20.19	20.40	20.44	20.45	20.45	20.41	20.11	10.67	10.24	(02)
	19.30	19.55	19.82	20.18	20.40	20.44	20.45	20.43	20.41	20.11	19.07	19.34] (53)
8. Space heatir	ng requirem	nent											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains,	ηm											
	1.00	0.99	0.98	0.91	0.73	0.51	0.36	0.42	0.73	0.96	0.99	1.00	(94)
Useful gains, nm	nGm, W (94	4)m x (84)n	n	Į	!	!						4]
	501.71	556.53	625.13	683.57	620.17	436.57	289.26	303.79	451.09	506.73	482.65	479.72	(95)
Monthly average	e external t	emperatur	·e from Tabl	e U1	1], ,
, 0	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 temp	erature. I m	. W [(39)m	x [(93)m	- (96)ml	10.00	10110	1 1 11 20	10.00	7.120] (30)
	1135 29	1101 /8	1002 57	8/9 11	654.45	/39.7/	289 53	304 53	475.00	715 / 7	946.24	1139 /17	(97)
Snace heating re		 kWh/mou	1002.37	[(97)m - (9	5)ml x (41)m	205.55	504.55	475.00	/15.4/	540.24	1155.47	
Space neuting re	471.20			110.10	25 51		0.00	0.00	0.00	165.21	222.70	400.9E	1
	471.56		200.01	119.19	23.51	0.00	0.00	0.00	5(0)	0\1 E 10	12 -	430.83] (08)
Choco booting re	auiromont	Wh /m2/	10.0 %						2(9)		· (4)	2243.04] (00)
Space nearing re	equirement	KVVH/IN-/y	lear							(98)	÷ (4)	25.72] (99)
9b. Energy req	uirements ·	- communi	ty heating s	cheme									
Fraction of space	e heat from	ı secondarı	y/suppleme	ntary syste	m (table 1	1)				'0' if r	none	0.00	(301)
Fraction of space	e heat from	n communi ^r	ty system							1 - (30	01) =	1.00	(302)
Fraction of com	munity hea	t from boil	ers									0.25	(303a)
Fraction of com	, munity hea	t from CHP										0.75	(303b)
Fraction of total	space heat	from com	munity CHP							(302) x (303	3a) =	0.75	(304a)
Fraction of total	space heat	from com	munity boil	ers						$(302) \times (302)$	3b) =	0.25	(304b)
Factor for contro	ol and char	ging metho	nd (Table 4c)	(3)) for com	nmunity si	nace heating	т			(002) // (000	· · · · ·	1 00	(305)
Factor for charg	ing method		$\frac{1}{2}$ for com	nunity wat	or bosting)					1.00] (305 ₂)
Distribution loss	factor (Tak	(130) = 40(heating sy	et meating	5						1.00] (3058)] (306)
Distribution 1055		ne 120) 101	community	fileating sy	stem							1.05] (300)
C													
Space neating									242.04	1			(00)
Annual space ne	eating requi	rement							243.04				(98)] (22 -)
Space heat from	T CHP							(98	3) x (304a)	x (305) x (30	J6) = <u> </u>	1766.39] (307a)
Space heat from	boilers							(98	3) x (304b)	x (305) x (30	06) =	588.80] (307b)
Water heating										7			
Annual water he	eating requi	rement						2	155.12				(64) 7
Water heat from	n CHP							(64)	x (303a) x	(305a) x (30	06) = [1697.15] (310a)

Water heat from boilers			(64) x (303b) x (305a) x (306) =	565.72	(310b)
Electricity used for heat distribution		0.01 × [(307a)(307e) + (3	10a)(310e)] =	46.18	(313)
Electricity for pumps, fans and electric keep-hot (Table 4f)						
mechanical ventilation fans - balanced, extract or positive input	t from outside		55.33			(330a)
Total electricity for the above, kWh/year					55.33	(331)
Electricity for lighting (Appendix L)					368.18	(332)
Total delivered energy for all uses	(307) + (309) +	(310) + (312)) + (315) + (331) + ((332)(337b) =	5041.57	(338)
						-
100. Fuel costs - community neating scheme	Freed		Fucharia		Freed	
	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from CHP	1766.39	х	2.97	x 0.01 =	52.46	(340a)
Space heating from boilers	588.80	x	4.24	x 0.01 =	24.97	(340b)
Water heating from CHP	1697.15	x	2.97	x 0.01 =	50.41	(342a)
Water heating from boilers	565.72	x	4.24	x 0.01 =	23.99	(342b)
Pumps and fans	55.33	x	13.19	x 0.01 =	7.30	(349)
Electricity for lighting	368.18	x	13.19	x 0.01 =	48.56	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)(342e) +	· (345)(354) =	327.68	(355)
11b. SAP rating - community heating scheme						
Energy cost deflator (Table 12)					0.42	(356)
Energy cost factor (ECF)					1.04	(357)
SAP value					85.48]
SAP rating (section 13)					85	(358)
						_
SAP band					В]
SAP band					В]
SAP band 12b. CO ₂ emissions - community heating scheme					<u> </u>]
SAP band 12b. CO ₂ emissions - community heating scheme	Energy kWh/year		Emission factor		B Emissions (kg/year)]
SAP band 12b. CO₂ emissions - community heating scheme <i>Emissions from community CHP (space and water heating)</i>	Energy kWh/year		Emission factor		B Emissions (kg/year)]
SAP band 12b. CO ₂ emissions - community heating scheme <i>Emissions from community CHP (space and water heating)</i> Power efficiency of CHP unit	Energy kWh/year 28.09		Emission factor		B Emissions (kg/year)	(361)
SAP band 12b. CO ₂ emissions - community heating scheme <i>Emissions from community CHP (space and water heating)</i> Power efficiency of CHP unit	Energy kWh/year 28.09 66.01		Emission factor		B Emissions (kg/year)) (361) (362)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [Energy kWh/year 28.09 66.01 2675.9278	x	Emission factor	_	B Emissions (kg/year) 578.0004	(361) (362) (363)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity [Energy kWh/year 28.09 66.01 2675.9278 -751.6561	X X	Emission factor 0.2160 0.5190	=	B Emissions (kg/year) 578.0004 -390.1095	(361) (362)] (363)] (364)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP	Energy kWh/year 28.09 66.01 2675.9278 -751.6561 2571.0383	X X X X	Emission factor 0.2160 0.5190 0.2160	= = =	B Emissions (kg/year) 578.0004 -390.1095 555.3443	(361) (362)] (363)] (364)] (365)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity	Energy kWh/year 28.09 66.01 2675.9278 -751.6561 2571.0383 -722.1932	X X X X X	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5	= = = =	B Emissions (kg/year) 578.0004 -390.1095 555.3443 -374.8182	(361) (362) (363) (364) (365) (366)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating)	Energy kWh/year 28.09 66.01 2675.9278 -751.6561 2571.0383 -722.1932	X X X X X	Emission factor 0.2160 0.5190 0.2160 0.5190	= = = =	B Emissions (kg/year) 578.0004 -390.1095 555.3443 -374.8182	(361) (362) (363) (364) (365) (366)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers	Energy kWh/year 28.09 66.01 2675.9278 -751.6561 2571.0383 -722.1932 94.00	x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190	= = = =	B Emissions (kg/year) 578.0004 -390.1095 555.3443 -374.8182	(361) (362) (363) (364) (365) (366) (367b)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Energy kWh/year 28.09 66.01 2675.9278 -751.6561 2571.0383 -722.1932 94.00 1228.21	х х х х х	Emission factor 0.2160 0.5190 0.2160 0.5190 0.216	= = = =	B Emissions (kg/year) 578.0004 -390.1095 555.3443 -374.8182 265.29	(361) (362) (363) (364) (365) (366) (367b) (368)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution	Energy kWh/year 28.09 66.01 2675.9278 -751.6561 2571.0383 -722.1932 94.00 1228.21 46.18	X X X X X X	Emission factor 0.2160 0.5190 0.2160 0.5190 0.52 0	= = = =	B Emissions (kg/year) 578.0004 -390.1095 555.3443 -374.8182 265.29 23.97	(361) (362) (363) (364) (365) (366) (367b) (368) (372)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution [Total CO2 associated with community systems	Energy kWh/year 28.09 66.01 2675.9278 -751.6561 2571.0383 -722.1932 94.00 1228.21 46.18	x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.216 0.5190	= = = = =	B Emissions (kg/year) 578.0004 -390.1095 555.3443 -374.8182 265.29 23.97 657.68	(361) (362) (363) (364) (365) (366) (367b) (368) (372) (373)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating	Energy kWh/year 28.09 66.01 2675.9278 -751.6561 2571.0383 -722.1932 94.00 1228.21 46.18	x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.52 0.52 0.52 0.52 0.52 0.52 0.52 0.5		B Emissions (kg/year) 578.0004 -390.1095 555.3443 -374.8182 265.29 23.97 657.68 657.68	(361) (362) (363) (364) (365) (366) (367b) (368) (372) (373) (376)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans	Energy kWh/year 28.09 66.01 2675.9278 -751.6561 2571.0383 -722.1932 94.00 1228.21 46.18	x x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.2160 0.5190		B Emissions (kg/year) 578.0004 -390.1095 555.3443 -374.8182 265.29 23.97 657.68 657.68 28.71	(361) (362) (363) (364) (365) (366) (366) (368) (372) (373) (373) (376)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting	Energy kWh/year 28.09 66.01 2675.9278 -751.6561 2571.0383 -722.1932 94.00 1228.21 46.18 55.33 368.18	x x x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190		B Emissions (kg/year) 578.0004 -390.1095 555.3443 -374.8182 265.29 23.97 657.68 657.68 657.68 28.71 191.09	(361) (362) (363) (364) (365) (365) (366) (367b) (368) (372) (373) (373) (378) (379)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting Total CO ₂ , kg/year	Energy kWh/year 28.09 66.01 2675.9278 -751.6561 2571.0383 -722.1932 94.00 1228.21 46.18 55.33 368.18	x x x x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.216 0.52 0.52 0.52	= = = = = = (376)(382) =	B Emissions (kg/year) 578.0004 -390.1095 555.3443 -374.8182 265.29 23.97 657.68 657.68 657.68 28.71 191.09 877.48	(361) (362) (363) (364) (365) (366) (366) (368) (372) (373) (373) (373) (378) (379) (383)
SAP band 12b. CO₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [307b)+(310b)] × 100 ÷ (367b) = Electrical energy for community heat distribution Total CO2 associated with space and water heating Pumps and fans Electricity for lighting Total CO2, kg/year Dwelling CO2 emission rate	Energy kWh/year 28.09 66.01 2675.9278 -751.6561 2571.0383 -722.1932 94.00 1228.21 46.18 55.33 368.18	x x x x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190	= = = = = (376)(382) = (383) ÷ (4) =	B Emissions (kg/year) 578.0004 -390.1095 555.3443 -374.8182 265.29 23.97 657.68 657.68 657.68 28.71 191.09 877.48 10.06	(361) (362) (363) (364) (365) (366) (366) (368) (372) (373) (373) (373) (378) (378) (379) (383)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with 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 28.09 66.01 2675.9278 -751.6561 2571.0383 -722.1932 94.00 1228.21 46.18 55.33 368.18	x x x x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.216 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190	= = = = = (376)(382) = (383) ÷ (4) =	B Emissions (kg/year) 578.0004 -390.1095 555.3443 -374.8182 265.29 23.97 657.68 657.68 657.68 28.71 191.09 877.48 10.06 91.11	(361) (362) (363) (364) (365) (366) (366) (368) (372) (373) (373) (373) (378) (378) (379) (383) (384)
SAP band 12b. CO ₂ emissions - community heating scheme <i>Emissions from community CHP (space and water heating)</i> Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers CO2 emissions from boilers [307b)+(310b)] × 100 ÷ (367b) = Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with 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 28.09 66.01 2675.9278 -751.6561 2571.0383 -722.1932 94.00 1228.21 46.18 55.33 368.18	х х х х х х х	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190	= = = = = (376)(382) = (383) ÷ (4) =	B Emissions (kg/year) 578.0004 -390.1095 555.3443 -374.8182 265.29 23.97 657.68 657.68 657.68 28.71 191.09 877.48 10.06 91.11 91	<pre>(361) (362) (363) (364) (365) (366) (366) (368) (372) (373) (373) (373) (373) (373) (378) (378) (379) (383) (384) (384)</pre>

13b. Primary energy - commu	nity heating scheme						
		Energy kWh/year		Primary factor		Primary energy (kWh/year)	,
Primary Energy from communit	y CHP (space and water heating)						
Power efficiency of CHP unit		28.09					(361)
Heat efficiency of CHP unit		66.01					(362)
Space heating from CHP	(307a) × 100 ÷ (362) =	2675.93	x	1.22	=	3264.63	(363)
less credit energy for electric	city	-751.66	x	3.07	=	-2307.58	(364)
Water heated by CHP		2571.04	x	1.22	=	3136.67	(365)
less credit energy for electricity		-722.19	x	3.07	=	-2217.13	(366)
Primary energy from other sour	ces (space heating)						
Efficiency of boilers		94.00					(367b)
Primary energy from boilers	[(307b)+(310b)] x 100 ÷ (367b) =	1228.21	x	1.22	=	1498.41	(368)
Electrical energy for community	heat distribution	46.18	x	3.07	=	141.77	(372)
Total primary energy associated	with community systems					3516.77	(373)
Total primary energy associated	with space and water heating					3516.77	(376)
Pumps and fans		55.33	x	3.07	=	169.85	(378)
Electricity for lighting		368.18	x	3.07	=	1130.31	(379)
Primary energy kWh/year						4816.93	(383)
Dwelling primary energy rate k	Nh/m2/year					55.23	(384)



Assessor name		Miss Jayr	na Parmar					ŀ	Assessor nur	nber	6549		
Client								L	ast modified	d	23/11	/2016	
Address		A-L04-60	A Centric (Close, Lond	on, N8								
1. Overall dwelling	g dimens	sions											
					A	area (m²)		Av	erage storey neight (m)	i	Vo	lume (m³)	
Lowest occupied						49.39	<mark>](1a)</mark> x		2.50	(2a) =		123.48	(3a)
Total floor area		(1a)	+ (1b) + (1e	c) + (1d)(1n) =	49.39	(4)						
Dwelling volume								(3	a) + (3b) + (3	3c) + (3d)(3	3n) =	123.48	(5)
2. Ventilation rate													
											m	³ per hour	
Number of chimney	/S								0	x 40 =		0	(6a)
Number of open flu	ies								0	 x 20 =	. [0	 (6b)
Number of intermit	tent fans	s							0	 x 10 =	: [0	(7a)
Number of passive	vents								0	 x 10 =	: [0	(7b)
Number of flueless	gas fires								0	 x 40 =	:	0	(7c)
											Airo	changes pe hour	r
Infiltration due to c	himneys	, flues, fans	s, PSVs		(6a)) + (6b) + (7	a) + (7b) + (7c) =	0	÷ (5) =	-	0.00	(8)
If a pressurisation t	est has b	een carrie	d out or is il	ntended, pl	roceed to ((17), otherv	vise continu	e from (9)) to (16)	_			_
Air permeability val	ue, q50,	expressed	in cubic me	etres per h	our per sq	uare metre	of envelope	e area				4.00	(17)
If based on air perm	neability	value, ther	n (18) = [(17	7) ÷ 20] + (8	3), otherwi	se (18) = (1	6)					0.20	(18)
Number of sides on	which th	he dwelling	g is sheltere	d								3	(19)
Shelter factor									1	- [0.075 x (1	9)] =	0.78	(20)
Infiltration rate inco	orporatin	ng shelter f	actor							(18) x (2	20) =	0.16	(21)
Infiltration rate mod	dified for	r monthly v	wind speed	:									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average w	ind spee	d from Tab	ole U2										_
	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22)m +	÷ 4						-		-	-			_
	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
Adjusted infiltration	n rate (al	lowing for	shelter and	wind facto	or) (21) x (2	22a)m	1			-		1	-
	0.20	0.19	0.19	0.17	0.17	0.15	0.15	0.14	0.16	0.17	0.17	0.18	(22b)
Calculate effective a	air chang	ge rate for t	the applical	ble case:									7
If mechanical ve	ntilation	: air chang	e rate throu	ugh system								0.50	(23a)
If balanced with	heat rec	covery: effi	ciency in %	allowing fo	or in-use fa	ictor from T	Table 4h					N/A	(23c)
c) whole house e	extract v	entilation o	or positive i	nput venti	lation from	n outside	1					-1	٦.
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(24c)
Effective air change	rate - er	nter (24a) o	or (24b) or ((24c) or (24	1d) in (25)	1	1	1			1	1	٦.
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(25)



3. Heat losses and heat loss parameter								
Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m²K	A x U W/	К к-valu kJ/m²	е, Ахк, К kJ/К	
Window			12.36	x 1.24	= 15.27		(2	27)
External wall			6.99	x 0.18	= 1.26		(2	29a)
Party wall			53.62	x 0.00	= 0.00		(3	32)
Total area of external elements ΣA , m ²			19.35				(3	31)
Fabric heat loss, $W/K = \sum (A \times U)$					(26)	(30) + (32) =	= 16.53 (3	33)
Heat capacity Cm = Σ(A x κ)				(28).	(30) + (32) +	(32a)(32e) =	= N/A (S	34)
Thermal mass parameter (TMP) in kJ/m²K							250.00 (3	35)
Thermal bridges: $\Sigma(L \times \Psi)$ calculated using App	endix K						4.11 (3	36)
Total fabric heat loss						(33) + (36) =	= 20.64 (3	37)
Jan Feb Mar	Apr	May	Jun .	Jul Aug	Sep	Oct	Nov Dec	
Ventilation heat loss calculated monthly 0.33	(25)m x (5)							
20.37 20.37 20.37	20.37	20.37	20.37 20	0.37 20.37	20.37	20.37 2	0.37 20.37 (3	38)
Heat transfer coefficient, W/K $(37)m + (38)m$								
41.01 41.01 41.01	41.01	41.01	41.01 43	1.01 41.01	41.01	41.01 4	1.01 41.01	
					Average = ∑(39)112/12 :	= 41.01 (3	39)
Heat loss parameter (HLP), W/m ² K (39)m \div (4)								
0.83 0.83 0.83	0.83	0.83	0.83 0	0.83 0.83	0.83	0.83	0.83 0.83	
					Average = ∑(40)112/12 =	= 0.83 (4	40)
Number of days in month (Table 1a)								
31.00 28.00 31.00	30.00	31.00	30.00 3	1.00 31.00	30.00	31.00 3	0.00 31.00 (4	40)
4. Water heating energy requirement								
Assumed occupancy, N							1.67 (4	42)
Assumed occupancy, N Annual average hot water usage in litres per da	iy Vd,average =	(25 x N) + 3	36				1.67 (4 73.91 (4	42) 43)
Assumed occupancy, N Annual average hot water usage in litres per da Jan Feb Mar	y Vd,average = Apr	(25 x N) + 3 May	36 Jun	Jul Aug	Sep	Oct	1.67 (4 73.91 (4 Nov Dec	42) 43)
Assumed occupancy, N Annual average hot water usage in litres per da Jan Feb Mar Hot water usage in litres per day for each mon	y Vd,average = Apr th Vd,m = factor	(25 x N) + 3 May r from Tabl	36 Jun e 1c x (43)	Jul Aug	Sep	Oct	1.67 (2 73.91 (2 Nov Dec	42) 43)
Assumed occupancy, N Annual average hot water usage in litres per da Jan Feb Mar Hot water usage in litres per day for each mon 81.31 78.35 75.39	iy Vd,average = Apr th Vd,m = factor 72.44	(25 x N) + 3 May r from Tabl 69.48	36 Jun . e 1c x (43) 66.52 66	Jul Aug 6.52 69.48	Sep	Oct 75.39 7	1.67 (4 73.91 (4 Nov Dec 8.35 81.31	42) 43)
Assumed occupancy, N Annual average hot water usage in litres per da Jan Feb Mar Hot water usage in litres per day for each mon 81.31 78.35 75.39	y Vd,average = Apr th Vd,m = factor 72.44	(25 x N) + : May r from Tabl 69.48	36 Jun . e 1c x (43) 66.52 60	Jul Aug 6.52 69.48	Sep 72.44	Oct 75.39 7 Σ(44)112 =	1.67 (4 73.91 (4 Nov Dec 8.35 81.31 = 886.96 (4	42) 43) 44)
Assumed occupancy, N Annual average hot water usage in litres per da Jan Feb Mar Hot water usage in litres per day for each mon 81.31 78.35 75.39 Energy content of hot water used = 4.18 x Vd,r	ny Vd,average = Apr th Vd,m = factor 72.44	(25 x N) + : May r from Tabl 69.48 00 kWh/ma	36 Jun . e 1c x (43) 66.52 60 onth (see Tabl	Jul Aug 6.52 69.48 es 1b, 1c 1d)	Sep 72.44	Oct 75.39 7 Σ(44)112 =	1.67 (2 73.91 (2 Nov Dec 8.35 81.31 = 886.96 (2	42) 43) 44)
Assumed occupancy, N Annual average hot water usage in litres per da Jan Feb Mar Hot water usage in litres per day for each mon 81.31 78.35 75.39 Energy content of hot water used = 4.18 x Vd,r 120.57 105.45 108.8	IV Vd,average = Apr th Vd,m = factor 72.44 n x nm x Tm/360 2 94.87	(25 x N) + : May r from Tabl 69.48 00 kWh/mo 91.03	36 Jun e 1c x (43) 66.52 60 onth (see Tabl 78.55 72	Jul Aug 6.52 69.48 les 1b, 1c 1d) 2.79	Sep 72.44 84.53	Oct 75.39 7 ∑(44)112 = 98.51 10	$ \begin{array}{c c} 1.67 & (4) \\ \hline 73.91 & (4) \\ Nov & Dec \\ \hline 8.35 & 81.31 \\ = & 886.96 & (4) \\ 07.53 & 116.77 \\ \end{array} $	42) 43) 44)
Assumed occupancy, N Annual average hot water usage in litres per da Jan Feb Mar Hot water usage in litres per day for each mon $\boxed{81.31}$ 78.35 75.39 Energy content of hot water used = 4.18 x Vd,r $\boxed{120.57}$ 105.45 108.8	y Vd,average = Apr th Vd,m = factor 72.44 n x nm x Tm/360 2 94.87	(25 x N) + : May r from Tabl 69.48 00 kWh/mo 91.03	36 Jun . e 1c x (43) 66.52 60 onth (see Tabl 78.55 72	Jul Aug 6.52 69.48 les 1b, 1c 1d) 2.79 83.53	Sep 72.44 84.53	Oct 75.39 7 Σ(44)112 7 98.51 10 Σ(45)112 10	$ \begin{array}{c c} 1.67 & (2) \\ \hline 73.91 & (2) \\ \hline 8.35 & 81.31 \\ \hline 8.35 & 81.31 \\ \hline 8.886.96 & (2) \\ \hline 07.53 & 116.77 \\ \hline 1162.95 & (2) \\ \hline \end{array} $	42) 43) 44) 45)
Assumed occupancy, N Annual average hot water usage in litres per day I an Feb Mar Hot water usage in litres per day for each mon $\boxed{81.31}$ 78.35 75.39 Energy content of hot water used = 4.18 x Vd,r $\boxed{120.57}$ 105.45 108.83 Distribution loss 0.15 x (45)m	y Vd,average = Apr th Vd,m = factor 72.44 n x nm x Tm/360 94.87	(25 x N) + : May r from Tabl 69.48 00 kWh/mo 91.03	36 Jun . e 1c x (43) 66.52 66 onth (see Tabl 78.55 72	Jul Aug 6.52 69.48 les 1b, 1c 1d) 2.79 83.53	Sep 72.44 84.53	Oct 75.39 7 Σ(44)112 98.51 1 Σ(45)112	$ \begin{array}{c c} 1.67 & (4) \\ \hline 73.91 & (4) \\ \hline Nov & Dec \\ \hline 8.35 & 81.31 \\ \hline = & 886.96 & (4) \\ \hline 07.53 & 116.77 \\ \hline = & 1162.95 & (4) \\ \hline \end{array} $	42) 43) 44) 45)
Assumed occupancy, N Annual average hot water usage in litres per day I an Feb Mar Hot water usage in litres per day for each mon $\boxed{81.31}$ 78.35 75.39 Energy content of hot water used = 4.18 x Vd,r $\boxed{120.57}$ 105.45 108.82 Distribution loss 0.15 x (45)m $\boxed{18.09}$ 15.82 16.32	y Vd,average = Apr th Vd,m = factor 72.44 n x nm x Tm/360 94.87 14.23	(25 x N) + : May r from Tabl 69.48 00 kWh/mo 91.03 13.65	36 Jun e 1c x (43) 66.52 60 onth (see Tabl 78.55 72 11.78 10	Jul Aug 6.52 69.48 es 1b, 1c 1d) 2.79 83.53 0.92 12.53	Sep 72.44 84.53 12.68	Oct 75.39 ζ(44)112 98.51 1 ζ(45)112 14.78	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	42) 43) 44) 45) 46)
Assumed occupancy, N Annual average hot water usage in litres per day I an Feb Mar Hot water usage in litres per day for each mon $\boxed{81.31}$ 78.35 75.39 Energy content of hot water used = 4.18 x Vd,r $\boxed{120.57}$ 105.45 108.82 Distribution loss 0.15 x (45)m $\boxed{18.09}$ 15.82 16.32 Storage volume (litres) including any solar or V	y Vd,average = Apr th Vd,m = factor 72.44 n x nm x Tm/360 94.87 14.23 /WHRS storage	(25 x N) + : May r from Tabl 69.48 00 kWh/mo 91.03 13.65 within sam	36 Jun e 1c x (43) 66.52 60 onth (see Tabl 78.55 72 11.78 10 e vessel	Jul Aug 6.52 69.48 es 1b, 1c 1d) 2.79 2.79 83.53 0.92 12.53	Sep 72.44 84.53 12.68	Oct 75.39 7 Σ(44)112 98.51 1 Σ(45)112 14.78	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	 42) 43) 44) 45) 46) 47)
Assumed occupancy, N Annual average hot water usage in litres per day I an Feb Mar Hot water usage in litres per day for each mon $\boxed{81.31}$ 78.35 75.39 Energy content of hot water used = 4.18 x Vd,r $\boxed{120.57}$ 105.45 108.8 Distribution loss $0.15 \times (45)m$ $\boxed{18.09}$ 15.82 16.32 Storage volume (litres) including any solar or W Water storage loss:	Ny Vd,average = Apr th Vd,m = factor 72.44 n x nm x Tm/360 94.87 14.23 /WHRS storage	(25 x N) + : May r from Tabl 69.48 00 kWh/me 91.03 13.65 within sam	36 Jun e 1c x (43) 66.52 60 onth (see Tabl 78.55 7: 11.78 10 ne vessel	Jul Aug 6.52 69.48 les 1b, 1c 1d) 2.79 83.53 0.92 12.53	Sep 72.44 84.53 12.68	Oct 75.39 7 Σ(44)112 98.51 1 Σ(45)112 14.78	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	42) 43) 44) 45) 46) 47)
Assumed occupancy, N Annual average hot water usage in litres per day Hot water usage in litres per day for each mon $\boxed{81.31}$ 78.35 75.39 Energy content of hot water used = $4.18 \times Vd$,r $\boxed{120.57}$ 105.45 108.82 Distribution loss $0.15 \times (45)m$ $\boxed{18.09}$ 15.82 16.32 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr	y Vd,average = Apr th Vd,m = factor 72.44 n x nm x Tm/360 94.87 14.23 /WHRS storage nown	(25 x N) + 3 May r from Tabl 69.48 00 kWh/ma 91.03 13.65 within sam	36 Jun e 1c x (43) 66.52 60 onth (see Tabl 78.55 72 11.78 10 e vessel	Jul Aug 6.52 69.48 es 1b, 1c 1d) 2.79 2.79 83.53 0.92 12.53	Sep 72.44 84.53 12.68	Oct 75.39 ζ(44)112 98.51 1 ζ(45)112 14.78	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	42) 43) 44) 45) 46) 47)
Assumed occupancy, N Annual average hot water usage in litres per day I an Feb Mar Hot water usage in litres per day for each mon $\boxed{81.31}$ 78.35 75.39 Energy content of hot water used = 4.18 x Vd,r $\boxed{120.57}$ 105.45 108.82 Distribution loss 0.15 x (45)m $\boxed{18.09}$ 15.82 16.32 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 (y Vd,average = Apr th Vd,m = factor 72.44 n x nm x Tm/360 94.87 14.23 /WHRS storage hown kWh/litre/day)	(25 x N) + : May r from Tabl 69.48 00 kWh/mo 91.03 13.65 within sam	36 Jun e 1c x (43) 66.52 66 onth (see Tabl 78.55 72 11.78 10 ne vessel	Jul Aug 6.52 69.48 les 1b, 1c 1d) 2.79 2.79 83.53 0.92 12.53	Sep 72.44 84.53 12.68	Oct 7 75.39 7 Σ(44)112 7 98.51 1 Σ(45)112 1 14.78 1	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	 42) 43) 44) 45) 46) 47) 51)
Assumed occupancy, N Annual average hot water usage in litres per day Hot water usage in litres per day for each mon 81.31 78.35 75.39 Energy content of hot water used = $4.18 \times Vd$,r 120.57 105.45 108.82 Distribution loss $0.15 \times (45)m$ 18.09 15.82 16.32 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 (Volume factor from Table 2a	y Vd,average = Apr th Vd,m = factor 72.44 n x nm x Tm/360 94.87 14.23 /WHRS storage hown kWh/litre/day)	(25 x N) + 3 May r from Tabl 69.48 00 kWh/ma 91.03 13.65 within sam	36 Jun e 1c x (43) 66.52 60 onth (see Tabl 78.55 72 11.78 10 e vessel	Jul Aug 6.52 69.48 es 1b, 1c 1d) 2.79 2.79 83.53 0.92 12.53	Sep 72.44 84.53 12.68	Oct 75.39 7 Σ(44)112 1 98.51 1 Σ(45)112 1 14.78 1	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	 42) 43) 44) 45) 46) 47) 51) 52)
Assumed occupancy, N Annual average hot water usage in litres per day I an Feb Mar Hot water usage in litres per day for each mon $\boxed{81.31}$ 78.35 75.39 Energy content of hot water used = 4.18 x Vd,r $\boxed{120.57}$ 105.45 108.83 Distribution loss 0.15 x (45)m $\boxed{18.09}$ 15.82 16.32 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 d Volume factor from Table 2a Temperature factor from Table 2b	y Vd,average = Apr th Vd,m = factor 72.44 n x nm x Tm/360 94.87 14.23 /WHRS storage hown kWh/litre/day)	(25 x N) + : May r from Tabl 69.48 00 kWh/mo 91.03 13.65 within sam	36 Jun e 1c x (43) 66.52 66 onth (see Tabl 78.55 72 11.78 10 e vessel	Jul Aug 6.52 69.48 les 1b, 1c 1d) 2.79 2.79 83.53 0.92 12.53	Sep 72.44 84.53 12.68	Oct 75.39 7 ζ(44)112 98.51 1 ζ(45)112 14.78	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	 42) 43) 44) 45) 46) 47) 51) 52) 53)
Assumed occupancy, N Annual average hot water usage in litres per day Hot water usage in litres per day for each mon 81.31 78.35 75.39 Energy content of hot water used = $4.18 \times Vd$,r 120.57 105.45 108.8 Distribution loss $0.15 \times (45)m$ 18.09 15.82 16.32 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 Volume factor from Table 2 Energy lost from water storage (kWh/day)	y Vd,average = Apr th Vd,m = factor 72.44 n x nm x Tm/360 94.87 14.23 /WHRS storage hown kWh/litre/day) (47) x (51) x (52	(25 x N) + : May r from Tabl 69.48 00 kWh/ma 91.03 13.65 within sam	36 Jun e 1c x (43) 66.52 60 onth (see Tabl 78.55 7: 11.78 10 ne vessel	Jul Aug 6.52 69.48 les 1b, 1c 1d) 2.79 2.79 83.53 0.92 12.53	Sep 72.44 84.53 12.68	Oct 75.39 7 Σ(44)112 1 98.51 1 Σ(45)112 1 14.78 1	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	 42) 43) 44) 45) 46) 47) 51) 52) 53) 54)
Assumed occupancy, N Annual average hot water usage in litres per day I an Feb Mar Hot water usage in litres per day for each mon 81.31 78.35 75.39 Energy content of hot water used = 4.18 x Vd,r 120.57 105.45 108.82 Distribution loss 0.15 x (45)m 18.09 15.82 16.32 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 (Volume factor from Table 2a Temperature factor from Table 2b Energy lost from water storage (kWh/day) Enter (50) or (54) in (55)	y Vd,average = Apr th Vd,m = factor 72.44 n x nm x Tm/360 94.87 14.23 /WHRS storage town kWh/litre/day) (47) x (51) x (52	(25 x N) + : May r from Tabl 69.48 00 kWh/ma 91.03 13.65 within sam	36 Jun e 1c x (43) 66.52 60 onth (see Tabl 78.55 72 11.78 10 e vessel 11.78 10	Jul Aug 6.52 69.48 les 1b, 1c 1d) 2.79 2.79 83.53 0.92 12.53	Sep 72.44 84.53 12.68	Oct 75.39 7 Σ(44)112 1 98.51 1 Σ(45)112 1 14.78 1	$\begin{array}{c c} 1.67 & (2) \\ \hline 73.91 & (2) \\ \hline Nov & Dec \\ \hline 8.35 & 81.31 \\ = & 886.96 & (2) \\ \hline 07.53 & 116.77 \\ = & 1162.95 & (2) \\ \hline 0.162 & (2) \\ \hline 1.10.00 & (2) \\ \hline 0.02 & (2) \\ \hline 1.03 & ($	 42) 43) 44) 45) 46) 47) 51) 52) 53) 54) 55)
Assumed occupancy, N Annual average hot water usage in litres per day I an Feb Mar Hot water usage in litres per day for each mon 81.31 78.35 75.39 Energy content of hot water used = $4.18 \times Vd$,r 120.57 105.45 108.8 Distribution loss 0.15 x (45)m 18.09 15.82 16.32 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 Volume factor from Table 2a Temperature factor from Table 2b Energy lost from water storage (kWh/day) Enter (50) or (54) in (55) Water storage loss calculated for each month	y Vd,average = Apr th Vd,m = factor 72.44 n x nm x Tm/360 94.87 14.23 /WHRS storage hown kWh/litre/day) (47) x (51) x (52 (55) x (41)m	(25 x N) + : May r from Tabl 69.48 00 kWh/me 91.03 13.65 within sam	36 Jun e 1c x (43) 66.52 60 onth (see Tabl 78.55 72 11.78 10 e vessel 11.78 10	Jul Aug 6.52 69.48 les 1b, 1c 1d) 2.79 2.79 83.53 0.92 12.53	Sep 72.44 84.53 12.68	Oct 75.39 7 Σ(44)112 1 98.51 1 Σ(45)112 1 14.78 1	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	 42) 43) 44) 45) 46) 47) 51) 52) 53) 54) 55)
Assumed occupancy, N Annual average hot water usage in litres per day for each moning that water usage in litres per day for each moning that water usage in litres per day for each moning that water usage in litres per day for each moning that water usage in litres per day for each moning that water usage in litres per day for each moning that water usage in litres per day for each moning that water usage in litres per day for each moning that water usage in litres per day for each moning that water usage in litres per day for each moning that water usage in litres per day for each moning that water usage in litres per day for each moning that water usage in litres per day for each moning that water storage loss factor is not water usage in litres in the water storage loss factor from Table 2 to Volume factor from Table 2 to Volume factor from Table 2 to Temperature factor from Table 2 to Temperature factor from Table 2 to Volume factor from the user storage (kWh/day) to the form the storage loss calculated for each month to the tot water storage loss calculated for each month to the tot water storage loss calculated for each month to the tot water storage loss calculated for each month to the tot water storage loss calculated for each month to the tot water storage loss calculated for each month to the tot water storage loss calculated for each month to the tot water storage loss calculated for each month to the tot water storage loss calculated for each month to the tot water storage loss calculated for each month to the tot water storage loss calculated for each month to the tot water storage loss calculated for each month to the tot water storage loss calculated for each month to the tot water storage loss calculated for each month to the tot water storage loss calculated for each month to the tot water storage loss calculated for each month to the tot water storage loss calculated for each month to the tot water storage loss calculated for each month to the tot water storage loss calculated for each mon	Apr Apr th Vd,m = factor 72.44 14.23 94.87 14.23 /WHRS storage town kWh/litre/day) (47) x (51) x (52 (55) x (41)m 30.98	(25 x N) + : May r from Tabl 69.48 00 kWh/ma 91.03 13.65 within sam within sam 2) x (53)	36 Jun	Jul Aug 6.52 69.48 es 1b, 1c 1d) 2.79 2.79 83.53 0.92 12.53 2.01 32.01	Sep 72.44 84.53 12.68 30.98	Oct 7 75.39 7 Σ(44)112 1 98.51 1 Σ(45)112 1 14.78 1 32.01 3	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	 42) 43) 44) 45) 46) 47) 51) 52) 53) 54) 55) 56)
Assumed occupancy, N Annual average hot water usage in litres per day I an Feb Mar Hot water usage in litres per day for each mon 81.31 78.35 75.39 Energy content of hot water used = 4.18 x Vd,r 120.57 105.45 108.83 Distribution loss 0.15 x (45)m 18.09 15.82 16.32 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 (Volume factor from Table 2a Temperature factor from Table 2b Energy lost from water storage (kWh/day) Enter (50) or (54) in (55) Water storage loss calculated for each month 32.01 28.92 32.01 If the vessel contains dedicated solar storage of	Apr Apr th Vd,m = factor 72.44 n x nm x Tm/360 94.87 14.23 /WHRS storage hown kWh/litre/day) (47) x (51) x (52) (55) x (41)m 30.98 r dedicated WW	(25 x N) + : May r from Tabl 69.48 00 kWh/mo 91.03 13.65 within sam t) x (53) 32.01 VHRS (56)m	36 Jun e 1c x (43) 66.52 60 onth (see Tabl 78.55 72 11.78 10 e vessel 11.78 30.98 32 n x [(47) - Vs] =	Jul Aug 6.52 69.48 les 1b, 1c 1d) 2.79 83.53 0.92 12.53 0.92 12.53 2.01 32.01 ÷ (47), else (56)	Sep 72.44 84.53 12.68 30.98	Oct 7 75.39 7 Σ(44)112 1 98.51 1 Σ(45)112 1 14.78 1 32.01 3	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	 42) 43) 44) 45) 46) 47) 51) 52) 53) 54) 55) 56)

$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Primary circuit	oss for each	month fro	m Table 3										
Contbillos for each month from Table 3a, 3b or 3c 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0		23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26 (59)
$ \begin{array}{ $	Combi loss for e	ach month	from Table	3a, 3b or 3	с									
Total hear required for water heating calculated for each month 0.8.8 x (d5)m (46)m (16)m (15)m + (15)m (16)m (15)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 (6	61)
$ \begin{array}{ $	Total heat requi	red for wat	er heating o	calculated f	or each mo	onth 0.85 x	(45)m + (4	6)m + (57)r	n + (59)m +	- (61)m				
Solar DHW input calculated using Appendix G or Appendix H 0.00 0.		175.85	155.38	164.10	148.36	146.31	132.05	128.07	138.81	138.02	153.78	161.02	172.05 (6	62)
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	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 (6	63)
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Output from wa	iter heater f	or each mo	onth (kWh/i	month) (62	2)m + (63)n	n							
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		175.85	155.38	164.10	148.36	146.31	132.05	128.07	138.81	138.02	153.78	161.02	172.05	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $				•							<u>Σ(64)1</u>	12 = 1	.813.79 (6	64)
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Heat gains from	water heat	ing (kWh/n	nonth) 0.2	5 × [0.85 ×	(45)m + (61	L)m] + 0.8 ×	[(46)m + (5	57)m + (59)	m]				
S. Internal gains Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Metabolic gains (Table 5) 83.61 66.83 66.97 8.45 10.73 12.52 13.35 (67) Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 145.65 147.16 143.35 13.24 12.50 11.53 108.96 107.45 111.26 119.37 12.960 139.22 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 10.00 0.00		84.31	75.01	80.40	74.34	74.49	68.91	68.42	71.99	70.90	76.98	78.55	83.05 (6	65)
S. Internal gains Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Retabolic gains (Table 5) 83.61													· · · · · · · · · · · · · · · · · · ·	
jan řeb Mar Áya May jun jun Aug Sep Oct Nov Dec Matability (Table 5) 83.61	5. Internal gair	าร												
Metabolic gains (Table 5) B3.61		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Metabolic gains	(Table 5)												
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 $ \begin{array}{c c c c c c c c c c c c c c c c c c c $		83.61	83.61	83.61	83.61	83.61	83.61	83.61	83.61	83.61	83.61	83.61	83.61 (6	66)
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	Lighting gains (c	alculated in	Appendix	L, equation	L9 or L9a),	also see Ta	able 5							
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 145.65 147.16 143.35 135.24 125.01 115.39 108.96 107.45 111.26 119.37 129.60 139.22 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 31.36<		12.98	11.53	9.38	7.10	5.31	4.48	4.84	6.29	8.45	10.73	12.52	13.35 (6	67)
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Appliance gains	(calculated	in Appendi	x L, equatio	on L13 or L1	L3a), also s	ee Table 5							
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 $\begin{array}{ c c c c c c c c c c c c c c c c c c c$		145.65	147.16	143.35	135.24	125.01	115.39	108.96	107.45	111.26	119.37	129.60	139.22 (6	68)
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	Cooking gains (c	alculated in	Appendix	L, equation	L15 or L15	a), also see	e Table 5							
Pump and fan gains (Table 5a) 0.00 0.00		31.36	31.36	31.36	31.36	31.36	31.36	31.36	31.36	31.36	31.36	31.36	31.36 (6	69)
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Pump and fan g	ains (Table !	5a)	•		•						•		
Losses e.g. evaporation (Table 5) $\begin{array}{c ccccccccccccccccccccccccccccccccccc$		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 (70)
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Losses e.g. evap	oration (Tal	ole 5)										· ·	
Water heating gains (Table 5) $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		-66.89	-66.89	-66.89	-66.89	-66.89	-66.89	-66.89	-66.89	-66.89	-66.89	-66.89	-66.89 (71)
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Water heating g	ains (Table	5)										,	,
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		113 32	111 62	108.07	103 25	100 12	95 71	91 97	96 77	98 47	103 46	109.09	111.62 (72)
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Total internal ga	ains (66)m -	+ (67)m + (f	58)m + (69)	m + (70)m ·	+ (71)m + (72)m	51.57	30.77	50.17	100.10	105.05	111.02	,
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		320.04	318 39	308.88	293.68	278 52	263.67	253.86	258 59	266.26	281.64	299.30	312.27 (73)
6. Solar gains Access factor Table 6d Area m ² Solar flux W/m ² g specific data or Table 6b FF specific data or Table 6c Gains W SouthWest 0.77 x 12.36 x 36.79 $v.0.9$ x 0.40 x 0.80 = 100.85 (79) Solar gains in watts $\Sigma(74)$ m(82)m 100.85 171.79 235.04 291.23 326.20 323.84 312.22 286.13 254.50 189.86 120.80 86.31 (83) Total gains - internal and solar (73)m + (83)m 420.89 490.18 543.93 584.91 604.72 587.51 566.08 544.72 520.77 471.50 420.09 398.58 (84) Temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1(°C) 21.00 (85) Jan Feb May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains for living area n1, m (see Table 9a) 0.98 0.96 0.90 0.79 0.62 0.45 0.32 0.35 0.54		520.04	518.55	508.88	235.08	278.52	203.07	255.80	238.33	200.20	201.04	299.30	512.27	73)
Access factor Table 6d Area m ² Solar flux W/m ² g specific data or Table 6b FF specific data or Table 6c Gains W SouthWest 0.77 x 12.36 x 36.79 x 0.9 x 0.40 x 0.80 = 100.85 (79) SouthWest 0.77 x 12.36 x 36.79 $x 0.9$ x 0.40 x 0.80 = 100.85 (79) Solar gains in watts $\Sigma(74)$ m(82)m 100.85 171.79 235.04 291.23 326.20 323.84 312.22 286.13 254.50 189.86 120.80 86.31 (83) Total gains - internal and solar (73)m + (83)m 420.89 490.18 543.93 584.91 604.72 587.51 566.08 544.72 520.77 471.50 420.09 398.58 (84) Temperature during heating periods in the living area from Table 9, Th1(°C) 21.00 (85) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains for living area 11 (steps 3 to 7 in Table 9c)	6. Solar gains													
Table 6d m² W/m² specific data or Table 6b specific data or Table 6c W SouthWest 0.77 x 12.36 x 36.79 $x 0.9 \times 0.40$ x 0.80 = 100.85 (79) Solar gains in watts $\Sigma(74)$ m(82)m 100.85 171.79 235.04 291.23 326.20 323.84 312.22 286.13 254.50 189.86 120.80 86.31 (83) Total gains - internal and solar (73)m + (83)m 420.89 490.18 543.93 584.91 604.72 587.51 566.08 544.72 520.77 471.50 420.09 398.58 (84) Temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1(°C) 21.00 (85) Question factor for gains for living area n1,m (see Table 9a) Utilisation factor for gains for living area n1,m (see Table 9a) 0.96 0.90 0.79 0.62 0.45 0.32 0.54 0.82 0.96 0.99 (86)				Access f	actor	Area	Sola	ar flux		g	FF		Gains	
SouthWest 0.77 x 12.36 x 36.79 x 0.9 x 0.40 x 0.80 = 100.85 (79) Solar gains in watts ∑(74)m(82)m 100.85 171.79 235.04 291.23 326.20 323.84 312.22 286.13 254.50 189.86 120.80 86.31 (83) Total gains - internal and solar (73)m + (83)m 420.89 490.18 543.93 584.91 604.72 587.51 566.08 544.72 520.77 471.50 420.09 398.58 (84) Temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1(°C) 21.00 (85) Jan Feb May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains for living area n1,m (see Table 9a) 0.98 0.96 0.90 0.79 0.62 0.45 0.32 0.35 0.54 0.82 0.96 0.99 (86) Mean internal temp of living area T1 (steps 3 to 7 in Table 9c) </td <td></td> <td></td> <td></td> <td>Table</td> <td>6d</td> <td>m²</td> <td>N</td> <td>//m²</td> <td>spec or T</td> <td>ific data able 6b</td> <td>specific c</td> <td>lata 60</td> <td>W</td> <td></td>				Table	6d	m²	N	//m²	spec or T	ific data able 6b	specific c	lata 60	W	
Solutivest 0.77 x 12.36 x 36.79 x 0.9 x 0.9 x 0.40 x 0.80 = 100.85 (79) Solar gains in watts $\Sigma(74)$ m(82)m 100.85 171.79 235.04 291.23 326.20 323.84 312.22 286.13 254.50 189.86 120.80 86.31 (83) Total gains - internal and solar (73)m + (83)m 420.89 490.18 543.93 584.91 604.72 587.51 566.08 544.72 520.77 471.50 420.09 398.58 (84) 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1(°C) Temperature during heating periods in the living area from Table 9, Th1(°C) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains for living area $1,m$ (see Table 9a) 0.98 0.96 0.90 0.79 0.62 0.45 0.32 0.35 0.54 0.82 0.96 0.99 (86) Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)	C					12.26		6 70					400.05	70)
Solar gains in watts 2(74)m(82)m 100.85 171.79 235.04 291.23 326.20 323.84 312.22 286.13 254.50 189.86 120.80 86.31 (83) Total gains - internal and solar (73)m + (83)m 420.89 490.18 543.93 584.91 604.72 587.51 566.08 544.72 520.77 471.50 420.09 398.58 (84) Temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1(°C) 21.00 (85) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains for living area n1,m (see Table 9a) 0.98 0.96 0.90 0.79 0.62 0.45 0.32 0.35 0.54 0.82 0.96 0.99 (86)	SouthWest		(02)	0.7	/X	12.36	X 3	6.79 x	0.9 x).40 x	0.80	=	100.85	79)
100.85 171.79 235.04 291.23 326.20 323.84 312.22 286.13 254.50 189.86 120.80 86.31 (83) Total gains - internal and solar (73)m + (83)m 420.89 490.18 543.93 584.91 604.72 587.51 566.08 544.72 520.77 471.50 420.09 398.58 (84) 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1(°C) 21.00 (85) Jan Feb May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains for living area n1,m (see Table 9a) 0.98 0.96 0.90 0.79 0.62 0.45 0.32 0.35 0.54 0.82 0.99 (86) Mean internal temp of living area T1 (steps 3 to 7 in Table 9r)	Solar gains in Wa	atts ∑(74)m	(82)m				L							
Total gains - internal and solar (73)m + (83)m 420.89 490.18 543.93 584.91 604.72 587.51 566.08 544.72 520.77 471.50 420.09 398.58 (84) 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1(°C) 21.00 (85) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains for living area n1,m (see Table 9a) 0.98 0.96 0.90 0.79 0.62 0.45 0.32 0.35 0.54 0.82 0.96 0.99 (86)		100.85	171.79	235.04	291.23	326.20	323.84	312.22	286.13	254.50	189.86	120.80	86.31 (8	83)
420.89 490.18 543.93 584.91 604.72 587.51 566.08 544.72 520.77 471.50 420.09 398.58 (84) 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1(°C) 21.00 (85) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains for living area n1,m (see Table 9a) O.98 0.96 0.90 0.79 0.62 0.45 0.32 0.35 0.54 0.82 0.96 0.99 (86) Mean internal temp of living area T1 (steps 3 to 7 in Table 9c) (86)	Total gains - inte	ernal and so	lar (73)m +	· (83)m			I							
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains for living area n1,m (see Table 9a) 0.98 0.96 0.90 0.79 0.62 0.45 0.32 0.35 0.54 0.82 0.96 0.99 (86)		420.89	490.18	543.93	584.91	604.72	587.51	566.08	544.72	520.77	471.50	420.09	398.58 (8	84)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains for living area n1,m (see Table 9a) 0.98 0.96 0.90 0.79 0.62 0.45 0.32 0.35 0.54 0.82 0.96 0.99 (86)	7. Mean intern	al t <u>empera</u>	ture <u>(heati</u>	ng s <u>eason)</u>										
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains for living area n1,m (see Table 9a) 0.98 0.96 0.90 0.79 0.62 0.45 0.32 0.35 0.54 0.82 0.96 0.99 (86)	Temperature du	uring heating	g periods in	the living :	area from T	able 9. Th1	1(°C)						21.00 (5	85)
Utilisation factor for gains for living area n1,m (see Table 9a) 0.98 0.96 0.90 0.79 0.62 0.45 0.32 0.35 0.54 0.82 0.96 0.99 (86) Mean internal temp of living area T1 (steps 3 to 7 in Table 9c) 0.62 0.45 0.32 0.35 0.54 0.82 0.96 0.99 (86)		Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1
0.98 0.96 0.90 0.79 0.62 0.45 0.32 0.35 0.54 0.82 0.96 0.99 (86) Mean internal temp of living area T1 (steps 3 to 7 in Table 9c) 0.62 0.45 0.32 0.35 0.54 0.82 0.96 0.99 (86)	Utilisation facto	r for gains f	or living ar	ea n1.m (se	e Table 9a)	- ,					- ••			
Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)		0.02			0.70	0.62	0.45	0.32	0.35	0.54	0.82	0 96	0.99 /	86)
	Mean internal to	emp of livin	g area T1 //	tens 3 to 7	in Table Or	- <u>0.02</u>	1 0.75	0.52	0.55	0.54	0.02	0.50		501

	20.45	20.62	20.79	20.93	20.99	21.00	21.00	21.00	21.00	20.92	20.66	20.40	(87)
Temperature durin	ng heating	; periods ir	n the rest of	f dwelling f	rom Table	9, Th2(°C)							
Γ	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	(88)
Utilisation factor fo	or gains fo	or rest of d	welling n2,	m	1				1				
Γ	0.98	0.95	0.88	0.75	0.57	0.39	0.26	0.29	0.48	0.78	0.95	0.98	(89)
Mean internal tem	perature	in the rest	of dwelling	g T2 (follow	v steps 3 to	7 in Table 9))						
	19.51	19.74	19.98	20.15	20.21	20.23	20.23	20.23	20.22	20.15	19.81	19.44	(90)
Living area fraction									L	iving area ÷	(4) =	0.52	(91)
Mean internal tem	perature	for the wh	ole dwellin	g fLA x T1 -	+(1 - fLA) x	Т2] (/
	20.00	20.19	20.40	20.55	20.61	20.62	20.63	20.63	20.62	20.55	20.25	19.94	(92)
Apply adjustment t	to the me	an interna	l temperati	ure from Ta	able 4e wh	ere appropr	iate	1 20100	1 10:01	20100		10101] (3 =)
·	20.00	20.19	20.40	20.55	20.61	20.62	20.63	20.63	20.62	20.55	20.25	19.94	(93)
	20.00	20.13	20.10	20.33	20.01	20:02	20.05	20.03	20.02	20.00	20.23	13.51] (33)
8. Space heating r	requirem	ent											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for	or gains, r	յՠ											
	0.98	0.95	0.89	0.77	0.60	0.42	0.29	0.32	0.51	0.80	0.95	0.98	(94)
Useful gains, ηmGr	m, W (94)m x (84)m	ı										
	411.61	465.14	482.70	448.34	360.14	246.61	165.07	173.24	265.84	376.06	398.96	392.01	(95)
Monthly average e	external te	emperatur	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 for n	nean inte	rnal tempe	erature, Lm	, W [(39)m	n x [(93)m -	(96)m]							
	643.86	627.26	570.06	477.89	365.54	247.09	165.11	173.31	267.48	407.91	539.43	645.52	(97)
Space heating requ	uirement,	kWh/mor	th 0.024 x	[(97)m - (9	5)m] x (41))m							
	172.79	108.95	64.99	21.27	4.02	0.00	0.00	0.00	0.00	23.70	101.14	188.62	
									Σ(9	8)15, 10	12 =	685.46	(98)
Space heating requ	uirement	kWh/m²/y	ear							(98)	÷ (4)	13.88	(99)
						_							
9b. Energy require	ements -	communit	ty heating s	cheme									7
Fraction of space h	leat from	secondary	/suppleme	ntary syste	m (table 1	1)				'0' if ı	none	0.00] (301)
Fraction of space h	leat from	communit	y system							1 - (30	01) =	1.00	(302)
Fraction of commu	inity heat	from boile	ers									0.25] (303a) _
Fraction of commu	inity heat	from CHP										0.75] (303b)
Fraction of total sp	ace heat	from com	munity CHP							(302) x (303	3a) =	0.75	(304a)
Fraction of total sp	ace heat	from com	munity boile	ers						(302) x (303	3b) =	0.25	(304 b)
Factor for control a	and charg	ing metho	d (Table 4c	(3)) for con	nmunity sp	ace heating						1.00	(305)
Factor for charging	g method	(Table 4c(3)) for comr	nunity wat	er heating							1.00	(305a)
Distribution loss fa	ctor (Tab	le 12c) for	community	heating sy	vstem							1.05	(306)
Space heating										_			
Annual space heati	ing requir	ement							685.46				(98)
Space heat from CH	HP							(98	8) x (304a)	x (305) x (30	06) =	539.80	(307a)
Space heat from bo	oilers							(98	8) x (304b)	x (305) x (30	06) =	179.93	(307b)
Water heating										_			
Annual water heati	ing requir	ement						1	1813.79				(64)
Water heat from C	ΗP							(64)) x (303a) x	: (305a) x (30	06) =	1428.36] (310a)
Water heat from be	oilers							(64)	x (303b) x	(305a) x (30	06) =	476.12	(310b)

Electricity used for heat distribution	0.03	L × [(307a)(307e) + (310a).	.(310e)] =	26.24	(313)
Electricity for pumps, fans and electric keep-hot (Table 4f)					
mechanical ventilation fans - balanced, extract or positiv	e input from outside	33.29			(330a)
Total electricity for the above, kWh/year				33.29	(331)
Electricity for lighting (Appendix L)				229.32	(332)
Total delivered energy for all uses	(307) + (309) + (310) +	(312) + (315) + (331) + (332)	(337b) =	2886.82	(338)
10b. Fuel costs - community heating scheme					
	Fuel	Fuel price		Fuel	
	kWh/year		c	ost £/year	
Space heating from CHP	539.80 x	2.97 x	0.01 =	16.03	(340a)
Space heating from boilers	179.93 x	4.24 x	0.01 =	7.63	(340b)
Water heating from CHP	1428.36 x	2.97 x	0.01 =	42.42	(342a)
Water heating from boilers	476.12 x	4.24 x	0.01 =	20.19	(342b)
Pumps and fans	33.29 x	13.19 x	0.01 =	4.39	(349)
Electricity for lighting	229.32 x	13.19 x	0.01 =	30.25	(350)
Additional standing charges			Ē	120.00	(351)
Total energy cost		(340a)(342e) + (345)(354) =	240.91	(355)
11b. SAP rating - community heating scheme					
Energy cost deflator (Table 12)				0.42	(356)
Energy cost factor (ECF)				1.07	(357)
SAP value				85.05]
SAP rating (section 13)				85] (358)
SAP hand] (330)
12b. CO ₂ emissions - community heating scheme					
12b. CO ₂ emissions - community heating scheme	Energy kWh/year	Emission factor		Emissions (kg/year)	
12b. CO₂ emissions - community heating scheme Emissions from community CHP (space and water heating)	Energy kWh/year	Emission factor		Emissions (kg/year)	
12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit	Energy kWh/year 28.09	Emission factor		Emissions (kg/year)	(361)
12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit	Energy kWh/year 28.09 66.01	Emission factor		Emissions (kg/year)	(361) (362)
12b. CO2 emissions - community heating schemeEmissions from community CHP (space and water heating)Power efficiency of CHP unitHeat efficiency of CHP unitSpace heating from CHP(307a) × 100 ÷ (3)	Energy kWh/year 28.09 66.01 362) = 817.7541 x	Emission factor	=	Emissions (kg/year) 176.6349	(361) (362) (363)
12b. CO2 emissions - community heating schemeEmissions from community CHP (space and water heating)Power efficiency of CHP unitHeat efficiency of CHP unitSpace heating from CHP(307a) × 100 ÷ (3)less credit emissions for electricity	Energy kWh/year 28.09 66.01 362) = 817.7541 x -229.7035 x	Emission factor 0.2160 0.5190	=	Emissions (kg/year) 176.6349	(361) (362)] (363)] (364)
12b. CO ₂ emissions - community heating scheme <i>Emissions from community CHP (space and water heating)</i> Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (3 less credit emissions for electricity Water heated by CHP	Energy kWh/year 28.09 66.01 362) = 817.7541 x -229.7035 x 2163.8390 x	Emission factor 0.2160 0.5190 0.2160	=	Emissions (kg/year) 176.6349 -119.2161 467.3892	(361) (362)] (363)] (364)] (365)
12b. CO2 emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (3) less credit emissions for electricity Water heated by CHP less credit emissions for electricity	Energy kWh/year 28.09 66.01 362) = 817.7541 x -229.7035 x 2163.8390 x -607.8127 x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5190	=	Emissions (kg/year) 176.6349 -119.2161 467.3892 -315.4548	(361) (362)] (363)] (364)] (365)] (366)
12b. CO ₂ emissions - community heating scheme <i>Emissions from community CHP (space and water heating)</i> Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (3 less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating)	Energy kWh/year 28.09 66.01 362) = 817.7541 x -229.7035 x 2163.8390 x -607.8127 x	Emission factor 0.2160 0.5190 0.2160 0.5190	=	Emissions (kg/year) 176.6349 -119.2161 467.3892 -315.4548	(361) (362)] (363)] (364)] (365)] (366)
12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (3 less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers	Energy kWh/year 28.09 66.01 362) = 817.7541 x -229.7035 x 2163.8390 x -607.8127 x	Emission factor 0.2160 0.5190 0.2160 0.5190	=	Emissions (kg/year) 176.6349 -119.2161 467.3892 -315.4548	(361) (362)] (363)] (364)] (365)] (366) (367b)
12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (3 less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from hollers [(307h)+(310h)] x 100 ÷ (36	Energy kWh/year $ \begin{array}{c} 28.09\\ 66.01\\ 362) = 817.7541 \\ -229.7035 \\ x\\ 2163.8390 \\ x\\ -607.8127 \\ x \end{array} $ $ \begin{array}{c} 94.00\\ 94.00\\ 70 \\ 94.00\\ 37 \\ 94.00\\ 37 \\ 94.00\\ 37 \\ 94.00\\ 37 \\ 94.00\\ 37 \\ 37 \\ 37 \\ 37 \\ 37 \\ 37 \\ 37 \\ 37 $	Emission factor 0.2160 0.5190 0.2160 0.5190		Emissions (kg/year) 176.6349 -119.2161 467.3892 -315.4548	(361) (362)] (363)] (364)] (365)] (366) (367b)] (368)
12b. CO2 emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (3) less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] x 100 ÷ (36) Electrical energy for community heat distribution	Energy kWh/year $ \begin{array}{c} 28.09\\ \hline 66.01\\ 362) = 817.7541 \\ x\\ -229.7035 \\ x\\ 2163.8390 \\ x\\ -607.8127 \\ x\\ \end{array} $ $ \begin{array}{c} 94.00\\ \hline 94.00\\ \hline 57b) = 697.93 \\ x\\ 26.24 \\ x\\ \end{array} $	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5190		Emissions (kg/year) 176.6349 -119.2161 467.3892 -315.4548 150.75 13.62	(361) (362)] (363)] (364)] (365)] (366) (367b)] (368)] (372)
12b. CO2 emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (3 less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers CO2 emissions from boilers CO2 associated with community systems	Energy kWh/year $ \begin{array}{c} 28.09\\ 66.01\\ x\\ -229.7035\\ x\\ 2163.8390\\ x\\ -607.8127\\ x\\ 94.00\\ 57b) = \begin{array}{c} 94.00\\ 697.93\\ x\\ 26.24\\ x\\ \end{array} $	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5190 0.5190		Emissions (kg/year) 176.6349 -119.2161 467.3892 -315.4548 150.75 13.62 373.73	(361) (362)] (363)] (364)] (365)] (366) (367b)] (368)] (372)] (373)
12b. CO2 emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (3) less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers CO2 emissions from boilers CO2 associated with community systems Total CO2 associated with space and water heating	Energy kWh/year $ \begin{array}{c} 28.09\\ \hline 66.01\\ 362) = 817.7541 \\ x\\ -229.7035 \\ x\\ 2163.8390 \\ x\\ -607.8127 \\ x\\ \end{array} $ $ \begin{array}{c} 94.00\\ 94.00\\ \hline 57b) = 697.93 \\ x\\ 26.24 \\ x\\ \end{array} $	0.2160 0.5190 0.2160 0.5190 0.5190		Emissions (kg/year) 176.6349 -119.2161 467.3892 -315.4548 150.75 13.62 373.73 373.73	(361) (362)] (363)] (364)] (365)] (366) (367b)] (368)] (372)] (373)] (376)
12b. CO2 emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (3) less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers CO2 emissions from boilers Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans	Energy kWh/year $ \begin{array}{c} 28.09\\ 66.01\\ 362) = 817.7541 \\ -229.7035 \\ x\\ 2163.8390 \\ x\\ -607.8127 \\ x \end{array} $ $ \begin{array}{c} 94.00\\ 697.93 \\ x\\ 26.24 \\ x \end{array} $	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5190		Emissions (kg/year) 176.6349 -119.2161 467.3892 -315.4548 150.75 13.62 373.73 373.73 17.28	(361) (362)] (363)] (364)] (365)] (366) [(367b)] (368)] (372)] (373)] (376)
12b. CO2 emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (3) less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers CO2 emissions from boilers Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting	Energy kWh/year $ \begin{array}{c} 28.09\\ 66.01\\ 362) = 817.7541 \\ x\\ -229.7035 \\ x\\ 2163.8390 \\ x\\ -607.8127 \\ x\\ \end{array} $ $ \begin{array}{c} 94.00\\ 94.00\\ 57b) = 697.93 \\ x\\ 26.24 \\ x\\ \end{array} $	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5190 0.5190		Emissions (kg/year) 176.6349 -119.2161 467.3892 -315.4548 150.75 13.62 373.73 373.73 373.73 17.28	(361) (362) (363) (364) (365) (366) (367b) (368) (372) (373) (376) (378)
12b. CO2 emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (3 less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers CO2 emissions from boilers Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting Total CO2 kg/war	Energy kWh/year $ \begin{array}{c} 28.09\\ 66.01\\ x\\ -229.7035\\ x\\ 2163.8390\\ x\\ -607.8127\\ x\\ 94.00\\ 57b) = \begin{array}{c} 94.00\\ 697.93\\ x\\ 26.24\\ x\\ \end{array} $	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5190 0.5190 0.5190		Emissions (kg/year) 176.6349 -119.2161 467.3892 -315.4548 150.75 13.62 373.73 373.73 17.28 119.01 510.02	(361) (362) (363) (364) (365) (366) (367b) (368) (372) (373) (373) (377) (378) (379)
12b. CO2 emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (3) less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers CO2 emissions from boilers Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting Total CO2, kg/year Dwalling CO, emission sete	Energy kWh/year $ \begin{array}{c} 28.09\\ \hline 66.01\\ x\\ -229.7035\\ x\\ 2163.8390\\ x\\ -607.8127\\ x\\ \hline 94.00\\ 697.93\\ x\\ 26.24\\ x\\ \hline 33.29\\ x\\ 229.32\\ x\\ \end{array} $	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190	= = = = = 5)(382) =	Emissions (kg/year) 176.6349 -119.2161 467.3892 -315.4548 150.75 13.62 373.73 373.73 17.28 119.01 510.02	(361) (362)] (363)] (364)] (365)] (365)] (366)] (368)] (372)] (373)] (376)] (378)] (379)] (383)
12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (3 less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (36 Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with 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 $ \begin{array}{c} 28.09\\ 66.01\\ x\\ -229.7035\\ x\\ 2163.8390\\ x\\ -607.8127\\ x\\ 94.00\\ 57b) = \begin{array}{c} 94.00\\ 697.93\\ x\\ 26.24\\ x\\ \end{array} $ $ \begin{array}{c} 33.29\\ x\\ 229.32\\ x\\ \end{array} $	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.52 0.52 (37) (37) (37) (37) (37)	=	Emissions (kg/year) 176.6349 -119.2161 467.3892 -315.4548 150.75 13.62 373.73 373.73 17.28 119.01 510.02 10.33	(361) (362) (363) (364) (365) (366) (367b) (368) (372) (373) (373) (377) (378) (378) (379) (383)
12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (3 less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (36 Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with 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 $ \begin{array}{c} 28.09\\ \hline 66.01\\ x\\ -229.7035\\ x\\ 2163.8390\\ x\\ -607.8127\\ x\\ \hline 94.00\\ 697.93\\ x\\ 26.24\\ x\\ \hline 33.29\\ x\\ 229.32\\ x\\ \end{array} $	Emission factor 0.2160 0.5190 0.2160 0.5190 0.216 0.52 0.52 (374 (374)	= = = = = 5)(382) = 83) ÷ (4) =	Emissions (kg/year) 176.6349 -119.2161 467.3892 -315.4548 150.75 13.62 373.73 373.73 17.28 119.01 510.02 10.33 92.76 02	(361) (362)] (363)] (364)] (365)] (365)] (366)] (368)] (373)] (373)] (373)] (373)] (379)] (384)]] (384)
12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (3 less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (36 Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14)	Energy kWh/year $ \begin{array}{c} 28.09\\ 66.01\\ x\\ -229.7035\\ x\\ 2163.8390\\ x\\ -607.8127\\ x\\ 367b) = \begin{array}{c} 94.00\\ 697.93\\ x\\ 26.24\\ x\\ 33.29\\ x\\ 229.32\\ x\\ \end{array} $	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.52 0.52 (37) (37) (37) (37) (37) (37) (37) (37) (37) (37) (37) (37) (37) (37) (37) (37)	=	Emissions (kg/year) 176.6349 -119.2161 467.3892 -315.4548 150.75 13.62 373.73 17.28 119.01 510.02 10.33 92.76 93	(361) (362) (363) (364) (365) (366) (367b) (368) (372) (373) (373) (373) (378) (378) (379) (383) (384) (385)
12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (3 less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (36 Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with 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 28.09 66.01 362) = 817.7541 x -229.7035 x 2163.8390 x -607.8127 x 26.24 x 33.29 x 229.32	Emission factor 0.2160 0.5190 0.2160 0.5190 0.216 0.52 0.52 (374 (374)	=	Emissions (kg/year) 176.6349 -119.2161 467.3892 -315.4548 150.75 13.62 373.73 17.28 119.01 510.02 10.33 92.76 93 A	(361) (362) (363) (364) (365) (366) (367b) (368) (372) (373) (373) (373) (379) (379) (383) (384) (385)

13b. Primary energy - comm	unity heating scheme						
		Energy kWh/year		Primary factor		Primary energy (kWh/year)	,
Primary Energy from communi	ity CHP (space and water heating)						
Power efficiency of CHP unit		28.09					(361)
Heat efficiency of CHP unit		66.01					(362)
Space heating from CHP	(307a) × 100 ÷ (362) =	817.75	х	1.22	=	997.66	(363)
less credit energy for electr	icity	-229.70	х	3.07	=	-705.19	(364)
Water heated by CHP		2163.84	х	1.22	=	2639.88	(365)
less credit energy for electricit	у	-607.81	х	3.07	=	-1865.98	(366)
Primary energy from other sou	rces (space heating)						
Efficiency of boilers		94.00					(367b)
Primary energy from boilers	[(307b)+(310b)] x 100 ÷ (367b) =	697.93	x	1.22	=	851.47	(368)
Electrical energy for communit	ty heat distribution	26.24	x	3.07	=	80.56	(372)
Total primary energy associate	ed with community systems					1998.41	(373)
Total primary energy associate	ed with space and water heating					1998.41	(376)
Pumps and fans		33.29	x	3.07	=	102.20	(378)
Electricity for lighting		229.32	x	3.07	=	704.00	(379)
Primary energy kWh/year						2804.61	(383)
Dwelling primary energy rate k	Wh/m2/year					56.78	(384)



Assessor name		Miss Jayr	na Parmar					А	ssessor nur	nber	6549		
Client								L	ast modifie	d	23/11	/2016	
Address		A-L04-65	A Centric (Close, Lond	on, N8								
1. Overall dwellin	ng dimens	sions											
					А	rea (m²)		Ave h	erage storey eight (m)	I	Vo	lume (m³)	
Lowest occupied						77.30	<mark>](1a)</mark> x		2.50	(2a) =		193.25	(3a)
Total floor area		(1a)	+ (1b) + (1e	c) + (1d)(1n) =	77.30	(4)						
Dwelling volume							-	(3a	ı) + (3b) + (3	3c) + (3d)(3	3n) =	193.25	(5)
2 Montilation rat										_			
2. Ventilation rat	e												
										_	m	' per hour	_
Number of chimne	eys								0	x 40 =	:	0	(6a)
Number of open fl	lues								0	x 20 =	:	0	(6b)
Number of interm	ittent fan	s							0	x 10 =		0	(7a)
Number of passive	e vents								0	x 10 =	:	0	(7b)
Number of flueles	s gas fires	;							0	 x 40 =		0	(7c)
										_	Air o	hanges pe hour	r
Infiltration due to	chimneys	, flues, fans	s, PSVs		(6a)	+ (6b) + (7	a) + (7b) + (7c) =	0	÷ (5) =		0.00	(8)
If a pressurisation	test has b	been carried	d out or is ii	ntended, pi	roceed to (17), otherw	vise continu	e from (9)	to (16)				
, Air permeability va	alue, q50,	expressed	in cubic me	etres per h	our per sau	uare metre	of envelope	e area	. ,			4.00	(17)
If based on air per	meability	value. ther	n (18) = [(17	7) ÷ 20] + (8). otherwi	se (18) = (1	6)					0.20	(18)
Number of sides o	n which t	he dwelling	is sheltere	d d	,,	() (-	-,					3	(19)
Shelter factor			,						1	- [0 075 x (1	9)] =	0.78	(20)
Infiltration rate in	ornoratir	ng shelter f	actor						-	(18) x (2	20) =	0.16	(21)
Infiltration rate m	odified fo	r monthly y								(10) × (2		0.10	_ (21)
	lan	Eob	Mar	Anr	May	lun	1.1	Aug	Son	Oct	Nov	Dec	
Monthly avorage		d from Tab		Abi	ividy	Jun	Jui	Aug	Sch	000	NOV	Dec	
			4.00	4.40	4.20	2.80	2.90	2.70	4.00	4.20	4.50	4.70	(22)
Wind factor (22)m	5.10	5.00	4.90	4.40	4.50	5.60	5.80	5.70	4.00	4.50	4.50	4.70	_ (22)
	1.20	4.25	1.22	1.10	1.00	0.05	0.05	0.02	1.00	1.00	1.12	1.10	7 (22-)
	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)
	on rate (al	liowing for	shelter and		Dr) (21) X (2		0.15			0.17	<u> </u>	0.10	
	0.20	0.19	0.19	0.17	0.17	0.15	0.15	0.14	0.16	0.17	0.17	0.18	(22b)
Calculate effective	e air chang	ge rate for t	the applical	ole case:									-
If mechanical v	entilation	: air chang	e rate throu	ugh system								0.50	_ (23a)
If balanced wit	h heat reo	covery: effi	ciency in %	allowing fo	or in-use fa	ctor from T	able 4h					N/A	(23c)
c) whole house	extract v	entilation o	or positive i	nput venti	ation from	outside							_
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(24c)
Effective air chang	ge rate - e	nter (24a) o	or (24b) or	(24c) or (24	ld) in (25)								
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(25)



5. Heat losses and heat loss parameter							
Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/	/Κ κ-value kJ/m².I	, Ахк, К kJ/К
Window			14.12	x 1.24	= 17.45		(27)
External wall			13.75	x 0.18	= 2.48		(29a)
Party wall			60.09	x 0.00	= 0.00		(32)
Total area of external elements ΣA , m ²			27.87				(31)
Fabric heat loss, $W/K = \sum (A \times U)$					(26)(30) + (32) =	19.92 (33)
Heat capacity Cm = Σ(A x κ)				(28)	(30) + (32) +	(32a)(32e) =	N/A (34)
Thermal mass parameter (TMP) in kJ/m²K							250.00 (35)
Thermal bridges: $\Sigma(L \times \Psi)$ calculated using App	endix K						4.23 (36)
Total fabric heat loss						(33) + (36) =	24.15 (37)
Jan Feb Mar	Apr	May	Jun	Jul Aug	Sep	Oct N	lov Dec
Ventilation heat loss calculated monthly 0.33	(25)m x (5)						
31.89 31.89 31.89	31.89	31.89	31.89 3	1.89 31.89	31.89	31.89 32	1.89 31.89 <mark>(38)</mark>
Heat transfer coefficient, W/K $(37)m + (38)m$							
56.04 56.04 56.04	56.04	56.04	56.04 5	6.04 56.04	56.04	56.04 56	5.04 56.04
					Average = ∑	(39)112/12 =	56.04 (39)
Heat loss parameter (HLP), W/m ² K (39)m \div (4)							
0.72 0.72 0.72	0.72	0.72	0.72 0	0.72 0.72	0.72	0.72 0	.72 0.72
					Average = ∑	(40)112/12 =	0.72 (40)
Number of days in month (Table 1a)							
31.00 28.00 31.00	30.00	31.00	30.00 3	1.00 31.00	30.00	31.00 30	0.00 31.00 (40)
4. Water heating energy requirement							
Assumed occupancy, N							2.41 (42)
Assumed occupancy, N Annual average hot water usage in litres per da	ay Vd,average = ((25 x N) + 3	36				2.41 (42) 91.43 (43)
Assumed occupancy, N Annual average hot water usage in litres per da Jan Feb Mar	ay Vd,average = (Apr	(25 x N) + 3 May	36 Jun	Jul Aug	Sep	Oct N	2.41 (42) 91.43 (43) lov Dec
Assumed occupancy, N Annual average hot water usage in litres per da Jan Feb Mar Hot water usage in litres per day for each mon	ay Vd,average = (Apr th Vd,m = factor	(25 x N) + 3 May from Table	36 Jun e 1c x (43)	Jul Aug	Sep	Oct N	2.41 (42) 91.43 (43) lov Dec
Assumed occupancy, N Annual average hot water usage in litres per da Jan Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26	ay Vd,average = (Apr th Vd,m = factor 89.60	(25 x N) + 3 May from Table 85.94	36 Jun e 1c x (43) 82.29 8	Jul Aug 2.29 85.94	Sep 89.60	Oct N 93.26 96	2.41 (42) 91.43 (43) lov Dec 5.91 100.57
Assumed occupancy, N Annual average hot water usage in litres per da Jan Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26	ay Vd,average = (Apr th Vd,m = factor 89.60	(25 x N) + 3 May from Table 85.94	36 Jun e 1c x (43) 82.29 8	Jul Aug 2.29 85.94	Sep 89.60	Oct Ν 93.26 96 Σ(44)112 =	2.41 (42) 91.43 (43) lov Dec 5.91 100.57 1097.15 (44)
Assumed occupancy, N Annual average hot water usage in litres per da Jan Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26 Energy content of hot water used = 4.18 x Vd,r	ay Vd,average = (Apr th Vd,m = factor 89.60 n x nm x Tm/360	(25 x N) + 3 May from Table 85.94	36 Jun e 1c x (43) 82.29 8 onth (see Tabl	Jul Aug 2.29 85.94 les 1b, 1c 1d)	Sep 89.60	Oct Ν 93.26 96 Σ(44)112 =	2.41 (42) 91.43 (43) lov Dec 5.91 100.57 1097.15 (44)
Assumed occupancy, N Annual average hot water usage in litres per day Jan Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26 Energy content of hot water used = 4.18 x Vd,r 149.14 130.44 134.6	ay Vd,average = (Apr th Vd,m = factor 89.60 n x nm x Tm/360 1 117.35	(25 x N) + 3 May from Table 85.94 00 kWh/mo 112.60	36 Jun e 1c x (43) 82.29 8 onth (see Tabl 97.17 9	Jul Aug 2.29 85.94 les 1b, 1c 1d) 0.04 103.32	Sep 89.60	Oct N 93.26 96 ∑(44)112 = 121.85 13	2.41 (42) 91.43 (43) lov Dec 5.91 100.57 1097.15 (44) 3.01 144.44
Assumed occupancy, N Annual average hot water usage in litres per day Jan Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26 Energy content of hot water used = 4.18 x Vd,r 149.14 130.44 134.6	ay Vd,average = (Apr th Vd,m = factor 89.60 n x nm x Tm/360 1 117.35	(25 x N) + 3 May from Table 85.94 00 kWh/mc 112.60	36 Jun e 1c x (43) 82.29 8 onth (see Tabl 97.17 9	Jul Aug 2.29 85.94 les 1b, 1c 1d) 0.04	Sep 89.60	Oct N 93.26 96 $\Sigma(44)112 =$ 13 121.85 13 $\Sigma(45)112 =$ 13	2.41 (42) 91.43 (43) lov Dec 5.91 100.57 1097.15 (44) 3.01 144.44 1438.53 (45)
Assumed occupancy, N Annual average hot water usage in litres per day I an Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26 Energy content of hot water used = $4.18 \times Vd$,r 149.14 130.44 134.6 Distribution loss 0.15 x (45)m	ay Vd,average = (Apr th Vd,m = factor 89.60 n x nm x Tm/360 1 117.35	(25 x N) + 3 May from Table 85.94 00 kWh/mo 112.60	36 Jun e 1c x (43) 82.29 8 onth (see Tabl 97.17 9	Jul Aug 2.29 85.94 les 1b, 1c 1d) 0.04	Sep 89.60	Oct Ν 93.26 96 Σ(44)112 = 121.85 13 Σ(45)112 =	2.41 (42) 91.43 (43) lov Dec 5.91 100.57 1097.15 (44) 3.01 144.44 1438.53 (45)
Assumed occupancy, N Annual average hot water usage in litres per day I an Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26 Energy content of hot water used = $4.18 \times Vd$,r 149.14 130.44 134.6 Distribution loss 0.15 x (45)m 22.37 19.57 20.19	ay Vd,average = (Apr th Vd,m = factor 89.60 n x nm x Tm/360 1 117.35 :	(25 x N) + 3 May from Table 85.94 00 kWh/mc 112.60 16.89	36 Jun e 1c x (43) 82.29 82.29 8 onth (see Table 97.17 9 14.58 1	Jul Aug 2.29 85.94 les 1b, 1c 1d) 0.04 0.04 103.32 3.51 15.50	Sep 89.60 104.56 15.68	Oct N 93.26 96 $\Sigma(44)112 =$ 13 121.85 13 $\Sigma(45)112 =$ 13 18.28 19	$\begin{array}{c c} 2.41 & (42) \\ \hline 91.43 & (43) \\ \hline 000 & Dec \\ \hline 5.91 & 100.57 \\ \hline 1097.15 & (44) \\ \hline 3.01 & 144.44 \\ \hline 1438.53 & (45) \\ \hline 0.95 & 21.67 & (46) \\ \hline \end{array}$
Assumed occupancy, N Annual average hot water usage in litres per day I an Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26 Energy content of hot water used = $4.18 \times Vd$,r 149.14 130.44 134.6 Distribution loss $0.15 \times (45)m$ 22.37 19.57 20.19 Storage volume (litres) including any solar or W	ay Vd,average = (Apr th Vd,m = factor 89.60 n x nm x Tm/360 1 117.35 17.60 /WHRS storage v	(25 x N) + 3 May from Table 85.94 00 kWh/mo 112.60 16.89 within sam	36 Jun e 1c x (43) 82.29 8 onth (see Tabl 97.17 9 14.58 1 e vessel	Jul Aug 2.29 85.94 les 1b, 1c 1d) 0.04 0.04 103.32 3.51 15.50	Sep 89.60 104.56 15.68	Oct N 93.26 96 $\Sigma(44)112 =$ 13 121.85 13 $\Sigma(45)112 =$ 13 18.28 19	$\begin{array}{c c} 2.41 & (42) \\ \hline 91.43 & (43) \\ \hline 000 & Dec \\ \hline 5.91 & 100.57 \\ \hline 1097.15 & (44) \\ \hline 3.01 & 144.44 \\ \hline 1438.53 & (45) \\ \hline 0.95 & 21.67 & (46) \\ \hline 110.00 & (47) \\ \hline \end{array}$
Assumed occupancy, N Annual average hot water usage in litres per day I an Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26 Energy content of hot water used = $4.18 \times Vd$,r 149.14 130.44 134.6 Distribution loss $0.15 \times (45)m$ 22.37 19.57 20.19 Storage volume (litres) including any solar or W Water storage loss:	ay Vd,average = (Apr th Vd,m = factor 89.60 n x nm x Tm/360 1 117.35 1 17.60 /WHRS storage v	(25 x N) + 3 May from Table 85.94 00 kWh/mo 112.60 16.89 within sam	36 Jun e 1c x (43) 82.29 82.29 8 onth (see Table 97.17 9 14.58 1 e vessel	Jul Aug 2.29 85.94 les 1b, 1c 1d) 0.04 0.04 103.32 3.51 15.50	Sep 89.60 104.56 15.68	Oct N 93.26 96 $\Sigma(44)112 =$ 13 121.85 13 $\Sigma(45)112 =$ 18.28	$\begin{array}{c c} 2.41 & (42) \\ \hline 91.43 & (43) \\ \hline 00 & Dec \\ \hline 5.91 & 100.57 \\ \hline 1097.15 & (44) \\ \hline 3.01 & 144.44 \\ \hline 1438.53 & (45) \\ \hline 0.95 & 21.67 & (46) \\ \hline 110.00 & (47) \\ \hline \end{array}$
Assumed occupancy, N Annual average hot water usage in litres per day I an Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26 Energy content of hot water used = $4.18 \times Vd$,r 149.14 130.44 134.6 Distribution loss 0.15 x (45)m 22.37 19.57 20.19 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kn	ay Vd,average = (Apr th Vd,m = factor 89.60 n x nm x Tm/360 1 117.35 17.60 /WHRS storage v hown	(25 x N) + 3 May from Table 85.94 00 kWh/mc 112.60 16.89 within sam	36 Jun e 1c x (43) 82.29 8 onth (see Tabl 97.17 9 14.58 1 e vessel	Jul Aug 2.29 85.94 les 1b, 1c 1d) 0.04 0.04 103.32 3.51 15.50	Sep 89.60 104.56 15.68	Oct N 93.26 96 $\Sigma(44)112 =$ 13 121.85 13 $\Sigma(45)112 =$ 18.28	2.41 (42) 91.43 (43) lov Dec 5.91 100.57 1097.15 (44) 3.01 144.44 1438.53 (45) 9.95 21.67 (46) 110.00 (47)
Assumed occupancy, N Annual average hot water usage in litres per day Jan Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26 Energy content of hot water used = $4.18 \times Vd$,r 149.14 130.44 134.6 Distribution loss $0.15 \times (45)m$ 22.37 19.57 20.19 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 (ay Vd,average = (Apr th Vd,m = factor 89.60 n x nm x Tm/360 1 117.35 1 117.35 1 17.60 WHRS storage v hown kWh/litre/day)	(25 x N) + 3 May from Table 85.94 00 kWh/mo 112.60 16.89 within sam	36 Jun e 1c x (43) 82.29 82.29 8 onth (see Table 97.17 9 14.58 1 e vessel	Jul Aug 2.29 85.94 les 1b, 1c 1d) 0.04 0.04 103.32 3.51 15.50	Sep 89.60 104.56 15.68	Oct N 93.26 96 $\Sigma(44)112 =$ 13 121.85 13 $\Sigma(45)112 =$ 13 18.28 19	$\begin{array}{c c} 2.41 & (42) \\ \hline 91.43 & (43) \\ \hline 0v & Dec \\ \hline 5.91 & 100.57 \\ \hline 1097.15 & (44) \\ \hline 3.01 & 144.44 \\ \hline 1438.53 & (45) \\ \hline 0.95 & 21.67 & (46) \\ \hline 110.00 & (47) \\ \hline 0.02 & (51) \\ \hline \end{array}$
Assumed occupancy, N Annual average hot water usage in litres per day Jan Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26 Energy content of hot water used = 4.18 x Vd,r 149.14 130.44 134.6 Distribution loss 0.15 x (45)m 22.37 19.57 20.19 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 (Volume factor from Table 2a	ay Vd,average = (Apr th Vd,m = factor 89.60 n x nm x Tm/360 1 117.35 1 17.60 /WHRS storage w hown kWh/litre/day)	(25 x N) + 3 May from Table 85.94 00 kWh/mc 112.60 16.89 within sam	36 Jun e 1c x (43) 82.29 82.29 83 onth (see Tabl 97.17 91 14.58 11 e vessel	Jul Aug 2.29 85.94 les 1b, 1c 1d) 0.04 0.04 103.32 3.51 15.50	Sep 89.60 104.56 15.68	Oct N 93.26 96 $\Sigma(44)112 =$ 13 121.85 13 $\Sigma(45)112 =$ 18.28	$\begin{array}{c c} 2.41 & (42) \\ \hline 91.43 & (43) \\ \hline 0v & Dec \\ \hline 5.91 & 100.57 \\ \hline 1097.15 & (44) \\ \hline 3.01 & 144.44 \\ \hline 1438.53 & (45) \\ \hline 0.95 & 21.67 & (46) \\ \hline 110.00 & (47) \\ \hline 0.02 & (51) \\ \hline 1.03 & (52) \\ \hline \end{array}$
Assumed occupancy, N Annual average hot water usage in litres per day Jan Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26 Energy content of hot water used = 4.18 x Vd,r 149.14 130.44 134.6 Distribution loss 0.15 x (45)m 22.37 19.57 20.19 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 Volume factor from Table 2a Temperature factor from Table 2b	ay Vd,average = (Apr th Vd,m = factor 89.60 n x nm x Tm/360 1 117.35 17.60 WHRS storage v hown kWh/litre/day)	(25 x N) + 3 May from Table 85.94 00 kWh/mo 112.60 16.89 within sam	36 Jun e 1c x (43) 82.29 82.29 8 onth (see Table 97.17 9 14.58 1 e vessel	Jul Aug 2.29 85.94 les 1b, 1c 1d) 0.04 0.04 103.32 3.51 15.50	Sep 89.60 104.56 15.68	Oct N 93.26 96 $\Sigma(44)112 =$ 13 121.85 13 $\Sigma(45)112 =$ 13 18.28 19	$\begin{array}{c c} 2.41 & (42) \\ \hline 91.43 & (43) \\ \hline 0v & Dec \\ \hline 5.91 & 100.57 \\ \hline 1097.15 & (44) \\ \hline 3.01 & 144.44 \\ \hline 1438.53 & (45) \\ \hline 0.95 & 21.67 & (46) \\ \hline 110.00 & (47) \\ \hline 0.02 & (51) \\ \hline 1.03 & (52) \\ \hline 0.60 & (53) \\ \hline \end{array}$
Assumed occupancy, N Annual average hot water usage in litres per day Jan Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26 Energy content of hot water used = $4.18 \times Vd$,r 149.14 130.44 134.6 Distribution loss $0.15 \times (45)m$ 22.37 19.57 20.19 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 20 Volume factor from Table 22 Temperature factor from Table 2b Energy lost from water storage (kWh/day)	ay Vd,average = (Apr th Vd,m = factor 89.60 n x nm x Tm/360 1 117.35 1 117.35 1 17.60 /WHRS storage v hown kWh/litre/day) (47) x (51) x (52)	(25 x N) + 3 May from Table 85.94 00 kWh/mo 112.60 16.89 within sam	36 Jun e 1c x (43) 82.29 82.29 83 onth (see Table) 97.17 94 14.58 13 e vessel	Jul Aug 2.29 85.94 les 1b, 1c 1d) 0.04 0.04 103.32 3.51 15.50	Sep 89.60 104.56 15.68	Oct N 93.26 96 $\Sigma(44)112 =$ 13 121.85 13 $\Sigma(45)112 =$ 18.28	$\begin{array}{c c} 2.41 & (42) \\ \hline 91.43 & (43) \\ \hline 0v & Dec \\ \hline 5.91 & 100.57 \\ \hline 1097.15 & (44) \\ \hline 3.01 & 144.44 \\ \hline 1438.53 & (45) \\ \hline 0.95 & 21.67 & (46) \\ \hline 110.00 & (47) \\ \hline 0.02 & (51) \\ \hline 1.03 & (52) \\ \hline 0.60 & (53) \\ \hline 1.03 & (54) \\ \hline \end{array}$
Assumed occupancy, N Annual average hot water usage in litres per day Jan Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26 Energy content of hot water used = 4.18 x Vd,r 149.14 130.44 134.6 Distribution loss 0.15 x (45)m 22.37 19.57 20.19 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 (Volume factor from Table 2a Temperature factor from Table 2b Energy lost from water storage (kWh/day) Enter (50) or (54) in (55)	Apr Apr th Vd,m = factor 89.60 n x nm x Tm/360 1 117.35 17.60 WHRS storage w hown kWh/litre/day) (47) x (51) x (52)	(25 x N) + 3 May from Table 85.94 00 kWh/mo 112.60 16.89 within sam	36 Jun e 1c x (43) 82.29 82.29 8 onth (see Table) 97.17 9 14.58 1 e vessel	Jul Aug 2.29 85.94 les 1b, 1c 1d) 0.04 0.04 103.32 3.51 15.50	Sep 89.60 104.56 15.68	Oct Ν 93.26 96 Σ(44)112 = 121.85 13 Σ(45)112 = 18.28 19	$\begin{array}{c c} 2.41 & (42) \\ \hline 91.43 & (43) \\ \hline 0v & Dec \\ \hline 5.91 & 100.57 \\ \hline 1097.15 & (44) \\ \hline 3.01 & 144.44 \\ \hline 1438.53 & (45) \\ \hline 0.95 & 21.67 & (46) \\ \hline 110.00 & (47) \\ \hline 0.02 & (51) \\ \hline 1.03 & (52) \\ \hline 0.60 & (53) \\ \hline 1.03 & (54) \\ \hline 1.03 & (55) \\ \hline \end{array}$
Assumed occupancy, N Annual average hot water usage in litres per day Jan Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26 Energy content of hot water used = 4.18 x Vd,r 149.14 130.44 134.6 Distribution loss 0.15 x (45)m 22.37 19.57 20.19 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 (Volume factor from Table 2a Temperature factor from Table 2b Energy lost from water storage (kWh/day) Enter (50) or (54) in (55) Water storage loss calculated for each month	ay Vd,average = (Apr th Vd,m = factor 89.60 n x nm x Tm/360 1 117.35 1 117.35 1 17.60 /WHRS storage v hown kWh/litre/day) (47) x (51) x (52) (55) x (41)m	(25 x N) + 3 May from Table 85.94 00 kWh/mo 112.60 16.89 within sam	36 Jun e 1c x (43) 82.29 82.29 8. onth (see Table 97.17 90 14.58 1. e vessel	Jul Aug 2.29 85.94 les 1b, 1c 1d) 0.04 0.04 103.32 3.51 15.50	Sep 89.60 104.56 15.68	Oct N 93.26 96 $\Sigma(44)112 =$ 13 121.85 13 $\Sigma(45)112 =$ 18 18.28 19	$\begin{array}{c c} 2.41 & (42) \\ \hline 91.43 & (43) \\ \hline 0v & Dec \\ \hline 5.91 & 100.57 \\ \hline 1097.15 & (44) \\ \hline 3.01 & 144.44 \\ \hline 1438.53 & (45) \\ \hline 0.95 & 21.67 & (46) \\ \hline 110.00 & (47) \\ \hline 0.02 & (51) \\ \hline 1.03 & (52) \\ \hline 0.60 & (53) \\ \hline 1.03 & (54) \\ \hline 1.03 & (55) \\ \hline \end{array}$
Assumed occupancy, N Annual average hot water usage in litres per day I an Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26 Energy content of hot water used = $4.18 \times Vd$,r 149.14 130.44 134.6 Distribution loss 0.15 x (45)m 22.37 19.57 20.19 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 20 Volume factor from Table 20 Temperature factor from Table 20 Energy lost from water storage (kWh/day) Enter (50) or (54) in (55) Water storage loss calculated for each month 32.01 28.92 32.01	ay Vd,average = (Apr th Vd,m = factor 89.60 n x nm x Tm/360 1 117.35 1 117.35 1 17.60 /WHRS storage w hown kWh/litre/day) (47) x (51) x (52) (55) x (41)m 30.98	(25 x N) + 3 May from Table 85.94 00 kWh/mo 112.60 16.89 within sam) x (53) 32.01	36 Jun e 1c x (43) 82.29 8. onth (see Table 97.17 9. 14.58 1. e vessel 30.98 3.	Jul Aug 2.29 85.94 les 1b, 1c 1d) 0.04 0.04 103.32 3.51 15.50 2.01 32.01	Sep 89.60 104.56 15.68 30.98	Oct N 93.26 96 $\zeta(44)112 =$ 13 121.85 13 $\zeta(45)112 =$ 13 18.28 19 18.28 19 32.01 30	$\begin{array}{c c c c c c c c c c c c c c c c c c c $
Assumed occupancy, N Annual average hot water usage in litres per day Jan Feb Mar Hot water usage in litres per day for each mon 100.57 96.91 93.26 Energy content of hot water used = $4.18 \times Vd$,r 149.14 130.44 134.6 Distribution loss $0.15 \times (45)m$ 22.37 19.57 20.19 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 Volume factor from Table 2a Temperature factor from Table 2b Energy lost from water storage (kWh/day) Enter (50) or (54) in (55) Water storage loss calculated for each month 32.01 28.92 32.01 If the vessel contains dedicated solar storage of	Apr Apr th Vd,m = factor 89.60 n x nm x Tm/360 1 117.35 117.60 WHRS storage v hown kWh/litre/day) (47) x (51) x (52) (55) x (41)m 30.98 r dedicated WW	(25 x N) + 3 May from Table 85.94 00 kWh/mo 112.60 16.89 within sam) x (53) 32.01 /HRS (56)m	36 Jun 81 82.29 8 97.17 9 14.58 1 e vessel 1 30.98 3 30.98 3 x [(47) - Vs] -	Jul Aug 2.29 85.94 2.29 85.94 des 1b, 1c 1d) 0.04 0.04 103.32 3.51 15.50 2.01 32.01 ÷ (47), else (56)	Sep 89.60 104.56 15.68 30.98	Oct N 93.26 96 $\Sigma(44)112 =$ 13 121.85 13 $\Sigma(45)112 =$ 13 18.28 19 18.28 19 32.01 30	$\begin{array}{c c c c c c c c c c c c c c c c c c c $

Primary circuit l	loss for each	month fro	om Table 3										
	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
Combi loss for e	each month	from Table	3a, 3b or 3	с									
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61
Total heat requi	ired for wat	er heating	calculated f	or each mo	onth 0.85 x	(45)m + (4	6)m + (57)r	n + (59)m +	- (61)m			1], ,
	204.42	180.37	180.88	170.85	167.88	150.66	1/15 22	158.60	158.05	177 12	186 50	100 72] (62)
			109.00		107.88	150.00	145.52	138.00	138.05	177.15	180.50	199.72] (02)
													7 (60)
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	63)
Output from wa	ater heater f	or each mo	onth (kWh/i	month) (62	2)m + (63)n 	n 							_
	204.42	180.37	189.88	170.85	167.88	150.66	145.32	158.60	158.05	177.13	186.50	199.72	
										∑(64)1	.12 = 2	.089.37	(64)
Heat gains from	n water heat	ing (kWh/r	nonth) 0.2	5 × [0.85 ×	(45)m + (61	L)m] + 0.8 >	(46)m + (57)m + (59)	m]				
	93.81	83.31	88.98	81.81	81.66	75.10	74.16	78.58	77.56	84.74	87.02	92.25	(65)
5. Internal gain	ns												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains	(Table 5)												
_	120.48	120.48	120.48	120.48	120.48	120.48	120.48	120.48	120.48	120.48	120.48	120.48] (66)
Lighting gains (c	alculated in	Annendix		19 or 19a)	also see Ta	able 5		1	,] (/
Eighting guing (c			12.01				7 1 2	0.26	12.42	15 70	10.40	10.64	
A 11 .	19.11	10.98	13.81	10.45	1.81		7.13	9.20	12.43	15.79	18.43	19.04] (67)
Appliance gains	(calculated	in Append	ix L, equatio	on L13 or L1	L3a), also s	ee Table 5	1						-
	213.71	215.92	210.33	198.44	183.42	169.31	159.88	157.66	163.25	175.14	190.16	204.28	(68)
Cooking gains (o	calculated ir	Appendix	L, equation	L15 or L15	a), also see	e Table 5							
	35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05	(69)
Pump and fan g	ains (Table	5a)											
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00] (70)
Losses e.g. evap	oration (Ta	ble 5)						•					_
0 1	-96 39	-96.39	-96 39	-96 39	-96 39	-96 39	-96 39	-96 39	-96 39	-96 39	-96 39	-96 39	7 (71)
Water beating o	Tains (Table	5)	50.55	50.55	50.55	50.55	50.55	50.55	50.55	50.55	50.55	50.55] (, -)
water neating a		5)	110 50	112.52	400 70	404.24	00.00	405.64	407.72	112.00	422.00	422.00	7 (70)
	126.09	123.98	119.59	113.63	109.76	104.31	99.68	105.61	107.72	113.89	120.86	123.99] (72)
lotal internal ga	ains (66)m -	+ (67)m + (68)m + (69)	m + (70)m ·	+ (71)m + (/2)m							_
	418.05	416.02	402.88	381.67	360.14	339.36	325.83	331.68	342.55	363.97	388.59	407.05	(73)
6 Solar gains													
					A	6-1	a f l		_			Caina	
			Access T Table	actor 6d	Area m ²	So V	ar flux V/m²	spec	g ific data	specific o	lata	W	
							•	or T	able 6b	or Table	6c		
NorthFast			0.7	7 X [14 12	□ x □ 1	1 28 x	09x (0 40 x	0.80		35 33] (75)
Solar gains in w	atts $\Sigma(74)m$	(82)m			1				<u> </u>	0.00] (, 5)
		74.04	400.57	242 70	205.02	224.04	205.20	227.44	457.00	07.00		20.05	
	35.33	/1.91	129.57	212.79	286.03	304.94	285.26	227.41	157.88	87.89	44.45	28.85] (83)
Total gains - inte	ernal and sc	lar (73)m +	+ (83)m				1		1				-
	453.38	487.94	532.45	594.45	646.17	644.29	611.09	559.09	500.43	451.86	433.05	435.90	(84)
7 Magazinter	aal terrerere	turo (heati											
7. Wean interr	nal tempera	ture (neat	ing season)										
Temperature du	uring heatin	g periods i	n the living a	area from T	able 9, Th	L(°C)						21.00	(85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	or for gains f	or living ar	ea n1,m (se	e Table 9a)									
	1.00	1.00	0.98	0.93	0.77	0.55	0.40	0.46	0.74	0.96	0.99	1.00	(86)
Mean internal t	emp of livin	g area T1 (steps 3 to 7	in Table 90	c)								

	20.36	20.45	20.62	20.84	20.97	21.00	21.00	21.00	20.98	20.80	20.54	20.33	(87)
Temperature du	ring heating	g periods ir	n the rest of	f dwelling f	rom Table !	9, Th2(°C)		•					-
	20.32	20.32	20.32	20.32	20.32	20.32	20.32	20.32	20.32	20.32	20.32	20.32	(88)
Utilisation factor	r for gains f	or rest of d	welling n2.	m] (/
	1.00	0.99	0.98	0.91	0.72	0.50	0.34	0.39	0.68	0.95	0.99	1.00	(89)
Mean internal te	emperature	in the rest	of dwelling	g T2 (follow	v steps 3 to	7 in Table 9) Ac)] (/
	19.46	19 59	19.83	20.13	20.29	20.32	20.32	20.32	20.30	20.09	19 72	19.42] (90)
Living area fracti	ion	19.99	19.00	20.15	20.23	20.52	20.32	20.52	1 20.00	ving area ÷	(4) =	0.34] (91)
Mean internal te	emperature	for the wh	ole dwellin	g fl A x T1 -	+(1 - fl A) x [·]	т2				ing area i	(')	0.01] (31)
	19.76	19.88	20.10	20.37	20.52	20.55	20.55	20.55	20.53	20.33	10 00	19.72] (92)
Annly adjustmer	t to the me	an interna	l temperati	ure from Ta	hle 4e whe	ere annronr	iate	20.55	20.55	20.55	15.55	15.72] (52)
	19.76	10.88	20.10	20.37	20.52	20.55	20.55	20.55	20.53	20.33	10.00	10.72] (03)
	19.70	19.00	20.10	20.37	20.32	20.33	20.33	20.55	20.33	20.33	19.99	19.72] (53)
8. Space heatin	ng requirem	ient											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor	r for gains,	ηm											
	1.00	0.99	0.98	0.91	0.74	0.52	0.36	0.42	0.70	0.95	0.99	1.00	(94)
Useful gains, ηm	iGm, W (94	l)m x (84)m	1										
	451.57	484.18	520.49	542.18	476.17	331.94	221.13	232.19	350.86	427.51	429.04	434.58	(95)
Monthly average	e external t	emperatur	e from Tabl	le U1									-
	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate fo	r mean inte	ernal tempe	erature, Lm	, W [(39)m	n x [(93)m -	(96)m]				•			-
	866.52	839.33	761.92	642.55	494.08	333.17	221.20	232.40	360.40	545.36	722.62	869.93	(97)
Space heating re	equirement,	, kWh/mon	1th 0.024 x	[(97)m - (9	5)m] x (41)	m					•		
	308.73	238.66	179.62	72.26	13.33	0.00	0.00	0.00	0.00	87.67	211.38	323.90	7
									Σ(9	8)15, 10	.12 =	1435.55	_] (98)
Space heating re	equirement	kWh/m²/y	ear							(98)	÷ (4)	18.57	(99)
						_							_
9b. Energy requ	uirements -	communi	ty heating s	scheme									
Fraction of space	e heat from	secondary	/suppleme	ntary syste	m (table 11	1)				'0' if ı	none	0.00	(301)
Fraction of space	e heat from	communit	y system							1 - (30	01) =	1.00	(302)
Fraction of com	munity heat	from boile	ers									0.25] (303a)
Fraction of com	munity heat	from CHP										0.75] (303b)
Fraction of total	space heat	from com	munity CHP							(302) x (30	3a) =	0.75	(304a)
Fraction of total	space heat	from com	munity boil	ers						(302) x (303	3b) =	0.25	(304b)
Factor for contro	ol and charg	ging metho	d (Table 4c	(3)) for con	nmunity spa	ace heating						1.00	(305)
Factor for chargi	ing method	(Table 4c(3)) for com	munity wat	er heating							1.00] (305a)
Distribution loss	factor (Tab	le 12c) for	community	/ heating sy	vstem							1.05	(306)
Space heating													
Annual space he	ating requi	rement						1	L435.55]			(98)
Space heat from	СНР							(93	8) x (304a)	x (305) x (30	06) =	1130.50] (307a)
Space heat from	boilers							(98	8) x (304b)	x (305) x (30	06) =	376.83	_] (307b)
													-
Water heating													
Annual water he	ating requi	rement							2089.37]			(64)
Water heat from	n CHP							(64) x (303a) x	– (305a) x (30	06) =	1645.38	(310a)
Water heat from	n boilers							(64)) x (303b) x	(305a) x (30	06) =	548.46] (310b)
									. ,				

Electricity used for heat distribution		0.01 × [(307a)(307e) + (3	10a)(310e)] = [37.01	(313)
Electricity for pumps, fans and electric keep-hot (Table 4f)					
mechanical ventilation fans - balanced, extract or positive inp	out from outside	52.10			(330a)
Total electricity for the above, kWh/year			[52.10	(331)
Electricity for lighting (Appendix L)			[337.53	(332)
Total delivered energy for all uses	(307) + (309) + (31	0) + (312) + (315) + (331) +	(332)(337b) =	4090.81	(338)
10b. Fuel costs - community heating scheme					
	Fuel kWh/year	Fuel price		Fuel cost £/year	
Space heating from CHP	1130.50	x 2.97	x 0.01 =	33.58	(340a)
Space heating from boilers	376.83	x 4.24	x 0.01 =	15.98	(340b)
Water heating from CHP	1645.38	x 2.97	x 0.01 =	48.87	(342a)
Water heating from boilers	548.46	x <u>4 24</u>	x 0.01 =	23.25	(342h)
Pumps and fans	52 10	x 13.19	x 0.01 =	6.87] (3420)] (349)
Electricity for lighting	337 53	x 13.19	x 0.01 =	44 52	(350)
Additional standing charges		X 13.15	x 0.01 = [120.00	(351)
Total energy cost		(340a)(342e) +	· (345)(354) = [293.07	(355)
с,			. , . , [
11b. SAP rating - community heating scheme			ſ		٦
Energy cost deflator (Table 12)			l	0.42] (356) -
Energy cost factor (ECF)				1.01	357)
SAP value				85.96	
SAP rating (section 13)				86	(358)
SAP band				В	
12b. CO ₂ emissions - community heating scheme					
12b. CO ₂ emissions - community heating scheme	Energy	Emission factor		Emissions	
12b. CO ₂ emissions - community heating scheme	Energy kWh/year	Emission factor		Emissions (kg/year)	
12b. CO₂ emissions - community heating scheme Emissions from community CHP (space and water heating)	Energy kWh/year	Emission factor		Emissions (kg/year)	
12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit	Energy kWh/year	Emission factor		Emissions (kg/year)	(361)
12b. CO₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit	Energy kWh/year 28.09 66.01	Emission factor		Emissions (kg/year)	(361) (362)
12b. CO2 emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) =	Energy kWh/year	Emission factor	= [Emissions (kg/year) 369.9226	(361) (362)] (363)
12b. CO₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP Iess credit emissions for electricity	Energy kWh/year 28.09 66.01 1712.6044 -481.0629	Emission factorx0.2160x0.5190	= [= [Emissions (kg/year) 369.9226 -249.6717	(361) (362)] (363)] (364)
12b. CO2 emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP Iess credit emissions for electricity Water heated by CHP	Energy kWh/year	Emission factor x 0.2160 x 0.5190 x 0.2160	= [= [= [Emissions (kg/year) 369.9226 -249.6717 538.4027	(361) (362)] (363)] (364)] (365)
12b. CO ₂ emissions - community heating scheme <i>Emissions from community CHP (space and water heating)</i> Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity	Energy kWh/year 28.09 66.01 -700.1616	Emission factor x 0.2160 x 0.5190 x 0.2160 x 0.5190	= [= [= [Emissions (kg/year) 369.9226 -249.6717 538.4027 -363.3839	(361) (362)] (363)] (364)] (365)] (366)
12b. CO2 emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating)	Energy kWh/year 28.09 66.01 4712.6044 -481.0629 2492.6050 -700.1616	Emission factor x 0.2160 x 0.5190 x 0.2160 x 0.5190	= [= [= [Emissions (kg/year) 369.9226 -249.6717 538.4027 -363.3839	(361) (362)] (363)] (364)] (365)] (366)
12b. CO ₂ emissions - community heating scheme <i>Emissions from community CHP (space and water heating)</i> Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers	Energy kWh/year 28.09 66.01 1712.6044 -481.0629 2492.6050 -700.1616	Emission factor x 0.2160 x 0.5190 x 0.2160 x 0.5190	= [= [= [Emissions (kg/year) 369.9226 -249.6717 538.4027 -363.3839	(361) (362)] (363)] (364)] (365)] (366) (367b)
12b. CO2 emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers	Energy kWh/year 28.09 66.01 1712.6044 -481.0629 2492.6050 -700.1616 94.00 984.35	Emission factor x 0.2160 x 0.5190 x 0.2160 x 0.5190 x 0.5190 x 0.2160 x 0.2160	= [= [= [= [Emissions (kg/year) 369.9226 -249.6717 538.4027 -363.3839 212.62	(361) (362)] (363)] (364)] (365)] (366) (367b)] (368)
12b. CO2 emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers Electrical energy for community heat distribution	Energy kWh/year 28.09 66.01 1712.6044 -481.0629 2492.6050 -700.1616 94.00 94.00 984.35 37.01	Emission factor x 0.2160 x 0.5190 x 0.2160 x 0.5190 x 0.5190 x 0.5190 x 0.5190	= [= [= [= [= [Emissions (kg/year) 369.9226 -249.6717 538.4027 -363.3839 212.62 19.21	(361) (362) (363) (364) (365) (366) (366) (367b) (368) (372)
12b. CO2 emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers Icor energy for community heat distribution Total CO2 associated with community systems	Energy kWh/year 28.09 66.01 1712.6044 -481.0629 2492.6050 -700.1616 94.00 984.35 37.01	Emission factor x 0.2160 x 0.5190 x 0.2160 x 0.5190 x 0.5190 x 0.5190 x 0.5190	= [= [= [= [= [Emissions (kg/year) 369.9226 -249.6717 538.4027 -363.3839 212.62 19.21 527.10	(361) (362) (363) (364) (365) (366) (367b) (368) (372) (373)
12b. CO2 emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers CO2 emissions from boilers CO2 associated with community systems Total CO2 associated with space and water heating	Energy kWh/year 28.09 66.01 1712.6044 -481.0629 2492.6050 -700.1616 94.00 = 984.35 37.01	Emission factor x 0.2160 x 0.5190 x 0.2160 x 0.5190 x 0.5190 x 0.5190 x 0.5190	= [= [= [= [_	Emissions (kg/year) 369.9226 -249.6717 538.4027 -363.3839 212.62 19.21 527.10	(361) (362) (363) (364) (365) (366) (367b) (368) (372) (373) (373)
12b. CO2 emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers CO2 emissions from boilers Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans	Energy kWh/year 28.09 66.01 1712.6044 -481.0629 2492.6050 -700.1616 94.00 984.35 37.01	Emission factor x 0.2160 x 0.5190 x 0.2160 x 0.5190	= [= [= [= [= [= [Emissions (kg/year) 369.9226 -249.6717 538.4027 -363.3839 212.62 19.21 527.10 527.10 27.04	(361) (362) (363) (364) (365) (366) (367b) (368) (372) (373) (373) (376) (378)
12b. CO2 emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers CO2 emissions from boilers CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting	Energy kWh/year 28.09 66.01 1712.6044 -481.0629 2492.6050 -700.1616 94.00 94.00 984.35 37.01 52.10 337.53	Emission factor x 0.2160 x 0.5190 x 0.2160 x 0.5190 x 0.52 x 0.52	= [= [= [= [= [= [= [Emissions (kg/year) 369.9226 -249.6717 538.4027 -363.3839 212.62 19.21 527.10 527.10 527.10 27.04 175.18	(361) (362) (363) (364) (365) (366) (367b) (368) (372) (373) (376) (378) (379)
12b. CO2 emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers CO2 emissions from boilers Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting Total CO2, kg/year	Energy kWh/year 28.09 66.01 1712.6044 -481.0629 2492.6050 -700.1616 94.00 984.35 37.01 52.10 337.53	x 0.2160 x 0.5190 x 0.2160 x 0.5190 x 0.52 x 0.52 x 0.52	= [= [= [= [= [= [(376)(382) = [Emissions (kg/year) 369.9226 -249.6717 538.4027 -363.3839 212.62 19.21 527.10 527.10 527.10 27.04 175.18 729.32	(361) (362) (363) (364) (365) (366) (368) (372) (373) (373) (376) (378) (379) (383)
12b. CO2 emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers CO2 emissions from boilers CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting Total CO2, kg/year Dwelling CO2 emission rate	Energy kWh/year 28.09 66.01 1712.6044 -481.0629 2492.6050 -700.1616 94.00 94.00 984.35 37.01 52.10 337.53	Emission factor x 0.2160 x 0.5190 x 0.2160 x 0.5190 x 0.52 x 0.52	= [= [= [= [= [= [(376)(382) = [(383) ÷ (4) = [Emissions (kg/year) 369.9226 -249.6717 538.4027 -363.3839 212.62 19.21 527.10 527.10 527.10 527.10 27.04 175.18 729.32 9.43	(361) (362) (363) (364) (365) (366) (367b) (368) (372) (373) (377) (377) (378) (379) (383) (384)
12b. CO2 emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting Total CO2, kg/year Dwelling CO2 emission rate El value	Energy kWh/year 28.09 66.01 1712.6044 -481.0629 2492.6050 -700.1616 94.00 984.35 37.01 52.10 337.53	x 0.2160 x 0.5190 x 0.2160 x 0.5190 x 0.52 x 0.52 x 0.52	= [= [= [= [= [[= [(376)(382) = [(383) ÷ (4) = [Emissions (kg/year) 369.9226 -249.6717 538.4027 -363.3839 212.62 19.21 527.10 527.10 527.10 527.10 27.04 175.18 729.32 9.43 92.01	(361) (362) (363) (364) (365) (366) (368) (372) (373) (373) (373) (378) (378) (379) (383) (384)
12b. CO2 emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with 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 28.09 66.01 1712.6044 -481.0629 2492.6050 -700.1616 94.00 984.35 37.01 52.10 337.53	Emission factor x 0.2160 x 0.5190 x 0.2160 x 0.5190 x 0.52 x 0.52	= [= [= [= [= [(376)(382) = [(383) ÷ (4) = [Emissions (kg/year) 369.9226 -249.6717 538.4027 -363.3839 212.62 19.21 527.10 527.10 527.10 527.10 527.10 27.04 175.18 729.32 9.43 92.01	(361) (362) (363) (364) (365) (366) (368) (372) (373) (377) (378) (379) (379) (383) (384) (385)
12b. CO2 emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers CO2 emissions from boilers CO2 emissions from boilers Total CO2 associated with community systems Total CO2 associated with 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	Energy kWh/year 28.09 66.01 1712.6044 -481.0629 2492.6050 -700.1616 94.00 984.35 37.01 52.10 337.53	x 0.2160 x 0.5190 x 0.2160 x 0.5190 x 0.52 x 0.52 x 0.52	= [= [= [= [= [[= [(376)(382) = [(383) ÷ (4) = [[[Emissions (kg/year) 369.9226 -249.6717 538.4027 -363.3839 212.62 19.21 527.10 527.10 527.10 527.10 527.10 27.04 175.18 729.32 9.43 92.01 92 A	(361) (362) (363) (364) (365) (366) (368) (373) (373) (373) (373) (378) (378) (378) (383) (384) (385)

13b. Primary energy - comm	unity heating scheme						
		Energy kWh/year		Primary factor		Primary energy (kWh/year)	,
Primary Energy from communi	ity CHP (space and water heating)						
Power efficiency of CHP unit		28.09					(361)
Heat efficiency of CHP unit		66.01					(362)
Space heating from CHP	(307a) × 100 ÷ (362) =	1712.60	x	1.22	=	2089.38	(363)
less credit energy for electr	icity	-481.06	x	3.07	=	-1476.86	(364)
Water heated by CHP		2492.60	x	1.22	=	3040.98	(365)
less credit energy for electricity	у	-700.16	x	3.07	=	-2149.50	(366)
Primary energy from other sou	irces (space heating)						
Efficiency of boilers		94.00					(367b)
Primary energy from boilers	[(307b)+(310b)] x 100 ÷ (367b) =	984.35	x	1.22	=	1200.91	(368)
Electrical energy for communit	y heat distribution	37.01	x	3.07	=	113.63	(372)
Total primary energy associate	d with community systems					2818.53	(373)
Total primary energy associate	d with space and water heating					2818.53	(376)
Pumps and fans		52.10	x	3.07	=	159.96	(378)
Electricity for lighting		337.53	x	3.07	=	1036.22	(379)
Primary energy kWh/year						4014.71	(383)
Dwelling primary energy rate k	:Wh/m2/year					51.94	(384)



Assessor name		Miss Jayr	na Parmar						Assessor nur	nber	6549		
Client									ast modified	d	23/11,	/2016	
Address		A-L06-73	A Centric (Close, Lond	on, N8								
1. Overall dwellin	g dimens	sions											
					А	rea (m²)		Av	erage storey height (m)	i	Vo	lume (m³)	
Lowest occupied						72.32	<mark>](1a)</mark> x		2.50	(2a) =		180.80	(3a)
Total floor area		(1a)	+ (1b) + (1	c) + (1d)(1n) =	72.32	(4)						
Dwelling volume								(3	a) + (3b) + (3	3c) + (3d)(3	sn) =	180.80	(5)
2. Ventilation rate	e									_			
											m³	per hour	
Number of chimner	vc								0	×40 =		0	(62)
Number of open fl	y5								0] (6b)
Number of intermi	ttont fan	c							0] (00)] (7a)
Number of meeting	vonte	3							0	10 - 10 - 10 - 10 - 10 - 10 - 10 - 10] (78)
Number of fluoloss	and fires								0	× 10 -] (7c)
Number of fideless	gas mes	•							0	X40 -	Airc	banges ne	_ (/C) r
												hour	
Infiltration due to o	chimneys	, flues, fans	s, PSVs		(6a)	+ (6b) + (7	a) + (7b) + (7c) =	0	÷ (5) =	:	0.00	(8)
If a pressurisation	test has b	been carried	d out or is i	ntended, pl	roceed to (17), otherw	ise continu/	e from (9) to (16)				
Air permeability va	lue, q50,	expressed	in cubic m	etres per h	our per squ	uare metre	of envelope	e area				4.00	(17)
If based on air perr	neability	value, ther	n (18) = [(17	7) ÷ 20] + (8	3), otherwi	se (18) = (1	6)					0.20	(18)
Number of sides or	n which t	he dwelling	g is sheltere	ed								2	(19)
Shelter factor									1	- [0.075 x (1	9)] =	0.85	(20)
Infiltration rate inc	orporatir	ng shelter fa	actor							(18) x (2	20) =	0.17	(21)
Infiltration rate mo	dified fo	r monthly v	wind speed	:									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average w	vind spee	d from Tab	le U2										
	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22)m	÷4												
	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
Adjusted infiltratio	n rate (al	llowing for	shelter and	I wind facto	or) (21) x (2	22a)m							_
	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.20	(22b)
Calculate effective	air chang	ge rate for t	the applica	ble case:									_
If mechanical ve	entilation	1: air chang	e rate throu	ugh system								0.50	(23a)
If balanced with	heat red	covery: effi	ciency in %	allowing fo	or in-use fa	ctor from T	able 4h					N/A	(23c)
c) whole house	extract v	entilation o	or positive i	input venti	lation from	outside	1	1					-
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(24c)
Effective air change	e rate - e	nter (24a) o	or (24b) or	(24c) or (24	ld) in (25)			1					7
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(25)



	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)
Primary circuit le	oss for each	month fro	m Table 3										
	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
Combi loss for e	ach month	from Table	3a, 3b or 3	C		•			•				
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
Total heat requi	red for wate	er heating o	alculated for	or each mo	nth 0.85 x	(45)m + (4	6)m + (57)n	n + (59)m +	⊦ (61)m			·	
	200.22	176.69	186.09	167.54	164.70	147.92	142.78	155.69	155.10	173.69	182.75	195.64	(62)
Solar DHW inpu	t calculated	using Appe	endix G or A	opendix 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	nth (kWh/r	nonth) (62	2 m + (63) m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.00)
		176.60	196.00	167 54	164 70	147.02	1/2 79	155 60	155 10	172.60	102.75	105.64	
	200.22	170.09	180.09	107.54	104.70	147.92	142.70	133.09	155.10	5(64)1	102.75	049.92	
lloat gains from	water beat	ing (WMb/n	oonth) 0.25		(4E) m + (61	\ml + 0.9 v	[(46) - (1	7)		2(64)1	12 =	048.82	,64)
Heat gains from	water neat			00.74		.)m] + 0.8 ×	[(40)11 + (3	57)m + (59)		02.50	05 77		
	92.41	82.09	87.72	80.71	80.61	74.19	73.32	//.61	76.58	83.59	85.77	90.89	,65)
5. Internal gair	ıs												
	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains	(Table 5)				,								
Sector Banno	115.06	115.06	115.06	115.06	115.06	115.06	115.06	115.06	115.06	115.06	115.06	115.06	(66)
Lighting gains (c	alculated in	Annendix	equation	115.00		hle 5	115.00	115.00	115.00	115.00	115.00	115.00	.00)
						6 22	6 74	0 76	11 75	14.02	17.40	19 57	(67)
Appliance gains	(calculated	in Annondi		9.00	7.59	0.25	0.74	0.70	11.75	14.92	17.42	10.57	.07)
Appliance gains							454.64	4 4 9 5 9	454.00	166.00	400.00		(60)
	202.65	204.75	199.45	188.17	173.93	160.55	151.61	149.50	154.80	166.08	180.32	193.71	,68)
COOKING gains (C	alculated in	Appendix	L, equation	L15 or L15	a), also see	Table 5							
	34.51	34.51	34.51	34.51	34.51	34.51	34.51	34.51	34.51	34.51	34.51	34.51	(69)
Pump and fan ga	ains (Table S	5a)											
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
Losses e.g. evap	oration (Tal	ole 5)											
	-92.04	-92.04	-92.04	-92.04	-92.04	-92.04	-92.04	-92.04	-92.04	-92.04	-92.04	-92.04	(71)
Water heating g	ains (Table	5)											
	124.21	122.16	117.90	112.10	108.34	103.04	98.54	104.31	106.36	112.36	119.13	122.17	(72)
Total internal ga	iins (66)m +	- (67)m + (6	8)m + (69)r	m + (70)m ·	+ (71)m + (7	72)m							
	402.45	400.48	387.92	367.67	347.18	327.34	314.40	320.09	330.43	350.88	374.39	391.96	(73)
C. Color action													
6. Solar gains						6-1			_			C alina	
			Access T Table	actor 6d	Area m²	- 501 W	ar flux //m²	spec	g ific data	FF specific d	lata	Gains	
								or T	able 6b	or Table	6c		
SouthWest			0.77	7 x	21.34	x 3	6.79 x	0.9 x 🚺	0.40 x	0.80	=	174.12	(79)
Solar gains in wa	atts ∑(74)m	(82)m											
	174.12	296.59	405.81	502.82	563.20	559.13	539.06	494.01	439.41	327.80	208.56	149.01	(83)
Total gains - inte	ernal and so	lar (73)m +	(83)m			I						·	
0 - 10	576.57	697.07	793.73	870.49	910.38	886.47	853.46	814.10	769.84	678.68	582.95	540.97	(84)
				0.0.10	220.00		000.10			0.0.00			1
7. Mean intern	al tempera	ture (heati	ng season)										
Temperature du	iring heating	g periods in	the living a	irea from T	able 9, Th1	.(°C)						21.00	(85)
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains f	or living are	ea n1,m (see	e Table 9a)									
	0.99	0.98	0.94	0.86	0.71	0.53	0.38	0.42	0.64	0.90	0.98	0.99	(86)
		-			-								

SAP version 9.92

Mean internal te	emp of livin	g area T1 (steps 3 to 7	in Table 9c	c)								
	20.10	20.31	20.56	20.80	20.94	20.99	21.00	21.00	20.97	20.78	20.38	20.05	(87)
Temperature du	iring heatin	g periods ir	n the rest of	dwelling fi	rom Table	9, Th2(°C)							
	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	(88)
Utilisation facto	r for gains f	or rest of d	lwelling n2,r	n									-
	0.99	0.97	0.93	0.83	0.66	0.46	0.30	0.33	0.57	0.86	0.97	0.99	(89)
Mean internal te	emperature	in the rest	of dwelling	T2 (follow	, steps 3 to	7 in Table	9c)	1	•				1
	18.88	19.17	19.52	19.83	20.00	20.05	20.06	20.05	20.04	19.82	19.28	18.80] (90)
Living area fract	ion								1	ving area ÷ (4) =	0.28) (91)
Mean internal te	emperature	for the wh	ole dwellin	σ fI Δ x T1 +	⊦(1 - fl A) x	т2				ing area i (.,	0.20] (31)
	10.22		10.81	20.10	20.27	20.31	20.32	20.32	20.30	20.09	10 50	10 15] (02)
Apply adjustme	15.22			20.10	20.27	20.31	20.32	20.32	20.30	20.09	19.39	19.15] (92)
Apply adjustmen] (22)
	19.22	19.49	19.81	20.10	20.27	20.31	20.32	20.32	20.30	20.09	19.59	19.15] (93)
8. Space heatir	ng requirem	hent											
	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains	nm			,								
			0.02	0.85	0.67	0.48	0.22	0.26	0.50	0.86	0.07	0.00] (04)
Licoful gains pr	0.99	1 0.97	0.92	0.85	0.07	0.48	0.33	0.30	0.39	0.80	0.97	0.99] (54)
Oserui gains, nn		F) III X (84) II		724.00	600.00	422.70	077.54	1 202 42	454.25] (05)
	568.96	674.14	/33.11	/21.36	609.30	422.79	277.51	292.12	451.35	586.05	565.51	535.68] (95)
Monthly average	e external t	emperatur	e from Table	e U1						,			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	J (96)
Heat loss rate fo	or mean inte	ernal tempe	erature, Lm,	W [(39)m	n x [(93)m -	- (96)m]				· · · · ·			-
	1114.76	1090.08	994.43	837.06	639.95	426.85	277.91	292.81	463.18	708.87	932.96	1116.77	(97)
Space heating re	equirement	, kWh/mor	1th 0.024 x	[(97)m - (9	5)m] x (41)m							_
	406.07	279.51	194.42	83.30	22.81	0.00	0.00	0.00	0.00	91.38	264.56	432.33]
									∑(9)	8)15, 10	12 =	1774.40	(98)
Space heating re	equirement	kWh/m²/y	ear							(98) ÷	+ (4)	24.54] (99)
			tu hooting c	chorac									
SD. Energy req	uirements ·	communi	ty neating s	cheme		4)				101 :f		0.00	
Fraction of space	e neat from	secondary	//supplemer	itary system	m (table 1	1)				0° if n	one	0.00] (301)
Fraction of space	e heat from	communit	ty system							1 - (30	1) = [1.00] (302)] (see 1
Fraction of com	munity heat	t from boile	ers									0.25] (303a) 1
Fraction of com	munity hea	t from CHP										0.75] (303b)
Fraction of total	space heat	from com	munity CHP							(302) x (303	a) =	0.75	(304a)
Fraction of total	space heat	from com	munity boile	ers						(302) x (303	b) =	0.25	(304b)
Factor for contro	ol and char	ging metho	d (Table 4c(3)) for com	nmunity sp	ace heating	B					1.00	(305)
Factor for charg	ing method	(Table 4c	3)) for comm	nunity wat	er heating							1.00	(305a)
Distribution loss	factor (Tab	ole 12c) for	community	heating sy	vstem							1.05	(306)
Space heating													
Annual space he	eating requi	rement						1	1774.40]			(98)
Space heat from	n CHP							(9)	8) x (304a)	– x (305) x (30	6) =	1397.34	(307a)
Space heat from	n boilers							(98	8) x (304b)	x (305) x (30	6) =	465.78	(307b)
								(0)	, (-)	, _,,	·] (= -/
Water heating													
Annual water be	ating requi	irement							2048 82	1			(64)
Water heat from	o CHD	· ciriciit						164) v (202 <u>~) v</u>		6) -	1612 //	(210-)
vvater nedt non								(04	, A (303d) X	(303a) X (30	- <u> </u>	1013.44	

Water heat from boilers			(64) x (303b) x (305a) x (306) =	537.81] (310b)
Electricity used for heat distribution		0.01 × [(307a)(307e) + (3	10a)(310e)] =	40.14	(313)
Electricity for pumps, fans and electric keep-hot (Table 4f)						
mechanical ventilation fans - balanced, extract or positive input	t from outside		45.88			(330a)
Total electricity for the above, kWh/year					45.88	(331)
Electricity for lighting (Appendix L)					319.06	(332)
Total delivered energy for all uses	(307) + (309) +	+ (310) + (312)	+ (315) + (331) +	(332)(337b) =	4379.32	(338)
10b. Fuel costs - community heating scheme						
	Fuel		Fuel price		Fuel	
	kWh/year				cost £/year	
Space heating from CHP	1397.34	х	2.97	x 0.01 =	41.50] (340a)
Space heating from boilers	465.78	x	4.24	x 0.01 =	19.75] (340b)
Water heating from CHP	1613.44	x	2.97	x 0.01 =	47.92] (342a)
Water heating from boilers	537.81	x	4.24	x 0.01 =	22.80	(342b)
Pumps and fans	45.88	x	13.19	x 0.01 =	6.05	(349)
Electricity for lighting	319.06	x	13.19	x 0.01 =	42.08	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)(342e) +	- (345)(354) =	300.11	(355)
11b. SAP rating - community heating scheme						
Energy cost deflator (Table 12)					0.42	(356)
Energy cost factor (ECF)					1.07] (357)
SAP value					85.01]
SAP rating (section 13)					85	」](358)
SAP band					В	7
SAP band					В]
SAP band 12b. CO ₂ emissions - community heating scheme					В	
SAP band 12b. CO ₂ emissions - community heating scheme	Energy kWh/year		Emission factor		B Emissions (kg/year)	
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating)	Energy kWh/year		Emission factor		B Emissions (kg/year)]
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit	Energy kWh/year 28.09		Emission factor		B Emissions (kg/year)	(361)
SAP band 12b. CO ₂ emissions - community heating scheme <i>Emissions from community CHP (space and water heating)</i> Power efficiency of CHP unit Heat efficiency of CHP unit	Energy kWh/year 28.09 66.01		Emission factor		B Emissions (kg/year)	(361) (362)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [Energy kWh/year 28.09 66.01 2116.8523	X	Emission factor	_	B Emissions (kg/year) 457.2401	(361) (362) (363)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity	Energy kWh/year 28.09 66.01 2116.8523 -594.6143	x	Emission factor	=	B Emissions (kg/year) 457.2401 -308.6048	(361) (362)](363)](364)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity [Water heated by CHP	Energy kWh/year 28.09 66.01 2116.8523 -594.6143 2444.2232	X X X	Emission factor 0.2160 0.5190 0.2160	= = =	B Emissions (kg/year) 457.2401 -308.6048 527.9522	(361) (362)] (363)] (364)] (365)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity	Energy kWh/year 28.09 66.01 2116.8523 -594.6143 2444.2232 -686.5713	X X X X X	Emission factor 0.2160 0.5190 0.2160 0.2160 0.5190 0.5	= = =	B Emissions (kg/year) 457.2401 -308.6048 527.9522 -356.3305	(361) (362)] (363)] (364)] (365)] (366)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating)	Energy kWh/year 28.09 66.01 2116.8523 -594.6143 2444.2232 -686.5713	x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190	= = = =	B Emissions (kg/year) 457.2401 -308.6048 527.9522 -356.3305	(361) (362)] (363)] (364)] (365)] (366)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers	Energy kWh/year 28.09 66.01 2116.8523 -594.6143 2444.2232 -686.5713	X X X X X	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5	= = = =	B Emissions (kg/year) 457.2401 -308.6048 527.9522 -356.3305	(361) (362)] (363)] (364)] (365)] (366) (367b)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Energy kWh/year 28.09 66.01 2116.8523 -594.6143 2444.2232 -686.5713 94.00 1067.65	x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.216	= = = =	B Emissions (kg/year) 457.2401 -308.6048 527.9522 -356.3305	(361) (362)] (363)] (364)] (365)] (366) (367b)] (368)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution	Energy kWh/year 28.09 66.01 2116.8523 -594.6143 2444.2232 -686.5713 94.00 1067.65 40.14	X X X X X X	Emission factor 0.2160 0.5190 0.2160 0.5190 0.52		B Emissions (kg/year) 457.2401 -308.6048 527.9522 -356.3305 230.61 20.83	(361) (362)] (363)] (364)] (365)] (366) (367b)] (368)] (372)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution [Total CO2 associated with community systems	Energy kWh/year 28.09 66.01 2116.8523 -594.6143 2444.2232 -686.5713 94.00 1067.65 40.14	x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.216 0.5190	= = = =	B Emissions (kg/year) 457.2401 -308.6048 527.9522 -356.3305 230.61 20.83 571.70	(361) (362)] (363)] (364)] (365)] (366) (367b)] (368)] (372)] (373)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating	Energy kWh/year 28.09 66.01 2116.8523 -594.6143 2444.2232 -686.5713 94.00 1067.65 40.14	X X X X X X X	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5190 0.5190 0.5190		B Emissions (kg/year) 457.2401 -308.6048 527.9522 -356.3305 230.61 20.83 571.70 571.70	(361) (362)] (363)] (364)] (365)] (366) (367b)] (368)] (372)] (373)] (376)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans	Energy kWh/year 28.09 66.01 2116.8523 -594.6143 2444.2232 -686.5713 94.00 1067.65 40.14	x x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.216 0.52		В Emissions (kg/year) 457.2401 -308.6048 527.9522 -356.3305 230.61 20.83 571.70 571.70 23.81	(361) (362)] (363)] (364)] (365)] (366) (366)] (368)] (372)] (373)] (376)] (378)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting	Energy kWh/year 28.09 66.01 2116.8523 -594.6143 2444.2232 -686.5713 94.00 1067.65 40.14 45.88 319.06	x x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.216 0.5190		B Emissions (kg/year) 457.2401 -308.6048 527.9522 -356.3305 230.61 20.83 571.70 571.70 23.81 165.59	(361) (362)] (363)] (364)] (365)] (366)] (366)] (368)] (372)] (373)] (376)] (378)] (379)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting Total CO2, kg/year	Energy kWh/year 28.09 66.01 2116.8523 -594.6143 2444.2232 -686.5713 94.00 1067.65 40.14 45.88 319.06	x x x x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5190 0.5190 0.5190 0.52 0.52	= = = = = = = (376) (382) =	B Emissions (kg/year) 457.2401 -308.6048 527.9522 -356.3305 230.61 20.83 571.70 571.70 23.81 165.59 761 11	(361) (362)] (363)] (364)] (365)] (366) (366)] (368)] (372)] (372)] (373)] (376)] (378)] (379)] (383)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution Total CO2 associated with space and water heating Pumps and fans Electricity for lighting Total CO ₂ , kg/year Dwelling CO ₂ emission rate	Energy kWh/year 28.09 66.01 2116.8523 -594.6143 2444.2232 -686.5713 94.00 1067.65 40.14 45.88 319.06	x x x x x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5190 0.5190 0.5190 0.5190	= = = = = (376)(382) = (383) ÷ (4) =	B Emissions (kg/year) 457.2401 -308.6048 527.9522 -356.3305 230.61 20.83 571.70 571.70 23.81 165.59 761.11 10 52	(361) (362)] (363)] (364)] (365)] (366)] (366)] (368)] (372)] (373)] (373)] (376)] (378)] (379)] (383)] (384)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with 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 28.09 66.01 2116.8523 -594.6143 2444.2232 -686.5713 94.00 1067.65 40.14 45.88 319.06	x x x x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5190 0.5190 0.52 0.52	= = = = = (376)(382) = (383) ÷ (4) =	B Emissions (kg/year) 457.2401 -308.6048 527.9522 -356.3305 230.61 20.83 571.70 571.70 571.70 23.81 165.59 761.11 10.52 91.31	(361) (362) (363) (364) (365) (366) (366) (368) (372) (373) (373) (373) (378) (378) (379) (383) (384)
SAP band 12b. CO2 emissions - community heating scheme <i>Emissions from community CHP (space and water heating)</i> Power efficiency of CHP unit [Heat efficiency of CHP unit [Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity [Water heated by CHP [less credit emissions for electricity [Emissions from other sources (space heating) [Efficiency of boilers [CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution [Total CO2 associated with community systems [Total CO2 associated with 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 28.09 66.01 2116.8523 -594.6143 2444.2232 -686.5713 94.00 1067.65 40.14 45.88 319.06	x x x x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5190 0.5190 0.5190 0.5190	= = = = = (376)(382) = (383) ÷ (4) =	B Emissions (kg/year) 457.2401 -308.6048 527.9522 -356.3305 230.61 20.83 571.70 23.81 165.59 761.11 10.52 91.31 91	(361) (362)] (363)] (364)] (365)] (366)] (366)] (368)] (372)] (373)] (373)] (373)] (378)] (379)] (383)] (384)] (385)

13b. Primary energy - community	/ heating scheme						
		Energy kWh/year		Primary factor		Primary energy (kWh/year)	,
Primary Energy from community Cl	HP (space and water heating)						
Power efficiency of CHP unit		28.09					(361)
Heat efficiency of CHP unit		66.01					(362)
Space heating from CHP	(307a) × 100 ÷ (362) =	2116.85	x	1.22	=	2582.56	(363)
less credit energy for electricity		-594.61	x	3.07	=	-1825.47	(364)
Water heated by CHP		2444.22	x	1.22	=	2981.95	(365)
less credit energy for electricity		-686.57	x	3.07	=	-2107.77	(366)
Primary energy from other sources	s (space heating)						
Efficiency of boilers		94.00					(367b)
Primary energy from boilers [(3	807b)+(310b)] x 100 ÷ (367b) =	1067.65	x	1.22	=	1302.54	(368)
Electrical energy for community he	at distribution	40.14	x	3.07	=	123.24	(372)
Total primary energy associated wi	th community systems					3057.05	(373)
Total primary energy associated wi	th space and water heating					3057.05	(376)
Pumps and fans		45.88	x	3.07	=	140.85	(378)
Electricity for lighting		319.06	x	3.07	=	979.51	(379)
Primary energy kWh/year						4177.41	(383)
Dwelling primary energy rate kWh/	/m2/year					57.76	(384)



Assessor name		Miss Jayr	na Parmar						Assessor nur	nber	6549		
Client									Last modifie	d	23/11	/2016	
Address		B-L00-02	B Centric (Close, Lond	on, N8								
1. Overall dwellin	g dimens	sions											
					A	Area (m²)		Av	erage storey height (m)	1	Vo	lume (m³)	
Lowest occupied						95.27	(1a) x		2.50	(2a) =		238.18	(3a)
Total floor area		(1a)	+ (1b) + (1	c) + (1d)(1n) =	95.27	(4)						
Dwelling volume								(3	a) + (3b) + (3	3c) + (3d)(3	3n) =	238.18	(5)
2. Ventilation rate	e												
											m	³ per hour	
Number of chimne	vs								0	x 40 =		0	(6a)
Number of open flu	ues								0	x 20 =	: [0	(6b)
Number of intermi	ttent fan	s							0	x 10 =	: [0] (7a)
Number of passive	vents								0	x 10 =	: [0] (7b)
Number of flueless	gas fires								0	x 40 =	: [0] (7c)
	0										Air o	hanges per	r
Infiltration due to o	chimnevs	. flues. fan	s. PSVs		(6a) + (6b) + (7	'a) + (7b) + ((7c) =	0	÷ (5) =	-	0.00	(8)
If a pressurisation	test has k	, been carried	d out or is i	ntended, p	roceed to ((17), otherw	vise continu	e from (9) to (16)		L		
Air permeability va	lue, q50,	expressed	in cubic m	etres per h	our per sq	uare metre	of envelop	e area				4.00	(17)
If based on air perr	neability	value, ther	n (18) = [(17	7) ÷ 20] + (8	3), otherwi	ise (18) = (1	.6)					0.20	(18)
Number of sides or	n which t	he dwelling	g is sheltere	ed								2	(19)
Shelter factor									1	- [0.075 x (1	9)] =	0.85	(20)
Infiltration rate inc	orporatir	ng shelter f	actor							(18) x (2	20) =	0.17	(21)
Infiltration rate mo	dified fo	r monthly v	wind speed	:									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average w	vind spee	d from Tab	ole U2										
	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22)m	÷4												
	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
Adjusted infiltratio	n rate (al	llowing for	shelter and	l wind facto	or) (21) x (2	22a)m							
	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.20	(22b)
Calculate effective	air chang	ge rate for t	the applica	ble case:									_
If mechanical ve	entilation	air chang	e rate thro	ugh system								0.50	(23a)
If balanced with	n heat reo	covery: effi	ciency in %	allowing fo	or in-use fa	actor from T	Table 4h					N/A	(23c)
c) whole house	extract v	entilation o	or positive i	input venti	lation from	n outside							_
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(24c)
Effective air change	e rate - e	nter (24a) o	or (24b) or	(24c) or (24	1d) in (25)			<u> </u>					_
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(25)


3. Heat losses a	and heat los	ss paramet	er										
Element			a	Gross rea, m²	Openings m ²	Net A,	area m²	U-value W/m²K	A x U W	/К к-\ kJ,	/alue, /m².K	Ахк, kJ/K	
Window						27	.95 x	1.24	= 34.54				(27)
Ground floor						95	.27 x	0.20	= 19.05				(28a)
External wall						25	.22 x	0.18	= 4.54				(29a)
Party wall						63	.29 x	0.00	= 0.00				(32)
Total area of ext	ernal eleme	ents ∑A, m²				148	3.44						(31)
Fabric heat loss,	W/K = ∑(A	× U)							(26)(30) + (32) =	58.13	(33)
Heat capacity Cr	n = ∑(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	lculated us	ing Append	dix K								10.27	(36)
Total fabric heat	loss									(33) + (3	36) = 🗌	68.41	(37)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat	loss calcula	ted month	ly 0.33 x (2	25)m x (5)									
	39.30	39.30	39.30	39.30	39.30	39.30	39.30	39.30	39.30	39.30	39.30	39.30	(38)
Heat transfer co	efficient, W	/K (37)m +	(38)m										
	107.70	107.70	107.70	107.70	107.70	107.70	107.70	107.70	107.70	107.70	107.70	107.70]
Heat loss param	eter (HLP).	W/m²K (39))m ÷ (4)						Average = ∑	(39)112/	/12 =	107.70] (39)
·····	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	٦
		1.10	1.10	1.10		1110		1 1.10	Average = Σ	(40)112/	/12 =	1.13	」 │(40)
Number of days	in month (1	able 1a)								(•• ,,			
	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00] (40)
4. Water heating	ng energy r	equiremen	t										
Assumed occupa	ancy, N											2.69	(42)
Annual average	hot water u	sage in litre	es per day \	/d,average	= (25 x N) +	36						98.12	(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 = fact	or from Tab	le 1c x (43)						
	107.93	104.00	100.08	96.15	92.23	88.30	88.30	92.23	96.15	100.08	104.00	107.93]
Energy content	of hot wate	r used = 4 1	8 v Vd m v	nm v Tm/3	600 kWh/m	onth (see	Tables 1h	1c 1d)		∑(44)1	.12 =	1177.40] (44)
Energy content (160.05	120 08	144.45	125.94	120.84	104 27	96.63	110.88	112.20	130.76	1/2 7/	155.00	٦
	100.05	135.50	144.45	125.54	120.04	104.27	50.05	110.00	112.20	5(45)1	12 =	1543 75	_ ☐ (45)
Distribution loss	0.15 x (45)	m								2(43)1	.12	1343.75] (43)
	24.01	21.00	21.67	18.89	18.13	15.64	14.49	16.63	16.83	19.61	21.41	23.25	(46)
Storage volume	(litres) inclu	iding any so	olar or WW	HRS storag	e within san	ne vessel						110.00	(47)
Water storage lo	DSS:												
b) Manufacturer	's declared	loss factor	is not knov	vn									_
Hot water sto	orage loss fa	actor from	Table 2 (kW	/h/litre/day	/)							0.02	(51)
Volume facto	or from Tabl	e 2a										1.03	(52)
Temperature	factor fron	n Table 2b										0.60	(53)
Energy lost fr	rom water s	torage (kW	'h/day) (47	') x (51) x (5	52) x (53)							1.03	(54)
Enter (50) or (54) in (55)											1.03	(55)
Water storage lo	oss calculate	ed for each	month (55	5) x (41)m					-				_
	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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

	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01 (5	7)
Primary circuit l	oss for each	month fro	m Table 3										
	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26 (5	9)
Combi loss for e	ach month	from Table	3a. 3b or 3	с								(•	-,
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 (6	1)
Total heat requi	red for wat	or beating (o.oo	or each mo	0.00	$(45)m \pm (4)$	$6)m \pm (57)n$	0.00 n ± (59)m ±	(61)m	0.00	0.00	0.00 (0	-,
iotai neat requi										100.04	106.22	210.20 /6	2)
	215.33	189.91	199.73	179.43	176.12	157.77	151.90	166.16	165.70	186.04	196.23	210.28 (6	2)
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 (6	3)
Output from wa	ter heater f	or each mo	nth (kWh/ı	month) (62	2)m + (63)m	1							
	215.33	189.91	199.73	179.43	176.12	157.77	151.90	166.16	165.70	186.04	196.23	210.28	
										∑(64)1	12 = 2	194.59 <mark>(6</mark>	4)
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]				
	97.44	86.49	92.25	84.67	84.40	77.47	76.35	81.09	80.10	87.70	90.26	95.76 <mark>(6</mark>	5)
					-			·					
5. Internal gair	าร												
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains	(Table 5)												
	134.56	134.56	134.56	134.56	134.56	134.56	134.56	134.56	134.56	134.56	134.56	134.56 <mark>(6</mark>	6)
Lighting gains (c	alculated in	Appendix	., equation	L9 or L9a),	also see Ta	able 5							
	22.15	19.67	16.00	12.11	9.05	7.64	8.26	10.74	14.41	18.30	21.35	22.76 <mark>(6</mark>	7)
Appliance gains	(calculated	in Appendi	x L, equatio	on L13 or L1	L3a), also se	ee Table 5							
	248.45	251.02	244.53	230.70	213.24	196.83	185.87	183.29	189.79	203.62	221.08	237.48 (6	8)
Cooking gains (c	alculated in	Appendix	L, equation	L15 or L15	a), also see	Table 5						·	•
	36.46	36.46	36.46	36.46	36.46	36.46	36.46	36.46	36.46	36.46	36.46	36.46 (6	9)
Pump and fan g	ains (Table '	5a)	00110	00110	00110	00110		00110	00110	00110	00110		-1
			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 (7	0)
	oration (Tal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 (7	0)
Losses e.g. evap			107.05	107.65	107.05	407.05	107.65	107.05	107.05	107.05	407.05		a \
	-107.65	-107.65	-107.65	-107.65	-107.65	-107.65	-107.65	-107.65	-107.65	-107.65	-107.65	-107.65 (/	1)
Water heating g	ains (Table	5)							1				
	130.97	128.70	123.99	117.60	113.44	107.59	102.62	108.99	111.25	117.88	125.35	128.71 <mark>(7</mark>	2)
Total internal ga	ains (66)m -	+ (67)m + (6	8)m + (69)ı	m + (70)m -	+ (71)m + (7	72)m							
	464.93	462.77	447.89	423.77	399.10	375.43	360.12	366.38	378.82	403.16	431.15	452.33 <mark>(7</mark>	3)
6 Solar gains													
			Accors f	iactor	Aroo	Sal	or flux		~			Cainc	
			Table	6d	m ²	- 301 W	//m²	spec	в ific data	specific d	ata	W	
								or T	able 6b	or Table	6c		
SouthWest			0.7	7 X	27.95	x 3	6.79 x	0.9 x 0	0.40 x	0.80	=	228.06 (7	9)
Solar gains in wa	atts ∑(74)m	(82)m											
	228.06	388.46	531.51	658.57	737.65	732.32	706.03	647.03	575.51	429.33	273.16	195.17 (8	3)
Total gains - inte	ernal and so	lar (73)m +	(83)m									· · · ·	,
0	692.99	851.22	979 /10	1082.34	1136 75	1107 75	1066 15	1013 // 2	954 22	832 /10	704 21	647 50 /2	4)
	052.33	051.25	575.40	1002.34	1130.73	1107.75	1000.13	1013.42	554.55	052.45	,04.31	0) 017.50	9
7. Mean intern	al tempera	ture (heati	ng season)										
Temperature du	iring heatin	g periods ir	the living a	area from T	able 9, Th1	.(°C)						21.00 (8	5)
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains f	or living are	ea n1,m (se	e Table 9a)									
	1.00	0.99	0.96	0.90	0.78	0.60	0.44	0.48	0.72	0.93	0.99	1.00 (8	6)
	L								–			(0	

19.90 20.12 20.39 20.68 20.98 21.00 20.99 20.94 20.66 20.21 19.85 (87) Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)
Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)
19.98 19.98 19.98 19.98 19.98 19.98 19.98 19.98 19.98 19.98 19.98 19.98 19.98 19.98 19.98 (88)
Utilisation factor for gains for rest of dwelling n2.m
Magn internal temperature in the rest of dwalling T2 (follow stops 2 to 7 in Table 9s)
18.53 18.83 19.22 19.62 19.87 19.96 19.97 19.97 19.93 19.60 18.97 18.45 (90)
Living area fraction Living area \div (4) = 0.41 (91)
Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2
19.0919.3619.7020.0520.2920.3820.3920.3920.3520.0419.4819.02(92)
Apply adjustment to the mean internal temperature from Table 4e where appropriate
19.09 19.36 19.70 20.05 20.29 20.38 20.39 20.35 20.04 19.48 19.02 (93)
8. Space heating requirement
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Utilisation factor for gains, nm
0.99 0.98 0.95 0.88 0.74 0.55 0.38 0.42 0.67 0.91 0.98 0.99 (94)
Useful gains, ηmGm, W (94)m x (84)m
687.32 832.99 928.54 948.36 840.67 607.37 406.68 426.80 634.95 755.09 691.18 643.60 (95)
Monthly average external temperature from Table U1
4.30 4.90 6.50 8.90 11.70 14.60 16.60 16.40 14.10 10.60 7.10 4.20 (96)
Heat loss rate for mean internal temperature $\lim_{n \to \infty} W[(39)m \times [(93)m - (96)m]$
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
Space nearing requirement, kwn/month 0.024 x [(97)m - (95)m] x (41)m
673.93 486.79 367.03 182.03 62.67 0.00 0.00 0.00 194.46 462.26 708.92
$\Sigma(98)15, 1012 = 3138.08$ (98)
Space heating requirement kWh/m ² /year $(98) \div (4)$ 32.94 (99)
9b. Energy requirements - community heating scheme
Eraction of space heat from secondary/supplementary system (table 11)
Fraction of space heat from secondary supplementary system (table 11) $1/(201) = 1.00$ (302)
Fraction of space feat from community system $1 - (301) = 1.00$ (302)
Fraction of community heat from bollers
Fraction of community heat from CHP 0.75 (303b)
Fraction of total space heat from community CHP(302) x (303a) = 0.75(304a)
Fraction of total space heat from community CHP(302) x (303a) =0.75(304a)Fraction of total space heat from community boilers(302) x (303b) =0.25(304b)
Fraction of total space heat from community CHP(302) x (303a) =0.75(304a)Fraction of total space heat from community boilers(302) x (303b) =0.25(304b)Factor for control and charging method (Table 4c(3)) for community space heating1.00(305)
Fraction of total space heat from community CHP(302) x (303a) =0.75(304a)Fraction of total space heat from community boilers(302) x (303b) =0.25(304b)Factor for control and charging method (Table 4c(3)) for community space heating1.00(305)Factor for charging method (Table 4c(3)) for community water heating1.00(305a)
Fraction of total space heat from community CHP(302) x (303a) =0.75(304a)Fraction of total space heat from community boilers(302) x (303b) =0.25(304b)Factor for control and charging method (Table 4c(3)) for community space heating1.00(305)Factor for charging method (Table 4c(3)) for community water heating1.00(305a)Distribution loss factor (Table 12c) for community heating system1.05(306)
Fraction of total space heat from community CHP(302) x (303a) =0.75(304a)Fraction of total space heat from community boilers(302) x (303b) =0.25(304b)Factor for control and charging method (Table 4c(3)) for community space heating1.00(305)Factor for charging method (Table 4c(3)) for community water heating1.00(305a)Distribution loss factor (Table 12c) for community heating system1.05(306)
Fraction of total space heat from community CHP(302) x (303a) =0.75(304a)Fraction of total space heat from community boilers(302) x (303b) =0.25(304b)Factor for control and charging method (Table 4c(3)) for community space heating1.00(305)Factor for charging method (Table 4c(3)) for community water heating1.00(305a)Distribution loss factor (Table 12c) for community heating system1.05(306)
Fraction of total space heat from community CHP (302) x (303a) = 0.75 (304a) Fraction of total space heat from community boilers (302) x (303b) = 0.25 (304b) Factor for control and charging method (Table 4c(3)) for community space heating 1.00 (305) Factor for charging method (Table 4c(3)) for community water heating 1.00 (305a) Distribution loss factor (Table 12c) for community heating system 1.05 (306)
Fraction of total space heat from community CHP (302) x (303a) = 0.75 (304a) Fraction of total space heat from community boilers (302) x (303b) = 0.25 (304b) Factor for control and charging method (Table 4c(3)) for community space heating 1.00 (305) Factor for charging method (Table 4c(3)) for community water heating 1.00 (305a) Distribution loss factor (Table 12c) for community heating system 1.05 (306) Space heating 3138.08 (98) Space heat from CHP (98) x (304a) x (305) x (306) = 2471 24 (307a)
Fraction of total space heat from community CHP (302) x (303a) = 0.75 (304a) Fraction of total space heat from community boilers (302) x (303b) = 0.25 (304b) Factor for control and charging method (Table 4c(3)) for community space heating 1.00 (305) Factor for charging method (Table 4c(3)) for community water heating 1.00 (305) Factor for charging method (Table 4c(3)) for community water heating 1.00 (305a) Distribution loss factor (Table 12c) for community heating system 1.05 (306) Space heating 3138.08 (98) Space heat from CHP (98) x (304a) x (305) x (306) = 2471.24 (307a) Space heat from boilors (98) x (304a) x (305) x (306) = 2471.24 (307a)
Fraction of total space heat from community CHP(302) x (303a) =0.75(304a)Fraction of total space heat from community boilers(302) x (303b) =0.25(304b)Factor for control and charging method (Table 4c(3)) for community space heating1.00(305)Factor for charging method (Table 4c(3)) for community water heating1.00(305a)Distribution loss factor (Table 12c) for community heating system1.05(306)Space heating3138.08(98)Space heat from CHP(98) x (304a) x (305) x (306) =2471.24(307a)Space heat from boilers(98) x (304b) x (305) x (306) =823.75(307b)
Fraction of total space heat from community CHP (302) x (303a) = 0.75 (304a) Fraction of total space heat from community boilers (302) x (303b) = 0.25 (304b) Factor for control and charging method (Table 4c(3)) for community space heating 1.00 (305) Factor for charging method (Table 4c(3)) for community water heating 1.00 (305) Distribution loss factor (Table 12c) for community heating system 1.05 (306) Space heating 3138.08 (98) Space heat from CHP (98) x (304a) x (305) x (306) = 2471.24 (307a) Space heat from boilers (98) x (304b) x (305) x (306) = 823.75 (307b)
Fraction of total space heat from community CHP (302) x (303a) = 0.75 (304a) Fraction of total space heat from community boilers (302) x (303b) = 0.25 (304b) Factor for control and charging method (Table 4c(3)) for community space heating 1.00 (305) Factor for charging method (Table 4c(3)) for community water heating 1.00 (305) Distribution loss factor (Table 12c) for community heating system 1.05 (306) Space heating 1.05 (307a) Space heating requirement 3138.08 (98) Space heat from CHP (98) x (304a) x (305) x (306) = 2471.24 (307a) Space heat from boilers (98) x (304b) x (305) x (306) = 823.75 (307b)
Fraction of total space heat from community CHP (302) x (303a) = 0.75 (304a) Fraction of total space heat from community boilers (302) x (303b) = 0.25 (304b) Factor for control and charging method (Table 4c(3)) for community space heating 1.00 (305) Factor for charging method (Table 4c(3)) for community space heating 1.00 (305) Factor for charging method (Table 4c(3)) for community water heating 1.00 (305) Distribution loss factor (Table 12c) for community heating system 1.05 (306) Space heating 3138.08 (98) Space heating requirement (98) x (304a) x (305) x (306) = 2471.24 (307a) Space heat from boilers (98) x (304b) x (305) x (306) = 823.75 (307b) Water heating (2194.59) (64)

Water heat from boilers			(64) x (303b) x (305a) x (306) =	576.08	(310b)
Electricity used for heat distribution		0.01 × [(307a)(307e) + (3	10a)(310e)] =	55.99	(313)
Electricity for pumps, fans and electric keep-hot (Table 4f)						
mechanical ventilation fans - balanced, extract or positive input	t from outside		60.44			(330a)
Total electricity for the above, kWh/year					60.44	(331)
Electricity for lighting (Appendix L)					391.16	(332)
Total delivered energy for all uses	(307) + (309) +	(310) + (312)	+ (315) + (331) +	(332)(337b) =	6050.91	(338)
10h Euclassic source in both schools						-
100. Fuel costs - community neating scheme	F uel		Fuel arise		Final	
	kWh/year		Fuel price		cost £/year	
Space heating from CHP	2471.24	х	2.97	x 0.01 =	73.40	(340a)
Space heating from boilers	823.75	x	4.24	x 0.01 =	34.93] (340b)
Water heating from CHP	1728.24	x	2.97	x 0.01 =	51.33	(342a)
Water heating from boilers	576.08	x	4.24	x 0.01 =	24.43	(342b)
Pumps and fans	60.44	x	13.19	x 0.01 =	7.97	(349)
Electricity for lighting	391.16	x	13.19	x 0.01 =	51.59	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)(342e) +	· (345)(354) =	363.64	(355)
11b. SAP rating - community heating scheme						
Energy cost deflator (Table 12)					0.42	(356)
Energy cost factor (ECF)					1.09	(357)
SAP value					84.81	1
SAP rating (section 13)					85	(358)
SAP band					В	
SAP band					В]
SAP band 12b. CO ₂ emissions - community heating scheme					B]
SAP band 12b. CO ₂ emissions - community heating scheme	Energy kWh/year		Emission factor		B Emissions (kg/year)]
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating)	Energy kWh/year		Emission factor		B Emissions (kg/year)	
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit	Energy kWh/year 28.09		Emission factor		B Emissions (kg/year)	(361)
SAP band 12b. CO ₂ emissions - community heating scheme <i>Emissions from community CHP (space and water heating)</i> Power efficiency of CHP unit	Energy kWh/year 28.09 66.01		Emission factor		B Emissions (kg/year)	(361) (362)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [Energy kWh/year 28.09 66.01 3743.7107	x	Emission factor	=	B Emissions (kg/year) 808.6415	(361) (362)] (363)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity [Energy kWh/year 28.09 66.01 3743.7107 -1051.5916	x x	Emission factor 0.2160 0.5190	=	B Emissions (kg/year) 808.6415 -545.7760	(361) (362)] (363)] (364)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP	Energy kWh/year 28.09 66.01 3743.7107 -1051.5916 2618.1322	x x x x	Emission factor 0.2160 0.5190 0.2160	= [B Emissions (kg/year) 808.6415 -545.7760 565.5165	(361) (362)] (363)] (364)] (365)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity	Energy kWh/year 28.09 66.01 3743.7107 -1051.5916 2618.1322 -735.4216	x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5	=	B Emissions (kg/year) 808.6415 -545.7760 565.5165 -381.6838	(361) (362)] (363)] (364)] (365)] (366)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating)	Energy kWh/year 28.09 66.01 3743.7107 -1051.5916 2618.1322 -735.4216	x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190	=	B Emissions (kg/year) 808.6415 -545.7760 565.5165 -381.6838	(361) (362)] (363)] (364)] (365)] (366)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers	Energy kWh/year 28.09 66.01 3743.7107 -1051.5916 2618.1322 -735.4216 94.00	x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190	= = =	B Emissions (kg/year) 808.6415 -545.7760 565.5165 -381.6838	(361) (362)] (363)] (364)] (365)] (366) (367b)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Energy kWh/year 28.09 66.01 3743.7107 -1051.5916 2618.1322 -735.4216 94.00 1489.18	x x x x x	Emission factor 0.2160 0.2160 0.5190 0.5190 0.216	= [B Emissions (kg/year) 808.6415 -545.7760 565.5165 -381.6838 321.66	(361) (362)] (363)] (364)] (365)] (366) (367b)] (368)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution	Energy kWh/year 28.09 66.01 3743.7107 -1051.5916 2618.1322 -735.4216 94.00 1489.18 55.99	x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.52 0	= = = =	B Emissions (kg/year) 808.6415 -545.7760 565.5165 -381.6838 321.66 29.06	(361) (362)] (363)] (364)] (365)] (366) (367b)] (368)] (372)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution [Total CO2 associated with community systems	Energy kWh/year 28.09 66.01 3743.7107 -1051.5916 2618.1322 -735.4216 94.00 1489.18 55.99	x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5190 0.5190	= [B Emissions (kg/year) 808.6415 -545.7760 565.5165 -381.6838 321.66 29.06 797.42	(361) (362)] (363)] (364)] (365)] (366) (367b)] (368)] (372)] (373)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating	Energy kWh/year 28.09 66.01 3743.7107 -1051.5916 2618.1322 -735.4216 94.00 1489.18 55.99	x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.52 0.52 0.52 0.52 0.52 0.52 0.52 0.5		B Emissions (kg/year) 808.6415 -545.7760 565.5165 -381.6838 321.66 29.06 797.42 797.42	(361) (362)] (363)] (364)] (365)] (366) (367b)] (368)] (372)] (373)] (376)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans	Energy kWh/year 28.09 66.01 3743.7107 -1051.5916 2618.1322 -735.4216 94.00 1489.18 55.99	x x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5190 0.5190 0.5190 0.52		B Emissions (kg/year) 808.6415 -545.7760 565.5165 -381.6838 321.66 29.06 797.42 797.42 31.37	(361) (362)] (363)] (364)] (365)] (366) (367b)] (368)] (372)] (373)] (376)] (378)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting	Energy kWh/year 28.09 66.01 3743.7107 -1051.5916 2618.1322 -735.4216 94.00 1489.18 55.99 60.44 391.16	x x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5190 0.5190 0.5190 0.52 0.52 0.52		B Emissions (kg/year) 808.6415 -545.7760 565.5165 -381.6838 321.66 29.06 797.42 797.42 31.37 203.01	<pre>(361) (362)] (363)] (364)] (365)] (365)] (366)] (368)] (368)] (372)] (373)] (376)] (378)] (379)</pre>
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP [less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers [(307b)+(310b)] x 100 ÷ (367b) = [Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans [Electricity for lighting Total CO ₂ , kg/year	Energy kWh/year 28.09 66.01 3743.7107 -1051.5916 2618.1322 -735.4216 94.00 1489.18 55.99 60.44 391.16	x x x x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.216 0.52 0.52 0.52	= = = = = = (376)(382) =	B Emissions (kg/year) 808.6415 -545.7760 565.5165 -381.6838 321.66 29.06 797.42 797.42 31.37 203.01 1031.80	(361) (362)] (363)] (364)] (365)] (366) (367b)] (368)] (372)] (373)] (376)] (378)] (379)] (383)
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP [less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans [Electricity for lighting Total CO ₂ , kg/year Dwelling CO ₂ emission rate	Energy kWh/year 28.09 66.01 3743.7107 -1051.5916 2618.1322 -735.4216 94.00 1489.18 55.99 60.44 391.16	x x x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5190 0.5190 0.52 0.52	= = = = = (376)(382) = (383) ÷ (4) =	B Emissions (kg/year) 808.6415 -545.7760 565.5165 -381.6838 321.66 29.06 797.42 797.42 31.37 203.01 1031.80 10.83	<pre>(361) (362)] (363)] (364)] (365)] (366) (366)] (368)] (372)] (373)] (373)] (378)] (378)] (379)] (384)</pre>
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with 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 28.09 66.01 3743.7107 -1051.5916 2618.1322 -735.4216 94.00 1489.18 55.99 60.44 391.16	x x x x x x x x x	Emission factor 0.2160 0.5190 0.2160 0.5190 0.5190 0.5190 0.52 0.52	= = = = = (376)(382) = (383) ÷ (4) =	B Emissions (kg/year) 808.6415 -545.7760 565.5165 -381.6838 321.66 29.06 797.42 797.42 31.37 203.01 1031.80 10.83 90.14	(361) (362)] (363)] (364)] (365)] (366) (367b)] (368)] (372)] (373)] (373)] (376)] (378)] (379)] (383)] (384)]
SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = [ss credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers (CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = [Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans [Electricity for lighting Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14)	Energy kWh/year 28.09 66.01 3743.7107 -1051.5916 2618.1322 -735.4216 94.00 1489.18 55.99 60.44 391.16		Emission factor 0.2160 0.5190 0.2160 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190 0.5190	= = = = = (376)(382) = (383) ÷ (4) =	B Emissions (kg/year) 808.6415 -545.7760 565.5165 -381.6838 321.66 29.06 797.42 797.42 31.37 203.01 1031.80 10.83 90.14 90	<pre>(361) (362) (363) (364) (365) (366) (366) (368) (372) (373) (373) (373) (378) (378) (378) (379) (383) (384)] (384)]</pre>

13b. Primary energy - community heating scheme						
	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary Energy from community CHP (space and water heatir	ng)					
Power efficiency of CHP unit	28.09					(361)
Heat efficiency of CHP unit	66.01					(362)
Space heating from CHP (307a) × 100 ÷ (36	2) = 3743.71	x	1.22	=	4567.33	(363)
less credit energy for electricity	-1051.59	x	3.07	=	-3228.39	(364)
Water heated by CHP	2618.13	x	1.22	=	3194.12	(365)
less credit energy for electricity	-735.42	x	3.07	=	-2257.74	(366)
Primary energy from other sources (space heating)						
Efficiency of boilers	94.00					(367b)
Primary energy from boilers [(307b)+(310b)] x 100 ÷ (367l	b) = 1489.18	x	1.22	=	1816.80	(368)
Electrical energy for community heat distribution	55.99	×	3.07	=	171.90	(372)
Total primary energy associated with community systems					4264.01	(373)
Total primary energy associated with space and water heating	g				4264.01	(376)
Pumps and fans	60.44	x	3.07	=	185.55	(378)
Electricity for lighting	391.16	x	3.07	=	1200.87	(379)
Primary energy kWh/year					5650.43	(383)
Dwelling primary energy rate kWh/m2/year					59.31	(384)

В



Assessor name	Miss Ja	ayna Parmar						Assessor nur	nber	6549		
Client								Last modified	b	23/11	/2016	
Address	B-L00-	05 B Centric (Close, Lond	on, N8								
1. Overall dwelling o	dimensions						_					
				Α	krea (m²)		A	verage storey height (m)	,	Vo	lume (m³)	
Lowest occupied					63.47	<mark>(1a)</mark> x	Ē	2.50] (2a) =		158.68	(3a)
Total floor area	(1	.a) + (1b) + (1	c) + (1d)(1n) =	63.47	(4)						
Dwelling volume								(3a) + (3b) + (3	3c) + (3d)(3	8n) =	158.68	(5)
2. Ventilation rate												
										m³	³ per hour	
Number of chimneys							Г	0	x 40 =		0	(6a)
Number of open flues	5						È	0	x 20 =		0	(6b)
Number of intermitte	nt fans						Ē	0	x 10 =		0	(7a)
Number of passive ve	nts							0	x 10 =		0	(7b)
Number of flueless ga	as fires						Ē	0	x 40 =		0	(7c)
									_	Air o	hanges per hour	r
Infiltration due to chi	mneys, flues, fa	ans, PSVs		(6a)) + (6b) + (7	a) + (7b) + (7c) = 🗌	0	÷ (5) =	: [0.00	(8)
If a pressurisation tes	t has been cari	ried out or is i	ntended, p	roceed to ((17), otherw	vise continu	e from (′9) to (16)				_
Air permeability value	e, q50, express	ed in cubic m	etres per h	our per squ	uare metre	of envelope	e area				4.00	(17)
If based on air perme	ability value, th	nen (18) = [(1	7) ÷ 20] + (8	3), otherwi	se (18) = (1	6)					0.20	(18)
Number of sides on w	hich the dwell	ing is sheltere	ed								3	(19)
Shelter factor								1	- [0.075 x (1	9)] =	0.78	(20)
Infiltration rate incorp	porating shelte	r factor							(18) x (2	20) =	0.16	(21)
Infiltration rate modif	fied for monthl	y wind speed	:									
I	an Feb	Mar	Apr	May	Jun	Jul	Aug	s Sep	Oct	Nov	Dec	
Monthly average win	d speed from T	able 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	ļ.											
1	.28 1.25	1.23	1.10	1.08	0.95	0.95	0.93	3 1.00	1.08	1.13	1.18	(22a)
Adjusted infiltration r	ate (allowing f	or shelter and	d wind facto	or) (21) x (2	22a)m			1				-
0	.20 0.19	0.19	0.17	0.17	0.15	0.15	0.14	0.16	0.17	0.17	0.18	(22b)
Calculate effective air	change rate fo	or the applica	ble case:									-
If mechanical vent	ilation: air cha	nge rate thro	ugh system	I							0.50] (23a)
If balanced with h	eat recovery: e	fficiency in %	allowing fo	or in-use fa	ictor from T	able 4h					N/A	(23c)
c) whole house ex	tract ventilatio	n or positive	input venti	lation from	n outside	1						٦.
0	.50 0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(24c)
Effective air change ra	ate - enter (24a	a) or (24b) or	(24c) or (24	1d) in (25)	1		1		1			٦.
0	.50 0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(25)



3. Heat losses a	and heat lo	ss paramet	er										
Element			а	Gross irea, m ²	Openings m ²	Net A	t area , m²	U-value W/m²K	A x U V	V/K ĸ-' kJ	value, /m².K	Ахк, kJ/K	
Window						12	2.76 x	1.24	= 15.7	7			(27)
Door						2	.32 x	1.80	= 4.18	;			(26)
Ground floor						63	3.47 x	0.20	= 12.6	9			(28a)
External wall						7	.89 x	0.18	= 1.42	!			(29a)
Party wall						57	7.47 x	0.00	= 0.00)			(32)
Total area of ext	ernal elem	ents ∑A, m²	1			86	5.44						(31)
Fabric heat loss,	W/K = ∑(A	× U)							(2	6)(30) + (32) =	34.06	(33)
Heat capacity Cr	n = ∑(А x к)	1						(28)	(30) + (32)	+ (32a)(3	2e) =	N/A	(34)
Thermal mass pa	arameter (1	「MP) in kJ/n	n²K									250.00	(35)
Thermal bridges	: Σ(L x Ψ) c	alculated us	sing Appen	dix K								5.06	(36)
Total fabric heat	loss									(33) + (36) =	39.11	(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)									
	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	(38)
Heat transfer co	efficient, W	//K (37)m +	- (38)m										
	65.30	65.30	65.30	65.30	65.30	65.30	65.30	65.30	65.30	65.30	65.30	65.30	
									Average =	∑(39)112	/12 =	65.30	(39)
Heat loss param	eter (HLP),	W/m²K (39	9)m ÷ (4)										
	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03]
									Average =	∑(40)112	/12 =	1.03	(40)
Number of days	in month (Table 1a)											
	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)
4 14/-1 h 1 ¹		· · · · · · · · · · · · · · · · · · ·											
4. water neath	ng energy r	requiremen	τ									• • • •	
Assumed occupa	ancy, N					26						2.08	(42)
Annual average	not water t	Eab	es per day	vo,average	$e = (25 \times N) +$	30	1.1	A	For	Oct		83.55 Dec	_ (43)
Hot water usage	Jan	rep	Ividi	Api	ividy		2)	Aug	Seh	001	NOV	Dec	
not water usage			05 22			75 10	75 10	70 51	01 00	05.33	00 50	01.00	٦
	91.90	06.50	85.22	81.88	78.54	75.19	75.19	78.54	81.88	5(44)1	12 -	1002 50	
Enormy contont (of hot wate	rusod = 4.1	8 x Vd m y	nm v Tm/	2600 kWb/m	onth (cor	n Tablas 1h	1c 1d)		2(44)1	12 =	1002.59	_ (44)
Lifergy content of	126.20	110.20	122.00	107.24		00 70			05.54	111 25	121 55	121.00	7
	150.29	119.20	125.00	107.24	102.90	00.79	02.20	94.42	95.54	5(AE)1	12 -	1214 55	
Distribution loss	$0.15 \times (45)$	Im								2(45)1	12 –	1514.55	_ (45)
Distribution 1033	20.44	17.88	18.45	16.09	15 / 2	12 27	12.34	14.16	1/ 22	16 70	18.22	10.80	7(46)
Storage volume	(litres) inclu	uding any s	10.45	/HRS stora	ge within san		12.54	14.10	14.55	10.70	10.25	110.00	
Water storage lo		uunig arry so			ge within san	110 103301						110.00](47)
h) Manufacturer	's declared	loss factor	is not know	wn									
Hot water sto	orage loss f	actor from	Table 2 (k)	Nh/litre/da	av)							0.02	7 (51)
Volume facto	or from Tab			vii) iiti c/ uu	·y)							1.03] (51)] (52)
Temperature	factor from	n Table 2h										0.60] (52)] (53)
Energy lost fr	om water		(h/dav) (1	7) x (51) v (52) x (52)							1.03] (57)
Enter (50) or (54) in (55)		, uuy) (4	,,,()+)^(<i>52 N</i> (33)							1.03] (55)
Water storage lo	oss calculat	ed for each	month (5	5) x (41)m							Ĺ	1.05	
	32 01	28.92	32 01	30.98	32 01	30 98	32 01	32.01	30 98	32.01	30 98	32.01	(56)
	52.01	20.52	32.01	50.50	32.01	50.50	52.01	32.01	50.90	52.01	50.50	52.01	

If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56) 32.01 28.92 32.01 30.98 32.01 30.98 32.01 32.01 30.98 32.01 30.98 32.01 (57)Primary circuit loss for each month from Table 3 23.26 21.01 23.26 22.51 23.26 22.51 23.26 23.26 22.51 23.26 22.51 23.26 (59)Combi loss for each month from Table 3a, 3b or 3c 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 (61)Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m 187.27 175.04 191.57 169.13 178.28 160.73 158.17 142.29 137.56 149.69 149.04 166.63 (62)Solar DHW input calculated using Appendix G or Appendix H 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 (63)Output from water heater for each month (kWh/month) (62)m + (63)m 149.04 191.57 169.13 178.28 160.73 158.17 142.29 137.56 149.69 166.63 175.04 187.27 1965.39 ∑(64)1...12 = (64)Heat gains from water heating (kWh/month) 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m] 89.54 79.58 85.12 78.45 78.43 72.32 71.58 75.62 74.56 81.24 83.21 88.11 (65) 5. Internal gains Feb Jan Mar Apr May Jun Jul Aug Sep Oct Nov Dec Metabolic gains (Table 5) 103.89 103.89 103.89 103.89 103.89 103.89 103.89 103.89 103.89 103.89 103.89 103.89 (66)Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 16.19 14.38 11.69 8.85 6.62 5.59 6.04 7.85 10.53 13.37 15.61 16.64 (67)Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 181.61 183.49 178.74 168.63 155.87 135.86 133.98 138.73 148.84 161.60 173.59 143.88 (68)Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 33.39 33.39 33.39 33.39 33.39 33.39 33.39 33.39 33.39 33.39 33.39 33.39 (69)Pump and fan gains (Table 5a) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 (70) Losses e.g. evaporation (Table 5) -83.11 -83.11 -83.11 -83.11 -83.11 -83.11 -83.11 -83.11 -83.11 -83.11 -83.11 -83.11 (71) Water heating gains (Table 5) 120.35 118.42 114.41 108.96 105.42 100.44 96.21 103.56 109.20 115.57 101.63 118.43 (72) Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m 372.31 370.46 359.01 340.61 322.08 304.07 292.28 297.63 306.99 325.58 346.94 362.83 (73) 6. Solar gains Access factor Solar flux FF Gains Area g Table 6d m² W/m² specific data specific data w or Table 6b or Table 6c 0.77 11.28 0.40 31.93 NorthEast 12.76 x 0.9 x 0.80 (75) х х _ Solar gains in watts ∑(74)m...(82)m 64.99 117.09 192.29 258.48 275.56 257.79 205.51 142.67 40.17 26.07 31.93 79.42 (83)Total gains - internal and solar (73)m + (83)m (84) 404.24 435.44 476.10 532.91 580.56 579.64 550.06 503.14 449.66 405.00 387.12 388.90 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1(°C) 21.00 (85) Feb Jul Oct Nov Dec Jan Mar Apr May Jun Aug Sep Utilisation factor for gains for living area n1,m (see Table 9a)

	1.00	1.00	0.99	0.96	0.86	0.68	0.52	0.58	0.85	0.98	0.99	1.00	(86)
Mean internal to	emp of livin	g area T1 (s	steps 3 to 7	in Table 90	:)								-
	19.96	20.07	20.28	20.58	20.84	20.97	20.99	20.99	20.89	20.57	20.21	19.93	(87)
Temperature du	iring heating	g periods ir	the rest of	f dwelling f	rom Table 9	9, Th2(°C)							_
	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	(88)
Utilisation facto	r for gains f	or rest of d	welling n2,	m	•		•	•		•		•	_
	1.00	0.99	0.98	0.94	0.82	0.60	0.41	0.47	0.78	0.96	0.99	1.00	(89)
Mean internal to	emperature	in the rest	of dwelling	g T2 (follow	steps 3 to	7 in Table 9	əc)	•				·	
	18.67	18.82	19.14	19.56	19.90	20.04	20.06	20.05	19.97	19.56	19.04	18.62	(90)
Living area fract	ion	•		•	•		•		Liv	ving area ÷	(4) =	0.54	(91)
Mean internal to	emperature	for the wh	ole dwellin	g fLA x T1 +	+(1 - fLA) x ⁻	Т2				-			_
	19.36	19.49	19.75	20.11	20.41	20.54	20.56	20.56	20.47	20.10	19.67	19.32	(92)
Apply adjustme	nt to the me	ean interna	l temperati	ure from Ta	ble 4e whe	ere appropr	iate				1		
	19.36	19.49	19.75	20.11	20.41	20.54	20.56	20.56	20.47	20.10	19.67	19.32	(93)
8. Space heating	ng requirem	ient											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains,	ηm											
	1.00	0.99	0.98	0.95	0.84	0.64	0.47	0.53	0.81	0.96	0.99	1.00	(94)
Useful gains, ηπ	nGm, W (94	l)m x (84)m	ı										
	402.44	432.24	467.92	503.91	486.03	372.52	256.46	267.17	364.79	390.63	383.81	387.50	(95)
Monthly averag	e external t	emperatur	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 for	or mean inte	ernal tempe	erature, Lm	, W [(39)m	ı x [(93)m -	(96)m]							
	983.65	952.79	865.23	731.82	568.56	387.68	258.64	271.44	415.85	620.40	820.56	987.59	(97)
Space heating re	equirement	, kWh/mon	th 0.024 x	[(97)m - (9	5)m] x (41)	m							
	432.42	349.81	295.60	164.09	61.40	0.00	0.00	0.00	0.00	170.95	314.46	446.47]
									∑(98	3)15, 10	12 =	2235.19	(98)
Space heating re	equirement	kWh/m²/y	ear							(98)	÷ (4)	35.22	(99)
					_								
9b. Energy req	uirements -	communit	ty heating s	scheme									7
Fraction of spac	e heat from	secondary	/suppleme	ntary syste	m (table 11	L)				'0' if r	none	0.00] (301)
Fraction of spac	e heat from	communit	y system							1 - (30	01) = [1.00] (302)] .
Fraction of com	munity heat	from boile	ers									0.25] (303a)
Fraction of com	munity heat	from CHP										0.75] (303b)
Fraction of total	space heat	from com	nunity CHP							(302) x (303	3a) =	0.75] (304a)
Fraction of total	space heat	from com	nunity boile	ers						(302) x (303	3b) = [0.25] (304b) ¬
Factor for contr	ol and char	ging metho	d (Table 4c	(3)) for con	nmunity spa	ace heating						1.00] (305) _
Factor for charg	ing method	(Table 4c(3	3)) for comr	nunity wat	er heating							1.00] (305a)
Distribution loss	factor (Tab	le 12c) for	community	heating sy	stem							1.05	(306)
Space heating													
Annual space he	eating requi	rement						2	235.19]			(98) 7
Space heat from	1 CHP							(98) x (304a) >	(305) x (30	06) =	1760.22	(307a)
Space heat from	boilers							(98) x (304b) >	« (305) x (30	06) =	586.74	(307b)
Water heating										1			
Annual water he	eating requi	rement						1	965.39	J			(64)

Water heat from CHP			(64) x (303a) x (305a) x (306) = 🛛	1547.75	(310a)
Water heat from boilers			(64) x (303b) x (305a) x (306) =	515.92	(310b)
Electricity used for heat distribution		0.01 ×	< [(307a)(307e) + (3	10a)(310e)] =	44.11	(313)
Electricity for pumps, fans and electric keep-hot (Table 4f)						_
mechanical ventilation fans - balanced, extract or positive inpu	t from outside		42.78			(330a)
Total electricity for the above, kWh/year					42.78	(331)
Electricity for lighting (Appendix L)				[285.93	(332)
Total delivered energy for all uses	(307) + (309) -	+ (310) + (32	12) + (315) + (331) + (332)(337b) = [4739.32	(338)
10b. Fuel costs - community heating scheme						
	Fuel		Fuel price		Fuel	
	kWh/year				cost £/year	_
Space heating from CHP	1760.22	х	2.97	x 0.01 =	52.28	(340a)
Space heating from boilers	586.74	x	4.24	x 0.01 =	24.88	(340b)
Water heating from CHP	1547.75	×	2.97	x 0.01 =	45.97	(342a)
Water heating from boilers	515.92	×	4.24	x 0.01 =	21.87	(342b)
Pumps and fans	42.78	x	13.19	x 0.01 =	5.64	(349)
Electricity for lighting	285.93	x	13.19	x 0.01 =	37.71	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)(342e) +	(345)(354) =	308.36	(355)
11b. SAP rating - community heating scheme						
Energy cost deflator (Table 12)					0.42	(356)
Energy cost factor (ECF)				[1.19	(357)
SAP value				[83.34	
SAP rating (section 13)				[83	(358)
SAP band				[В	
12b. CO₂ emissions - community heating scheme						
	Energy		Emission factor		Emissions	
	kWh/year				(kg/year)	
Emissions from community CHP (space and water heating)						
Power efficiency of CHP unit	28.09					(361)
Heat efficiency of CHP unit	66.01			1		(362)
Space heating from CHP $(307a) \times 100 \div (362) =$	2666.5716	х	0.2160	= [575.9795	_ (363)
less credit emissions for electricity	-749.0280	х	0.5190	= [-388.7455	_ (364)
Water heated by CHP	2344.6983	х	0.2160] =	506.4548	(365)
less credit emissions for electricity	-658.6153	х	0.5190	= [-341.8213	(366)
Emissions from other sources (space heating)						
Efficiency of boilers	94.00			ī		(367b)
CO2 emissions from boilers $[(307b)+(310b)] \times 100 \div (367b) =$	1173.04	х	0.216	= [253.38	_ (368)
Electrical energy for community heat distribution	44.11	х	0.52	= [22.89	_ (372)
Total CO2 associated with community systems				l	628.13	_ (373)
Total CO2 associated with space and water heating				l	628.13	_ (376)
Pumps and fans	42.78	х	0.52	= [22.20	_ (378) □ .
Electricity for lighting	285.93	х	0.52	=	148.40	_ (379) □ .
Total CO ₂ , kg/year				(376)(382) =	798.73	_ (383)
Dwelling CO ₂ emission rate				(383) ÷ (4) = [12.58	_ (384) ⊐
El value				l	90.13	

13b. Primary energy - commu	unity heating scheme						
		Energy kWh/year		Primary factor		Primary energy (kWh/year)	/
Primary Energy from communi	ty CHP (space and water heating)						
Power efficiency of CHP unit		28.09]				(361)
Heat efficiency of CHP unit		66.01]				(362)
Space heating from CHP	(307a) × 100 ÷ (362) =	2666.57] x	1.22	=	3253.22	(363)
less credit energy for electr	icity	-749.03] x	3.07	=	-2299.52	(364)
Water heated by CHP		2344.70] x	1.22	=	2860.53	(365)
less credit energy for electricity	Ý	-658.62] x	3.07	=	-2021.95	(366)
Primary energy from other sou	rces (space heating)						
Efficiency of boilers		94.00					(367b
Primary energy from boilers	[(307b)+(310b)] x 100 ÷ (367b) =	1173.04	x	1.22	=	1431.10	(368)
Electrical energy for communit	y heat distribution	44.11] x	3.07	=	135.41	(372)
Total primary energy associate	d with community systems					3358.79	(373)
Total primary energy associate	d with space and water heating					3358.79	(376)
Pumps and fans		42.78	x	3.07	=	131.34	(378)
Electricity for lighting		285.93] x	3.07	=	877.79	(379)
Primary energy kWh/year						4367.93	(383)
Dwelling primary energy rate k	Wh/m2/year					68.82	(384)



Assessor name		Miss Jayr	na Parmar						Assessor nur	nber	6549		
Client									Last modifie	d	23/11	/2016	
Address		B-L04-26	B Centric C	Close, Lond	on, N8								
1. Overall dwellin	ng dimen	sions											
					A	area (m²)		Av	erage storey height (m)	1	Vo	lume (m³)	
Lowest occupied						49.68	<mark>](1a)</mark> x		2.50	(2a) =		124.20	(3a)
Total floor area		(1a)	+ (1b) + (1e	c) + (1d)(1n) =	49.68	(4)						
Dwelling volume								(3	a) + (3b) + (3	3c) + (3d)(3	3n) =	124.20	(5)
2. Ventilation rat	te												
											mª	³ per hour	
Number of chimne	evs								0	x 40 =		0	(6a)
Number of open f	lues								0	x 20 =	. [0	(6b)
Number of interm	ittent fan	s							0	x 10 =	: [0] (02)
Number of passive	e vents								0	x 10 =	:	0] (7b)
Number of flueles	s gas fires								0	x 40 =	: [0	(7c)
	0 840 11 00										Air c	hanges pe	r (, , ,
												hour	
Infiltration due to	chimneys	, flues, fans	s, PSVs		(6a)) + (6b) + (7	a) + (7b) + (7c) =	0	÷ (5) =	-	0.00	(8)
If a pressurisation	test has b	been carried	d out or is ii	ntended, pi	roceed to (17), otherv	vise continu	e from (9) to (16)				
Air permeability va	alue, q50,	expressed	in cubic me	etres per h	our per sq	uare metre	of envelope	e area				4.00	(17)
If based on air per	meability	value, ther	n (18) = [(17	7) ÷ 20] + (8	3), otherwi	se (18) = (1	6)					0.20	(18)
Number of sides o	on which t	he dwelling	g is sheltere	d								2	(19)
Shelter factor									1	- [0.075 x (1	9)] =	0.85	(20)
Infiltration rate inc	corporatir	ng shelter fa	actor							(18) x (2	20) =	0.17	(21)
Infiltration rate me	odified fo	r monthly v	wind speed	:									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average	wind spee	d from Tab	ole U2				-			-		-	-
	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22)m	1 ÷ 4	-				-1	1			1	r	1	-
L	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 infiltratio	on rate (al	llowing for	shelter and	l wind facto	or) (21) x (2	22a)m							٦
	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.20	(22b)
Calculate effective	e air chang	ge rate for t	the applical	ble case:									٦
If mechanical v	entilation	1: air chang	e rate throu	ugh system								0.50	_ (23a)
If balanced wit	h heat red	covery: effi	ciency in %	allowing fo	or in-use fa	ictor from T	able 4h					N/A	(23c)
c) whole house	e extract v	entilation o	or positive i	nput venti	lation from	i outside	1						
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	_ (24c)
Effective air chang	ge rate - e	nter (24a) (or (24b) or ((24c) or (24	id) in (25)		1			I - 1		1	
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(25)



3. Heat losses a	and heat lo	ss paramet	er.										
Element			а	Gross rea, m²	Openings m ²	Net A,	area m²	U-value W/m²K	A x U W	//К к-\ kJ	/alue, /m².K	Ахк, kJ/K	
Window						15	.15 x	1.24	= 18.72	2			(27)
External wall						11	.17 x	0.18	= 2.01				(29a
Party wall						44	.15 x	0.00	= 0.00				(32)
Roof						49	.68 x	0.16	= 7.95				(30)
Total area of ext	ernal elem	ents ∑A, m ²	2			76	.00						(31)
Fabric heat loss,	W/K = Σ(A	× U)							(20	5)(30) + (1	32) =	28.68	(33)
Heat capacity Cr	m = ∑(Ахк)							(28)	.(30) + (32)	+ (32a)(3	2e) =	N/A	(34)
Thermal mass pa	arameter (T	MP) in kJ/r	m²K							. , .		250.00] (35)
Thermal bridges	: Σ(L x Ψ) ca	alculated u	sing Appen	dix K								4.30] (36)
Total fabric heat	loss		0 11							(33) + (36) =	32.98	/ (37)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	_ ` `
Ventilation heat	loss calcula	ated month	ılv 0.33 x (2	25)m x (5)	•			Ū					
	20.49	20.49	20.49	20.49	20.49	20 49	20.49	20.49	20.49	20.49	20.49	20.49	(38)
Heat transfer co	efficient. W	/K (37)m -	+ (38)m	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	
	53.48	53.48	53 / 8	53/18	53.48	53 / 8	53.48	53.48	53.48	53/18	53.48	53/18	٦
	55.40	55.40	55.40	55.40	55.40	55.40	55.40	55.40	Average = S	(39)1 12	/12 =	53 / 8	 (30)
Heat loss naram	otor (HI P)	M/m^2K (30	(A)						Average - 2	<u>/////////////////////////////////////</u>	12 -	55.48	_ (55)
			1 09	1.09	1.09	1.00	1.09	1.09	1.09	1.09	1.09	1.09	7
	1.08	1.08	1.08	1.08	1.08	1.00	1.08	1.08	1.00	1.00	1.08	1.00	
Number of days	in month (Table 1a)							Average = 2	<u>>(</u> 40)112/	12 =	1.08	_ (40)
Nulliber of udys			24.00	20.00	21.00	20.00	21.00	21.00	20.00	24.00	20.00	21.00	
	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	ng energy r	equiremen	t										
Assumed occupa	ancy, N											1.68	(42
Annual average	hot water u	isage in litr	es per day	Vd,average	e = (25 x N) +	36						74.12	(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	;)						
	81.53	78.56	75.60	72.63	69.67	66.70	66.70	69.67	72.63	75.60	78.56	81.53	7
										∑(44)1	.12 =	889.39	 (44)
Energy content	of hot wate	r used = 4.:	18 x Vd,m x	nm x Tm/3	3600 kWh/m	onth (see	Tables 1b	, 1c 1d)					
	120.90	105.74	109.12	95.13	91.28	78.77	72.99	83.76	84.76	98.78	107.82	117.09	٦
					1 1			1		Σ(45)1	.12 =	1166.14	 (45'
Distribution loss	0.15 x (45)m								2(10)211			
	18 1/	15.86	16.37	1/1 27	13.69	11 87	10.95	12 56	12 71	1/ 82	16.17	17 56	46
Storage volume	(litres) inclu	15.00	olar or \//\/	HRS storag	within car		10.95	12.50	12.71	14.02	10.17	110.00	_ (40) _ (47)
Water storage lo		any s			se within san	10 103301						110.00	_ (47)
h) Manufacturo	r's doclarad	loss factor	is not know	un.									
				VII								0.02	
Hot water sto	orage loss to		Table 2 (KV	vn/litre/da	Y)							0.02] (51)] (51)
Volume facto	or from Tab	le 2a										1.03	_ (52) _ (52)
I emperature	e tactor fron	n Table 2b										0.60	_] (53) _]
Energy lost fr	rom water s	torage (kW	/h/day) (47	7) x (51) x (5	52) x (53)							1.03	_] (54)
Enter (50) or (54	l) in (55)											1.03	(55)
Water storage lo	oss calculate	ed for each	month (55	5) x (41)m					_				-
	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)
If the vessel con	tains dedica	ated solar s	torage or d	ledicated W	VWHRS (56)n	n x [(47) -	Vs] ÷ (47)	, else (56)					

	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01 (57)
Primary circuit lo	oss for each	month fror	n Table 3					1			I	
	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26 (59)
Combi loss for e	ach month t	from Table	3a, 3b or 3	с								
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 (61)
Total heat requi	red for wate	er heating c	alculated f	or each mo	onth 0.85 x	(45)m + (40	6)m + (57)r	n + (59)m +	- (61)m			
	176.18	155.67	164.39	148.62	146.56	132.26	128.27	139.03	138.25	154.05	161.32	172.37 (62)
Solar DHW input	calculated	using Appe	ndix G or A	ppendix H				1			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 (63)
Output from wa	ter heater f	or each moi	nth (kWh/r	month) (62	2)m + (63)m	1					1	
	176.18	155.67	164.39	148.62	146.56	132.26	128.27	139.03	138.25	154.05	161.32	172.37
		I IIII								Σ(64)1	12 = 1	.816.98 (64)
Heat gains from	water heat	ing (kWh/m	onth) 0.25	5 × [0.85 ×	(45)m + (61	.)m] + 0.8 ×	[(46)m + (5	57)m + (59)	m]	2(-)		
Ū	84.42	75.10	80.50	- 74.43	74.57	68.99	68.49	72.07	70.98	77.06	78.65	83.15 (65)
5. Internal gain	s										_	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabolic gains	(Table 5)											
	84.03	84.03	84.03	84.03	84.03	84.03	84.03	84.03	84.03	84.03	84.03	84.03 (66)
Lighting gains (ca	alculated in	Appendix L	, equation	L9 or L9a),	also see Ta	ible 5						
	13.05	11.59	9.43	7.14	5.34	4.50	4.87	6.33	8.49	10.78	12.58	13.41 (67)
Appliance gains	(calculated	in Appendix	(L, equatio	on L13 or L	L3a), also se	ee Table 5						
	146.40	147.92	144.09	135.94	125.66	115.99	109.53	108.01	111.84	119.99	130.27	139.94 (68)
Cooking gains (c	alculated in	Appendix L	, equation	L15 or L15	a), also see	Table 5						
	31.40	31.40	31.40	31.40	31.40	31.40	31.40	31.40	31.40	31.40	31.40	31.40 (69)
Pump and fan ga	ains (Table 5	5a)										
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 (70)
Losses e.g. evap	oration (Tab	ole 5)										
	-67.23	-67.23	-67.23	-67.23	-67.23	-67.23	-67.23	-67.23	-67.23	-67.23	-67.23	-67.23 (71)
Water heating g	ains (Table	5)										
	113.47	111.76	108.20	103.37	100.23	95.81	92.06	96.87	98.58	103.58	109.23	111.77 (72)
Total internal ga	ins (66)m +	- (67)m + (6	8)m + (69)ı	m + (70)m	+ (71)m + (7	72)m		•		•		
	321.14	319.48	309.93	294.66	279.43	264.51	254.66	259.41	267.12	282.56	300.30	313.33 (73)
								4	1	1	1	
6. Solar gains						_						
			Access f	actor	Area	Sola	ar flux //m²		g ific data	FF coocific o	lata	Gains
			Table	bu		v	//111	or T	able 6b	or Table	6C	vv
North			0.7	7 X	2 09	x □ 1	0.63 x	09x (n 40 x	0.80	=	4 93 (74)
NorthFast			0.7		13.06		1 28 x	0.9 x ($\frac{1}{1}$			32.68 (75)
Solar gains in wa	atts 5(74)m	(82)m	0.7		15.00		1.20		<u>, , , , , , , , , , , , , , , , , , , </u>	0.00		(75)
Solar Ballis III We	37.61	75.93	125.8/	222 52	200 18	210 12	208.46	227.80	165.27	92.50	47.20	30.79 (83)
Total gains - inte	ornal and so	73.95 ar (73)m +	(83)m	222.52	299.10	519.12	298.40	237.80	105.27	92.30	47.20	(83)
				F17 10	F79.62	F92 62	FF2 12	407.21	422.20	275.06	247.40	244.12 (94)
	358.74	395.42	445.78	517.18	578.02	583.03	553.12	497.21	432.39	375.00	347.49	344.13 (84)
7. Mean intern	al tempera	ture (heatin	ng season)									
Temperature du	ring heating	g periods in	the living a	area from T	able 9, Th1	(°C)						21.00 (85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor	r for gains fo	or living are	a n1,m (se	e Table 9a)								

	1.00	0.99	0.98	0.92	0.77	0.57	0.42	0.49	0.77	0.96	0.99	1.00	(86)
Mean internal to	emp of livin	g area T1 (steps 3 to 7	in Table 90	:)								-
	19.97	20.10	20.35	20.67	20.90	20.98	21.00	20.99	20.93	20.62	20.24	19.94	(87)
Temperature du	iring heatin	g periods ir	n the rest of	f dwelling f	rom Table	9, Th2(°C)			•		•		
	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	(88)
Utilisation facto	r for gains f	or rest of d	welling n2,	m		•						-	_
	0.99	0.99	0.97	0.89	0.71	0.49	0.33	0.39	0.69	0.94	0.99	0.99	(89)
Mean internal to	emperature	in the rest	of dwelling	g T2 (follow	steps 3 to	7 in Table 9	Đc)					_	
	18.66	18.85	19.20	19.65	19.93	20.01	20.02	20.02	19.97	19.59	19.04	18.61	(90)
Living area fract	ion					4			Liv	ving area ÷	(4) =	0.47	(91)
Mean internal to	emperature	for the wh	nole dwellin	g fLA x T1 +	+(1 - fLA) x	Т2				0	.,		、 、
	19.28	19.44	19.75	20.13	20.39	20.47	20.48	20.48	20.42	20.08	19.61	19.24	(92)
Apply adjustme	nt to the me	ean interna	l temperati	ure from Ta	ble 4e whe	ere appropr	iate						` `
	19.28	19.44	19.75	20.13	20.39	20.47	20.48	20.48	20.42	20.08	19.61	19.24	(93)
8. Space heatir	ng requirem	ient											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains,	ղՠ											
	0.99	0.99	0.97	0.90	0.74	0.53	0.37	0.44	0.72	0.94	0.98	0.99	(94)
Useful gains, ηπ	nGm <i>,</i> W (94	l)m x (84)m	ı										
	355.92	389.95	430.78	463.92	426.52	308.41	206.88	216.62	312.70	351.82	342.22	341.93	(95)
Monthly averag	e external t	emperatur	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 temp	erature, Lm	, W [(39)m	ı x [(93)m -	(96)m]							
	801.18	777.60	708.31	600.66	464.76	313.94	207.60	218.19	338.10	506.92	668.85	804.05	(97)
Space heating re	equirement	, kWh/mor	nth 0.024 x	[(97)m - (9	5)m] x (41)	m							
	331.27	260.50	206.48	98.46	28.45	0.00	0.00	0.00	0.00	115.39	235.18	343.82	
									Σ(98	3)15, 10	.12 =	1619.54	(98)
Space heating re	equirement	kWh/m²/y	ear							(98)	÷ (4)	32.60	(99)
			_								L		-
9b. Energy req	uirements ·	communi	ty heating s	scheme									_
Fraction of spac	e heat from	secondary	/suppleme	ntary syste	m (table 11	1)				'0' if ı	none	0.00	(301)
Fraction of spac	e heat from	communit	ty system							1 - (30	01) =	1.00	(302)
Fraction of com	munity heat	t from boile	ers									0.25	(303a)
Fraction of com	munity hea	t from CHP										0.75	(303b)
Fraction of total	space heat	from com	munity CHP	·						(302) x (303	3a) =	0.75	(304a)
Fraction of total	space heat	from com	munity boil	ers						(302) x (303	3b) =	0.25	(304b)
Factor for contro	ol and char	ging metho	d (Table 4c	(3)) for com	nmunity sp	ace heating						1.00	(305)
Factor for charg	ing method	(Table 4c(3)) for com	munity wat	er heating							1.00	(305a)
Distribution loss	factor (Tab	le 12c) for	community	heating sy	stem							1.05	(306)
Space heating													
Annual space he	eating requi	rement						1	619.54]			(98)
Space heat from	CHP							(98	3) x (304a) x	x (305) x (30	06) =	1275.39	(307a)
Space heat from	boilers							(98	3) x (304b) x	x (305) x (30	06) =	425.13	(307b)
											_	_	
Water heating													
Annual water he	eating requi	rement						_ 1	816.98]			(64)

			(64) x (303a) x (305a) x (306) =	1430.87	(310a)
Water heat from boilers			(64) x (303b) x (305a) x (306) =	476.96	(310b)
Electricity used for heat distribution		0.01 × [(3	07a)(307e) + (3	10a)(310e)] =	36.08	(313)
Electricity for pumps, fans and electric keep-hot (Table 4f)						
mechanical ventilation fans - balanced, extract or positive inp	ut from outside		33.49			(330a)
Total electricity for the above, kWh/year					33.49	(331)
Electricity for lighting (Appendix L)					230.50	(332)
Total delivered energy for all uses	(307) + (309) +	· (310) + (312) -	+ (315) + (331) + (332)(337b) =	3872.33	(338)
10b. Fuel costs - community heating scheme						
	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from CHP	1275.39	x	2.97	x 0.01 =	37.88	(340a)
Space heating from boilers	425.13	x	4.24	x 0.01 =	18.03	(340b)
Water heating from CHP	1430.87	x	2.97	x 0.01 =	42.50	(342a)
Water heating from boilers	476.96	х	4.24	x 0.01 =	20.22	(342b)
Pumps and fans	33.49	x	13.19	x 0.01 =	4.42	(349)
Electricity for lighting	230.50	x	13.19	x 0.01 =	30.40	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)(342e) +	(345)(354) =	273.44	(355)
11b. SAP rating - community heating scheme						
Energy cost deflator (Table 12)					0.42	(356)
Energy cost factor (ECF)					1.21	(357)
SAP value					83.08]
SAP rating (section 13)					83	(358)
SAP band					В]
12b. CO ₂ emissions - community heating scheme						
	Energy		Emission factor		Emissions	
Emissions from community CHP (space and water beating)	kwn/year				(kg/year)	
Power efficiency of CHP unit	28.09					(361)
Heat efficiency of CHP unit	66.01					(362)
Heat efficiency of CHP unit Space heating from CHP $(307a) \times 100 \div (362) =$	66.01 1932.1019	x	0.2160	=	417.3340	(362)
Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity	66.01 1932.1019 -542.7188	x x	0.2160	= =	417.3340	(362)] (363)] (364)
Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP	66.01 1932.1019 -542.7188 2167.6404	x x x	0.2160 0.5190 0.2160	= = =	417.3340 -281.6710 468.2103	(362)] (363)] (364)] (365)
Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity	66.01 1932.1019 -542.7188 2167.6404 -608.8805	x x x x	0.2160 0.5190 0.2160 0.5190	= = =	417.3340 -281.6710 468.2103 -316.0090	(362)] (363)] (364)] (365)] (366)
Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating)	66.01 1932.1019 -542.7188 2167.6404 -608.8805	x x x x	0.2160 0.5190 0.2160 0.5190	= = =	417.3340 -281.6710 468.2103 -316.0090	(362)] (363)] (364)] (365)] (366)
Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers	66.01 1932.1019 -542.7188 2167.6404 -608.8805 94.00	x x x x	0.2160 0.5190 0.2160 0.5190	= = =	417.3340 -281.6710 468.2103 -316.0090	(362)] (363)] (364)] (365)] (366) (367b)
Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) =	66.01 1932.1019 -542.7188 2167.6404 -608.8805 94.00 959.67	x x x x	0.2160 0.5190 0.2160 0.5190 0.216	= = =	417.3340 -281.6710 468.2103 -316.0090 207.29	(362)] (363)] (364)] (365)] (366) (367b)] (368)
Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] x 100 ÷ (367b) = Electrical energy for community heat distribution	66.01 1932.1019 -542.7188 2167.6404 -608.8805 94.00 959.67 36.08	x x x x x	0.2160 0.5190 0.2160 0.5190 0.216 0.216	= = = =	417.3340 -281.6710 468.2103 -316.0090 207.29 18.73	(362)] (363)] (364)] (365)] (366) (367b)] (368)] (372)
Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = Electrical energy for community heat distribution Total CO2 associated with community systems	66.01 1932.1019 -542.7188 2167.6404 -608.8805 94.00 959.67 36.08	x x x x x	0.2160 0.5190 0.2160 0.5190 0.216 0.52	= = = =	417.3340 -281.6710 468.2103 -316.0090 207.29 18.73 513.88	(362) (363) (364) (365) (365) (366) (367b) (368) (372) (373)
Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] x 100 ÷ (367b) = Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating	66.01 1932.1019 -542.7188 2167.6404 -608.8805 94.00 959.67 36.08	x x x x x	0.2160 0.5190 0.2160 0.5190 0.216 0.52	= = = =	417.3340 -281.6710 468.2103 -316.0090 207.29 18.73 513.88 513.88	(362) (363) (364) (365) (366) (367b) (368) (372) (373) (373)
Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] x 100 ÷ (367b) = Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans	66.01 1932.1019 -542.7188 2167.6404 -608.8805 94.00 959.67 36.08 33.49	x x x x x x	0.2160 0.5190 0.2160 0.5190 0.216 0.52	= = = =	417.3340 -281.6710 468.2103 -316.0090 207.29 18.73 513.88 513.88 513.88	(362) (363) (364) (365) (365) (366) (367b) (368) (372) (373) (376) (378)
Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting	66.01 1932.1019 -542.7188 2167.6404 -608.8805 94.00 959.67 36.08 33.49 230.50	x x x x x x x	0.2160 0.5190 0.2160 0.5190 0.5190 0.52 0.52	= = = = =	417.3340 -281.6710 468.2103 -316.0090 207.29 18.73 513.88 513.88 513.88 17.38 119.63	(362) (363) (364) (365) (366) (366) (368) (372) (373) (376) (378) (379)
Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] x 100 ÷ (367b) = Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting Total CO ₂ , kg/year	66.01 1932.1019 -542.7188 2167.6404 -608.8805 94.00 959.67 36.08 33.49 230.50	x x x x x x x	0.2160 0.5190 0.2160 0.5190 0.5190 0.52 0.52	= = = = = (376)(382) =	417.3340 -281.6710 468.2103 -316.0090 207.29 18.73 513.88 513.88 17.38 119.63 650.89	(362) (363) (364) (365) (365) (366) (367b) (368) (372) (373) (373) (373) (378) (378) (379) (383)
Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting Total CO ₂ , kg/year Dwelling CO ₂ emission rate	66.01 1932.1019 -542.7188 2167.6404 -608.8805 94.00 959.67 36.08 33.49 230.50	x x x x x x x	0.2160 0.5190 0.2160 0.5190 0.5190 0.52 0.52	= = = = = (376)(382) = (383) ÷ (4) =	417.3340 -281.6710 468.2103 -316.0090 207.29 18.73 513.88 513.88 17.38 119.63 650.89 13.10	(362) (363) (364) (365) (365) (366) (368) (372) (373) (377) (377) (378) (379) (383) (384)
Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value	66.01 1932.1019 -542.7188 2167.6404 -608.8805 94.00 959.67 36.08 33.49 230.50	x x x x x x x	0.2160 0.5190 0.2160 0.5190 0.5190 0.52 0.52	= = = = = (376)(382) = (383) ÷ (4) =	417.3340 -281.6710 468.2103 -316.0090 207.29 18.73 513.88 513.88 17.38 119.63 650.89 13.10 90.79	(362) (363) (364) (365) (365) (366) (368) (372) (373) (377) (373) (376) (378) (379) (383) (384)

EI band

[91	(385)
[В	

13b. Primary energy - commu	unity heating scheme						
		Energy kWh/year		Primary factor		Primary energy (kWh/year)	,
Primary Energy from communi	ty CHP (space and water heating)						
Power efficiency of CHP unit		28.09					(361)
Heat efficiency of CHP unit		66.01					(362)
Space heating from CHP	(307a) × 100 ÷ (362) =	1932.10	x	1.22	=	2357.16	(363)
less credit energy for electr	icity	-542.72	x	3.07	=	-1666.15	(364)
Water heated by CHP		2167.64	x	1.22	=	2644.52	(365)
less credit energy for electricity	Ý	-608.88	x	3.07	=	-1869.26	(366)
Primary energy from other sou	rces (space heating)						
Efficiency of boilers		94.00					(367b)
Primary energy from boilers	[(307b)+(310b)] x 100 ÷ (367b) =	959.67	x	1.22	=	1170.79	(368)
Electrical energy for communit	y heat distribution	36.08	x	3.07	=	110.78	(372)
Total primary energy associate	d with community systems					2747.84	(373)
Total primary energy associate	d with space and water heating					2747.84	(376)
Pumps and fans		33.49	x	3.07	=	102.80	(378)
Electricity for lighting		230.50	x	3.07	=	707.64	(379)
Primary energy kWh/year						3558.29	(383)
Dwelling primary energy rate k	Wh/m2/year					71.62	(384)



Assessor name		Miss Jayr	iss Jayna Parmar						Assessor number			6549	
Client								L	ast modified	b	25/11/2016		
Address		A-L00-28	A Centric (Close, Lond	on, N8								
1. Overall dwellin	ng dimens	sions											
					А	rea (m²)		Ave h	erage storey leight (m)	,	Vo	lume (m³)	
Lowest occupied						73.69	<mark>](1a)</mark> x		2.50	(2a) =		184.23	(3a)
Total floor area		(1a)	+ (1b) + (1	c) + (1d)(1n) =	73.69	(4)						
Dwelling volume							_	(3a	a) + (3b) + (3	3c) + (3d)(3	in) =	184.23	(5)
2 Montilation not													
2. Ventilation rat	e										-		
										-		per hour	_
Number of chimne	eys								0	x 40 =		0	(6a)
Number of open fl	ues								0	x 20 =		0	(6b)
Number of intermi	ittent fan	S							0	x 10 =		0	(7a)
Number of passive	vents								0	x 10 =		0	(7b)
Number of flueless	s gas fires	;							0	x 40 =		0	(7c)
											Air c	hanges pei hour	r
Infiltration due to	chimneys	, flues, fans	s, PSVs		(6a)	+ (6b) + (7	a) + (7b) + (7c) =	0	÷ (5) =		0.00	(8)
If a pressurisation	test has b	been carried	d out or is i	ntended, pi	roceed to (17), otherw	vise continu	e from (9)	to (16)				
Air permeability va	alue, q50,	expressed	in cubic m	etres per h	our per squ	uare metre	of envelope	e area				4.00	(17)
If based on air peri	meability	value, ther	n (18) = [(17	7) ÷ 20] + (8	3), otherwi	se (18) = (1	6)					0.20	(18)
Number of sides or	n which t	he dwelling	g is sheltere	ed								2	(19)
Shelter factor									1	- [0.075 x (1	9)] =	0.85	(20)
Infiltration rate inc	orporatir	ng shelter fa	actor							(18) x (2	20) =	0.17	(21)
Infiltration rate mo	odified fo	r monthly v	wind speed	:						(-) (
	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average w	vind spee	d from Tab	ole U2		,								
Г	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	5.00	4.50	4.40	4.50	5.00	5.00	5.70	4.00	4.50	4.50	4.70	_ (22)
,	1 28	1 25	1 23	1 10	1.08	0.95	0.95	0.93	1.00	1.08	1 1 3	1 18	(22a)
Adjusted infiltratio	n rate (al	llowing for	shelter and	wind facto	$(21) \times (21)$	2a)m	0.55	0.55	1.00	1.00	1.15	1.10	_ (220)
	0.22	0.21		0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.10	0.20	(22h)
	air chang	e rate for t	the applica	ble case:	0.10	0.10	0.10	0.10	0.17	0.10	0.15	0.20	_ (220)
If mechanical w		· air chang	e rate throu	igh system								0.50	(232)
If balanced with	heat red		ciency in %	allowing fo	or in-use fa	ctor from T	able 1h					N/A	(23c)
c) whole house	extract v	entilation of	or nositive i	innut venti	ation from								
	0.50						0.50	0 50	0.50	0 50	0 50	0.50	(240)
	o rate o	$\frac{0.50}{100}$	1 0.50	$(24c) \circ (24)$	ld) in (25)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	_ (Z4U)
						0.50	0.50	0.50	0.50	0.50	0.50	0.50	
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(25)



3. Heat losses a	and heat los	ss paramet	er										
Element			a	Gross rea, m²	Openings m ²	Net a A, I	area m²	U-value W/m²K	A x U W	/К к-v kJ	/alue, /m².K	Ахк, kJ/K	
Window						23.	06 x	1.24	= 28.50				(27)
Ground floor						73.	69 x	0.20	= 14.74				(28a)
External wall						20.	99 x	0.18	= 3.78				(29a)
Party wall						56.	27 x	0.00	= 0.00				(32)
Total area of ext	ernal eleme	ents ∑A, m²				117	.74						(31)
Fabric heat loss,	W/K = ∑(A	× U)							(26	5)(30) + (32) =	47.01	(33)
Heat capacity Cr	n = ∑(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	lculated us	ing Append	dix K								8.56	(36)
Total fabric heat	loss									(33) + (36) =	55.58	(37)
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat	loss calcula	ted month	ly 0.33 x (2	25)m x (5)									
	30.40	30.40	30.40	30.40	30.40	30.40	30.40	30.40	30.40	30.40	30.40	30.40	(38)
Heat transfer co	efficient, W	/K (37)m +	- (38)m										
	85.97	85.97	85.97	85.97	85.97	85.97	85.97	85.97	85.97	85.97	85.97	85.97	
Heat loss param	eter (HIP)	W/m²K (39))m ÷ (4)						Average = 2	(39)112,	/12 =	85.97	(39)
neut 1055 purun	1 17	1 17	1 17	1 17	1 17	1 17	1 17	1 17	1 17	1 17	1 17	1 17	7
	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	Average = S	(40)1 12	/12 =	1 17	
Number of days	in month (1	able 1a)							Average - 2	<u>(</u> +0)112)	12 -	1.17] (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)
4. Water heatin	ng energy re	equiremen	t										
Assumed occupa	ancy, N											2.33	(42)
Annual average	hot water u	sage in litre	es per day \	/d,average	= (25 x N) +	36						89.59	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage	in litres pe	r day for ea	ch month	Vd,m = fact	tor from Tabl	e 1c x (43)							
	98.55	94.97	91.38	87.80	84.22	80.63	80.63	84.22	87.80	91.38	94.97	98.55	
F	(],						T-1-1 41	4 - 4 -1)		∑(44)1	.12 =	1075.10	(44)
Energy content of		rused = 4.1	131 00					, 10 10)	402.45	110.10	120.24		7
	146.15	127.82	131.90	114.99	110.34	95.21	88.23	101.25	102.45	5(45)4	130.34	141.54	
Distribution loss	0.15 x (45)	ım								<u>}</u> (45)1	.12 =	1409.62	_ (45)
	21.92	19.17	19.79	17.25	16.55	14.28	13.23	15.19	15.37	17.91	19.55	21.23	(46)
Storage volume	(litres) inclu	iding any so	olar or WW	HRS storag	ge within sam	ne vessel						110.00	(47)
Water storage lo	oss:												
b) Manufacturer	's declared	loss factor	is not know	vn									
Hot water sto	orage loss fa	actor from ⁻	Table 2 (kW	/h/litre/day	y)							0.02	(51)
Volume facto	or from Tabl	e 2a										1.03	(52)
Temperature	factor fron	n Table 2b										0.60	(53)
Energy lost fr	om water s	torage (kW	'h/day) (47	') x (51) x (5	52) x (53)							1.03	(54)
Enter (50) or (54) in (55)											1.03	(55)
Water storage lo	oss calculate	ed for each	month (55	5) x (41)m									_

If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] \div (47), else (56)

	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)
Primary circuit l	oss for each	month fro	m Table 3										
	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
Combi loss for e	ach month	from Table	3a. 3b or 30	с	I			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	(61)
Total heat requi	red for wat	er heating (alculated fo	or each mo	onth 0.85 x	(45)m + (4	6)m + (57)r	m + (59)m +	- (61)m	0.00	0.00	0.00	(01)
iotal licat requi		177.75	107 10	169.40	165.63	140 71		15652		174.69	102.02	106.91	(c_{2})
	201.42	1/7.75	187.18	108.49	105.02	148.71	143.51	150.52	155.95	174.08	183.83	190.81	(62)
Solar DHW Inpu	t calculated	using Appe	endix G or A	ppenaix H				1					
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
Output from wa	iter heater f	or each mo	onth (kWh/r	nonth) (62	2)m + (63)n	1							
	201.42	177.75	187.18	168.49	165.62	148.71	143.51	156.52	155.95	174.68	183.83	196.81	
										∑(64)1	12 = 2	060.46	(64)
Heat gains from	water heat	ing (kWh/n	nonth) 0.25	5 × [0.85 × ((45)m + (61	l)m] + 0.8 ×	[(46)m + (57)m + (59)	m]				
	92.82	82.44	88.08	81.03	80.91	74.45	73.56	77.89	76.86	83.92	86.13	91.28	(65)
5. Internal gair	าร												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains	(Table 5)												
	116.61	116.61	116.61	116.61	116.61	116.61	116.61	116.61	116.61	116.61	116.61	116.61	(66)
Lighting gains (c	alculated in	Appendix	L, equation	L9 or L9a),	also see Ta	able 5							
	18.34	16.29	13.25	10.03	7.50	6.33	6.84	8.89	11.93	15.15	17.68	18.85	(67)
Appliance gains	(calculated	in Appendi	x L, equatio	on L13 or L1	L3a), also s	ee Table 5							
	205.75	207.89	202.51	191.05	176.59	163.00	153.93	151.79	157.17	168.63	183.08	196.67	(68)
Cooking gains (c	alculated in	Appendix	L, equation	L15 or L15	a), also see	Table 5							
	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	(69)
Pump and fan g	ains (Table !	5a)											()
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
Losses e g evan	oration (Tal) 1e 5)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
200020 0.8. 0000			02.20	02.20	02.20	02.20	02.20	02.20	02.20	02.20	02.20	02.20	(71)
Mater besting	-93.29	-93.29	-93.29	-93.29	-93.29	-93.29	-93.29	-93.29	-93.29	-93.29	-93.29	-93.29	(/1)
water neating g		5)			100	100.11							(=0)
	124.75	122.68	118.38	112.54	108.75	103.41	98.87	104.69	106.75	112.80	119.63	122.69	(72)
Total internal ga	ains (66)m +	- (67)m + (6	68)m + (69)r	m + (70)m -	+ (71)m + (72)m		1	1				
	406.83	404.85	392.13	371.61	350.83	330.73	317.62	323.35	333.84	354.56	378.38	396.20	(73)
6. Solar gains													
			Access f	actor	Area	Sol	ar flux		σ	FF		Gains	
			Table	6d	m²	W	//m²	spec	ы ific data	specific d	ata	W	
								or T	able 6b	or Table	6c		
SouthWest			0.77	7 x	23.06	x 3	6.79 x	0.9 x	0.40 x	0.80	=	188.16	(79)
Solar gains in wa	atts ∑(74)m	(82)m											
	188.16	320.50	438.52	543.35	608.60	604.19	582.51	533.83	474.83	354.22	225.37	161.02	(83)
Total gains - inte	ernal and so	lar (73)m +	(83)m		Į		I	1		1			
0	594 99	725 34	830.65	914 96	959 42	934 92	900.13	857 18	808.67	708 78	603 75	557.22	(84)
	551.55	723.31	030.03	511.50	555.12	551.52	500.15	007110	000.07	700.70	000.70	337.22	(01)
7. Mean intern	al tempera	ture (heati	ng season)										
Temperature du	uring heating	g periods in	the living a	rea from T	able 9, Th	L(°C)						21.00	(85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains f	or living are	ea n1,m (see	e Table 9a)									
	0.99	0.98	0.95	0.88	0.75	0.57	0.42	0.46	0.68	0.91	0.98	0.99	(86)

Mean internal te	emp of livin	g area T1 (steps 3 to 7	in Table 90	c)								
	19.93	20.14	20.42	20.70	20.90	20.98	21.00	20.99	20.95	20.69	20.24	19.87	(87)
Temperature du	iring heatin	g periods i	n the rest of	dwelling f	rom Table	e 9, Th2(°C)							
	19.95	19.95	19.95	19.95	19.95	19.95	19.95	19.95	19.95	19.95	19.95	19.95	(88)
Utilisation factor	r for gains f	or rest of c	dwelling n2,	m									
	0.99	0.97	0.94	0.85	0.69	0.48	0.32	0.35	0.60	0.88	0.98	0.99	(89)
Mean internal te	emperature	in the res	t of dwelling	g T2 (follow	steps 3 to	o 7 in Table	9c)	•		•	•	-	-
	18.54	18.85	19.24	19.62	19.86	19.93	19.95	19.94	19.91	19.61	18.99	18.46	(90)
Living area fract	ion	1				-	1	1	Li	ving area ÷	(4) =	0.39	(91)
Mean internal te	emperature	for the w	hole dwellin	g fLA x T1 +	+(1 - fLA) >	< T2				0	.,		
	19.07	19.35	19 70	20.04	20.26	20.34	20.35	20.35	20.31	20.03	19/17	19.00	(92)
Apply adjustmen	nt to the m	an intern:	al temperatu	re from Ta	20.20		riate	20:55	20.51	20.05	15.47	15.00] (32)
								20.25	20.21	20.02	10.47	10.00	
	19.07	19.35	19.70	20.04	20.26	20.34	20.35	20.35	20.31	20.03	19.47	19.00] (93)
8. Space heatir	ng requiren	hent											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor	r for gains,	ηm		-	-			-	-				
	0.99	0.97	0.93	0.85	0.71	0.52	0.36	0.39	0.63	0.88	0.97	0.99	(94)
Useful gains nm	Gm W (94	1)m x (84)r	n 0.000	0.00	0.72	0.01	0.00	1 0.05	0.00	0.00	0.07] (0 .)
600101 Barris, III	587.60	703.64	774.67	778 / 7	677.95	183.23	321 16	337 //	508 70	625.80	587 52	552.01] (05)
Monthly avorage	o ovtornal t		ro from Tabl	0.111	077.95	405.25	521.10	557.44	508.75	025.80	567.52] (93)
wontiny average					11.70	11.00	16.60	16.40	1110	10.00	7.10	1.20	
	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 to	or mean inte	ernal temp	erature, Lm,	, w [(39)m	1 x [(93)m	- (96)mj				L] ()
	1270.16	1242.46	1134.56	957.62	/35.62	493.16	322.42	339.50	533.98	810.37	1063.42	1272.48] (97)
Space heating re	equirement	, kWh/mor	1th 0.024 x	[(97)m - (9	5)mJ x (41	L)m				1			7
	507.82	362.08	267.76	128.99	42.91	0.00	0.00	0.00	0.00	137.32	342.65	536.03]
									∑(9	8)15, 10	.12 =	2325.56] (98) -
Space heating re	equirement	kWh/m²/y	/ear							(98)	÷ (4)	31.56	(99)
9b. Energy reg	uirements ·	- communi	tv heating s	cheme									
Eraction of space	e heat from	secondari	v/sunnleme	ntary syste	m (table 1	1)				יח' if ו		0.00	(301)
Fraction of space	e heat from		ty support	intary syste						1 /2		1.00	
Fraction of com		t from boil	cy system							1 - (50	J1) – [0.25	(302)
Fraction of com			515									0.23] (303a)
	munity nea	t from CHP								(202) (20)		0.75	
Fraction of total	space neat	from com	munity CHP							(302) x (30	3a) = [0.75] (304a)
Fraction of total	space heat	from com	munity boile	ers						(302) x (303	3b) = [0.25] (304b)
Factor for contro	ol and char	ging metho	od (Table 4c((3)) for com	nmunity s	pace heating	5					1.00] (305) -
Factor for charg	ing method	(Table 4c(3)) for comr	nunity wat	er heating	5						1.00	(305a)
Distribution loss	factor (Tab	ole 12c) for	community	heating sy	vstem							1.05	(306)
Space heating													
Annual space he	eating requi	rement						2	325.56]			(98)
Space heat from	CHP							(98	3) x (304a)	x (305) x (30	06) = 🗌 🖸	1831.38	(307a)
Space heat from	boilers							(98	3) x (304b)	x (305) x (30) =	610.46	(307b)
Water heating													
Annual water he	eating requi	rement						2	060.46]			(64)
Water heat from	n CHP							(64)	x (303a) x	(305a) x (30	06) = 🔤	1622.62	(310a)

						_
Water heat from boilers			(64) x (303b) x (30	05a) x (306) =	540.87	(310b)
Electricity used for heat distribution		0.01 × [(3	307a)(307e) + (310)a)(310e)] =	46.05	(313)
Electricity for pumps, fans and electric keep-hot (Table 4f)						
mechanical ventilation fans - balanced, extract or positive in	put from outside		49.67			(330a)
Total electricity for the above, kWh/year					49.67	(331)
Electricity for lighting (Appendix L)					323.94	(332)
Energy saving/generation technologies						
electricity generated by PV (Appendix M)					-53.23	(333)
Total delivered energy for all uses	(307) + (309)	+ (310) + (312)	+ (315) + (331) + (33	32)(337b) =	4925.70	(338)
10b. Fuel costs - community heating scheme						
	Fuel		Fuel price		Fuel	
	kWh/year				cost £/year	
Space heating from CHP	1831.38] x	2.97	x 0.01 =	54.39	(340a)
Space heating from boilers	610.46] x	4.24	x 0.01 =	25.88	(340b)
Water heating from CHP	1622.62] x	2.97	x 0.01 =	48.19	(342a)
Water heating from boilers	540.87] x	4.24	x 0.01 =	22.93	(342b)
Pumps and fans	49.67] x	13.19	x 0.01 =	6.55	(349)
Electricity for lighting	323.94] x	13.19	x 0.01 =	42.73	(350)
Additional standing charges					120.00	(351)
Energy saving/generation technologies						
pv savings	-53.23] x	13.19	x 0.01 =	0.00	(352)
Total energy cost			(340a)(342e) + (345)(354) =	320.68	(355)
11b. SAP rating - community heating scheme						
Energy cost deflator (Table 12)					0.42	(356)
Energy cost factor (ECF)					1.13	(357)
SAP value					84.17]
SAP rating (section 13)					84	(358)
SAP band					В]

12b. CO₂ emissions - community heating scheme

		Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from community CH	P (space and water heating)						
Power efficiency of CHP unit		28.09					(361)
Heat efficiency of CHP unit		66.01					(362)
Space heating from CHP	(307a) × 100 ÷ (362) =	2774.3769	х	0.2160	=	599.2654	(363)
less credit emissions for ele	ctricity	-779.3100	х	0.5190	=	-404.4619	(364)
Water heated by CHP		2458.1194	х	0.2160	=	530.9538	(365)
less credit emissions for ele	ctricity	-690.4747	х	0.5190	=	-358.3564	(366)
Emissions from other sources (space heating)						
Efficiency of boilers		94.00					(367b)
CO2 emissions from boilers	[(307b)+(310b)] x 100 ÷ (367b) =	1224.82	х	0.216	=	264.56	(368)
Electrical energy for communit	y heat distribution	46.05	х	0.52	=	23.90	(372)
Total CO2 associated with com	munity systems					655.86	(373)
Total CO2 associated with space	e and water heating					655.86	(376)
Pumps and fans		49.67	х	0.52	=	25.78	(378)
Electricity for lighting		323.94	х	0.52	=	168.13	(379)

Energy saving/generation tech	nologies						
pv savings		-53.23	х	0.52	=	-27.63	(380)
Total CO₂, kg/year					(376)(382) =	822.14	(383)
Dwelling CO ₂ emission rate					(383) ÷ (4) =	11.16	(384)
El value						90.72]
EI rating (section 14)						91	(385)
El band						В]
13b. Primary energy - commu	unity heating scheme						
		Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary Energy from communi	ty CHP (space and water heating)						
Power efficiency of CHP unit		28.09					(361)
Heat efficiency of CHP unit		66.01					(362)
Space heating from CHP	(307a) × 100 ÷ (362) =	2774.38	x	1.22	=	3384.74	(363)
less credit energy for electr	icity	-779.31	x	3.07	=	-2392.48	(364)
Water heated by CHP		2458.12	x	1.22	=	2998.91	(365)
less credit energy for electricity	ł	-690.47	x	3.07	=	-2119.76	(366)
Primary energy from other sou	rces (space heating)						
Efficiency of boilers		94.00					(367b)
Primary energy from boilers	[(307b)+(310b)] x 100 ÷ (367b) =	1224.82	x	1.22	=	1494.28	(368)
Electrical energy for communit	y heat distribution	46.05	х	3.07	=	141.38	(372)
Total primary energy associate	d with community systems					3507.07	(373)
Total primary energy associate	d with space and water heating					3507.07	(376)
Pumps and fans		49.67	x	3.07	=	152.49	(378)
Electricity for lighting		323.94	x	3.07	=	994.50	(379)
Energy saving/generation tech	nologies						
Electricity generated - PVs		-53.23	x	3.07	=	-163.43	(380)
Primary energy kWh/year						4490.63	(383)
Dwelling primary energy rate k	Wh/m2/year					60.94	(384)



Assessor name		Miss Jayr	na Parmar						Assessor nur	nber	6549		
Client									Last modified	d	25/11	/2016	
Address		A-L03-19	A Centric (Close, Lond	on, N8								
1. Overall dwellin	ng dimens	sions											
					A	Area (m²)		Av	erage storey height (m)	1	Vo	lume (m³)	
Lowest occupied						87.58	<mark>](1a)</mark> x		2.50	(2a) =		218.95	(3a)
Total floor area		(1a)	+ (1b) + (1e	c) + (1d)(1n) =	87.58	(4)						
Dwelling volume								(3	a) + (3b) + (3	3c) + (3d)(3	3n) =	218.95	(5)
2. Ventilation rat	e												
											mª	³ per hour	
Number of chimne	eys								0	x 40 =		0	(6a)
Number of open fl	ues								0	 x 20 =		0	(6b)
Number of intermi	ittent fan	s							0	 x 10 =	. [0	(7a)
Number of passive	vents								0	 x 10 =	: [0	(7b)
Number of flueless	s gas fires	;							0	x 40 =	: [0	(7c)
										_	Air o	hanges pe hour	r
Infiltration due to	chimneys	, flues, fans	s, PSVs		(6a)) + (6b) + (7	a) + (7b) + ((7c) =	0	÷ (5) =	: [0.00	(8)
If a pressurisation	test has b	been carried	d out or is ii	ntended, pi	roceed to ((17), otherw	vise continu	e from (9) to (16)	_			-
Air permeability va	alue, q50,	expressed	in cubic me	etres per h	our per sq	uare metre	of envelope	e area				4.00	(17)
If based on air peri	meability	value, ther	n (18) = [(17	7) ÷ 20] + (8	3), otherwi	ise (18) = (1	6)					0.20	(18)
Number of sides of	n which t	he dwelling	g is sheltere	ed								2	(19)
Shelter factor									1	- [0.075 x (1	9)] =	0.85	(20)
Infiltration rate inc	corporatir	ng shelter f	actor							(18) x (2	20) =	0.17	(21)
Infiltration rate mo	odified fo	r monthly v	wind speed	:									
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average v	vind spee	d from Tab	ole U2										
	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22)m	÷4												
	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
Adjusted infiltratio	on rate (al	llowing for	shelter and	l wind facto	or) (21) x (2	22a)m	-			-		-	_
	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.20	(22b)
Calculate effective	air chang	ge rate for t	the applical	ble case:									-
If mechanical v	entilation	: air chang	e rate throu	ugh system								0.50	(23a)
If balanced with	n heat reo	covery: effi	ciency in %	allowing fo	or in-use fa	actor from T	Table 4h					N/A	(23c)
c) whole house	extract v	entilation o	or positive i	input venti	ation from	n outside	-			_		-	-
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(24c)
Effective air chang	e rate - e	nter (24a) o	or (24b) or ((24c) or (24	ld) in (25)		1	1					-
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(25)



3. Heat losses a	and heat los	ss paramet	er										
Element			а	Gross rea, m²	Openings m ²	Net a A, m	rea 1²	U-value W/m²K	A x U W	//К к-ч kJ	value, /m².K	Ахк, kJ/K	
Window						29.4	5 x	1.24	= 36.39)			(27)
External wall						21.9	7 x	0.18	= 3.95				(29a
Party wall						57.0	5 x	0.00	= 0.00				(32)
Roof						87.5	8 x	0.16	= 14.01				(30)
Total area of ext	ternal eleme	ents ∑A, m²	2			139.0	00						(31)
Fabric heat loss,	W/K = ∑(A	× U)							(2	6)(30) + (32) =	54.36	(33)
Heat capacity Cr	m = ∑(А x к)							(28)	.(30) + (32)	+ (32a)(3	2e) =	N/A	(34)
Thermal mass p	arameter (T	MP) in kJ/r	n²K									250.00	(35)
Thermal bridges	:: Σ(L x Ψ) ca	lculated us	sing Appen	dix K								7.51	(36)
Total fabric heat	t loss		0 11							(33) + (36) =	61.87	(37)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat	loss calcula	ted month	ly 0.33 x (2	25)m x (5)	-			_					
	36.13	36.13	36.13	36.13	36.13	36.13	36.13	36.13	36.13	36.13	36.13	36.13	(38)
Heat transfer co	efficient. W	/K (37)m +	+ (38)m										_ (,
	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	7
	50.00	50.00	50.00	50.00	50.00	50.00	30.00		Average = '	$\Sigma(39)112$	/12 =	98.00	 (39)
Heat loss param	eter (HLP). '	W/m²K (30	9)m ÷ (4)						, werage	2(33)112		50.00	
	1 12	1 12	1 12	1 1 2	1 12	1 1 2	1 1 2	1 12	1 1 2	1 1 2	1 12	1 1 2	7
	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12		(40)1 12	/12 -	1 1 2	
Number of days	in month (T	able 1a)							Average -	2(40)112,	12 -	1.12	_ (40)
Number of days		28.00	21.00	20.00	21.00	20.00	21.00	21.00	20.00	21.00	20.00	21.00	
	51.00	28.00	51.00	30.00	51.00	30.00	51.00	31.00	30.00	51.00	50.00	51.00	_ (40)
4. Water heati	ng energy r	equiremen	t										
Assumed occupa	ancy, N											2.59	(42)
Annual average	hot water u	sage in litre	es per day '	Vd,average	= (25 x N) +	36						95.74	(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 Tabl	le 1c x (43)							
	105.31	101.48	97.65	93.82	89.99	86.17	86.17	89.99	93.82	97.65	101.48	105.31	
										<u>Σ</u> (44)1	.12 =	1148.87	(44)
Energy content	of hot wate	r used = 4.2	18 x Vd,m x	nm x Tm/3	3600 kWh/m	onth (see T	ables 1b), 1c 1d)					
	156.18	136.59	140.95	122.89	117.91	101.75	94.28	108.19	109.49	127.59	139.28	151.25	
										Σ(45)1	.12 =	1506.35	 (45)
Distribution loss	0.15 x (45)	m								2(-7			
	23.43	20.49	21.14	18.43	17.69	15.26	14.14	16.23	16.42	19.14	20.89	22.69	(46)
Storage volume	(litres) inclu	iding any s	olar or WW	HRS storag	re within sam	ne vessel	1	10.23	10.12	13.11		110.00] (10)] (47)
Water storage lo					,						L	110100	
h) Manufacture	r's declared	loss factor	is not know	wn									
Hot water st	orage loss fr	ector from	Table 2 (k)	/h/litre/day	v)							0.02	7 (51)
Volumo facto	or from Tabl			vily intrey day	y)							1.02] (51)] (52)
	factor from	e za										0.60	_ (52) _ (52)
Enorgy lost f			(b (day) (4-	7) / [1) / [- 2) y (F 2)							1.02	_ (55) _ (54)
	ioni water s	torage (KM	myuay) (47	7 (T C) X (S	JZJ X (JJ)							1.03	(54) (55)
Enter (50) or (54	+) III (55)	d for c	month /Fr) v (41)								1.03	_ (55)
water storage lo	Jss calculate	eu for each	month (55	5) X (41)M									
	22.01	20.02	22.01	20.00	22.04	20.00	22.01	22.21	20.00	22.01	20.05	22.24	7
-			•										
	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)
Primary circuit le	oss for each	month fro	m Table 3					•					
	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
Combi loss for e	each month	from Table	3a. 3b or 3] ()
	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
Total boat roqui	rod for wat	or heating (o.oo	or oach mo	0.00	$(45)m \pm (4)$	$6m \pm (57)r$	1 + (50)m +	(61)m	0.00	0.00	0.00] (01)
iotal field fequi					472.40					402.07	102 77	200 52	
	211.45	186.52	196.23	1/6.38	173.19	155.24	149.56	163.47	162.98	182.87	192.77	206.53	(62)
Solar DHW inpu	t calculated	using Appe	endix G or A	ppendix H		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	63) (63)
Output from wa	iter heater f	or each mo	onth (kWh/r	nonth) (62	.)m + (63)n	n 							_
	211.45	186.52	196.23	176.38	173.19	155.24	149.56	163.47	162.98	182.87	192.77	206.53	
										∑(64)1	12 = 2	157.19	(64)
Heat gains from	water heat	ing (kWh/n	nonth) 0.25	5 × [0.85 × (45)m + (63	1)m] + 0.8 ×	[(46)m + (57)m + (59))m]				
	96.15	85.36	91.09	83.65	83.43	76.63	75.57	80.20	79.20	86.65	89.11	94.51	(65)
5. Internal gair	าร												
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains	(Table 5)												_
	129.56	129.56	129.56	129.56	129.56	129.56	129.56	129.56	129.56	129.56	129.56	129.56	(66)
Lighting gains (c	alculated in	Appendix	L, equation	L9 or L9a),	also see Ta	able 5							
	20.91	18.57	15.10	11.43	8.55	7.22	7.80	10.14	13.60	17.27	20.16	21.49	(67)
Appliance gains	(calculated	in Appendi	x L, equatio	n L13 or L1	.3a), also s	ee Table 5							
	234.55	236.99	230.85	217.80	201.31	185.82	175.47	173.04	179.17	192.23	208.71	224.21	(68)
Cooking gains (c	alculated in	Appendix	L, equation	L15 or L15	a), also see	e Table 5							
	35.96	35.96	35.96	35.96	35.96	35.96	35.96	35.96	35.96	35.96	35.96	35.96	(69)
Pump and fan ga	ains (Table S	5a)											
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
Losses e g evan	oration (Tal	ole 5)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00] (, 0)
200000 0.8. 0140		102 65	102.65	102.65	102.65	102.65	102.65	102 65	102.65	102.65	102 65	102 65	(71)
Mator booting g	-105.05	-105.05	-105.05	-105.05	-105.05	-105.05	-105.05	-105.05	-105.05	-105.05	-105.05	-105.05] (/1)
water neating g		5)				100.10						107.00	1 (
	129.23	127.02	122.43	116.19	112.13	106.43	101.57	107.79	110.00	116.46	123.76	127.03] (72)
Total internal ga	ains (66)m +	- (67)m + (6	68)m + (69)r	n + (70)m +	+ (71)m + (72)m		1	1			1	1
	446.57	444.45	430.26	407.29	383.86	361.33	346.71	352.83	364.64	387.83	414.50	434.60	(73)
6. Solar gains													
			Access f	actor	Area	Sol	ar fluv		σ	FF		Gains	
			Table	6d	m²	W	//m²	spec	ific data	specific d	ata	W	
								or T	able 6b	or Table	6c		
SouthWest			0.77	7 X	29.45	x 3	6.79 x	0.9 x 🛛 🕻	0.40 x	0.80	=	240.29	(79)
Solar gains in wa	atts ∑(74)m	(82)m											
	240.29	409.31	560.04	693.91	777.24	771.62	743.92	681.76	606.40	452.37	287.82	205.64	(83)
Total gains - inte	ernal and so	lar (73)m +	(83)m										1
-	686.86	853.76	990.29	1101.20	1161.10	1132.95	1090.64	1034.59	971.04	840.21	702.32	640.24	(84)
					0110					- /0.21			1 ()
7. Mean intern	al tempera	ture (heati	ng season)										
Temperature du	uring heating	g periods in	the living a	irea from T	able 9, Th	1(°C)						21.00	(85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains f	or living are	ea n1,m (see	e Table 9a)									
	0.99	0.98	0.95	0.87	0.72	0.54	0.39	0.43	0.66	0.91	0.98	1.00	(86)
	_	_					-	-					1.5.7

Mean internal te	emp of livin	ig area T1 (s	steps 3 to 7	in Table 90	c)								
	19.97	20.20	20.48	20.75	20.92	20.99	21.00	21.00	20.96	20.72	20.28	19.91	(87)
Temperature du	iring heatin	g periods ir	n the rest of	dwelling f	rom Table	9 <i>,</i> Th2(°C)							
	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	(88)
Utilisation facto	r for gains f	for rest of d	lwelling n2,	m									
	0.99	0.97	0.93	0.83	0.66	0.46	0.30	0.34	0.58	0.87	0.98	0.99	(89)
Mean internal te	emperature	in the rest	t of dwelling	g T2 (follow	, steps 3 to	7 in Table 9	Əc)	•					_
	18.63	18.96	19.35	19.72	19.92	19.98	19.98	19.98	19.96	19.69	19.08	18.55	(90)
Living area fract	ion	4	4		I		1	1	Li	ving area ÷	(4) =	0.34	(91)
Mean internal te	emperature	or the wh	ole dwellin	g fl A x T1 +	⊦(1 - fl A) x	Т2			_		(.)] (0 -)
	19.09	19.39	19.74	20.07	20.26	20.32	20.33	20.33	20.30	20.04	19/19	19.01	(92)
Apply adjustmer	15.05		15.74	re from Ta	20.20	ere appropr	ioto	20.33	20.30	20.04	19.49	19.01] (32)
								20.22	20.20	20.04	10.40	10.01	
	19.09	19.39	19.74	20.07	20.26	20.32	20.33	20.33	20.30	20.04	19.49	19.01] (93)
8. Space heatir	ng requiren	nent											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor	r for gains,	ηm		-	-			-					
	0.99	0.97	0.93	0.83	0.68	0.49	0.33	0.37	0.60	0.87	0.97	0.99	(94)
Useful gains, nm	1Gm. W (94	4)m x (84)r	1 0.00	0.00	0.00	0.15	0.00		0.00	0.07	0.07] (0 .)
obertar game, rin	678.99	827.66	018.02	010 02	788.21	553.04	364.84	383 72	586.13	73/ 03	683.88	63/ 87] (05)
Monthly avorage	o ovtornal t			0.111	788.21	555.04	504.84	505.72	580.15	734.95	085.88	034.87] (93)
					44.70	14.60	16.60	16.40	14.40	10.00	7.40	1.20	
11	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 to	or mean into	arnal tempe	erature, Lm,	, w [(39)m	1 x [(93)m ·	- (96)mj				I] ()
	1449.54	1419.78	1297.51	1094.66	838.95	560.78	365.73	385.24	607.84	925.51	1213.90	1451.82] (97)
Space heating re	equirement	, kWh/mon	1th 0.024 x	[(97)m - (9	5)mJ x (41)m							7
	573.29	397.91	282.34	126.46	37.75	0.00	0.00	0.00	0.00	141.79	381.62	607.81	
									∑(9)	8)15, 10	.12 = 2	2548.97] (98) _
Space heating re	equirement	kWh/m²/y	ear							(98)	÷ (4)	29.10	(99)
9b. Energy req	uirements	- communi	ty heating s	cheme									
Eraction of space	e heat from	secondary	/sunnleme	ntary syste	m (table 1	1)				יח' if ו		0.00	(301)
Fraction of space	e heat from		ty supplement	intary syste		1)				1 (2)		1.00	
Fraction of some		t from boil	ly system							1 - (50	JI) – [0.25	(302)
			215									0.25] (3034)] (3036)
	munity nea									(222) (222		0.75	(3030)
Fraction of total	space neat	: from comi	munity CHP							(302) x (30	3a) =	0.75] (304a)
Fraction of total	space heat	: from com	munity boile	ers						(302) x (303	3b) =	0.25] (304b)
Factor for contro	ol and char	ging metho	d (Table 4c	(3)) for com	nmunity sp	bace heating						1.00] (305) -
Factor for charg	ing method	i (Table 4c(3)) for comr	nunity wat	er heating							1.00	(305a)
Distribution loss	factor (Tak	ble 12c) for	community	heating sy	vstem							1.05	(306)
Space heating													
Annual space he	eating requi	rement						2	548.97				(98)
Space heat from	СНР							(98	3) x (304a)	x (305) x (30	06) = 2	2007.31	(307a)
Space heat from	boilers							(98	3) x (304b)	x (305) x (30	06) =	669.10	(307b)
Water heating													
Annual water he	eating requi	irement						2	157.19]			(64)
Water heat from	n CHP							(64)	x (303a) x	(305a) x (30	06) = 1	1698.79	(310a)

Water heat from boilers			(64) x (303b) x (3	05a) x (306) =	566.26	(310b)
Electricity used for heat distribution		0.01 × [(3	307a)(307e) + (310	Da)(310e)] =	49.41	(313)
Electricity for pumps, fans and electric keep-hot (Table 4f)						
mechanical ventilation fans - balanced, extract or positive inpu	t from outside		55.56			(330a)
Total electricity for the above, kWh/year					55.56	(331)
Electricity for lighting (Appendix L)					369.29	(332)
Energy saving/generation technologies						
electricity generated by PV (Appendix M)					-53.23	(333)
Total delivered energy for all uses	(307) + (309)	+ (310) + (312)	+ (315) + (331) + (3	32)(337b) =	5313.08	(338)
10b. Fuel costs - community heating scheme						
	Fuel kWh/year		Fuel price		Fuel cost f/year	
				0.01	50.60	
Space heating from CHP	2007.31	x	2.97	x 0.01 =	59.62	(340a)
Space heating from boilers	669.10	x	4.24	x 0.01 =	28.37	(340b)
Water heating from CHP	1698.79	x	2.97	x 0.01 =	50.45	(342a)
Water heating from boilers	566.26	x	4.24	x 0.01 =	24.01	(342b)
Pumps and fans	55.56	x	13.19	x 0.01 =	7.33	(349)
Electricity for lighting	369.29	x	13.19	x 0.01 =	48.71	(350)
Additional standing charges					120.00	(351)
Energy saving/generation technologies						
pv savings	-53.23	x	13.19	x 0.01 =	0.00	(352)
Total energy cost			(340a)(342e) + (345)(354) =	338.49	(355)
11h CAD rating community heating scheme						
					0.42	
Energy cost deflator (Table 12)					0.42	(356)
Energy cost factor (ECF)					1.07	(357)
SAP value					85.04]
SAP rating (section 13)					85	(358)
SAP band					В]
12b. CO₂ emissions - community heating scheme						

	Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from community CHP (space and water heating)						
Power efficiency of CHP unit	28.09					(361)
Heat efficiency of CHP unit	66.01					(362)
Space heating from CHP $(307a) \times 100 \div (362) =$	3040.9017	х	0.2160	=	656.8348	(363)
less credit emissions for electricity	-854.1757	x	0.5190	=	-443.3172	(364)
Water heated by CHP	2573.5136	x	0.2160	=	555.8789	(365)
less credit emissions for electricity	-722.8884	x	0.5190	=	-375.1791	(366)
Emissions from other sources (space heating)						
Efficiency of boilers	94.00					(367b)
CO2 emissions from boilers [(307b)+(310b)] x 100 ÷ (367b) =	1314.22	x	0.216	=	283.87	(368)
Electrical energy for community heat distribution	49.41	x	0.52	=	25.65	(372)
Total CO2 associated with community systems					703.74	(373)
Total CO2 associated with space and water heating					703.74	(376)
Pumps and fans	55.56	х	0.52	=	28.84	(378)
Electricity for lighting	369.29	х	0.52	=	191.66	(379)

Energy saving/generation techr	nologies						
pv savings		-53.23	x	0.52	=	-27.63	(380)
Total CO ₂ , kg/year					(376)(382) =	896.60	(383)
Dwelling CO ₂ emission rate					(383) ÷ (4) =	10.24	(384)
EI value						90.94]
El rating (section 14)						91	(385)
El band						В]
13b. Primary energy - commu	nity heating scheme						
		Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary Energy from communit	ty CHP (space and water heating)						
Power efficiency of CHP unit		28.09					(361)
Heat efficiency of CHP unit		66.01					(362)
Space heating from CHP	(307a) × 100 ÷ (362) =	3040.90	x	1.22	=	3709.90	(363)
less credit energy for electri	city	-854.18	x	3.07	=	-2622.32	(364)
Water heated by CHP		2573.51	x	1.22	=	3139.69	(365)
less credit energy for electricity	,	-722.89	x	3.07	=	-2219.27	(366)
Primary energy from other sou	rces (space heating)						
Efficiency of boilers		94.00					(367b)
Primary energy from boilers	[(307b)+(310b)] x 100 ÷ (367b) =	1314.22	x	1.22	=	1603.35	(368)
Electrical energy for community	y heat distribution	49.41	х	3.07	=	151.70	(372)
Total primary energy associated	d with community systems					3763.05	(373)
Total primary energy associated	d with space and water heating					3763.05	(376)
Pumps and fans		55.56	x	3.07	=	170.57	(378)
Electricity for lighting		369.29	x	3.07	=	1133.72	(379)
Energy saving/generation techr	nologies						
Electricity generated - PVs		-53.23	x	3.07	=	-163.43	(380)
Primary energy kWh/year						4903.91	(383)
Dwelling primary energy rate k	Wh/m2/year					55.99	(384)



Assessor name		Miss Jayr	na Parmar						Assessor nun	nber	6549		
Client									Last modified	ł	25/11,	/2016	
Address		A-L03-48	A Centric (Close, Lond	on, N8								
1. Overall dwelli	ng dimen	sions											
					А	area (m²)		F	verage storey height (m)	,	Vo	lume (m³)	
Lowest occupied						87.21	<mark>](1a)</mark> x	Ē	2.50] (2a) =		218.03	(3a)
Total floor area		(1a)	+ (1b) + (1	c) + (1d)(1n) =	87.21	(4)						
Dwelling volume									(3a) + (3b) + (3	sc) + (3d)(3	n) =	218.03	(5)
2. Ventilation rat	te									_			
											m³	' per hour	
Number of chimne	evs							Г	0	x 40 =		0	(6a)
Number of open f	lues							Ē	0	x 20 =] (6b)
Number of interm	nittent fan	s							0	x 10 =] (02)
Number of passive	e vents								0	x 10 =] (7b)
Number of flueles	s gas fires								0	x 40 =] (7c)
											Air c	hanges pe	r
								_		_		hour	_
Infiltration due to	chimneys	s, flues, fan	s, PSVs		(6a)) + (6b) + (7	a) + (7b) + (7c) =	0	÷ (5) =		0.00	(8)
If a pressurisation	test has b	been carrie	d out or is i	ntended, p	roceed to (17), otherw	ise continu/	e from	(9) to (16)				_
Air permeability v	alue, q50,	expressed	in cubic m	etres per h	our per squ	uare metre	of envelope	e area				4.00	(17)
If based on air per	rmeability	value, the	n (18) = [(17	7) ÷ 20] + (8	3), otherwi	se (18) = (1	6)					0.20	(18)
Number of sides of	on which t	he dwelling	g is sheltere	ed								2	(19)
Shelter factor									1	- [0.075 x (19	9)] = [0.85	(20)
Infiltration rate in	corporatir	ng shelter f	actor							(18) x (2	0) =	0.17	(21)
Infiltration rate m	odified fo	r monthly v	wind speed	:									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	g Sep	Oct	Nov	Dec	
Monthly average	wind spee	d from Tab	ole U2			1				1 1		1	۰
	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	0 4.00	4.30	4.50	4.70	_ (22)
wind factor (22)m	1÷4	4.25	1.22	1.10	1.00	0.05	0.05		1.00	1.00	4.42	1.10	(22-)
	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.9	3 1.00	1.08	1.13	1.18	_ (22a)
) (21) X (2		0.16	0.1	0.17	0.18	0.10	0.20	(22b)
	0.22	0.21	the applica	0.19	0.18	0.16	0.16	0.10	0.17	0.18	0.19	0.20	_ (220)
If mochanical v		se rate for	o roto throu	ugh cystom								0.50] (<u>)</u> ()
If halanced wit	h heat red	roverv: effi		allowing fo	or in-use fa	ctor from T	able 1b					N/A	(23a)
c) whole house	extract v	entilation of	or positive i	input venti	lation from	n outside	411					11/7	
ς,οις πουsε	0 50	0.50	0.50	0.50	0 50	0.50	0.50	0.50	0.50	0.50	0 50	0.50	(24c)
Effective air chang	ze rate - e	nter (24a) o	or (24b) or	(24c) or (24	1d) in (25)	0.50	0.50	1 0.50	. 0.50	0.50	0.50	0.50	_ (2+0)
	0 50		0.50	0 50	0 50	0.50	0.50	0.50) 0.50	0.50	0 50	0.50	(25)
L	0.00	0.50	0.00	0.00	0.50	0.50	0.50	1 0.50	0.50	0.00	5.50	0.50	_ (23)



Element	Gross area, m ²	Openings m ²	Net ar A, m	rea I ²	U-value W/m²K	A x U W,	/Κ κ-ν: kJ/	alue, 'm².K	Ахк, kJ/K	
Window			23.1	7 x	1.24	= 28.63				(27)
External wall			23.1	0 x	0.18	= 4.16				(29a)
Party wall			63.5	2 x	0.00	= 0.00				(32)
Total area of external elements ΣA , m ²			46.2	7						(31)
Fabric heat loss, $W/K = \Sigma(A \times U)$						(26)(30) + (3	2) =	32.79	(33)
Heat capacity Cm = Σ(A x κ)					(28)	(30) + (32) +	(32a)(32	e) =	N/A	(34)
Thermal mass parameter (TMP) in kJ/m²K									250.00	(35)
Thermal bridges: $\Sigma(L \times \Psi)$ calculated using App	endix K								6.50	(36)
Total fabric heat loss							(33) + (3	6) =	39.29	(37)
Jan Feb Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly 0.33 >	(25)m x (5)									
35.97 35.97 35.97	35.97	35.97	35.97	35.97	35.97	35.97	35.97	35.97	35.97	(38)
Heat transfer coefficient, W/K (37)m + (38)m										
75.26 75.26 75.26	75.26	75.26	75.26	75.26	75.26	75.26	75.26	75.26	75.26	
						Average = ∑	(39)112/	12 =	75.26	(39)
Heat loss parameter (HLP), W/m ² K (39)m \div (4)										
0.86 0.86 0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	
						Average = ∑	(40)112/	12 =	0.86	(40)
Number of days in month (Table 1a)										
31.00 28.00 31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)
4. Water heating energy requirement									2.50	(42)
Assumed occupancy, N	v Vd avorago -	- (25 y NI) + 1	26						2.59	(42)
	y vu,average –	- (23 x N) +	30		Aug		Oct	Nov	 	(43)
IAU FEO IVIAU	Δnr	May	lun	Int		Sen		14114	LIEC	
Hot water usage in litres per day for each mon	Apr h Vd.m = facto	May or from Tabl	Jun le 1c x (43)	Jul	Aug	Sep	ott	NOV	Dec	
Hot water usage in litres per day for each mont	Apr h Vd,m = facto	May or from Tabl	Jun le 1c x (43)	Jul 86.05	Aug	Sep	97 52	101 34	105 17	
Hot water usage in litres per day for each mont 105.17 101.34 97.52	Apr h Vd,m = facto 93.70	May or from Tabl 89.87	Jun le 1c x (43) 86.05	Jul 86.05	89.87	Sep 93.70	97.52 Σ(44)1	101.34 12 =	105.17 1147.29	(44)
Hot water usage in litres per day for each moni- 105.17 101.34 $97.52Energy content of hot water used = 4.18 \times Vd.n$	Apr h Vd,m = facto 93.70	May or from Tabl 89.87	Jun le 1c x (43) 86.05	Jul 86.05 ables 1b.	Aug 89.87	Sep 93.70	97.52 Σ(44)1	101.34 12 =	105.17 1147.29	(44)
Hot water usage in litres per day for each mont 105.17 101.34 $97.52Energy content of hot water used = 4.18 \times Vd,m155.96$ 136.40 140.76	Apr h Vd,m = facto 93.70 n x nm x Tm/36	May or from Tabl 89.87 500 kWh/m 117.75	Jun le 1c x (43) 86.05 onth (see Ta	Jul 86.05 ables 1b, 94.15	Aug 89.87 1c 1d)	Sep 93.70	97.52 Σ(44)1	101.34 12 = 139.09	105.17 1147.29	(44)
Hot water usage in litres per day for each mont 105.17 101.34 $97.52Energy content of hot water used = 4.18 \times Vd,n155.96$ 136.40 140.76	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72	May or from Tabl 89.87 500 kWh/m 117.75	Jun le 1c x (43) 86.05 onth (see Ta 101.61	Jul 86.05 ables 1b, 94.15	Aug 89.87 1c 1d) 108.04	Sep 93.70 109.33	97.52 Σ(44)1 127.42 Σ(45)1	101.34 12 = 139.09 12 =	105.17 1147.29 151.04	(44)
Hot water usage in litres per day for each moning 105.17 101.34 $97.52Energy content of hot water used = 4.18 \times Vd, m155.96$ 136.40 $140.76Distribution loss 0.15 \times (45)m$	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72	May or from Tabl 89.87 500 kWh/m 117.75	Jun le 1c x (43) 86.05 onth (see Ta 101.61	Jul 86.05 ables 1b, 94.15	Aug 89.87 1c 1d) 108.04	Sep 93.70 109.33	97.52 Σ(44)1 127.42 Σ(45)1	101.34 12 = 139.09 12 =	105.17 1147.29 151.04 1504.28	(44) (45)
Hot water usage in litres per day for each mont 105.17 101.34 $97.52Energy content of hot water used = 4.18 \times Vd,m155.96$ 136.40 $140.76Distribution loss 0.15 \times (45)m23.39$ 20.46 21.11	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41	May or from Tabl 89.87 500 kWh/m 117.75	Jun le 1c x (43) 86.05 onth (see Ta 101.61	Jul 86.05 ables 1b, 94.15	Aug 89.87 1c 1d) 108.04 16.21	Sep 93.70 109.33	97.52 Σ(44)1 127.42 Σ(45)1 19.11	101.34 12 = 139.09 12 = 20.86	105.17 1147.29 151.04 1504.28 22.66	(44) (45) (46)
Hot water usage in litres per day for each montant 105.17 101.34 $97.52Energy content of hot water used = 4.18 \times Vd,m155.96$ 136.40 $140.76Distribution loss 0.15 \times (45)m23.39$ 20.46 $21.11Storage volume (litres) including any solar or W$	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41 WHRS storage	May or from Tabl 89.87 500 kWh/m 117.75 17.66 within sam	Jun le 1c x (43) 86.05 onth (see Ta 101.61 15.24	Jul 86.05 ables 1b, 94.15 14.12	Aug 89.87 1c 1d) 108.04 16.21	Sep 93.70 109.33 16.40	97.52 Σ(44)1 127.42 Σ(45)1 19.11	101.34 12 = 139.09 12 = 20.86	105.17 1147.29 151.04 1504.28 22.66 110.00	(44) (45) (46) (47)
Hot water usage in litres per day for each mont 105.17 101.34 $97.52Energy content of hot water used = 4.18 \times Vd,m155.96$ 136.40 $140.76Distribution loss 0.15 \times (45)m23.39$ 20.46 $21.11Storage volume (litres) including any solar or WWater storage loss:$	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41 WHRS storage	May or from Tabl 89.87 500 kWh/mi 117.75 17.66 within sam	Jun le 1c x (43) 86.05 00000000000000000000000000000000000	Jul 86.05 ables 1b, 94.15 14.12	Aug 89.87 1c 1d) 108.04 16.21	Sep 93.70 109.33 16.40	97.52 Σ(44)1 127.42 Σ(45)1 19.11	101.34 12 = 139.09 12 = 20.86	105.17 1147.29 151.04 1504.28 22.66 110.00	(44) (45) (46) (47)
Hot water usage in litres per day for each montain 105.17 101.34 $97.52Energy content of hot water used = 4.18 \times Vd, n155.96$ 136.40 $140.76Distribution loss 0.15 \times (45)m23.39$ 20.46 $21.11Storage volume (litres) including any solar or WWater storage loss:b) Manufacturer's declared loss factor is not kr$	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41 WHRS storage own	May or from Tabl 89.87 500 kWh/m 117.75 17.66 e within sam	Jun le 1c x (43) 86.05 0nth (see Ta 101.61 15.24 ne vessel	Jul 86.05 ables 1b, 94.15 14.12	Aug 89.87 1c 1d) 108.04 16.21	Sep 93.70 109.33 16.40	97.52 Σ(44)1 127.42 Σ(45)1 19.11	101.34 12 = 139.09 12 = 20.86	105.17 1147.29 151.04 1504.28 22.66 110.00	(44) (45) (46) (47)
Hot water usage in litres per day for each mont 105.17 101.34 $97.52Energy content of hot water used = 4.18 \times Vd,m155.96$ 136.40 $140.76Distribution loss 0.15 \times (45)m23.39$ 20.46 $21.11Storage volume (litres) including any solar or WWater storage loss:b) Manufacturer's declared loss factor is not krHot water storage loss factor from Table 2 ($	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41 WHRS storage own kWh/litre/day)	May or from Tabl 89.87 500 kWh/mi 117.75 17.66 within sam	Jun le 1c x (43) 86.05 00000000000000000000000000000000000	Jul 86.05 ables 1b, 94.15 14.12	Aug 89.87 1c 1d) 108.04 16.21	Sep 93.70 109.33 16.40	97.52 Σ(44)1 127.42 Σ(45)1 19.11	101.34 12 = 139.09 12 = 20.86	105.17 1147.29 151.04 1504.28 22.66 110.00 0.02	(44) (45) (46) (47) (51)
Hot water usage in litres per day for each montain 105.17 101.34 $97.52Energy content of hot water used = 4.18 \times Vd,m155.96$ 136.40 $140.76Distribution loss 0.15 \times (45)m23.39$ 20.46 $21.11Storage volume (litres) including any solar or WWater storage loss:b) Manufacturer's declared loss factor is not krHot water storage loss factor from Table 2 (Volume factor from Table 2a$	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41 WHRS storage own kWh/litre/day)	May or from Tabl 89.87 500 kWh/mo 117.75 17.66 e within same	Jun le 1c x (43) 86.05 0nth (see Ta 101.61 15.24 ne vessel	Jul 86.05 ables 1b, 94.15 14.12	Aug 89.87 1c 1d) 108.04 16.21	Sep 93.70 109.33 16.40	97.52 Σ(44)1 127.42 Σ(45)1 19.11	101.34 12 = 139.09 12 = 20.86	105.17 1147.29 151.04 1504.28 22.66 110.00 0.02 1.03	(44) (45) (46) (47) (51) (52)
Hot water usage in litres per day for each montant 105.17 101.34 $97.52Energy content of hot water used = 4.18 \times Vd,m155.96$ 136.40 $140.76Distribution loss 0.15 \times (45)m23.39$ 20.46 $21.11Storage volume (litres) including any solar or WWater storage loss:b) Manufacturer's declared loss factor is not krHot water storage loss factor from Table 2 (Volume factor from Table 2aTemperature factor from Table 2b$	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41 WHRS storage own kWh/litre/day)	May or from Tabl 89.87 500 kWh/mi 117.75 17.66 e within same	Jun le 1c x (43) 86.05 00000000000000000000000000000000000	Jul 86.05 ables 1b, 94.15 14.12	Aug 89.87 1c 1d) 108.04 16.21	Sep 93.70 109.33 16.40	97.52 Σ(44)1 127.42 Σ(45)1 19.11	101.34 12 = 139.09 12 = 20.86	105.17 1147.29 151.04 1504.28 22.66 110.00 0.02 1.03 0.60	 (44) (45) (46) (47) (51) (52) (53)
Hot water usage in litres per day for each mont 105.17 101.34 $97.52Energy content of hot water used = 4.18 \times Vd,m155.96$ 136.40 $140.76Distribution loss 0.15 \times (45)m23.39$ 20.46 $21.11Storage volume (litres) including any solar or WWater storage loss:b) Manufacturer's declared loss factor is not krHot water storage loss factor from Table 2 (Volume factor from Table 2aTemperature factor from Table 2bEnergy lost from water storage (kWh/day)$	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41 WHRS storage own kWh/litre/day) 47) x (51) x (52	May or from Tabl 89.87 500 kWh/m 117.75 17.66 17.66 within sam	Jun le 1c x (43) 86.05 onth (see Ta 101.61 15.24 ne vessel	Jul 86.05 ables 1b, 94.15 14.12	Aug 89.87 1c 1d) 108.04 16.21	Sep 93.70 109.33 16.40	97.52 Σ(44)1 127.42 Σ(45)1 19.11	101.34 12 = 139.09 12 = 20.86	105.17 1147.29 151.04 1504.28 22.66 110.00 0.02 1.03 0.60 1.03	 (44) (45) (46) (47) (51) (52) (53) (54)
JainFebIvialHot water usage in litres per day for each monit105.17101.3497.52Energy content of hot water used = 4.18 x Vd,n155.96136.40140.76Distribution loss0.15 x (45)m23.3920.4621.11Storage volume (litres) including any solar or WWater storage loss:b) Manufacturer's declared loss factor is not krHot water storage loss factor from Table 2 (Volume factor from Table 2a Temperature factor from Table 2b Energy lost from water storage (kWh/day)Enter (50) or (54) in (55)	Apr h Vd,m = facto 93.70 h x nm x Tm/36 122.72 18.41 WHRS storage own kWh/litre/day) 47) x (51) x (52	May or from Tabl 89.87 500 kWh/m 117.75 17.66 2 within sam	Jun le 1c x (43) 86.05 0nth (see Ta 101.61 15.24 he vessel	Jul 86.05 ables 1b, 94.15 14.12	Aug 89.87 1c 1d) 108.04 16.21	Sep 93.70 109.33 16.40	97.52 Σ(44)1 127.42 Σ(45)1 19.11	101.34 12 = 139.09 12 = 20.86	105.17 1147.29 151.04 1504.28 22.66 110.00 0.02 1.03 0.60 1.03 1.03	 (44) (45) (46) (47) (51) (52) (53) (54) (55)
Hot water usage in litres per day for each mont 105.17 101.34 97.52 Energy content of hot water used = 4.18 x Vd,n $ 155.96 136.40 140.76 $ Distribution loss $0.15 \times (45)m$ 23.39 20.46 21.11 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 (Volume factor from Table 2a Temperature factor from Table 2b Energy lost from water storage (kWh/day) = Enter (50) or (54) in (55) Water storage loss calculated for each month	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41 WHRS storage own kWh/litre/day) 47) x (51) x (52 55) x (41)m	May or from Tabl 89.87 500 kWh/m 117.75 17.66 within sam	Jun le 1c x (43) 86.05 onth (see Ta 101.61 15.24 ne vessel	Jul 86.05 ables 1b, 94.15 14.12	Aug 89.87 1c 1d) 108.04 16.21	Sep 93.70 109.33 16.40	97.52 Σ(44)1 127.42 Σ(45)1 19.11	101.34 12 =	105.17 1147.29 151.04 1504.28 22.66 110.00 0.02 1.03 0.60 1.03 1.03	 (44) (45) (46) (47) (51) (52) (53) (54) (55)
Hot water usage in litres per day for each mont 105.17 101.34 97.52 Energy content of hot water used = 4.18 x Vd,n 155.96 136.40 140.76 Distribution loss 0.15 x (45)m 23.39 20.46 21.11 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 (Volume factor from Table 2a Temperature factor from Table 2b Energy lost from water storage (kWh/day) Enter (50) or (54) in (55) Water storage loss calculated for each month 32.01 28.92 32.01	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41 WHRS storage own kWh/litre/day) 47) x (51) x (52 55) x (41)m 30.98	May or from Tabl 89.87 500 kWh/mo 117.75 17.66 within sam 2) x (53) 32.01	Jun le 1c x (43) 86.05 onth (see Ta 101.61 15.24 ne vessel 30.98	Jul 86.05 ables 1b, 94.15 14.12 32.01	Aug 89.87 1c 1d) 108.04 16.21 32.01	Sep 93.70 109.33 16.40 30.98	97.52 Σ(44)1 127.42 Σ(45)1 19.11 32.01	101.34 12 = 139.09 12 = 20.86	105.17 1147.29 151.04 1504.28 22.66 110.00 0.02 1.03 0.60 1.03 1.03 32.01	 (44) (45) (46) (47) (51) (52) (53) (54) (55) (56)
JainFebIvialHot water usage in litres per day for each mont 105.17 101.34 97.52 Energy content of hot water used = $4.18 \times Vd$,n 155.96 136.40 140.76 Distribution loss $0.15 \times (45)m$ 23.39 20.46 21.11 Storage volume (litres) including any solar or WWater storage loss:b) Manufacturer's declared loss factor is not krHot water storage loss factor from Table 2aTemperature factor from Table 2aTemperature factor from Table 2bEnergy lost from water storage (kWh/day)Enter (50) or (54) in (55)Water storage loss calculated for each month 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 28.92 32.01 32.01	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41 'WHRS storage own kWh/litre/day) 47) x (51) x (52 55) x (41)m 30.98 r dedicated WV	May or from Tabl 89.87 500 kWh/mi 117.75 17.66 e within sam 2) x (53) 32.01 WHRS (56)n	Jun le 1c x (43) 86.05 00000000000000000000000000000000000	Jul 86.05 ables 1b, 94.15 14.12 14.12 32.01 s] ÷ (47),	Aug 89.87 1c 1d) 108.04 16.21 32.01 else (56)	Sep 93.70 109.33 16.40 30.98	97.52 Σ(44)1 127.42 Σ(45)1 19.11 32.01	101.34 12 = 139.09 12 = 20.86 30.98	105.17 1147.29 151.04 1504.28 22.66 110.00 0.02 1.03 0.60 1.03 1.03 1.03 32.01	 (44) (45) (46) (47) (51) (52) (53) (54) (55) (56)
Hot water usage in litres per day for each mont 105.17 101.34 97.52 Energy content of hot water used = 4.18 x Vd,n 155.96 136.40 140.76 Distribution loss 0.15 x (45)m 23.39 20.46 21.11 Storage volume (litres) including any solar or W Water storage loss: b) Manufacturer's declared loss factor is not kr Hot water storage loss factor from Table 2 (Volume factor from Table 2a Temperature factor from Table 2b Energy lost from water storage (kWh/day) Enter (50) or (54) in (55) Water storage loss calculated for each month 32.01 28.92 32.01 If the vessel contains dedicated solar storage of 32.01 28.92 32.01	Apr h Vd,m = facto 93.70 n x nm x Tm/36 122.72 18.41 WHRS storage own kWh/litre/day) 47) x (51) x (52 55) x (41)m 30.98 r dedicated WV 30.98	May or from Tabl 89.87 500 kWh/mo 117.75 17.66 within sam 2) x (53) 32.01 WHRS (56)n 32.01	Jun le 1c x (43) 86.05 onth (see Ta 101.61 15.24 ne vessel 30.98 n x [(47) - Vs 30.98	Jul 86.05 ables 1b, 94.15 14.12 14.12 32.01 s] ÷ (47), 32.01	Aug 89.87 1c 1d) 108.04 16.21 16.21 32.01 else (56) 32.01	Sep 93.70 109.33 16.40 30.98	97.52 Σ(44)1 127.42 Σ(45)1 19.11 19.11 32.01	101.34 12 = 139.09 12 = 20.86 20.86 30.98 30.98	105.17 1147.29 151.04 1504.28 22.66 110.00 0.02 1.03 0.60 1.03 32.01	 (44) (45) (46) (47) (51) (52) (53) (54) (55) (56) (57)

Primary circuit lo	ss for each	month fro	m Table 3										
	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
Combi loss for ea	ach month f	from Table	3a, 3b or 3	с									
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
Total heat requir	ed for wate	er heating o	calculated f	or each mo	nth 0.85 x	: (45)m + (4	6)m + (57)r	n + (59)m +	· (61)m				
	211.24	186.33	196.03	176.21	173.03	155.10	149.43	163.32	162.83	182.70	192.58	206.32	(62)
Solar DHW input	calculated	using Appe	endix 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 wat	er heater fo	or each mo	onth (kWh/i	month) (62	!)m + (63)n	n							
	211.24	186.33	196.03	176.21	173.03	155.10	149.43	163.32	162.83	182.70	192.58	206.32	
										∑(64)1	.12 = 2	155.12	(64)
Heat gains from	water heati	ing (kWh/n	nonth) 0.25	5 × [0.85 × ((45)m + (61	L)m] + 0.8 ×	[(46)m + (57)m + (59)	m]				
	96.08	85.30	91.02	83.60	83.37	76.58	75.53	80.15	79.15	86.59	89.04	94.44	(65)
5 Internal gain	e .												
J. Internal gain.	lan	Eeb	Mar	Apr	May	lun	tul.	Δυσ	Sen	Oct	Nov	Dec	
Metabolic gains	Jan (Table 5)	reb	Ividi	Арі	iviay	Jun	Jui	Aug	Seh	00	NOV	Dec	
wietabolic gains		120.20	120.29	120.29	120.20	120.29	120.29	120.20	120.20	120.20	120.29	120.20	(66)
Lighting gains (ca	lculated in	Annendix		129.20	129.20	123.20	129.20	129.20	129.20	129.20	129.20	129.20] (00)
LIGHTING BUILD (CC	20.85	18 52	15.06		8 52	7 10	7 77	10.11	12.56	17.22	20.10	21 / 2	(67)
Annliance gains (calculated	in Annendi	ix Lequatio	n 13 or 1	3a) also si	ee Table 5	1.11	10.11	15.50	17.22	20.10	21.45] (07)
Abbinarice Bailio (222.85	236.28	230.16	217 14	200 71	185.27	17/ 05	172 52	178.64	101.65	208.09	222 52	(68)
Cooking gains (ca	alculated in	Annendix	equation	115 or 115	a) also see	Table 5	174.95	172.52	178.04	191.05	208.09	223.33] (00)
COOKING Barris (CC	35.02	25.02	25.02	25.02	25 92	25.02	25.02	35.03	35.03	35.03	25.02	25.02	(60)
Pump and fan ga	ins (Table 5	55.55 (a)	55.55	55.55	33.33	33.33	33.33	55.55	35.55	55.55	55.55	55.55] (03)
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
Losses e g evano	pration (Tab	ole 5)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00] (70)
200000 0.8. 01000	-103 42	-103 42	-103.42	-103 42	-103 42	-103 42	-103.42	-103.42	-103.42	-103 42	-103 42	-103 42	(71)
Water heating ga	ains (Table !	5)	105.12	103.12	103.12	100.12	103.12	103.12	103.12	103.12	103.12	103.12] (/ =/
	129 14	126.93	122 34	116 11	112.06	106 36	101 52	107 72	109 93	116 38	123 67	126 94	(72)
Total internal gai	ins (66)m +	· (67)m + (6	58)m + (69)i	m + (70)m ·	+ (71)m + (72)m	101.01	10777	200.00	110.00	120107] (' =/
	445.62	443.51	429.35	406.44	383.08	, 360.60	346.02	352,13	363,91	387.04	413.64	433.68	(73)
	113102	110.01	123.33	100.11	303.00	300.00	510.02	332.13	303.51	307.01	115.01	133.00] (, 3)
6. Solar gains													
			Access f	actor	Area	Sol	ar flux		g Sfia data	FF	1	Gains	
			Table	bu	m-	v	//m-	or Ta	able 6b	or Table	6c	vv	
North			0.7	7 x [2.09	x 1	0.63 x	0.9 x 0).40 x	0.80		4.93	(74)
NorthEast			0.7	7 X	21.08	x 1	1.28 x	0.9 x 0).40 x	0.80		52.74	(75)
Solar gains in wa	tts Σ(74)m	(82)m] (/
Ū	57.67	116.78	209.44	343.38	461.64	492.31	460.48	366.97	254.94	142.42	72.45	47.18	(83)
Total gains - inte	rnal and so	lar (73)m +	· (83)m					1			1		1, ,
	503.29	560.29	638.79	749.82	844.72	852.92	806.50	719.10	618.86	529.46	486.09	480.86	(84)
			I			•		1			1		
7. Mean interna	al temperat	ture (heati	ng season)										
Temperature dur	ring heating	g periods ir	n the living a	area from T	able 9, Th1	L(°C)						21.00	(85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor	for gains fo	or living are	ea n1,m (se	e Table 9a)		1		1			1		1
	1.00	1.00	0.99	0.93	0.77	0.56	0.41	0.48	0.78	0.97	1.00	1.00	(86)

Mean internal to	emp of livin	g area T1 (s	steps 3 to 7	in Table 90	c)								
	20.14	20.26	20.48	20.76	20.95	20.99	21.00	21.00	20.96	20.70	20.36	20.11	(87)
Temperature du	uring heatin	g periods ir	1 the rest of	dwelling f	rom Table	9, Th2(°C)							
	20.20	20.20	20.20	20.20	20.20	20.20	20.20	20.20	20.20	20.20	20.20	20.20	(88)
Utilisation facto	r for gains f	or rest of d	welling n2,	m									
	1.00	0.99	0.98	0.91	0.72	0.49	0.34	0.40	0.71	0.96	0.99	1.00	(89)
Mean internal to	emperature	in the rest	of dwelling	T2 (follow	steps 3 to	o 7 in Table	9c)						
	19.04	19.21	19.53	19.92	20.15	20.20	20.20	20.20	20.17	19.84	19.36	18.99	(90)
Living area fract	ion	-			•	•			Li	ving area ÷	(4) =	0.31	(91)
Mean internal to	emperature	for the wh	ole dwellin	g fLA x T1 +	+(1 - fLA) x	T2							-
	19.38	19.53	19.82	20.18	20.40	20.44	20.45	20.45	20.41	20.11	19.67	19.34	(92)
Apply adjustme	nt to the m	ean interna	l temperati	ire from Ta	ble 4e wh	ere approp	riate				1	1] , ,
	19.38	19.53	19.82	20.18	20.40	20.44	20.45	20.45	20.41	20.11	19.67	19.34	(93)
						-		1] (/
8. Space heatir	ng requiren	hent											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains,	ηm											
	1.00	0.99	0.98	0.91	0.73	0.51	0.36	0.42	0.73	0.96	0.99	1.00	(94)
Useful gains, ηπ	nGm, W (94	4)m x (84)m	ı										
	501.71	556.53	625.13	683.57	620.17	436.57	289.26	303.79	451.09	506.73	482.65	479.72	(95)
Monthly average	e external t	emperatur	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]							
	1135.29	1101.48	1002.57	849.11	654.45	439.74	289.53	304.53	475.00	715.47	946.24	1139.47	(97)
Space heating re	equirement	, kWh/mon	th 0.024 x	[(97)m - (9	5)m] x (41)m							
	471.38	366.20	280.81	119.19	25.51	0.00	0.00	0.00	0.00	155.31	333.78	490.85]
									Σ(9	8)15, 10	.12 = 2	2243.04	(98)
Space heating re	equirement	kWh/m²/y	ear							(98)	÷ (4)	25.72	(99)
													-
9b. Energy req	uirements ·	communit	y heating s	cheme									1
Fraction of spac	e heat from	l secondary	/supplemer	ntary syste	m (table 1	.1)				'0' if ı	none	0.00	(301)
Fraction of spac	e heat from	ı communit	y system							1 - (30	01) =	1.00	(302)
Fraction of com	munity hea	t from boile	ers									0.25	(303a)
Fraction of com	munity hea	t from CHP										0.75	(303b)
Fraction of total	l space heat	from comr	nunity CHP							(302) x (30	3a) =	0.75	(304a)
Fraction of total	l space heat	from com	nunity boile	ers						(302) x (303	3b) =	0.25	(304b)
Factor for contro	ol and char	ging metho	d (Table 4c(3)) for com	nmunity sp	bace heating	5					1.00	(305)
Factor for charg	ing method	(Table 4c(3)) for comr	nunity wat	er heating	5						1.00	(305a)
Distribution loss	s factor (Tab	ole 12c) for	community	heating sy	rstem							1.05	(306)
Space heating													
Annual space he	eating requi	rement						2	243.04]			(98)
Space heat from	n CHP							(98	8) x (304a) :	x (305) x (30	06) = 🗌	1766.39	(307a)
Space heat from	n boilers							(98	3) x (304b) :	x (305) x (30	06) =	588.80	(307b)
Water heating													
Annual water he	eating requi	rement						2	155.12]			(64)
Water heat fron	n CHP							(64)	x (303a) x	(305a) x (30	06) = 🔤	L697.15	(310a)

Water heat from boilers			(64) x (303b) x (30	05a) x (306) =	565.72	(310b)
Electricity used for heat distribution		0.01 × [(3	307a)(307e) + (310	Da)(310e)] =	46.18	(313)
Electricity for pumps, fans and electric keep-hot (Table 4f)						
mechanical ventilation fans - balanced, extract or positive input	ut from outside		55.33			(330a)
Total electricity for the above, kWh/year					55.33	(331)
Electricity for lighting (Appendix L)					368.18	(332)
Energy saving/generation technologies						
electricity generated by PV (Appendix M)					-53.23	(333)
Total delivered energy for all uses	(307) + (309) +	(310) + (312)	+ (315) + (331) + (33	32)(337b) =	4988.33	(338)
10b. Fuel costs - community heating scheme						
	Fuel kWb/year		Fuel price		Fuel cost f/year	
Space heating from CHP	1766.39	v	2 97	x 0 01 =	52.46] (340a)
Space heating from boilers	588.80	×	4.24	x 0.01 =	2/ 97] (340a)
Water heating from CHP	1697.15	×	2.97	x 0.01 =	50.41	(3400)
Water heating from boilers	565.72	Ŷ	4.24	x 0.01 =	23.99] (3420)
Pumps and fans	55 33	Ŷ	13 19	x 0.01 =	7 30] (3420)] (349)
Electricity for lighting	368 18	x	13.19	x = 0.01	48 56	(350)
Additional standing charges	500.10	'n	15.15	X 0.01	120.00	(351)
Energy saving/generation technologies					120.00] (331)
py savings	-53.23	x	13.19	x 0.01 =	0.00	(352)
Total energy cost	33.23	Â	(340a) $(342e) + ($	345) (354) =	327.68	(355)
				0.07.11(00.17	02/100	
11b. SAP rating - community heating scheme						
Energy cost deflator (Table 12)					0.42	(356)
Energy cost factor (ECF)					1.04	(357)
SAP value					85.48]
SAP rating (section 13)					85	(358)
SAP band					В]
12b. CO ₂ emissions - community heating scheme						
	Energy kWb/year		Emission factor		Emissions (kg/year)	
Emissions from community CHP (space and water beating)	ittin, yeur				() J.cu.)	
Power efficiency of CHP unit	28.00					(361)
Heat efficiency of CHP unit	66.01					(362)
Space heating from CHP $(307a) \times 100 \div (362) =$	2675.9278	x	0.2160	=	578.0004	(363)

Space heating from CHP	(307a) × 100 ÷ (362) = [2675.9278	x	0.2160	=	578.0004				
less credit emissions for electrici	ity	-751.6561	x	0.5190	=	-390.1095				
Water heated by CHP	[2571.0383	x 0.2160 =							
less credit emissions for electrici	ity [-722.1932	х	0.5190	=	-374.8182				
Emissions from other sources (space heating)										
Efficiency of boilers	[94.00								
CO2 emissions from boilers [(30	07b)+(310b)] x 100 ÷ (367b) = [1228.21	x	0.216	=	265.29				
Electrical energy for community hea	at distribution	46.18	х	0.52	=	23.97				
Total CO2 associated with communi	ity systems					657.68				
Total CO2 associated with space and	d water heating					657.68				
Pumps and fans	[55.33	x	0.52	=	28.71				
Electricity for lighting	[368.18	x	0.52	=	191.09				

(364) (365) (366)

(367b)] (368)] (372)] (373)] (376)] (378)

(379)

Energy saving/generation tech	nologies										
pv savings		-53.23	x	0.52	=	-27.63	(380)				
Total CO ₂ , kg/year					(376)(382) =	849.85	(383)				
Dwelling CO ₂ emission rate					(383) ÷ (4) =	9.74	(384)				
EI value						91.39]				
El rating (section 14)						91	(385)				
El band						В]				
13b. Primary energy - community heating scheme											
		Energy kWh/year		Primary factor		Primary energy (kWh/year)					
Primary Energy from communi	ty CHP (space and water heating)										
Power efficiency of CHP unit		28.09					(361)				
Heat efficiency of CHP unit		66.01					(362)				
Space heating from CHP	(307a) × 100 ÷ (362) =	2675.93	x	1.22	=	3264.63	(363)				
less credit energy for electri	icity	-751.66	x	3.07	=	-2307.58	(364)				
Water heated by CHP		2571.04	x	1.22	=	3136.67	(365)				
less credit energy for electricity	-722.19	x	3.07	=	-2217.13	(366)					
Primary energy from other sources (space heating)											
Efficiency of boilers		94.00					(367b)				
Primary energy from boilers	[(307b)+(310b)] x 100 ÷ (367b) =	1228.21	x	1.22	=	1498.41	(368)				
Electrical energy for communit	y heat distribution	46.18	х	3.07	=	141.77	(372)				
Total primary energy associate	d with community systems					3516.77	(373)				
Total primary energy associate					3516.77	(376)					
Pumps and fans		55.33	x	3.07	=	169.85	(378)				
Electricity for lighting		368.18	x	3.07	=	1130.31	(379)				
Energy saving/generation tech	nologies										
Electricity generated - PVs		-53.23	x	3.07	=	-163.43	(380)				
Primary energy kWh/year					4653.51	(383)					
Dwelling primary energy rate k	Wh/m2/year					53.36	(384)				



Assessor name		Miss Jayna Parmar						Assessor nun	nber	6549	6549		
Client									Last modified	25/11	25/11/2016		
Address		A-L04-60	A Centric (Close, Lond	on, N8								
					· ·								
1. Overall dwelli	ng dimen	sions											
					ļ	Area (m²)			Average storey height (m)	1	Vo	lume (m³)	
Lowest occupied						49.39	(1a) x	Ē	2.50	(2a) =		123.48	(3a)
Total floor area		(1a)	+ (1b) + (1	c) + (1d)(1n) =	49.39	(4)						
Dwelling volume									(3a) + (3b) + (3	8c) + (3d)(3	8n) =	123.48	(5)
2. Ventilation ra	te												
											mª	³ per hour	
Number of chimn	evs							Г	0	x 40 =		0	(6a)
Number of open f	lues							Ē	0	 x 20 =		0	 (6b)
Number of interm	nittent fan	S						Г	0	 x 10 =	· [0] (7a)
Number of passiv	e vents							Ē	0	 x 10 =	· [0	 (7b)
Number of flueles	s gas fires	5						Ē	0	 x 40 =		0	(7c)
	-										Air c	hanges pe	r
Infiltration due to	chimneys	s, flues, fan	s, PSVs		(6a) + (6b) + (7	'a) + (7b) + ((7c) = [0	÷ (5) =		0.00	(8)
If a pressurisation	test has l	been carrie	d out or is i	ntended, p	roceed to	(17), otherv	vise continu	le from	(9) to (16)				_
Air permeability v	alue, q50,	, expressed	in cubic m	etres per h	our per sq	uare metre	of envelop	e area				4.00	(17)
If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, otherwise $(18) = (16)$											0.20	(18)	
Number of sides on which the dwelling is sheltered											3	(19)	
Shelter factor								1	- [0.075 x (1	9)] =	0.78	(20)	
Infiltration rate incorporating shelter factor									(18) x (2	20) =	0.16	(21)	
Infiltration rate m	odified fo	r monthly v	wind speed	:									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Au	g Sep	Oct	Nov	Dec	
Monthly average	wind spee	ed from Tab	le U2										
	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.7	0 4.00	4.30	4.50	4.70	(22)
Wind factor (22)m	n ÷ 4												
	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.9	3 1.00	1.08	1.13	1.18	(22a)
Adjusted infiltration	on rate (a	llowing for	shelter and	I wind fact	or) (21) x (22a)m							
	0.20	0.19	0.19	0.17	0.17	0.15	0.15	0.1	4 0.16	0.17	0.17	0.18	(22b)
Calculate effective	e air chan	ge rate for	the applica	ble case:									
If mechanical ventilation: air change rate through system											0.50	(23a)	
If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h N/A (23c)									(23c)				
c) whole house	e extract v	entilation o	or positive i	nput venti	lation fron	n outside							_
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.5	0 0.50	0.50	0.50	0.50	(24c)
Effective air chang	ge rate - e	nter (24a) (or (24b) or	(24c) or (24	1d) in (25)								_
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.5	0.50	0.50	0.50	0.50	(25)


Element	Gross area, m ²	Openings m ²	Net are A, m ²	ea U· ² W	-value V/m²K	A x U W/	′К к-v kJ/	alue, ′m².K	Ахк, kJ/K	
Window			12.36	5 x 🗌	1.24 :	= 15.27				(27)
External wall			6.99	x	0.18 :	= 1.26				(29a)
Party wall			53.62	2 x	0.00 :	= 0.00				(32)
Total area of external elements ΣA , m ²			19.35	5						(31)
Fabric heat loss, W/K = ∑(A × U)						(26)(30) + (3	32) =	16.53	(33)
Heat capacity Cm = ∑(А x к)					(28)(30) + (32) +	(32a)(32	2e) =	N/A	(34)
Thermal mass parameter (TMP) in kJ/m²K									250.00	(35)
Thermal bridges: $\Sigma(L \times \Psi)$ calculated using A	oppendix K								4.11	(36)
Total fabric heat loss							(33) + (3	36) =	20.64	(37)
Jan Feb N	lar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly 0.2	33 x (25)m x (5)									
20.37 20.37 20	.37 20.37	20.37	20.37	20.37	20.37	20.37	20.37	20.37	20.37	(38)
Heat transfer coefficient, W/K (37)m + (38)	m									
41.01 41.01 41	01 41.01	41.01	41.01	41.01	41.01	41.01	41.01	41.01	41.01]
					A	Average = ∑	(39)112/	12 =	41.01	(39)
Heat loss parameter (HLP), W/m ² K (39)m \div	(4)									
0.83 0.83 0.	.83 0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83]
					A	Average = Σ	(40)112/	12 =	0.83	(40)
Number of days in month (Table 1a)										
31.00 28.00 31	00 30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)
A Water besting energy requirement										
4. Water heating energy requirement									1.67	(42)
Assumed occupancy, N									1.07	(42)
Annual average bot water usage in litres ne	r day Vd average	= (25 x N) +	36						73 91	(13)
Annual average hot water usage in litres pe Jan Feb N	r day Vd,average Iar Apr	= (25 x N) + May	36 Jun	Jul	Aug	Sep	Oct	Nov	73.91 Dec	(43)
Annual average hot water usage in litres pe Jan Feb N Hot water usage in litres per day for each m	r day Vd,average 1ar Apr 100nth Vd.m = fact	= (25 x N) + May for from Tabl	36 Jun le 1c x (43)	Jul	Aug	Sep	Oct	Nov	73.91 Dec] (43)
Annual average hot water usage in litres pe Jan Feb N Hot water usage in litres per day for each m	r day Vd,average lar Apr lonth Vd,m = fact	= (25 x N) + May for from Tabl	36 Jun le 1c x (43)	Jul	Aug	Sep	Oct	Nov	73.91 Dec] (43)
Annual average hot water usage in litres per Jan Feb M Hot water usage in litres per day for each m 81.31 78.35 75	r day Vd,average Tar Apr conth Vd,m = fact 5.39 72.44	= (25 x N) + May for from Tabl	36 Jun le 1c x (43) 66.52	Jul 66.52	Aug 69.48	Sep 72.44	Oct 75.39 Σ(44)1	Nov 78.35	73.91 Dec 81.31] (43)]] (44)
Annual average hot water usage in litres per Jan Feb M Hot water usage in litres per day for each m 81.31 78.35 75 Energy content of hot water used = 4.18 x V	r day Vd,average Tar Apr ionth Vd,m = fact i.39 72.44 /d,m x nm x Tm/3	= (25 x N) + May or from Tabl 69.48 8600 kWh/m	36 Jun le 1c x (43) 66.52 onth (see Ta	Jul 66.52	Aug 69.48	Sep 72.44	Oct 75.39 Σ(44)1	Nov 78.35 12 =	73.91 Dec 81.31 886.96] (43)]] (44)
Annual average hot water usage in litres perJanFebNHot water usage in litres per day for each m81.3178.3575Energy content of hot water used = 4.18 x V120.57105.45105	r day Vd,average Tar Apr ionth Vd,m = fact 5.39 72.44 7d,m x nm x Tm/3 8.82 94.87	= (25 x N) + May for from Tabl 69.48 600 kWh/m 91.03	36 Jun le 1c x (43) 66.52 onth (see Ta 78.55	Jul 66.52 bles 1b, 1c 72.79	Aug 69.48 1d) 83.53	Sep 72.44	Oct 75.39 Σ(44)1 98.51	Nov 78.35 12 = 107.53	73.91 Dec 81.31 886.96 116.77] (43)]] (44)]
Annual average hot water usage in litres perJanFebMHot water usage in litres per day for each m 81.31 78.35 75 Energy content of hot water used = 4.18×10^{-10} 120.57 105.45 105	r day Vd,average Tar Apr 1000000000000000000000000000000000000	= (25 x N) + May for from Tabl 69.48 8600 kWh/m 91.03	36 Jun le 1c x (43) 66.52 onth (see Ta 78.55	Jul 66.52 bles 1b, 1c 72.79	Aug 69.48 1d) 83.53	Sep 72.44 84.53	Oct 75.39 Σ(44)1 98.51 Σ(45)1	Nov 78.35 12 = 107.53 12 =	73.91 Dec 81.31 886.96 116.77 1162.95] (43)]] (44)] (45)
Annual average hot water usage in litres per Jan Feb N Hot water usage in litres per day for each m $\boxed{81.31}$ 78.35 75 Energy content of hot water used = 4.18 x V $\boxed{120.57}$ 105.45 100 Distribution loss 0.15 x (45)m	r day Vd,average Tar Apr aonth Vd,m = fact 3.39 72.44 7d,m x nm x Tm/3 8.82 94.87	= (25 x N) + May for from Tabl 69.48 8600 kWh/m 91.03	36 Jun le 1c x (43) 66.52 onth (see Ta 78.55	Jul 66.52 bles 1b, 1c 72.79	Aug 69.48 1d) 83.53	Sep 72.44 84.53	Oct 75.39 Σ(44)1 98.51 Σ(45)1	Nov 78.35 12 = 107.53 12 =	73.91 Dec 81.31 886.96 1162.95] (43)] (44)] (45)
Annual average hot water usage in litres perJanFebMHot water usage in litres per day for each m 81.31 78.35 75 Energy content of hot water used = $4.18 \times V$ 120.57 105.45 106 Distribution loss $0.15 \times (45)m$ 18.09 15.82 166	r day Vd,average Tar Apr ionth Vd,m = fact 3.39 72.44 7d,m x nm x Tm/3 8.82 94.87 5.32 14.23	= (25 x N) + May for from Table 69.48 8600 kWh/m 91.03 13.65	36 Jun le 1c x (43) 66.52 onth (see Ta 78.55 11.78	Jul 66.52 bles 1b, 1c 72.79	Aug 69.48 1d) 83.53	Sep 72.44 84.53 12.68	Oct 75.39 Σ(44)1 98.51 Σ(45)1 14.78	Nov 78.35 12 = 107.53 12 = 16.13	73.91 Dec 81.31 886.96 1162.95 1162.95] (43)] (44)] (45)] (46)
Feb M Jan Feb M Hot water usage in litres per day for each m 81.31 78.35 75 Energy content of hot water used = 4.18 x M 120.57 105.45 105 Distribution loss 0.15 x (45)m 18.09 15.82 16 Storage volume (litres) including any solar of the set of	r day Vd,average Tar Apr ionth Vd,m = fact 3.39 72.44 7d,m x nm x Tm/3 8.82 94.87 5.32 14.23 or WWHRS storag	= (25 x N) + May for from Table 69.48 8600 kWh/m 91.03 13.65 re within sam	36 Jun le 1c x (43) 66.52 onth (see Ta 78.55 11.78 ne vessel	Jul 66.52 bles 1b, 1c 72.79 10.92	Aug 69.48 1d) 83.53 12.53	Sep 72.44 84.53 12.68	Oct 75.39 Σ(44)1 98.51 Σ(45)1 14.78	Nov 78.35 12 = 107.53 12 = 16.13	73.91 Dec 81.31 886.96 1162.95 1162.95 17.52 110.00] (43)] (44)] (44)] (45)] (46)] (47)
Annual average hot water usage in litres perJanFebMHot water usage in litres per day for each m 81.31 78.35 75 Energy content of hot water used = $4.18 \times V$ 120.57 105.45 106 Distribution loss $0.15 \times (45)m$ 18.09 15.82 166 Storage volume (litres) including any solar of Water storage loss: $1000 \times 1000 \times 10000 \times 100000 \times 100000000$	r day Vd,average Tar Apr ionth Vd,m = fact 5.39 72.44 7d,m x nm x Tm/3 8.82 94.87 5.32 14.23 or WWHRS storag	= (25 x N) + May for from Table 69.48 8600 kWh/m 91.03 13.65 re within sam	36 Jun le 1c x (43) 66.52 onth (see Ta 78.55 11.78 ne vessel	Jul 66.52 bles 1b, 1c 72.79 10.92	Aug 69.48 1d) 83.53 12.53	Sep 72.44 84.53 12.68	Oct 75.39 Σ(44)1 98.51 Σ(45)1 14.78	Nov 78.35 12 = 107.53 12 = 16.13	73.91 Dec 81.31 886.96 1162.95 1162.95 17.52 110.00] (43)] (44)] (45)] (46)] (47)
Feb N Jan Feb N Hot water usage in litres per day for each m 81.31 78.35 75 Energy content of hot water used = 4.18 x V 120.57 105.45 105 Distribution loss 0.15 x (45)m 18.09 15.82 16 Storage volume (litres) including any solar of Water storage loss: b) Manufacturer's declared loss factor is no 105	r day Vd,average Tar Apr ionth Vd,m = fact 5.39 72.44 7d,m x nm x Tm/3 8.82 94.87 5.32 14.23 or WWHRS storage t known	= (25 x N) + May for from Tabl 69.48 3600 kWh/m 91.03 13.65 re within sam	36 Jun le 1c x (43) 66.52 onth (see Ta 78.55 11.78 ne vessel	Jul 66.52 bles 1b, 1c 72.79 10.92	Aug 69.48 1d) 83.53 12.53	Sep 72.44 84.53 12.68	Oct 75.39 Σ(44)1 98.51 Σ(45)1 14.78	Nov 78.35 12 = 107.53 12 = 16.13	73.91 Dec 81.31 886.96 1162.95 1162.95 17.52 110.00] (43)] (44)] (45)] (46)] (47)
Feb N Jan Feb N Hot water usage in litres per day for each m 81.31 78.35 75 Energy content of hot water used = 4.18 x V 120.57 105.45 106 Distribution loss 0.15 x (45)m 18.09 15.82 16 Storage volume (litres) including any solar of Water storage loss: b) Manufacturer's declared loss factor is no Hot water storage loss factor from Table	r day Vd,average Tar Apr ionth Vd,m = fact .39 72.44 /d,m x nm x Tm/3 8.82 94.87 .32 14.23 or WWHRS storage t known 2 (kWh/litre/day	= (25 x N) + May for from Table 69.48 8600 kWh/m 91.03 13.65 re within sam	36 Jun le 1c x (43) 66.52 onth (see Ta 78.55 11.78 he vessel	Jul 66.52 bles 1b, 1c 72.79 10.92	Aug 69.48 1d) 83.53 12.53	Sep 72.44 84.53 12.68	Oct 75.39 Σ(44)1 98.51 Σ(45)1 14.78	Nov 78.35 12 = 107.53 12 = 16.13	73.91 Dec 81.31 886.96 116.77 1162.95 17.52 110.00] (43)] (44)] (44)] (45)] (45)] (46)] (47)
Feb N Jan Feb N Hot water usage in litres per day for each m 81.31 78.35 75 Energy content of hot water used = 4.18 x V 120.57 105.45 100 Distribution loss 0.15 x (45)m 18.09 15.82 16 Storage volume (litres) including any solar of Water storage loss: b) Manufacturer's declared loss factor is no Hot water storage loss factor from Table 2a 100	r day Vd,average Tar Apr ionth Vd,m = fact 3.39 72.44 7d,m x nm x Tm/3 8.82 94.87 5.32 14.23 or WWHRS storage t known 2 (kWh/litre/day	= (25 x N) + May for from Table 69.48 8600 kWh/m 91.03 13.65 re within sam	36 Jun le 1c x (43) 66.52 onth (see Ta 78.55 11.78 ne vessel	Jul 66.52 bles 1b, 1c 72.79 10.92	Aug 69.48 1d) 83.53 12.53	Sep 72.44 84.53 12.68	Oct 75.39 Σ(44)1 98.51 Σ(45)1 14.78	Nov 78.35 12 = 107.53 12 = 16.13	73.91 Dec 81.31 886.96 116.77 1162.95 110.00 0.02 1.03] (43)] (44)] (44)] (45)] (46)] (47)] (51)] (51)] (52)
Feb N Jan Feb N Hot water usage in litres per day for each m 81.31 78.35 75 Energy content of hot water used = 4.18 x V 120.57 105.45 105 Distribution loss 0.15 x (45)m 18.09 15.82 16 Storage volume (litres) including any solar of Water storage loss: b) Manufacturer's declared loss factor is no Hot water storage loss factor from Table Za Temperature factor from Table 2b 100	r day Vd,average lar Apr onth Vd,m = fact 3.39 72.44 /d,m x nm x Tm/3 8.82 94.87 5.32 14.23 or WWHRS storage t known 2 (kWh/litre/day	= (25 x N) + May for from Table 69.48 8600 kWh/m 91.03 13.65 re within sam	36 Jun le 1c x (43) 66.52 onth (see Ta 78.55 11.78 ne vessel	Jul 66.52 bles 1b, 1c 72.79 10.92	Aug 69.48 1d) 83.53 12.53	Sep 72.44 84.53 12.68	Oct 75.39 Σ(44)1 98.51 Σ(45)1 14.78	Nov 78.35 12 = 107.53 12 = 16.13	73.91 Dec 81.31 886.96 116.77 1162.95 17.52 110.00 0.02 1.03 0.60] (43)] (44)] (44)] (45)] (45)] (46)] (47)] (51)] (52)] (52)] (53)
Feb N Jan Feb N Hot water usage in litres per day for each m 81.31 78.35 75 Energy content of hot water used = 4.18 x V 120.57 105.45 106 Distribution loss 0.15 x (45)m 106 106 Storage volume (litres) including any solar of Water storage loss: 100 15.82 166 b) Manufacturer's declared loss factor is no Hot water storage loss factor from Table 2a Temperature factor from Table 2b 106 Energy lost from water storage (kWh/date) 101 106 106	r day Vd,average lar Apr ionth Vd,m = fact 3.39 72.44 /d,m x nm x Tm/3 8.82 94.87 5.32 14.23 or WWHRS storage t known 2 (kWh/litre/day y) (47) x (51) x (51)	= (25 x N) + May for from Table 69.48 8600 kWh/m 91.03 13.65 re within sam y) 52) x (53)	36 Jun le 1c x (43) 66.52 onth (see Ta 78.55 11.78 ne vessel	Jul 66.52 bles 1b, 1c 72.79 10.92	Aug 69.48 1d) 83.53 12.53	Sep 72.44 84.53 12.68	Oct 75.39 Σ(44)1 98.51 Σ(45)1 14.78	Nov 78.35 12 = 107.53 12 = 16.13	73.91 Dec 81.31 886.96 116.77 1162.95 110.00 0.02 1.03 0.60 1.03] (43)] (44)] (44)] (45)] (45)] (46)] (47)] (51)] (51)] (52)] (53)] (54)
Jan Feb N Hot water usage in litres per day for each m 81.31 78.35 75 Energy content of hot water used = 4.18 x V 120.57 105.45 105 Distribution loss 0.15 x (45)m 18.09 15.82 16 Storage volume (litres) including any solar of Water storage loss: b) Manufacturer's declared loss factor is no Hot water storage loss factor from Table 2a Temperature factor from Table 2b Temperature factor from Table 2b Energy lost from water storage (kWh/da Enter (50) or (54) in (55) 105	r day Vd,average Tar Apr ionth Vd,m = fact 3.39 72.44 7d,m x nm x Tm/3 8.82 94.87 5.32 14.23 or WWHRS storage t known 5.2 (kWh/litre/day y) (47) x (51) x (51)	= (25 x N) + May for from Table 69.48 3600 kWh/m 91.03 13.65 re within sam y) 52) x (53)	36 Jun le 1c x (43) 66.52 onth (see Ta 78.55 11.78 ne vessel	Jul 66.52 bles 1b, 1c 72.79 10.92	Aug 69.48 1d) 83.53 12.53	Sep 72.44 84.53 12.68	Oct 75.39 Σ(44)1 98.51 Σ(45)1 14.78	Nov 78.35 12 = 107.53 12 = 16.13	73.91 Dec 81.31 886.96 116.77 1162.95 110.00 0.02 1.03 0.60 1.03 1.03] (43)] (44)] (44)] (45)] (45)] (46)] (46)] (47)] (51)] (51)] (52)] (53)] (54)] (55)
Jan Feb M Hot water usage in litres per day for each m 81.31 78.35 75 Energy content of hot water used = 4.18 x W 120.57 105.45 106 Distribution loss 0.15 x (45)m 18.09 15.82 16 Storage volume (litres) including any solar of Water storage loss: b) Manufacturer's declared loss factor is no Hot water storage loss factor from Table 2a Temperature factor from Table 2b Temperature factor from Table 2b Energy lost from water storage (kWh/date) Enter (50) or (54) in (55) Water storage loss calculated for each mon	r day Vd,average lar Apr ionth Vd,m = fact 3.39 72.44 /d,m x nm x Tm/3 8.82 94.87 5.32 14.23 or WWHRS storag t known • 2 (kWh/litre/day y) (47) x (51) x (5 th (55) x (41)m	= (25 x N) + May for from Table 69.48 8600 kWh/m 91.03 13.65 re within sam y) 52) x (53)	36 Jun le 1c x (43) 66.52 onth (see Ta 78.55 11.78 11.78 ne vessel	Jul 66.52 bles 1b, 1c 72.79 10.92	Aug 69.48 1d) 83.53 12.53	Sep 72.44 84.53 12.68	Oct 75.39 Σ(44)1 98.51 Σ(45)1 14.78	Nov 78.35 12 = 107.53 12 = 16.13	73.91 Dec 81.31 886.96 116.77 1162.95 17.52 110.00 0.02 1.03 0.60 1.03 1.03] (43)] (44)] (44)] (45)] (45)] (46)] (47)] (51)] (51)] (52)] (53)] (54)] (55)
Jan Feb N Hot water usage in litres per day for each m 81.31 78.35 75 Energy content of hot water used = 4.18 x V 120.57 105.45 102 Distribution loss 0.15 x (45)m 18.09 15.82 16 Storage volume (litres) including any solar of Water storage loss: b) Manufacturer's declared loss factor is no Hot water storage loss factor from Table 2a Temperature factor from Table 2a Temperature factor from Table 2b Energy lost from water storage (kWh/date cols) or (54) in (55) 32.01 28.92 32	r day Vd,average Tar Apr ionth Vd,m = fact 3.39 72.44 7d,m x nm x Tm/3 8.82 94.87 5.32 14.23 or WWHRS storage t known 2 (kWh/litre/day y) (47) x (51) x (5 th (55) x (41)m 2.01 30.98	= (25 x N) + May for from Table 69.48 3600 kWh/m 91.03 13.65 re within sam y) 52) x (53) 32.01	36 Jun le 1c x (43) 66.52 onth (see Ta 78.55 11.78 11.78 ne vessel 30.98	Jul 66.52 bles 1b, 1c 72.79 10.92 32.01	Aug 69.48 1d) 83.53 12.53	Sep 72.44 84.53 12.68	Oct 75.39 Σ(44)1 98.51 Σ(45)1 14.78	Nov 78.35 12 = 107.53 12 = 16.13	73.91 Dec 81.31 886.96 116.77 1162.95 110.00 0.02 1.03 0.60 1.03 1.03 32.01] (43)] (44)] (44)] (45)] (45)] (46)] (46)] (47)] (51)] (51)] (52)] (53)] (54)] (55)
Annual average hot water usage in litres per day for each mJanFebMHot water usage in litres per day for each m 81.31 78.35 75 Energy content of hot water used = $4.18 \times W$ 120.57 105.45 106 Distribution loss $0.15 \times (45)m$ 18.09 15.82 166 Storage volume (litres) including any solar of Water storage loss: 0 0 0 b) Manufacturer's declared loss factor from Table 2a 166 0 166 Hot water storage loss factor from Table 2a 166 160 160 Energy lost from water storage (kWh/da) 165) 166 162 Water storage loss calculated for each mon 32.01 28.92 32 If the vessel contains dedicated solar storage 160 160 160	r day Vd,average lar Apr ionth Vd,m = fact 3.39 72.44 /d,m x nm x Tm/3 8.82 94.87 5.32 14.23 or WWHRS storag t known • 2 (kWh/litre/day y) (47) x (51) x (5 th (55) x (41)m 1.01 30.98 re or dedicated W	 = (25 x N) + May for from Table 69.48 600 kWh/m 91.03 13.65 a within sam y) 52) x (53) 32.01 /WHRS (56)n 	36 Jun le 1c x (43) 66.52 onth (see Ta 78.55 11.78 ne vessel 11.78 ne vessel 30.98 n x [(47) - Vs	Jul 66.52 bles 1b, 1c 72.79 10.92 10.92	Aug 69.48 1d) 83.53 12.53 12.53 32.01 se (56)	Sep 72.44 84.53 12.68 30.98	Oct 75.39 Σ(44)1 98.51 Σ(45)1 14.78 32.01	Nov 78.35 12 = 107.53 12 = 16.13 30.98	73.91 Dec 81.31 886.96 116.77 1162.95 17.52 170.00 0.02 1.03 0.60 1.03 1.03 1.03 1.03 1.03] (43)] (44)] (44)] (45)] (45)] (45)] (46)] (47)] (51)] (51)] (52)] (53)] (54)] (55)] (56)
Annual average hot water usage in litres per day for each mJanFebMHot water usage in litres per day for each m 81.31 78.35 75 Energy content of hot water used = $4.18 \times W$ 120.57 105.45 106 Distribution loss $0.15 \times (45)m$ 18.09 15.82 166 Storage volume (litres) including any solar of Water storage loss: $0.15 \times (45)m$ 106 b) Manufacturer's declared loss factor is no Hot water storage loss factor from Table 2a 106 Temperature factor from Table 2a 106 106 Energy lost from water storage (kWh/da) 106 Enter (50) or (54) in (55) 32.01 28.92 32 If the vessel contains dedicated solar storage 32.01 28.92 32	r day Vd,average Tar Apr ionth Vd,m = fact 3.39 72.44 7d,m x nm x Tm/3 8.82 94.87 5.32 14.23 or WWHRS storag t known 2 (kWh/litre/day y) (47) x (51) x (5 th (55) x (41)m 1.01 30.98 ie or dedicated W 2.01 30.98	 = (25 x N) + May :or from Table 69.48 3600 kWh/m 91.03 13.65 a within sam y) 52) x (53) 32.01 /WHRS (56)n 32.01 	36 Jun le 1c x (43) 66.52 onth (see Ta 78.55 11.78 11.78 ne vessel 11.78 a. 30.98 n x [(47) - Vs 30.98	Jul 66.52 bles 1b, 1c 72.79 10.92 10.92 32.01] ÷ (47), els 32.01	Aug 69.48 1d) 83.53 12.53 32.01 se (56) 32.01	Sep 72.44 84.53 12.68 30.98	Oct 75.39 Σ(44)1 98.51 Σ(45)1 14.78 32.01	Nov 78.35 12 = 107.53 12 = 16.13 30.98 30.98	73.91 Dec 81.31 886.96 116.77 1162.95 110.00 110.00 0.02 1.03 0.60 1.03 32.01 32.01] (43)] (44)] (44)] (45)] (45)] (46)] (47)] (51)] (51)] (52)] (53)] (54)] (55)] (56)] (56)

Primary circuit	oss for each	n month fro	m Table 3										
	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
Combi loss for e	each month	from Table	3a, 3b or 3	с									
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
Total heat requi	ired 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				_
	175.85	155.38	164.10	148.36	146.31	132.05	128.07	138.81	138.02	153.78	161.02	172.05	(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	for each mo	nth (kWh/i	month) (62	2)m + (63)n	n		1			1	4	
	175.85	155 38	164 10	148 36	146 31	132.05	128.07	138.81	138.02	153 78	161.02	172.05	7
	175.05	100.00	10.110	110.00	110.51	152.05	120.07	100.01	100.02	Σ(64)1	12 = 12	1813 79	」](64)
Heat gains from	water heat	ing (kWh/m	nonth) 0.25	5 x [0 85 x]	(45)m + (61	1)m] + 0.8 x	: [(46)m + (¹	57)m + (59)	ml	2(01)1			
fieur gams nom	Q4 21	75.01	80.40	74.24		69.01	69 42	71.00	70.90	76.09	79 55	82.05	7 (65)
	04.31	/ 75.01	80.40	74.54	74.49	08.91	08.42	/1.55	70.90	70.58	/8.55	83.03] (03)
5. Internal gair	าร												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains	(Table 5)												
	83.61	83.61	83.61	83.61	83.61	83.61	83.61	83.61	83.61	83.61	83.61	83.61	(66)
Lighting gains (c	alculated in	Appendix I	, equation	L9 or L9a),	also see Ta	able 5]
	12.98	11.53	9.38	7.10	5.31	4.48	4.84	6.29	8.45	10.73	12.52	13.35	(67)
Appliance gains	(calculated	in Appendi	x L, equatio	on L13 or L1	L3a), also s	ee Table 5					1	4	
	145 65	147.16	143 35	135 24	125.01	115 39	108.96	107.45	111 26	119 37	129.60	139.22] (68)
Cooking gains (c	alculated in	Annendix		115 or 115	a) also see	Table 5	100.50	107.15	111.20	115.57	125.00	133.22] (00)
COOKING BUILD (C	21.26	21.26	21.26	21.26	21.26	21.26	21.26	21.26	21.26	21.26	21.26	21.26	
Pump and fap g	ains (Table I	[<u>31.30</u> 5a)	51.50	51.50	51.50	51.50	51.30	51.50	51.50	51.50	51.50	51.50] (09)
Pullip allu lali g			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			7 (70)
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00] (70)
Losses e.g. evap	oration (Tai					L					<u> </u>	1	٦
	-66.89	-66.89	-66.89	-66.89	-66.89	-66.89	-66.89	-66.89	-66.89	-66.89	-66.89	-66.89] (/1)
Water heating g	gains (Table	5)				1		1	1	1			٦
	113.32	111.62	108.07	103.25	100.12	95.71	91.97	96.77	98.47	103.46	109.09	111.62	_ (72)
Total internal ga	ains (66)m -	+ (67)m + (6 -	58)m + (69)i	m + (70)m ·	+ (71)m + (72)m		1					_
	320.04	318.39	308.88	293.68	278.52	263.67	253.86	258.59	266.26	281.64	299.30	312.27	(73)
6. Solar gains													
			Access f	actor	Area	Sol	ar flux		g	FF		Gains	
			Table	6d	m²	v	V/m²	spec	ific data	specific o	data	W	
								or T	able 6b	or Table	9 6c		
SouthWest			0.7	7 X	12.36	x 3	6.79 x	0.9 x 🚺 🤇).40 x	0.80	=	100.85	(79)
Solar gains in wa	atts ∑(74)m	n(82)m											
	100.85	171.79	235.04	291.23	326.20	323.84	312.22	286.13	254.50	189.86	120.80	86.31	(83)
Total gains - inte	ernal and so	əlar (73)m +	(83)m										
	420.89	490.18	543.93	584.91	604.72	587.51	566.08	544.72	520.77	471.50	420.09	398.58	(84)
													-
7. Mean intern	nal tempera	ture (heati	ng season)										_
Temperature du	uring heatin	g periods in	the living a	area from T	able 9, Th	1(°C)						21.00	(85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	or for gains f	or living are	ea n1,m (se	e Table 9a)									
	0.98	0.96	0.90	0.79	0.62	0.45	0.32	0.35	0.54	0.82	0.96	0.99	(86)
Mean internal to	emp of livin	g area T1 (s	teps 3 to 7	in Table 90	:)								

	20.45	20.62	20.79	20.93	20.99	21.00	21.00	21.00	21.00	20.92	20.66	20.40	(87)
Temperature durin	ng heating	; periods ir	n the rest of	f dwelling f	rom Table	9, Th2(°C)							
Γ	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	(88)
Utilisation factor fo	or gains fo	or rest of d	welling n2,	m	1				1				
Γ	0.98	0.95	0.88	0.75	0.57	0.39	0.26	0.29	0.48	0.78	0.95	0.98	(89)
Mean internal tem	perature	in the rest	of dwelling	g T2 (follow	v steps 3 to	7 in Table 9))						
	19.51	19.74	19.98	20.15	20.21	20.23	20.23	20.23	20.22	20.15	19.81	19.44	(90)
Living area fraction									L	iving area ÷	(4) =	0.52	(91)
Mean internal tem	perature	for the wh	ole dwellin	g fLA x T1 -	+(1 - fLA) x	Т2] (/
	20.00	20.19	20.40	20.55	20.61	20.62	20.63	20.63	20.62	20.55	20.25	19.94	(92)
Apply adjustment t	to the me	an interna	l temperati	ure from Ta	able 4e wh	ere appropr	iate	1 20100	1 10:01	20100		10101] (3 =)
·	20.00	20.19	20.40	20.55	20.61	20.62	20.63	20.63	20.62	20.55	20.25	19.94	(93)
	20.00	20.13	20.10	20.33	20.01	20:02	20.05	20.03	20.02	20.00	20.25	13.51] (33)
8. Space heating r	requirem	ent											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for	or gains, r	յՠ											
	0.98	0.95	0.89	0.77	0.60	0.42	0.29	0.32	0.51	0.80	0.95	0.98	(94)
Useful gains, ηmGr	m, W (94)m x (84)m	ı										
	411.61	465.14	482.70	448.34	360.14	246.61	165.07	173.24	265.84	376.06	398.96	392.01	(95)
Monthly average e	external te	emperatur	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 for n	nean inte	rnal tempe	erature, Lm	, W [(39)m	n x [(93)m -	(96)m]							
	643.86	627.26	570.06	477.89	365.54	247.09	165.11	173.31	267.48	407.91	539.43	645.52	(97)
Space heating requ	uirement,	kWh/mor	th 0.024 x	[(97)m - (9	5)m] x (41))m							
	172.79	108.95	64.99	21.27	4.02	0.00	0.00	0.00	0.00	23.70	101.14	188.62	
									Σ(9	8)15, 10	12 =	685.46	(98)
Space heating requ	uirement	kWh/m²/y	ear							(98)	÷ (4)	13.88	(99)
						_							
9b. Energy require	ements -	communit	ty heating s	cheme									7
Fraction of space h	leat from	secondary	/suppleme	ntary syste	m (table 1	1)				'0' if ı	none	0.00] (301)
Fraction of space h	leat from	communit	y system							1 - (30	01) =	1.00	(302)
Fraction of commu	inity heat	from boile	ers									0.25] (303a) _
Fraction of commu	inity heat	from CHP										0.75] (303b)
Fraction of total sp	ace heat	from com	munity CHP							(302) x (303	3a) =	0.75	(304a)
Fraction of total sp	ace heat	from com	munity boile	ers						(302) x (303	3b) =	0.25	(304 b)
Factor for control a	and charg	ing metho	d (Table 4c	(3)) for con	nmunity sp	ace heating						1.00	(305)
Factor for charging	g method	(Table 4c(3)) for comr	nunity wat	er heating							1.00	(305a)
Distribution loss fa	ctor (Tab	le 12c) for	community	heating sy	vstem							1.05	(306)
Space heating										-			
Annual space heati	ing requir	ement							685.46				(98)
Space heat from CH	HP							(98	8) x (304a)	x (305) x (30	06) =	539.80	(307a)
Space heat from bo	oilers							(98	8) x (304b)	x (305) x (30	06) =	179.93	(307b)
Water heating										_			
Annual water heati	ing requir	ement						1	1813.79				(64)
Water heat from C	ΗP							(64)) x (303a) x	: (305a) x (30	06) =	1428.36] (310a)
Water heat from be	oilers							(64)	x (303b) x	(305a) x (30	06) =	476.12	(310b)

		0.01 × [(307a)(307e)	+ (310a)(310e)] =	26.24	(313)
Electricity for pumps, fans and electric keep-hot (Table 4f)					
mechanical ventilation fans - balanced, extract or positive inpu	It from outside	33.29			(330a)
Total electricity for the above, kWh/year				33.29	(331)
Electricity for lighting (Appendix L)				229.32	(332)
Energy saving/generation technologies					
electricity generated by PV (Appendix M)				-53.23	(333)
Total delivered energy for all uses	(307) + (309)	+ (310) + (312) + (315) + (331	.) + (332)(337b) =	2833.59	(338)
10b. Fuel costs - community heating scheme					
	Fuel kWh/year	Fuel price	3	Fuel cost £/year	
Space heating from CHP	539.80	x 2.97	x 0.01 =	16.03	(340a)
Space heating from boilers	179.93	x 4.24	x 0.01 =	7.63	(340b)
Water heating from CHP	1428.36	x 2.97	x 0.01 =	42.42	(342a)
Water heating from boilers	476.12	x 4.24	x 0.01 =	20.19	(342b)
Pumps and fans	33.29	x 13.19	x 0.01 =	4.39	(349)
Electricity for lighting	229.32	x 13.19	x 0.01 =	30.25	(350)
Additional standing charges				120.00	(351)
Energy saving/generation technologies					
pv savings	-53.23	x 13.19	x 0.01 =	0.00	(352)
Total energy cost		(340a)(342	2e) + (345)(354) =	240.91	(355)
11h SAP rating - community heating scheme					
Energy cost deflator (Table 12)				0.42	(356)
Energy cost factor (ECE)				1.07	(350)
				85.05]
SAF Value					
SAP rating (section 12)				85) (258)
SAP rating (section 13)				85.05 85	(358)
SAP rating (section 13) SAP band				85.03 85 B] (358)]
SAP rating (section 13) SAP band 12b. CO ₂ emissions - community heating scheme				85.03 85 B] (358)]
SAP rating (section 13) SAP band 12b. CO ₂ emissions - community heating scheme	Energy	Emission fac	tor	B Emissions] (358)]
SAP rating (section 13) SAP band 12b. CO ₂ emissions - community heating scheme	Energy kWh/year	Emission fac	tor	Emissions (kg/year)] (358)
SAP rating (section 13) SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating)	Energy kWh/year	Emission fac	tor	Emissions (kg/year)	(358)
SAP rating (section 13) SAP band 12b. CO₂ emissions - community heating scheme <i>Emissions from community CHP (space and water heating)</i> Power efficiency of CHP unit	Energy kWh/year	Emission fac	tor	Emissions (kg/year)	(358)
SAP rating (section 13) SAP band 12b. CO₂ emissions - community heating scheme <i>Emissions from community CHP (space and water heating)</i> Power efficiency of CHP unit Heat efficiency of CHP unit	Energy kWh/year	Emission fac	tor	Emissions (kg/year)	(358) (358) (361) (362)
SAP rating (section 13) SAP band 12b. CO₂ emissions - community heating scheme <i>Emissions from community CHP (space and water heating)</i> Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) =	Energy kWh/year 28.09 66.01 817.7541	Emission fac x 0.2160	tor	85 85 Emissions (kg/year)	(358) (358) (361) (362) (363)
SAP rating (section 13) SAP band 12b. CO₂ emissions - community heating scheme <i>Emissions from community CHP (space and water heating)</i> Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity	Energy kWh/year 28.09 66.01 817.7541 -229.7035	Emission fac x 0.2160 x 0.5190	tor = =	85 85 Emissions (kg/year) 176.6349 -119.2161	(358) (358) (361) (362) (363) (364)
SAP rating (section 13) SAP band 12b. CO ₂ emissions - community heating scheme Emissions from community CHP (space and water heating) Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP	Energy kWh/year 28.09 66.01 817.7541 -229.7035 2163.8390	Emission fac x 0.2160 x 0.5190 x 0.2160	tor = =	85 85 B Emissions (kg/year) 176.6349 -119.2161 467.3892	(358) (358) (361) (362) (363) (364) (365)
SAP rating (section 13) SAP band 12b. CO₂ emissions - community heating scheme <i>Emissions from community CHP (space and water heating)</i> Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity	Energy kWh/year 28.09 66.01 817.7541 -229.7035 2163.8390 -607.8127	x 0.2160 x 0.5190 x 0.5190	tor =	83.03 85 B Emissions (kg/year) 176.6349 -119.2161 467.3892 -315.4548	(358) (358) (361) (362) (363) (364) (365) (366)
SAP rating (section 13) SAP band 12b. CO₂ emissions - community heating scheme <i>Emissions from community CHP (space and water heating)</i> Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating)	Energy kWh/year 28.09 66.01 817.7541 -229.7035 2163.8390 -607.8127	Emission fac x 0.2160 x 0.5190 x 0.5190	tor = = =	85 B Emissions (kg/year) 176.6349 -119.2161 467.3892 -315.4548	(358) (358) (361) (362) (363) (364) (365) (366)
SAP rating (section 13) SAP band 12b. CO₂ emissions - community heating scheme <i>Emissions from community CHP (space and water heating)</i> Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers	Energy kWh/year 28.09 66.01 817.7541 -229.7035 2163.8390 -607.8127 94.00	x 0.2160 x 0.5190 x 0.5190 x 0.5190	tor = = = = = =	85 85 B Emissions (kg/year) 176.6349 -119.2161 467.3892 -315.4548	(358) (358) (361) (362) (363) (364) (365) (366) (367b)
SAP rating (section 13) SAP band 12b. CO₂ emissions - community heating scheme <i>Emissions from community CHP (space and water heating)</i> Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) =	Energy kWh/year 28.09 66.01 817.7541 -229.7035 2163.8390 -607.8127 94.00 697.93	Emission fac x 0.2160 x 0.5190 x 0.2160 x 0.5190 x 0.216	tor =	85 B Emissions (kg/year) 176.6349 -119.2161 467.3892 -315.4548	(361) (362) (363) (364) (365) (366) (367b) (368)
SAP rating (section 13) SAP band 12b. CO₂ emissions - community heating scheme <i>Emissions from community CHP (space and water heating)</i> Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = Electrical energy for community heat distribution	Energy kWh/year 28.09 66.01 817.7541 -229.7035 2163.8390 -607.8127 94.00 697.93 26.24	x 0.2160 x 0.5190 x 0.2160 x 0.5190 x 0.5190 x 0.5190	tor =	85 85 B Emissions (kg/year) 176.6349 -119.2161 467.3892 -315.4548 150.75 13.62	(358) (358) (361) (362) (363) (364) (365) (366) (366) (367b) (368) (372)
SAP rating (section 13) SAP band 12b. CO₂ emissions - community heating scheme <i>Emissions from community CHP (space and water heating)</i> Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] x 100 ÷ (367b) = Electrical energy for community heat distribution Total CO2 associated with community systems	Energy kWh/year 28.09 66.01 817.7541 -229.7035 2163.8390 -607.8127 94.00 697.93 26.24	x 0.2160 x 0.5190 x 0.5190 x 0.5190 x 0.5190	tor =	85 B Emissions (kg/year) 176.6349 -119.2161 467.3892 -315.4548 150.75 13.62 373.73	(361) (362) (363) (364) (365) (366) (366) (367b) (368) (372) (373)
SAP rating (section 13) SAP band 12b. CO₂ emissions - community heating scheme <i>Emissions from community CHP (space and water heating)</i> Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = Electrical energy for community heat distribution Total CO2 associated with space and water heating	Energy kWh/year 28.09 66.01 817.7541 -229.7035 2163.8390 -607.8127 94.00 697.93 26.24	x 0.2160 x 0.2160 x 0.2160 x 0.5190 x 0.5190 x 0.5190 x 0.5190	tor	83.03 85 B Emissions (kg/year) 176.6349 -119.2161 467.3892 -315.4548 150.75 13.62 373.73 373.73	(358) (358) (361) (362) (363) (364) (365) (366) (367b) (368) (372) (373) (373)
SAP rating (section 13) SAP band 12b. CO₂ emissions - community heating scheme <i>Emissions from community CHP (space and water heating)</i> Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans	Energy kWh/year 28.09 66.01 817.7541 -229.7035 2163.8390 -607.8127 94.00 697.93 26.24 33.29	x 0.2160 x 0.5190 x 0.2160 x 0.5190 x 0.5190 x 0.5190 x 0.5190 x 0.5190	tor =	83.03 85 B Emissions (kg/year) 176.6349 -119.2161 467.3892 -315.4548 150.75 13.62 373.73 373.73 17.28	(361) (362) (363) (364) (365) (366) (366) (366) (368) (372) (372) (373) (376) (378)
SAP rating (section 13) SAP band 12b. CO₂ emissions - community heating scheme <i>Emissions from community CHP (space and water heating)</i> Power efficiency of CHP unit Heat efficiency of CHP unit Space heating from CHP (307a) × 100 ÷ (362) = less credit emissions for electricity Water heated by CHP less credit emissions for electricity Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307b)+(310b)] × 100 ÷ (367b) = Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting	Energy kWh/year 28.09 66.01 817.7541 -229.7035 2163.8390 -607.8127 94.00 697.93 26.24 33.29 229.32	x 0.2160 x 0.5190 x 0.2160 x 0.5190 x 0.5190 x 0.5190 x 0.5190 x 0.5190 x 0.5190 x 0.52 x 0.52 x 0.52	tor =	83.03 85 B Emissions (kg/year) 176.6349 -119.2161 467.3892 -315.4548 150.75 13.62 373.73 373.73 17.28 119.01	(358) (358) (361) (362) (363) (364) (365) (366) (366) (368) (368) (372) (373) (373) (376) (378) (379)

pv savings		-53.23	х	0.52	=	-27.63	(380)
Total CO₂, kg/year					(376)(382) =	482.39	(383)
Dwelling CO₂ emission rate					(383) ÷ (4) =	9.77	(384)
EI value						93.15]
El rating (section 14)						93	(385)
El band						A]
13b. Primary energy - comm	unity heating scheme						
		Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary Energy from commun	ity CHP (space and water heating)						
Power efficiency of CHP unit		28.09					(361)
Heat efficiency of CHP unit		66.01					(362)
Space heating from CHP	(307a) × 100 ÷ (362) =	817.75	x	1.22	=	997.66	(363)
less credit energy for electr	icity	-229.70	x	3.07	=	-705.19	(364)
Water heated by CHP		2163.84	x	1.22	=	2639.88	(365)
less credit energy for electricit	у	-607.81	x	3.07	=	-1865.98	(366)
Primary energy from other sou	urces (space heating)						
Efficiency of boilers		94.00					(367b)
Primary energy from boilers	[(307b)+(310b)] x 100 ÷ (367b) =	697.93	x	1.22	=	851.47	(368)
Electrical energy for community	ty heat distribution	26.24	x	3.07	=	80.56	(372)
Total primary energy associate	ed with community systems					1998.41	(373)
Total primary energy associate	ed with space and water heating					1998.41	(376)
Pumps and fans		33.29	x	3.07	=	102.20	(378)
Electricity for lighting		229.32	x	3.07	=	704.00	(379)
Energy saving/generation tech	nologies						
Electricity generated - PVs		-53.23	x	3.07	=	-163.43	(380)
Primary energy kWh/year						2641.18	(383)

Dwelling primary energy rate kWh/m2/year

53.48

(384)



Assessor name		Miss Jayr	na Parmar					А	ssessor nur	nber	6549		
Client								Li	ast modified	d	25/11	/2016	
Address		A-L04-65	A Centric (Close, Lond	on, N8								
1. Overall dwellin	ng dimens	sions											
					А	rea (m²)		Ave h	erage storey eight (m)	I	Vo	lume (m³)	
Lowest occupied						77.30	<mark>](1a)</mark> x		2.50	(2a) =		193.25	(3a)
Total floor area		(1a)	+ (1b) + (1e	c) + (1d)(1n) =	77.30	(4)						
Dwelling volume							-	(3a	ı) + (3b) + (3	3c) + (3d)(3	3n) =	193.25	(5)
2 Montilation ust										_			
2. Ventilation rate	e												
										_	m	' per hour	_
Number of chimne	ys								0	x 40 =	:	0	(6a)
Number of open fl	ues								0	x 20 =	:	0	(6b)
Number of intermi	ttent fan	s							0	x 10 =		0	(7a)
Number of passive	vents								0	x 10 =	:	0	(7b)
Number of flueless	s gas fires	;							0	x 40 =	: [0	(7c)
										_	Air o	hanges pe hour	r
Infiltration due to o	chimneys	, flues, fans	s, PSVs		(6a)	+ (6b) + (7	a) + (7b) + (7c) =	0	÷ (5) =	-	0.00	(8)
If a pressurisation	test has b	been carried	d out or is ii	ntended, pi	roceed to (17), otherw	vise continu	e from (9)	to (16)				
, Air permeability va	ilue, a50,	expressed	in cubic me	etres per h	our per sau	uare metre	of envelope	e area	. ,			4.00	(17)
If based on air perr	meability	value. ther	n (18) = [(17	7) ÷ 20] + (8). otherwi	se (18) = (1	6)					0.20	(18)
Number of sides or	n which t	he dwelling	is sheltere	d d	//	() (-	-,					3	(19)
Shelter factor			,						1	- [0 075 x (1	9)] =	0.78	(20)
Infiltration rate inc	ornoratir	ng shelter f	actor						-	(18) x (1	20) =	0.16	(21)
Infiltration rate mo		r monthly y								(10) X (2		0.10	_ (21)
initiation face me	lan	Eob	Mar	Anr	May	lun	1.1	Aug	Son	Oct	Nov	Doc	
Monthly avorage w	vind shop	d from Tab		Λ μ ι	ividy	Jun	Jui	Aug	JCP	000	NOV	Det	
			4.00	4.40	4.20	2.80	2.90	2.70	4.00	4.20	4.50	4.70	(22)
Wind factor (22)m	· 1	5.00	4.90	4.40	4.50	5.60	5.80	5.70	4.00	4.50	4.50	4.70	_ (22)
	1 20	1.25	1.22	1 10	1.00	0.05	0.05	0.02	1.00	1.00	1 1 2	1 1 0] (22-)
	1.28	1.25	1.23		1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	_ (22a)
	n rate (al	liowing for	shelter and		Dr) (21) X (2		0.15				<u> </u>	0.10	
	0.20	0.19	0.19	0.17	0.17	0.15	0.15	0.14	0.16	0.17	0.17	0.18	(22b)
Calculate effective	air chang	ge rate for t	the applicat	ble case:									٦
If mechanical ve	entilation	i: air chang	e rate throu	ugh system								0.50	_ (23a)
If balanced with	n heat red	covery: effi	ciency in %	allowing fo	or in-use fa	ctor from T	able 4h					N/A	(23c)
c) whole house	extract v	entilation o	or positive i	input venti	ation from	outside	-		-	-		-	_
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(24c)
Effective air change	e rate - e	nter (24a) o	or (24b) or	(24c) or (24	ld) in (25)			. <u> </u>					_
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(25)



3. Heat 1033e3 and heat 1033 par											
Element	a	Gross area, m ²	Openings m ²	Net a A, m	rea 1²	U-value W/m²K	A x U W,	/К к-\ kJ,	/alue, /m².K	Ахк, kJ/K	
Window				14.1	.2 x	1.24	= 17.45				(27)
External wall				13.7	′5 x	0.18	= 2.48				(29a)
Party wall				60.0	9 x	0.00	= 0.00				(32)
Total area of external elements 2	A, m²			27.8	57						(31)
Fabric heat loss, W/K = ∑(A × U)							(26)(30) + (3	32) =	19.92	(33)
Heat capacity Cm = ∑(А x к)						(28)	.(30) + (32) +	(32a)(3	2e) =	N/A	(34)
Thermal mass parameter (TMP) i	in kJ/m²K									250.00	(35)
Thermal bridges: $\Sigma(L \times \Psi)$ calcula	ted using Appen	dix K								4.23	(36)
Total fabric heat loss								(33) + (3	36) =	24.15	(37)
Jan F	eb Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated r	monthly 0.33 x (2	25)m x (5)									
31.89 31	.89 31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	(38)
Heat transfer coefficient, W/K (3	37)m + (38)m										
56.04 56	5.04 56.04	56.04	56.04	56.04	56.04	56.04	56.04	56.04	56.04	56.04]
							Average = ∑	(39)112/	/12 =	56.04	(39)
Heat loss parameter (HLP), W/m	²K (39)m ÷ (4)										
0.72 0.	72 0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72]
							Average = ∑	(40)112/	/12 =	0.72	(40)
Number of days in month (Table	1a)										
31.00 28	.00 31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)
4. Water heating energy requir	ement										
											1
Assumed occupancy, N										2.41	(42)
Assumed occupancy, N Annual average hot water usage	in litres per day	Vd,average	e = (25 x N) +	36						2.41 91.43	(42) (43)
Assumed occupancy, N Annual average hot water usage Jan F	in litres per day eb Mar	Vd,average Apr	e = (25 x N) + May	36 Jun	Jul	Aug	Sep	Oct	Nov	2.41 91.43 Dec	(42)](43)
Assumed occupancy, N Annual average hot water usage Jan F Hot water usage in litres per day	in litres per day eb Mar for each month	Vd,average Apr Vd,m = fact	e = (25 x N) + May tor from Tab	36 Jun le 1c x (43)	Jul	Aug	Sep	Oct	Nov	2.41 91.43 Dec] (42)] (43)
Assumed occupancy, N Annual average hot water usage Jan F Hot water usage in litres per day 100.57 96	in litres per day eb Mar for each month 5.91 93.26	Vd,average Apr Vd,m = fact 89.60	e = (25 x N) + May tor from Tab 85.94	36 Jun le 1c x (43) 82.29	Jul 82.29	Aug 85.94	Sep	Oct 93.26	Nov	2.41 91.43 Dec 100.57] (42)] (43)]
Assumed occupancy, N Annual average hot water usage Jan F Hot water usage in litres per day 100.57 96	in litres per day eb Mar for each month .91 93.26	Vd,average Apr Vd,m = fact 89.60	e = (25 x N) + May tor from Tab 85.94	36 Jun le 1c x (43) 82.29	Jul 82.29	Aug 85.94	Sep 89.60	Oct 93.26 ∑(44)1	Nov 96.91 .12 =	2.41 91.43 Dec 100.57 1097.15] (42)] (43)]] (44)
Assumed occupancy, N Annual average hot water usage Jan F Hot water usage in litres per day 100.57 96 Energy content of hot water user	in litres per day eb Mar for each month 5.91 93.26 d = 4.18 x Vd,m >	Vd,average Apr Vd,m = fact 89.60	e = (25 x N) + May tor from Tab 85.94 3600 kWh/m	36 Jun le 1c x (43) 82.29 onth (see T	Jul 82.29 ables 1b,	Aug 85.94 1c 1d)	Sep 89.60	Oct 93.26 Σ(44)1	Nov 96.91 .12 =	2.41 91.43 Dec 100.57 1097.15] (42)] (43)]] (44)
Assumed occupancy, N Annual average hot water usage Jan F Hot water usage in litres per day 100.57 96 Energy content of hot water user 149.14 130	in litres per day eb Mar for each month .91 93.26 d = 4.18 x Vd,m > 0.44 134.61	Vd,average Apr Vd,m = fact 89.60 (nm x Tm/3 117.35	e = (25 x N) + May tor from Tab 85.94 3600 kWh/m 112.60	36 Jun le 1c x (43) 82.29 onth (see T 97.17	Jul 82.29 ables 1b, 90.04	Aug 85.94 1c 1d) 103.32	Sep 89.60 104.56	Oct 93.26 Σ(44)1 121.85	Nov 96.91 .12 =	2.41 91.43 Dec 100.57 1097.15 144.44] (42)] (43)] (44)]
Assumed occupancy, N Annual average hot water usage Jan F Hot water usage in litres per day 100.57 96 Energy content of hot water used 149.14 130	in litres per day eb Mar for each month .91 93.26 d = 4.18 x Vd,m > 0.44 134.61	Vd,average Apr Vd,m = fact 89.60 (nm x Tm/3 117.35	e = (25 x N) + May tor from Tab 85.94 3600 kWh/m 112.60	36 Jun le 1c x (43) 82.29 onth (see T 97.17	Jul 82.29 ables 1b, 90.04	Aug 85.94 1c 1d) 103.32	Sep 89.60 104.56	Oct 93.26 Σ(44)1 121.85 Σ(45)1	Nov 96.91 .12 = 133.01 .12 =	2.41 91.43 Dec 100.57 1097.15 1438.53] (42)] (43)] (44)]] (45)
Assumed occupancy, N Annual average hot water usage Jan F Hot water usage in litres per day 100.57 96 Energy content of hot water used 149.14 130 Distribution loss 0.15 x (45)m	in litres per day eb Mar for each month .91 93.26 d = 4.18 x Vd,m > 0.44 134.61	Vd,average Apr Vd,m = fact 89.60 (nm x Tm/3 117.35	e = (25 x N) + May tor from Tab 85.94 3600 kWh/m 112.60	36 Jun le 1c x (43) 82.29 onth (see T 97.17	Jul 82.29 ables 1b, 90.04	Aug 85.94 1c 1d) 103.32	Sep 89.60 104.56	Oct 93.26 Σ(44)1 121.85 Σ(45)1	Nov 96.91 .12 = 133.01 .12 =	2.41 91.43 Dec 100.57 1097.15 144.44 1438.53] (42)] (43)] (44)] (44)] (45)
Assumed occupancy, N Annual average hot water usage Jan F Hot water usage in litres per day 100.57 96 Energy content of hot water user 149.14 130 Distribution loss 0.15 x (45)m 22.37 19 Charge uplyme (litres) including	in litres per day eb Mar for each month .91 93.26 d = 4.18 x Vd,m > 0.44 134.61 .57 20.19	Vd,average Apr Vd,m = fact 89.60 (mm x Tm/3) 117.35 17.60	e = (25 x N) + May tor from Tab 85.94 3600 kWh/m 112.60 16.89	36 Jun le 1c x (43) 82.29 onth (see T 97.17 14.58	Jul 82.29 ables 1b, 90.04 13.51	Aug 85.94 1c 1d) 103.32 15.50	Sep 89.60 104.56 15.68	Oct 93.26 Σ(44)1 121.85 Σ(45)1 18.28	Nov 96.91 .12 = 133.01 .12 = 19.95	2.41 91.43 Dec 100.57 1097.15 144.44 1438.53 21.67 110.00] (42)] (43)] (44)] (44)] (45)] (46)] (46)
Assumed occupancy, N Annual average hot water usage Jan F Hot water usage in litres per day 100.57 96 Energy content of hot water user 149.14 130 Distribution loss 0.15 x (45)m 22.37 19 Storage volume (litres) including Water storage loss:	in litres per day eb Mar for each month 5.91 93.26 d = 4.18 x Vd,m > 0.44 134.61 5.57 20.19 any solar or WW	Vd,average Apr Vd,m = fact 89.60 (mm x Tm/3) 117.35 17.60 /HRS storage	e = (25 x N) + May tor from Tab 85.94 3600 kWh/m 112.60 16.89 ge within sam	36 Jun le 1c x (43) 82.29 onth (see T 97.17 14.58 ne vessel	Jul 82.29 ables 1b, 90.04 13.51	Aug 85.94 1c 1d) 103.32 15.50	Sep 89.60 104.56 15.68	Oct 93.26 Σ(44)1 121.85 Σ(45)1 18.28	Nov 96.91 .12 = 133.01 .12 = 19.95	2.41 91.43 Dec 100.57 1097.15 144.44 1438.53 21.67 110.00] (42)] (43)] (44)] (44)] (45)] (45)] (46)] (47)
Assumed occupancy, N Annual average hot water usage Jan F Hot water usage in litres per day 100.57 96 Energy content of hot water user 149.14 130 Distribution loss 0.15 x (45)m 22.37 19 Storage volume (litres) including Water storage loss: b) Mapufacturor's doclared loss of	in litres per day eb Mar for each month .91 93.26 d = 4.18 x Vd,m > 0.44 134.61 .57 20.19 any solar or WW	Vd,average Apr Vd,m = fact 89.60 (nm x Tm/3 117.35 17.60 /HRS storage	e = (25 x N) + May tor from Tab 85.94 3600 kWh/m 112.60 16.89 ge within sam	36 Jun le 1c x (43) 82.29 onth (see T 97.17 14.58 ne vessel	Jul 82.29 ables 1b, 90.04 13.51	Aug 85.94 1c 1d) 103.32 15.50	Sep 89.60 104.56 15.68	Oct 93.26 Σ(44)1 121.85 Σ(45)1 18.28	Nov 96.91 .12 = 133.01 .12 = 19.95	2.41 91.43 Dec 100.57 1097.15 1444.44 1438.53 21.67 110.00] (42)] (43)] (44)] (44)] (45)] (45)] (46)] (47)
Assumed occupancy, N Annual average hot water usage Jan F Hot water usage in litres per day 100.57 96 Energy content of hot water used 149.14 130 Distribution loss 0.15 x (45)m 22.37 19 Storage volume (litres) including Water storage loss: b) Manufacturer's declared loss f	in litres per day eb Mar for each month 5.91 93.26 d = 4.18 x Vd,m > 0.44 134.61 5.57 20.19 any solar or WW factor is not know	Vd,average Apr Vd,m = fact 89.60 x nm x Tm/3 117.35 17.60 VHRS storage wn	e = (25 x N) + May tor from Tab 85.94 3600 kWh/m 112.60 16.89 ge within sam	36 Jun le 1c x (43) 82.29 onth (see T 97.17 14.58 ne vessel	Jul 82.29 ables 1b, 90.04 13.51	Aug 85.94 1c 1d) 103.32 15.50	Sep 89.60 104.56 15.68	Oct 93.26 Σ(44)1 121.85 Σ(45)1 18.28	Nov 96.91 .12 = 133.01 .12 = 19.95	2.41 91.43 Dec 100.57 1097.15 144.44 1438.53 21.67 110.00] (42)] (43)] (44)] (44)] (45)] (45)] (46)] (47)
Assumed occupancy, N Annual average hot water usage Jan F Hot water usage in litres per day 100.57 96 Energy content of hot water user 149.14 130 Distribution loss 0.15 x (45)m 22.37 19 Storage volume (litres) including Water storage loss: b) Manufacturer's declared loss f Hot water storage loss factor	in litres per day eb Mar for each month .91 93.26 d = 4.18 x Vd,m > 0.44 134.61 .57 20.19 any solar or WW factor is not know from Table 2 (kW	Vd,average Apr Vd,m = fact 89.60 (nm x Tm/3 117.35 117.60 /HRS storage wn Wh/litre/da	e = (25 x N) + May tor from Tab 85.94 3600 kWh/m 112.60 16.89 ge within sam	36 Jun le 1c x (43) 82.29 oonth (see T 97.17 14.58 ne vessel	Jul 82.29 ables 1b, 90.04 13.51	Aug 85.94 1c 1d) 103.32 15.50	Sep 89.60 104.56 15.68	Oct 93.26 Σ(44)1 121.85 Σ(45)1 18.28	Nov 96.91 .12 = 133.01 .12 = 19.95	2.41 91.43 Dec 100.57 1097.15 144.44 1438.53 21.67 110.00 0.02 1.02] (42)] (43)] (44)] (44)] (45)] (45)] (46)] (47)] (51)] (51)
Assumed occupancy, N Annual average hot water usage Jan F Hot water usage in litres per day 100.57 96 Energy content of hot water user 149.14 130 Distribution loss 0.15 x (45)m 22.37 19 Storage volume (litres) including Water storage loss: b) Manufacturer's declared loss factor Volume factor from Table 2a Teamourtume factor from Table 2a	in litres per day eb Mar for each month 5.91 93.26 d = 4.18 x Vd,m > 0.44 134.61 5.57 20.19 any solar or WW factor is not know from Table 2 (kW	Vd,average Apr Vd,m = fact 89.60 (nm x Tm/3 117.35 17.60 /HRS storage wn Nh/litre/da	e = (25 x N) + May tor from Tab 85.94 3600 kWh/m 112.60 16.89 ge within sam	36 Jun le 1c x (43) 82.29 onth (see T 97.17 14.58 ne vessel	Jul 82.29 ables 1b, 90.04 13.51	Aug 85.94 1c 1d) 103.32 15.50	Sep 89.60 104.56 15.68	Oct 93.26 Σ(44)1 121.85 Σ(45)1 18.28	Nov 96.91 .12 = 133.01 .12 = 19.95	2.41 91.43 Dec 100.57 1097.15 144.44 1438.53 21.67 110.00 0.02 1.03 2.62] (42)] (43)] (44)] (44)] (45)] (45)] (46)] (47)] (51)] (51)] (52)
Assumed occupancy, N Annual average hot water usage Jan F Hot water usage in litres per day 100.57 96 Energy content of hot water user 149.14 130 Distribution loss 0.15 x (45)m 22.37 19 Storage volume (litres) including Water storage loss: b) Manufacturer's declared loss f Hot water storage loss factor Volume factor from Table 2a Temperature factor from Table	in litres per day eb Mar for each month .91 93.26 d = 4.18 x Vd,m > 0.44 134.61 9.57 20.19 any solar or WW factor is not know from Table 2 (kv le 2b	Vd,average Apr Vd,m = fact 89.60 (nm x Tm/3 117.35 17.60 VHRS storage wn Wh/litre/da	e = (25 x N) + May tor from Tab 85.94 3600 kWh/m 112.60 16.89 ge within sam y)	36 Jun le 1c x (43) 82.29 onth (see T 97.17 14.58 ne vessel	Jul 82.29 ables 1b, 90.04 13.51	Aug 85.94 1c 1d) 103.32 15.50	Sep 89.60 104.56 15.68	Oct 93.26 Σ(44)1 121.85 Σ(45)1 18.28	Nov 96.91 .12 = 133.01 .12 = 19.95	2.41 91.43 Dec 100.57 1097.15 144.44 1438.53 21.67 110.00 0.02 1.03 0.60 1.03] (42)] (43)] (44)] (44)] (44)] (45)] (45)] (46)] (47)] (51)] (51)] (52)] (53)] (53)
Assumed occupancy, N Annual average hot water usage Jan F Hot water usage in litres per day 100.57 96 Energy content of hot water user 149.14 130 Distribution loss 0.15 x (45)m 22.37 19 Storage volume (litres) including Water storage loss: b) Manufacturer's declared loss factor Volume factor from Table 2a Temperature factor from Table 2a Temperature factor from Table 2a Storage loss factor from Table 2a Temperature factor from Table 2a Temperature factor from Table 2a Temperature factor from Table 2a	in litres per day eb Mar for each month 5.91 93.26 d = 4.18 x Vd,m > 0.44 134.61 5.57 20.19 any solar or WW factor is not know from Table 2 (kW le 2b ge (kWh/day) (4)	Vd,average Apr Vd,m = fact 89.60 (nm x Tm/3 117.35 17.60 VHRS storage wn Vh/litre/da 7) x (51) x (5	e = (25 x N) + May tor from Tab 85.94 3600 kWh/m 112.60 16.89 ge within sam γ) 52) x (53)	36 Jun le 1c x (43) 82.29 onth (see T 97.17 14.58 ne vessel	Jul 82.29 ables 1b, 90.04 13.51	Aug 85.94 1c 1d) 103.32 15.50	Sep 89.60 104.56 15.68	Oct 93.26 Σ(44)1 121.85 Σ(45)1 18.28	Nov 96.91 .12 = 133.01 .12 = 19.95	2.41 91.43 Dec 100.57 1097.15 144.44 1438.53 21.67 110.00 0.02 1.03 0.60 1.03 1.03] (42)] (43)] (43)] (44)] (44)] (45)] (45)] (46)] (47)] (51)] (51)] (52)] (53)] (54)] (55)
Assumed occupancy, N Annual average hot water usage Jan F Hot water usage in litres per day 100.57 96 Energy content of hot water user 149.14 130 Distribution loss 0.15 x (45)m 22.37 19 Storage volume (litres) including Water storage loss: b) Manufacturer's declared loss f Hot water storage loss factor Volume factor from Table 2a Temperature factor from Table 2a Temperature factor from Table Energy lost from water storage Enter (50) or (54) in (55)	in litres per day eb Mar for each month .91 93.26 d = 4.18 x Vd,m > 0.44 134.61 2.57 20.19 any solar or WW factor is not know from Table 2 (kW le 2b ge (kWh/day) (4)	Vd,average Apr Vd,m = fact 89.60 (nm x Tm/3 117.35 17.60 /HRS storage wn Wh/litre/da 7) x (51) x (51)	e = (25 x N) + May tor from Tab 85.94 3600 kWh/m 112.60 16.89 ge within sam y) 52) x (53)	36 Jun le 1c x (43) 82.29 onth (see T 97.17 14.58 ne vessel	Jul 82.29 ables 1b, 90.04 13.51	Aug 85.94 1c 1d) 103.32 15.50	Sep 89.60 104.56 15.68	Oct 93.26 Σ(44)1 121.85 Σ(45)1 18.28	Nov 96.91 .12 = 133.01 .12 = 19.95	2.41 91.43 Dec 100.57 1097.15 144.44 1438.53 21.67 10.00 10.02 1.03 0.60 1.03 1.03] (42)] (43)] (44)] (44)] (45)] (45)] (46)] (47)] (51)] (51)] (52)] (53)] (54)] (55)
Assumed occupancy, N Annual average hot water usage Jan F Hot water usage in litres per day 100.57 96 Energy content of hot water user 149.14 130 Distribution loss 0.15 x (45)m 22.37 19 Storage volume (litres) including Water storage loss: b) Manufacturer's declared loss factor Volume factor from Table 2a Temperature factor from Table Energy lost from water storage Enter (50) or (54) in (55) Water storage loss calculated for	in litres per day eb Mar for each month 5.91 93.26 d = 4.18 x Vd,m > 0.44 134.61 5.57 20.19 any solar or WW factor is not know from Table 2 (kV le 2b ge (kWh/day) (4 r each month (52) 1.02 22.01	Vd,average Apr Vd,m = fact 89.60 (nm x Tm/3) 117.35 17.60 /HRS storage wn Wh/litre/da 7) x (51) x (51) 5) x (41)m	e = (25 x N) + May tor from Tab 85.94 3600 kWh/m 112.60 16.89 ge within sam y) 52) x (53)	36 Jun le 1c x (43) 82.29 onth (see T 97.17 14.58 ne vessel	Jul 82.29 ables 1b, 90.04 13.51	Aug 85.94 1c 1d) 103.32 15.50	Sep 89.60 104.56 15.68	Oct 93.26 Σ(44)1 121.85 Σ(45)1 18.28	Nov 96.91 .12 = 133.01 .12 = 19.95	2.41 91.43 Dec 100.57 1097.15 144.44 1438.53 21.67 110.00 0.02 1.03 0.60 1.03 1.03] (42)] (43)] (43)] (44)] (44)] (45)] (45)] (46)] (47)] (51)] (51)] (52)] (53)] (54)] (55)
Assumed occupancy, N Annual average hot water usage Jan F Hot water usage in litres per day 100.57 96 Energy content of hot water user 149.14 130 Distribution loss 0.15 x (45)m 22.37 19 Storage volume (litres) including Water storage loss: b) Manufacturer's declared loss f Hot water storage loss factor Volume factor from Table 2a Temperature factor factor factor f	in litres per day eb Mar for each month 91 93.26 d = 4.18 x Vd,m > 0.44 134.61 0.57 20.19 any solar or WW factor is not know from Table 2 (kW le 2b ge (kWh/day) (4 each month (5) 3.92 32.01 color stores of the st	Vd,average Apr Vd,m = fact 89.60 (nm x Tm/3 117.35 17.60 /HRS storage wn Wh/litre/da 7) x (51) x (1 5) x (41)m 30.98 dedicate d	e = (25 x N) + May tor from Tab 85.94 3600 kWh/m 112.60 16.89 ge within sam γ) 52) x (53) 32.01	36 Jun le 1c x (43) 82.29 onth (see T 97.17 14.58 ne vessel ne vessel	Jul 82.29 ables 1b, 90.04 13.51 32.01 cl : (47)	Aug 85.94 1c 1d) 103.32 15.50 32.01 also (55)	Sep 89.60 104.56 15.68 30.98	Oct 93.26 Σ(44)1 121.85 Σ(45)1 18.28 18.28	Nov 96.91 .12 = [2.41 91.43 Dec 100.57 100.57 100.57 110.057 144.44 1438.53 21.67 10.00 1.03 1.03 1.03 1.03 1.03 1.03 1.03] (42)] (43)] (43)] (44)] (44)] (45)] (45)] (46)] (47)] (51)] (51)] (52)] (53)] (54)] (55)] (56)
Assumed occupancy, N Annual average hot water usage Jan F Hot water usage in litres per day 100.57 96 Energy content of hot water user 149.14 130 Distribution loss 0.15 x (45)m 22.37 19 Storage volume (litres) including Water storage loss: b) Manufacturer's declared loss factor Volume factor from Table 2a Temperature factor from Table Energy lost from water storage Enter (50) or (54) in (55) Water storage loss calculated for 32.01 28 If the vessel contains dedicated s	in litres per day eb Mar for each month 3.91 93.26 d = 4.18 x Vd,m > 0.44 134.61 3.57 20.19 any solar or WW factor is not know from Table 2 (kW le 2b ge (kWh/day) (4 r each month (51 3.92 32.01 solar storage or 0 102 2.201	Vd,average Apr Vd,m = fact 89.60 (nm x Tm/3 117.35 17.60 /HRS storage wn Wh/litre/da 7) x (51) x (5 5) x (41)m 30.98 dedicated V	e = (25 x N) + May tor from Tab 85.94 3600 kWh/m 112.60 16.89 ge within sam y) 52) x (53) 32.01 WHRS (56)r	36 Jun le 1c x (43) 82.29 conth (see T 97.17 14.58 ne vessel 14.58 ne vessel 30.98 n x [(47) - V	Jul 82.29 ables 1b, 90.04 13.51 13.51 (47), 32.01	Aug 85.94 1c 1d) 103.32 15.50 32.01 else (56)	Sep 89.60 104.56 15.68 30.98	Oct 93.26 Σ(44)1 121.85 Σ(45)1 18.28 18.28	Nov 96.91 .12 = [2.41 91.43 Dec 100.57 1097.15 144.44 1438.53 21.67 110.00 0.02 1.03 0.60 1.03 1.03 1.03 1.03] (42)] (43)] (43)] (44)] (44)] (45)] (45)] (46)] (47)] (51)] (51)] (52)] (53)] (53)] (54)] (55)] (56)

Primary circuit l	oss for each	n month fro	om Table 3										
	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
Combi loss for e	each month	from Table	3a, 3b or 3	с									
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
Total heat requi	ired for wat	er heating	calculated f	or each mc	onth 0.85 x	: (45)m + (4	6)m + (57)ı	m + (59)m +	· (61)m				
	204.42	180.37	189.88	170.85	167.88	150.66	145.32	158.60	158.05	177.13	186.50	199.72	(62)
Solar DHW inpu	t calculated	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 wa	ater heater f	or each mo	onth (kWh/ı	month) (62	2)m + (63)n	n		•					_
	204.42	180.37	189.88	170.85	167.88	150.66	145.32	158.60	158.05	177.13	186.50	199.72	1
	L				1		1			Σ(64)1	12 = 2	089.37] (64)
Heat gains from	water heat	ing (kWh/r	nonth) 0.25	5 × [0.85 ×	(45)m + (61	L)m] + 0.8 ×	< [(46)m + (57)m + (59)	m]	2.], ,
U	93,81	83.31	88.98	81.81	81.66	75.10	74.16	78.58	77.56	84.74	87.02	92.25	(65)
	55.61	00.01	00.50	01.01	01.00	, 5.10	,	1 70.50	77.50	0	07.02	52.25] (00)
5. Internal gain	ns												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains	(Table 5)												
	120.48	120.48	120.48	120.48	120.48	120.48	120.48	120.48	120.48	120.48	120.48	120.48	(66)
Lighting gains (c	calculated in	Appendix	L, equation	L9 or L9a),	also see Ta	able 5							
	19.11	16.98	13.81	10.45	7.81	6.60	7.13	9.26	12.43	15.79	18.43	19.64	(67)
Appliance gains	(calculated	in Append	ix L, equatio	on L13 or L1	L3a), also s	ee Table 5							-
	213.71	215.92	210.33	198.44	183.42	169.31	159.88	157.66	163.25	175.14	190.16	204.28	(68)
Cooking gains (d	calculated in	n Appendix	L, equation	L15 or L15	a), also see	e Table 5							-
	35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05	(69)
Pump and fan g	ains (Table	5a)											_
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7(70)
Losses e.g. evap	oration (Ta	ble 5)							1	I	I		
	-96.39	-96.39	-96.39	-96.39	-96.39	-96.39	-96.39	-96.39	-96.39	-96.39	-96.39	-96.39	(71)
Water heating g	gains (Table	5)				1		1	1		1], ,
	126.09	123.98	119.59	113.63	109.76	104.31	99.68	105.61	107.72	113.89	120.86	123.99	(72)
Total internal ga	ains (66)m -	+ (67)m + (6	58)m + (69)i	m + (70)m ·	+ (71)m + (72)m] (: =)
	418.05	416.02	402.88	381.67	360 14	, 339.36	325.83	331.68	342 55	363 97	388 59	407.05	7(73)
	110.05	110.02	102.00	501.07	300.11	555.50	323.03	331.00	312.33	303.37	300.33	107105] (, 5)
6. Solar gains													
			Access f	actor	Area	Sol	lar flux		g	FF		Gains	
			lable	6d	m-	v	V/m²	spec or T	able 6b	specific c or Table	lata 6c	w	
NorthFact			0.7	7	14.12		1 20		<u>10</u>	0.80		25.22] (75)
Solar gains in w	atte 5(71)m	(82)m	0.7	/ × L	14.12		1.20 X	0.9 X	.40 X	0.80	= [33.33] (75)
		71.01	120.57	212 70	200.02	204.04	205.20	227.41	157.00	07.00	44.45	20.05	
Total asian int	35.33	/1.91	(82)	212.79	286.03	304.94	285.26	227.41	157.88	87.89	44.45	28.85] (83)
Total gains - Inte		biar (73)m 4	- (83)m] (2.1)
	453.38	487.94	532.45	594.45	646.17	644.29	611.09	559.09	500.43	451.86	433.05	435.90] (84)
7. Mean interr	nal tempera	ture (heati	ing season)	- X-									
Temperature du	uring heatin	g periods ir	n the living a	area from T	able 9. Th1	L(°C)						21.00	(85)
,	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aug	Sep	Oct	Nov	Dec	」 (- <i>- 1</i>
Utilisation facto	or for gains f	or living an	ea n1,m (se	e Table 9a)	•			č	•				
	1.00	1.00	0.98	0.93	0.77	0.55	0.40	0.46	0.74	0.96	0.99	1.00	(86)
Mean internal t	emp of livin	g area T1 (steps 3 to 7	in Table 90	:)		1	1					」 (<i>− ∞</i> /
		- (•								

	20.36	20.45	20.62	20.84	20.97	21.00	21.00	21.00	20.98	20.80	20.54	20.33	(87)
Temperature du	ring heating	g periods ir	n the rest of	f dwelling f	rom Table !	9, Th2(°C)		•					
	20.32	20.32	20.32	20.32	20.32	20.32	20.32	20.32	20.32	20.32	20.32	20.32	(88)
Utilisation factor	r for gains f	or rest of d	welling n2.	m] (/
	1.00	0.99	0.98	0.91	0.72	0.50	0.34	0.39	0.68	0.95	0.99	1.00	(89)
Mean internal te	emperature	in the rest	of dwelling	g T2 (follow	v steps 3 to	7 in Table 9) Ac)] (/
	19.46	19 59	19.83	20.13	20.29	20.32	20.32	20.32	20.30	20.09	19 72	19.42] (90)
Living area fracti	ion	19.99	19.00	20.15	20.23	20.52	20.32	20.52	1 20.00	ving area ÷	(4) =	0.34] (91)
Mean internal te	emperature	for the wh	ole dwellin	g fl A x T1 -	+(1 - fl A) x [·]	т2				ing area i	(')	0.01] (31)
	19.76	19.88	20.10	20.37	20.52	20.55	20.55	20.55	20.53	20.33	10 00	19.72] (92)
Annly adjustmer	t to the me	an interna	l temperati	ure from Ta	hle 4e whe	ere annronr	iate	20.55	20.55	20.55	15.55	15.72] (52)
	19.76	10.88	20.10	20.37	20.52	20.55	20.55	20.55	20.53	20.33	10.00	10.72] (03)
	19.70	19.00	20.10	20.37	20.32	20.33	20.33	20.55	20.33	20.33	19.99	19.72] (53)
8. Space heatin	ng requirem	ient											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor	r for gains,	ηm											
	1.00	0.99	0.98	0.91	0.74	0.52	0.36	0.42	0.70	0.95	0.99	1.00	(94)
Useful gains, ηm	iGm, W (94	l)m x (84)m	1										
	451.57	484.18	520.49	542.18	476.17	331.94	221.13	232.19	350.86	427.51	429.04	434.58	(95)
Monthly average	e external t	emperatur	e from Tabl	le U1									-
	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate fo	r mean inte	ernal tempe	erature, Lm	, W [(39)m	n x [(93)m -	(96)m]				•			-
	866.52	839.33	761.92	642.55	494.08	333.17	221.20	232.40	360.40	545.36	722.62	869.93	(97)
Space heating re	equirement,	, kWh/mon	1th 0.024 x	[(97)m - (9	5)m] x (41)	m					•		
	308.73	238.66	179.62	72.26	13.33	0.00	0.00	0.00	0.00	87.67	211.38	323.90	7
									Σ(9	8)15, 10	.12 =	1435.55	_] (98)
Space heating re	equirement	kWh/m²/y	ear							(98)	÷ (4)	18.57	(99)
						_							_
9b. Energy requ	uirements -	communi	ty heating s	scheme									
Fraction of space	e heat from	secondary	/suppleme	ntary syste	m (table 11	1)				'0' if ı	none	0.00	(301)
Fraction of space	e heat from	communit	y system							1 - (30	01) =	1.00	(302)
Fraction of com	munity heat	from boile	ers									0.25] (303a)
Fraction of com	munity heat	from CHP										0.75] (303b)
Fraction of total	space heat	from com	munity CHP							(302) x (30	3a) =	0.75	(304a)
Fraction of total	space heat	from com	munity boil	ers						(302) x (303	3b) =	0.25	(304b)
Factor for contro	ol and charg	ging metho	d (Table 4c	(3)) for con	nmunity spa	ace heating						1.00	(305)
Factor for chargi	ing method	(Table 4c(3)) for comi	munity wat	er heating							1.00] (305a)
Distribution loss	factor (Tab	le 12c) for	community	/ heating sy	vstem							1.05	(306)
Space heating													
Annual space he	ating requi	rement						1	L435.55]			(98)
Space heat from	СНР							(93	8) x (304a)	x (305) x (30	06) =	1130.50] (307a)
Space heat from	boilers							(98	8) x (304b)	x (305) x (30	06) =	376.83	_] (307b)
													-
Water heating													
Annual water he	ating requi	rement							2089.37]			(64)
Water heat from	n CHP							(64) x (303a) x	– (305a) x (30	06) =	1645.38	(310a)
Water heat from	n boilers							(64)) x (303b) x	(305a) x (30	06) =	548.46] (310b)
									. ,				

Electricity used for heat distribution		0.01 × [(307a)(307	7e) + (310a)(310e)] =	= 37.01	(313)
Electricity for pumps, fans and electric keep-hot (Table 4f)], ,
mechanical ventilation fans - balanced, extract or positive input	t from outside	52.1	0		(330a)
Total electricity for the above. kWh/year				52.10	(331)
Electricity for lighting (Appendix L)				337.53	(332)
Energy saving/generation technologies] (001)
electricity generated by PV (Appendix M)				_52.22	(222)
Total delivered energy for all uses	(302) + (300) +	(210) + (212) + (215) + (221) + (222) (227h) -	- 4037 57	(338)
Total delivered energy for all uses	(307) + (303) +	(310) + (312) + (313) + (<u>551)</u> + (552)(5570) -	4037.37	[(556)
10b. Fuel costs - community heating scheme					
	Fuel kWh/year	Fuel p	rice	Fuel cost £/year	
Space heating from CHP	1130.50	x 2.9	7 x 0.01 =	33.58	(340a)
Space heating from boilers	376.83	x 4.24	4 x 0.01 =	15.98	(340b)
Water heating from CHP	1645.38	x 2.9	7 x 0.01 =	48.87	(342a)
Water heating from boilers	548.46	x 4.24	4 x 0.01 =	23.25	(342b)
Pumps and fans	52.10	x 13.1	.9 x 0.01 =	6.87	(349)
Electricity for lighting	337.53	x 13.1	19 x 0.01 =	44.52	(350)
Additional standing charges				120.00	(351)
Energy saving/generation technologies]
pv savings	-53.23	x 13.1	19 x 0.01 =	0.00	(352)
Total energy cost		(340a)([342e) + (345)(354) =	= 293.07	(355)
-				L	J · · ·
11b. SAP rating - community heating scheme					-
Energy cost deflator (Table 12)				0.42	(356)
Energy cost factor (ECF)				1.01	(357)
SAP value				85.96]
SAP rating (section 13)				86	(358)
SAP band				В]
12h CO ₂ emissions - community heating scheme					
	Fnergy	Emission	factor	Emissions	
	kWh/year			(kg/year)	
Emissions from community CHP (space and water heating)					
Power efficiency of CHP unit	28.09				(361)
Heat efficiency of CHP unit	66.01				(362)
Space heating from CHP $(307a) \times 100 \div (362) = \begin{bmatrix} 1 \\ 307a \end{bmatrix}$	1712.6044	x 0.21	60 =	369.9226	(363)
less credit emissions for electricity	-481.0629	x 0.51	90 =	-249.6717	(364)
Water heated by CHP	2492.6050	x 0.210	60 =	538.4027	(365)
less credit emissions for electricity	-700.1616	x 0.519	90 =	-363.3839	(366)
Emissions from other sources (space heating)					
Efficiency of boilers	94.00				(367b)
CO2 emissions from boilers $[(307b)+(310b)] \times 100 \div (367b) =$	984.35	x 0.21	6 =	212.62	(368)
Electrical energy for community heat distribution	27.01	v 0.5	2 =	19.21	(372)
	37.01	A 1 0.1	1		_ ··· _/
Total CO2 associated with community systems	37.01	× 0.5		527.10	(373)
Total CO2 associated with community systems	37.01	A _ 0.5		527.10	(373)
Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans	52 10	x 0.5	2 =	527.10 527.10 27.04	(373) (376) (378)
Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans	52.10 337.53	x 0.5	<u>2</u> =	527.10 527.10 27.04 175.18) (373)) (376)) (378)) (379)
Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting Energy saving/generation technologies	52.10 337.53	x 0.53 x 0.55	2 = 2 =	527.10 527.10 27.04 175.18] (373)] (376)] (378)] (379)

pv savings		-53.23	x	0.52	=	-27.63	(380)
Total CO₂, kg/year					(376)(382) =	701.69	(383)
Dwelling CO ₂ emission rate					(383) ÷ (4) =	9.08	(384)
El value						92.31]
El rating (section 14)						92	(385)
El band						A]
13b. Primary energy - comm	unity heating scheme						
		Energy kWh/year		Primary factor		Primary energy (kWh/year)	,
Primary Energy from commun	ity CHP (space and water heating)						
Power efficiency of CHP unit		28.09					(361)
Heat efficiency of CHP unit		66.01					(362)
Space heating from CHP	(307a) × 100 ÷ (362) =	1712.60	x	1.22	=	2089.38	(363)
less credit energy for electr	ficity	-481.06	×	3.07	=	-1476.86	(364)
Water heated by CHP		2492.60	×	1.22	=	3040.98	(365)
less credit energy for electricit	У	-700.16	x	3.07	=	-2149.50	(366)
Primary energy from other sou	urces (space heating)						
Efficiency of boilers		94.00					(367b)
Primary energy from boilers	[(307b)+(310b)] x 100 ÷ (367b) =	984.35	x	1.22	=	1200.91	(368)
Electrical energy for communit	ty heat distribution	37.01	x	3.07	=	113.63	(372)
Total primary energy associate	ed with community systems					2818.53	(373)
Total primary energy associate	ed with space and water heating					2818.53	(376)
Pumps and fans		52.10	x	3.07	=	159.96	(378)
Electricity for lighting		337.53	x	3.07	=	1036.22	(379)
Energy saving/generation tech	nologies						
Electricity generated - PVs		-53.23	x	3.07	=	-163.43	(380)
Primary energy kWh/year						3851.28	(383)
Dwelling primary energy rate	wh/m2/year					49.82	(384)



Assessor name		Miss Jayı	na Parmar					ŀ	ssessor nur	nber	6549		
Client								L	ast modified	d	25/11	/2016	
Address		A-L06-73	A Centric (Close, Lond	on, N8								
1. Overall dwelli	ng dimen	sions											
					А	rea (m²)		Ave	erage storey neight (m)	i	Vo	lume (m³)	
Lowest occupied						72.32	<mark>](1a)</mark> x		2.50	(2a) =		180.80	(3a)
Total floor area		(1a)	+ (1b) + (1	c) + (1d)(1n) =	72.32	(4)						
Dwelling volume								(3	a) + (3b) + (3	3c) + (3d)(3	3n) =	180.80	(5)
2. Ventilation ra	te												
											m	³ ner hour	
Number of chimp	0.46								0	×40 -			(62)
Number of children	eys								0	X40-	·		
Number of open f	iues								0	_ x 20 =			_ (88) _ (7)
Number of Interm	littent fan	S							0	X 10 =] (7a)
Number of passive	e vents								0	x 10 =			_ (7b)
Number of flueles	is gas fires	5							0	x 40 =	·	<u> </u>	_ (/c)
											Air d	hour	r
Infiltration due to	chimneys	s, flues, fan	s, PSVs		(6a)	+ (6b) + (7	a) + (7b) + (7c) =	0	÷ (5) =	-	0.00	(8)
If a pressurisation	test has b	been carrie	d out or is i	ntended, pl	roceed to (17), otherw	ise continu	e from (9)	to (16)				
Air permeability v	alue, q50,	expressed	in cubic m	etres per h	our per squ	uare metre	of envelope	e area				4.00	(17)
If based on air per	rmeability	value, the	n (18) = [(17	7) ÷ 20] + (8), otherwi	se (18) = (1	6)					0.20	(18)
Number of sides c	, on which t	he dwelling	g is sheltere	ed								2	(19)
Shelter factor									1	- [0.075 x (1	9)] =	0.85	(20)
Infiltration rate in	corporatir	ng shelter f	actor							(18) x (2	20) =	0.17	(21)
Infiltration rate m	odified fo	r monthly v	wind speed	:						. , .	·		
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average	wind spee	d from Tab	le U2										
Γ	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	ו ÷ 4									-		-	_
Γ	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	on rate (al	llowing for	shelter and	l wind facto	or) (21) x (2	22a)m	•			-		-	_
Γ	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.20	(22b)
Calculate effective	e air chan	ge rate for	the applica	ble case:									
If mechanical v	ventilation	n: air chang	e rate thro	ugh system								0.50	(23a)
If balanced wit	h heat red	covery: effi	ciency in %	allowing fo	or in-use fa	ctor from T	able 4h					N/A	(23c)
c) whole house	e extract v	entilation o	or positive i	input venti	lation from	outside							
Γ	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(24c)
Effective air change	ge rate - e	nter (24a) (or (24b) or	(24c) or (24	ld) in (25)								
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(25)



3. Heat losses a	and heat lo	ss paramet	er:										
Element			а	Gross rea, m²	Openings m ²	Net A,	area m²	U-value W/m²K	A x U W	//К к-v kJ	/alue, /m².K	Ахк, kJ/K	
Window						21	.34 x	1.24	= 26.37	7			(27)
External wall						11	.81 x	0.18	= 2.13				(29a
Party wall						51	.97 x	0.00	= 0.00				(32)
Roof						72	.32 x	0.16	= 11.57	7			(30)
Total area of ext	ternal eleme	ents ∑A, m²	2			105	5.47						(31)
Fabric heat loss,	W/K = ∑(A	× U)							(2	6)(30) + (32) =	40.07	(33)
Heat capacity Cr	m = ∑(А x к)							(28).	(30) + (32)	+ (32a)(3	2e) =	N/A	(34)
Thermal mass p	arameter (T	MP) in kJ/r	m²K									250.00	(35)
Thermal bridges	: Σ(L x Ψ) ca	alculated us	sing Appen	dix K								4.81	(36)
Total fabric heat	tloss									(33) + (36) =	44.88	(37)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat	loss calcula	ited month	ily 0.33 x (2	25)m x (5)	-								
	29.83	29.83	29.83	29.83	29.83	29.83	29.83	29.83	29.83	29.83	29.83	29.83	(38)
Heat transfer co	efficient, W	' ′/K (37)m ⊦	+ (38)m		1			1					
	74.71	74.71	74.71	74.71	74.71	74.71	74.71	74.71	74.71	74.71	74.71	74.71	7
		1			I				Average =	Σ(39)112	/12 =	74.71	_] (39)
Heat loss param	eter (HLP),	W/m²K (39	9)m ÷ (4)						0	,			
	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	7
									Average =	$\Sigma(40)112$	/12 =	1.03	_] (40)
Number of days	in month (1	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)
			1		I I						1		
4. Water heati	ng energy r	equiremen	t										
Assumed occupa	ancy, N											2.30	(42)
Annual average	hot water u	sage in litr	es per day	Vd,average	= (25 x N) +	36						88.85	(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)						
	97.74	94.18	90.63	87.07	83.52	79.97	79.97	83.52	87.07	90.63	94.18	97.74	
										∑(44)1	.12 =	1066.22	(44)
Energy content	of hot wate	r used = 4.:	18 x Vd,m x	nm x Tm/3	3600 kWh/m	onth (see	Tables 1b	, 1c 1d)					
	144.94	126.77	130.81	114.04	109.43	94.43	87.50	100.41	101.61	118.41	129.26	140.37	
										∑(45)1	.12 =	1397.98	(45)
Distribution loss	0.15 x (45)	m											
	21.74	19.01	19.62	17.11	16.41	14.16	13.13	15.06	15.24	17.76	19.39	21.06	(46)
Storage volume	(litres) inclu	iding any s	olar or WW	/HRS storag	ge within sam	ne vessel						110.00	(47)
Water storage lo													
water storage it	55.												
b) Manufacture	r's declared	loss factor	is not know	wn									
b) Manufacture Hot water ste	r's declared orage loss fa	loss factor actor from	is not knov Table 2 (kV	wn Vh/litre/da	y)							0.02	(51)
b) Manufacturei Hot water sto Volume facto	r's declared orage loss fa or from Tabl	loss factor actor from le 2a	is not knov Table 2 (kV	wn Vh/litre/da	y)							0.02	(51) (52)
b) Manufacturei Hot water sto Volume facto Temperature	r's declared orage loss fa or from Table factor fron	loss factor actor from le 2a n Table 2b	is not knov Table 2 (kV	vn Vh/litre/da	y)							0.02 1.03 0.60	(51) (52) (53)
b) Manufacturer Hot water sto Volume facto Temperature Energy lost fi	r's declared orage loss fa or from Table factor fron rom water s	loss factor actor from le 2a n Table 2b torage (kW	is not knov Table 2 (kV /h/day) (47	wn Vh/litre/da 7) x (51) x (5	y) 52) x (53)							0.02 1.03 0.60 1.03	(51) (52) (53) (54)
b) Manufacturer Hot water sto Volume facto Temperature Energy lost fi Enter (50) or (54	r's declared orage loss fa or from Tabl e factor fron rom water s I) in (55)	loss factor actor from le 2a n Table 2b torage (kW	is not knov Table 2 (kV /h/day) (47	vn Vh/litre/da 7) x (51) x (!	y) 52) x (53)							0.02 1.03 0.60 1.03 1.03	(51) (52) (53) (54) (55)
b) Manufacturer Hot water sto Volume facto Temperature Energy lost fi Enter (50) or (54 Water storage lo	r's declared orage loss fa or from Tabl e factor fron rom water s I) in (55) oss calculate	loss factor actor from le 2a n Table 2b torage (kW ed for each	is not knov Table 2 (kV /h/day) (47 month (55	vn Vh/litre/da 7) x (51) x (! 5) x (41)m	y) 52) x (53)							0.02 1.03 0.60 1.03 1.03) (51) (52) (53) (54) (55)
b) Manufacturen Hot water sto Volume facto Temperature Energy lost fi Enter (50) or (54 Water storage lo	r's declared orage loss fa or from Table factor fron rom water s l) in (55) oss calculate	loss factor actor from le 2a n Table 2b torage (kW ed for each 28.92	is not know Table 2 (kV /h/day) (47 month (55 32.01	vn Vh/litre/da 7) x (51) x (5 5) x (41)m 30.98	y) 52) x (53) <u>32.01</u>	30.98	32.01	32.01	30.98	32.01	30.98	0.02 1.03 0.60 1.03 1.03 32.01) (51) (52) (53) (54) (55) (56)

	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)
Primary circuit l	oss for each	month fro	m Table 3										
	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
Combi loss for e	ach month	from Table	3a, 3b or 3	с									
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
Total heat requi	red for wate	er heating (calculated f	or each mo	nth 0.85 x	(45)m + (4	6)m + (57)r	n + (59)m +	⊦ + (61)m			I]	. ,
·	200.22	176.69	186.09	167 54	164 70	147 92	142 78	155.69	155 10	173 69	182 75	195 64	(62)
Solar DHW innu	t calculated		endix G or A	nnendix H	101.70	117.52	112.70	100.00	155.10	175.05	102.75	155.01	(02)
					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(62)
Output from wa	tor bootor f	or each me	0.00	0.00	1 0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(05)
Output nom wa						1	442 70	155.60	155.40	470.00	400 75	405.64	
	200.22	176.69	186.09	167.54	164.70	147.92	142.78	155.69	155.10	173.69	182.75	195.64	
	_									∑(64)1	12 = 2	.048.82	(64)
Heat gains from	water heat	ing (kWh/n	nonth) 0.25	5 × [0.85 × ((45)m + (61	L)m] + 0.8 ×	: [(46)m + (!	57)m + (59))m]				
	92.41	82.09	87.72	80.71	80.61	74.19	73.32	77.61	76.58	83.59	85.77	90.89	(65)
E Internal gair	26												
5. Internal gai	15	E.L		A			1.1	A	6	0.1	New	Dee	
	Jan	Feb	War	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains	(Table 5)										~		
	115.06	115.06	115.06	115.06	115.06	115.06	115.06	115.06	115.06	115.06	115.06	115.06	(66)
Lighting gains (c	alculated in	Appendix	L, equation	L9 or L9a),	also see Ta	able 5							
	18.07	16.05	13.05	9.88	7.39	6.23	6.74	8.76	11.75	14.92	17.42	18.57	(67)
Appliance gains	(calculated	in Appendi	ix L, equatio	on L13 or L1	.3a), also s	ee Table 5							
	202.65	204.75	199.45	188.17	173.93	160.55	151.61	149.50	154.80	166.08	180.32	193.71	(68)
Cooking gains (c	alculated in	Appendix	L, equation	L15 or L15	a), also see	Table 5							
	34.51	34.51	34.51	34.51	34.51	34.51	34.51	34.51	34.51	34.51	34.51	34.51	(69)
Pump and fan g	ains (Table 5	5a)											
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
Losses e.g. evap	oration (Tal	ble 5)								II		,J	
0 1	-92.04	-92.04	-92.04	-92 04	-92 04	-92 04	-92 04	-92.04	-92.04	-92 04	-92 04	-92.04	(71)
Water heating g	ains (Table	5)	52.04	52.04	52.04	52.04	52.04	52.04	52.04	52.04	52.04	52.04	(, 1)
Water nearing g		122.16	117.00	112 10	109.24	102.04	09.54	104.21	106.26	112.26	110.12	122.17	(72)
T - t - 1 ¹ - t	124.21	122.16	117.90	112.10	108.34	103.04	98.54	104.31	106.36	112.36	119.13	122.17	(72)
Total Internal ga	ains (66)m +	+ (67)m + (6	58)m + (69)r	n + (70)m ·	+ (/1)m + (72)m							
	402.45	400.48	387.92	367.67	347.18	327.34	314.40	320.09	330.43	350.88	374.39	391.96	(73)
6. Solar gains													
			Access f	actor	Area	Sol	ar flux		g	FF		Gains	
			Table	6d	m ²	W	V/m²	spec	ific data	specific d	lata	W	
								or T	able 6b	or Table	6c		
SouthWest			0.77	7 X	21.34	x 3	6.79 x	0.9 x	0.40 x	0.80	=	174.12	(79)
Solar gains in wa	atts ∑(74)m	(82)m											
	174.12	296.59	405.81	502.82	563.20	559.13	539.06	494.01	439.41	327.80	208.56	149.01	(83)
Total gains - inte	ernal and so	lar (73)m +	· (83)m										
	576.57	697.07	793.73	870.49	910.38	886.47	853.46	814.10	769.84	678.68	582.95	540.97	(84)
													x /
7. Mean intern	al tempera	ture (heati	ng season)										
Temperature du	iring heating	g periods ir	the living a	rea from T	able 9, Th1	L(°C)						21.00	(85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains f	or living are	ea n1,m (se	e Table 9a)									
	0.99	0.98	0.94	0.86	0.71	0.53	0.38	0.42	0.64	0.90	0.98	0.99	(86)
									1				x 1

SAP version 9.92

20.10 20.31 20.56 20.80 20.94 20.99 21.00 21.00 20.97 20.78 20.38 20.05 (87) Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C) 20.06 20.06 20.06 20.06 20.06 20.06 20.06 20.06 20.06 20.06 20.06 20.06 88) Utilisation factor for gains for rest of dwelling n2,m 0.99 0.97 0.93 0.83 0.66 0.46 0.30 0.33 0.57 0.86 0.97 0.99 (89) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) 18.88 19.17 19.52 19.83 20.00 20.06 20.05 20.04 19.82 19.28 18.80 (90) Living area fraction Living area ÷ (4) = 0.28 (91) Mean internal temperature for the whole dwelling fLA x T1 + (1 - fLA) x T2 19.22 19.49 19.81 20.10 20.27 20.31 20.32 20.30 20.09 19.59 19.15 (92)										
Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C) 20.06 20.07 0.99 0.97 0.93 0.83 0.66 0.46 0.30 0.33 0.57 0.86 0.97 0.99 (89) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) 18.88 19.17 19.52 19.83 20.00 20.05 20.06 20.04 19.82 19.28 18.80 (90) Living area fraction Living area ÷ (4) = 0.28 0.28 (91) <td rowspa="</td"></td>										
20.06 20.07 0.99 (89) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) 18.88 19.17 19.52 19.83 20.00 20.05 20.06 20.04 19.82 19.28 18.80 (90) Living area fraction Living area ÷ (4) = 0.28 (91) Mean internal temperature for the whole dwelling fLA x T1 + (1 - fLA) x T2 Living area 20.00 20.27 20.31 20.32 20.30 20.09 19.59 19.15 (92)										
Utilisation factor for gains for rest of dwelling n2,m 0.99 0.97 0.93 0.83 0.66 0.46 0.30 0.33 0.57 0.86 0.97 0.99 (89) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) 18.88 19.17 19.52 19.83 20.00 20.05 20.05 20.04 19.82 19.28 18.80 (90) Living area fraction Living area \div (4) = 0.28 (91) Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2 Living area \div (20.09 19.59 19.15 (92)										
0.99 0.97 0.93 0.83 0.66 0.46 0.30 0.33 0.57 0.86 0.97 0.99 (89)Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)18.8819.1719.5219.8320.0020.0520.0620.0520.0419.8219.2818.80(90)Living area fractionLiving area \div (4) =0.28(91)Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T219.2219.4919.8120.1020.2720.3120.3220.3020.0919.5919.15(92)										
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) 18.88 19.17 19.52 19.83 20.00 20.05 20.06 20.05 20.04 19.82 19.28 18.80 (90) Living area fraction Living area \div (4) = 0.28 (91) Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2 (92)										
18.88 19.17 19.52 19.83 20.00 20.05 20.06 20.05 20.04 19.82 19.28 18.80 (90) Living area fraction Living area ÷ (4) = 0.28 (91) Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2 (91) 19.22 19.49 19.81 20.10 20.27 20.31 20.32 20.30 20.09 19.59 19.15 (92)										
10.00 15.17 15.02 15.03 20.00 20.03 20.03 20.04 15.02 15.02 10.00 (00) Living area fraction Living area \div (4) = 0.28 (91) Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2 19.20 19.49 19.81 20.10 20.27 20.31 20.32 20.30 20.09 19.59 19.15 (92)										
Living area fraction Living area fraction Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2 19.22 19.49 19.81 20.10 20.27 20.31 20.32 20.30 20.09 19.59 19.15 (92)										
Image: Internal temperature for the whole dwelling ICA X 11 +(1 - ICA) X 12 19.22 19.49 19.81 20.10 20.27 20.31 20.32 20.30 20.09 19.59 19.15 (92)										
<u>19.22</u> <u>19.49</u> <u>19.81</u> <u>20.10</u> <u>20.27</u> <u>20.31</u> <u>20.32</u> <u>20.32</u> <u>20.30</u> <u>20.09</u> <u>19.59</u> <u>19.15</u> (92)										
A sub-sub-sub-sub-sub-sub-sub-sub-sub-sub-										
Apply adjustment to the mean internal temperature from Table 4e where appropriate										
<u>19.22</u> <u>19.49</u> <u>19.81</u> <u>20.10</u> <u>20.27</u> <u>20.31</u> <u>20.32</u> <u>20.32</u> <u>20.30</u> <u>20.09</u> <u>19.59</u> <u>19.15</u> (93)										
8. Space heating requirement										
lan Feb Mar Anr May Jun Jul Aug Sen Oct Nov Dec										
Litilization factor for gains nm										
0.99 0.97 0.92 0.83 0.67 0.48 0.33 0.36 0.59 0.86 0.97 0.99 (94)										
Useful gains, ŋmGm, W (94)m x (84)m										
<u>568.96</u> 674.14 733.11 721.36 609.30 422.79 277.51 292.12 451.35 586.05 565.51 535.68 (95)										
Monthly average external temperature from Table U1										
4.304.906.508.9011.7014.6016.6016.4014.1010.607.104.20(96)										
Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]										
1114.76 1090.08 994.43 837.06 639.95 426.85 277.91 292.81 463.18 708.87 932.96 1116.77 (97)										
Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m										
406.07 279.51 194.42 83.30 22.81 0.00 0.00 0.00 0.00 91.38 264.56 432.33										
<u>Σ(98)15, 1012 = 1774.40</u> (98)										
Space heating requirement kWh/m ² /year (98) \div (4) 24.54 (99)										
9h. Energy requirements - community heating scheme										
Fraction of space heat from secondary/supplementary system (table 11) '0' if none 0.00 (301)										
Fraction of space heat from community system (a) Fraction of space heat from community system 1 - (301) = 1.00 (302)										
Fraction of space heat from secondary/supplementary system (table 11) '0' if none 0.00 (301) Fraction of space heat from community system 1 - (301) = 1.00 (302) Fraction of community heat from boilers 0.25 (303a)										
Fraction of space heat from secondary/supplementary system (table 11) '0' if none 0.00 (301) Fraction of space heat from community system 1 - (301) = 1.00 (302) Fraction of community heat from boilers 0.25 (303a) Fraction of community heat from CHP 0.75 (303a)										
Fraction of space heat from secondary/supplementary system (table 11)'0' if none0.00(301)Fraction of space heat from community system1 - (301) =1.00(302)Fraction of community heat from boilers0.25(303a)Fraction of community heat from CHP0.75(303b)Fraction of total space heat from community CHP(302) x (303a) =0.75										
Fraction of space heat from secondary/supplementary system (table 11)'0' if none0.00(301)Fraction of space heat from community system1 - (301) =1.00(302)Fraction of community heat from boilers0.25(303a)Fraction of community heat from CHP0.75(303b)Fraction of total space heat from community CHP(302) x (303a) =0.75Fraction of total space heat from community boilers(302) x (303b) =0.25(304a)Fraction of total space heat from community boilers(302) x (303b) =0.25										
Fraction of space heat from secondary/supplementary system (table 11)'0' if none0.00(301)Fraction of space heat from community system1 - (301) =1.00(302)Fraction of community heat from boilers0.25(303a)Fraction of community heat from CHP0.75(304a)Fraction of total space heat from community boilers(302) x (303a) =0.75Fraction of total space heat from community boilers(302) x (303b) =0.25Fraction of total space heat from community boilers(302) x (303b) =0.25Fraction of total space heat from community boilers(302) x (303b) =0.25Factor for control and charging method (Table 4c(3)) for community space heating1.00(305)										
Fraction of space heat from secondary/supplementary system (table 11)'0' if none0.00(301)Fraction of space heat from community system1 - (301) =1.00(302)Fraction of community heat from boilers0.25(303a)Fraction of community heat from CHP0.75(304a)Fraction of total space heat from community boilers(302) x (303a) =0.75Fraction of total space heat from community boilers(302) x (303b) =0.25Fractor for control and charging method (Table 4c(3)) for community space heating1.00(305)Factor for charging method (Table 4c(3)) for community water heating1.00(305a)										
Fraction of space heat from secondary/supplementary system (table 11)'0' if none0.00(301)Fraction of space heat from community system1 - (301) =1.00(302)Fraction of community heat from boilers0.25(303a)Fraction of community heat from CHP0.75(304a)Fraction of total space heat from community boilers(302) x (303a) =0.75Fraction of total space heat from community boilers(302) x (303b) =0.25Fractor for control and charging method (Table 4c(3)) for community space heating1.00(305)Factor for charging method (Table 4c(3)) for community water heating1.00(305)Distribution loss factor (Table 12c) for community heating system1.05(306)										
Fraction of space heat from secondary/supplementary system (table 11)'0' if none 0.00 (301)Fraction of space heat from community system $1 - (301) =$ 1.00 (302)Fraction of community heat from boilers 0.25 (303a)Fraction of community heat from CHP 0.75 (304a)Fraction of total space heat from community CHP $(302) \times (303a) =$ Fraction of total space heat from community boilers $(302) \times (303b) =$ Fractor for control and charging method (Table 4c(3)) for community space heating 1.00 (305)Factor for charging method (Table 4c(3)) for community water heating 1.00 (305)Distribution loss factor (Table 12c) for community heating system 1.05 (306)										
Fraction of space heat from secondary/supplementary system (table 11) '0' if none 0.00 (301) Fraction of space heat from community system 1 - (301) = 1.00 (302) Fraction of community heat from boilers 0.25 (303a) Fraction of total space heat from community CHP 0.75 (304a) Fraction of total space heat from community boilers (302) x (303a) = 0.75 (304a) Fraction of total space heat from community boilers (302) x (303b) = 0.25 (304a) Fraction of total space heat from community boilers (302) x (303b) = 0.25 (304a) Fraction of total space heat from community boilers (302) x (303b) = 0.25 (304a) Fractor for control and charging method (Table 4c(3)) for community space heating 1.00 (305) Factor for charging method (Table 4c(3)) for community water heating 1.00 (305a) Distribution loss factor (Table 12c) for community heating system 1.05 (306)										
Fraction of space heat from secondary/supplementary system (table 11) '0' if none 0.00 (301) Fraction of space heat from community system 1 - (301) = 1.00 (302) Fraction of community heat from boilers 0.25 (303a) Fraction of community heat from CHP 0.75 (304a) Fraction of total space heat from community boilers (302) x (303a) = 0.75 (304a) Fraction of total space heat from community boilers (302) x (303b) = 0.25 (304a) Fraction of total space heat from community boilers (302) x (303b) = 0.25 (304a) Fraction of total space heat from community boilers (302) x (303b) = 0.25 (304a) Factor for control and charging method (Table 4c(3)) for community space heating 1.00 (305) Factor for charging method (Table 4c(3)) for community water heating 1.00 (305) Distribution loss factor (Table 12c) for community heating system 1.05 (306)										
Fraction of space heat from secondary/supplementary system (table 11) '0' if none 0.00 (301) Fraction of space heat from community system 1 - (301) = 1.00 (302) Fraction of community heat from boilers 0.25 (303) Fraction of community heat from CHP 0.75 (304) Fraction of total space heat from community boilers 0.75 (304) Fraction of total space heat from community boilers (302) x (303a) = 0.75 (304) Fraction of total space heat from community boilers (302) x (303b) = 0.25 (304) Fraction of total space heat from community boilers (302) x (303b) = 0.25 (304) Fraction of total space heat from community boilers (302) x (303b) = 0.25 (304) Fractor for control and charging method (Table 4c(3)) for community space heating 1.00 (305) Factor for charging method (Table 4c(3)) for community water heating 1.00 (305) Distribution loss factor (Table 12c) for community heating system 1.05 (306) Space heating 1.774.40 (98) Space heating requirement (704) x (204) x (204) x (204) x (205) x (204) = 1207.24 (207)										
Fraction of space heat from secondary/supplementary system (table 11) '0' if none 0.00 (301) Fraction of space heat from community system 1 - (301) = 1.00 (302) Fraction of community heat from boilers 0.25 (303a) Fraction of total space heat from community CHP (302) x (303a) = 0.75 (304a) Fraction of total space heat from community boilers (302) x (303b) = 0.25 (304a) Fraction of total space heat from community boilers (302) x (303b) = 0.25 (304a) Fraction of total space heat from community boilers (302) x (303b) = 0.25 (304a) Fractor for control and charging method (Table 4c(3)) for community space heating 1.00 (305a) Factor for charging method (Table 4c(3)) for community water heating 1.00 (305a) Distribution loss factor (Table 12c) for community heating system 1.05 (306) Space heating 1.774.40 (98) (304a) x (305) x (306) = 1397.34 (307a) Space heat from CHP (98) x (304a) x (305) x (306) = 1397.34 (307a) (307a)										
Fraction of space heat from secondary/supplementary system (table 11)'0' if none0.00(301)Fraction of space heat from community system1 - (301) =1.00(302)Fraction of community heat from boilers0.25(303a)Fraction of community heat from CHP(302) x (303a) =0.75(304a)Fraction of total space heat from community boilers(302) x (303b) =0.25(304a)Fraction of total space heat from community boilers(302) x (303b) =0.25(304b)Factor for control and charging method (Table 4c(3)) for community space heating1.00(305)(305)Factor for charging method (Table 4c(3)) for community water heating1.00(305)(305)Distribution loss factor (Table 12c) for community heating system1.05(306)(306)Space heat from CHP(98) x (304a) x (305) x (306) =1397.34(307a)Space heat from CHP(98) x (304b) x (305) x (306) =1397.34(307a)Space heat from boilers(98) x (304b) x (305) x (306) =(307a)Space heat from boilers(98) x (304b) x (305) x (306) =(307a)										
Fraction of space heat from secondary/supplementary system (table 11) '0' if none 0.00 (301) Fraction of space heat from community system 1 - (301) = 1.00 (302) Fraction of community heat from boilers 0.25 (303a) Fraction of community heat from CHP (302) x (303a) = 0.75 (304a) Fraction of total space heat from community boilers (302) x (303b) = 0.25 (304a) Fraction of total space heat from community boilers (302) x (303b) = 0.25 (304b) Fraction of total space heat from community boilers (302) x (303b) = 0.25 (304b) Factor for control and charging method (Table 4c(3)) for community space heating 1.00 (305) Factor for charging method (Table 4c(3)) for community water heating 1.00 (305) Distribution loss factor (Table 12c) for community heating system 1.05 (306) Space heating 1.074.40 (98) (98) x (304a) x (305) x (306) = 1397.34 (307a) Space heat from CHP (98) x (304a) x (305) x (306) = 1397.34 (307a) (307b) Space heat from boilers (98) x (304b) x (305) x (306) = 1455.78 (307b) (307b) (302b) x (
Fraction of space heat from secondary/supplementary system (table 11) '0' if none 0.00 (301) Fraction of space heat from community system 1 - (301) = 1.00 (302) Fraction of community heat from boilers 0.25 (303) Fraction of community heat from CHP 0.75 (304) Fraction of total space heat from community boilers (302) x (303) = 0.25 (304) Fraction of total space heat from community boilers (302) x (303) = 0.25 (304) Fraction of total space heat from community boilers (302) x (303) = 0.25 (304) Fractor for control and charging method (Table 4c(3)) for community space heating 1.00 (305) (306) Factor for charging method (Table 4c(3)) for community water heating 1.00 (305) (306) Distribution loss factor (Table 12c) for community heating system 1.05 (306) Space heating 1.074.40 (98) (304a) x (305) x (306) = 1397.34 (307) Space heat from boilers (98) x (304a) x (305) x (306) = 1397.34 (307) Water heating (98) x (304b) x (305) x (306) = 465.78 (307)										
Fraction of space heat from secondary/supplementary system (table 11) '0' if none 0.00 (301) Fraction of space heat from community system 1 - (301) = 1.00 (302) Fraction of community heat from boilers 0.25 (303) Fraction of total space heat from community CHP (302) x (303a) = 0.75 (304) Fraction of total space heat from community boilers (302) x (303b) = 0.25 (304) Fraction of total space heat from community boilers (302) x (303b) = 0.25 (304) Fraction of total space heat from community boilers (302) x (303b) = 0.25 (304) Fractor for control and charging method (Table 4c(3)) for community space heating 1.00 (305) (306) Fractor for charging method (Table 4c(3)) for community water heating 1.00 (305) (306) Space heating 1.00 (305) (306) (306) (306) Space heating 1.00 (305) x (306) = 1397.34 (307) Space heat from CHP (98) x (304a) x (305) x (306) = (455.78 (307) Space heat from CHP (98) x (304b) x (305) x (306) = (455.78 (307) Water heating										

Water heat from boilers			(64) x (303b) x (305a) x (306) =	537.81	(310b)
Electricity used for heat distribution		0.01 × [(307a)(307e) + (33	10a)(310e)] =	40.14	(313)
Electricity for pumps, fans and electric keep-hot (Table 4f)						
mechanical ventilation fans - balanced, extract or positive input	ut from outside		45.88			(330a)
Total electricity for the above, kWh/year					45.88	(331)
Electricity for lighting (Appendix L)					319.06	(332)
Energy saving/generation technologies						
electricity generated by PV (Appendix M)					-53.23	(333)
Total delivered energy for all uses	(307) + (309)) + (310) + (312)	+ (315) + (331) + (332)(337b) =	4326.09	(338)
10b. Fuel costs - community heating scheme						
	Fuel		Fuel price		Fuel	
	kWh/year				cost £/year	
Space heating from CHP	1397.34] x	2.97	x 0.01 =	41.50	(340a)
Space heating from boilers	465.78] x	4.24	x 0.01 =	19.75	(340b)
Water heating from CHP	1613.44] x	2.97	x 0.01 =	47.92	(342a)
Water heating from boilers	537.81] x	4.24	x 0.01 =	22.80	(342b)
Pumps and fans	45.88] x	13.19	x 0.01 =	6.05	(349)
Electricity for lighting	319.06] x	13.19	x 0.01 =	42.08	(350)
Additional standing charges					120.00	(351)
Energy saving/generation technologies						
pv savings	-53.23] x	13.19	x 0.01 =	0.00	(352)
Total energy cost			(340a)(342e) +	(345)(354) =	300.11	(355)
11b. SAP rating - community heating scheme					ſ	1
Energy cost deflator (Table 12)					0.42	(356) 1
Energy cost factor (ECF)					1.07	(357)
SAP value					85.01]
SAP rating (section 13)					85	(358)
SAP band					В	J
12b. CO ₂ emissions - community heating scheme						
	Friendly		Emission factor			

	Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from community CHP (space and water heating)						
Power efficiency of CHP unit	28.09					(361)
Heat efficiency of CHP unit	66.01					(362)
Space heating from CHP $(307a) \times 100 \div (362) =$	2116.8523	x	0.2160	=	457.2401	(363)
less credit emissions for electricity	-594.6143	x	0.5190	=	-308.6048	(364)
Water heated by CHP	2444.2232	x	0.2160	=	527.9522	(365)
less credit emissions for electricity	-686.5713	х	0.5190	=	-356.3305	(366)
Emissions from other sources (space heating)						
Efficiency of boilers	94.00					(367b)
CO2 emissions from boilers [(307b)+(310b)] x 100 ÷ (367b) =	1067.65	x	0.216	=	230.61	(368)
Electrical energy for community heat distribution	40.14	x	0.52	=	20.83	(372)
Total CO2 associated with community systems					571.70	(373)
Total CO2 associated with space and water heating					571.70	(376)
Pumps and fans	45.88	х	0.52	=	23.81	(378)
Electricity for lighting	319.06	х	0.52	=	165.59	(379)

Energy saving/generation tech	nologies						
pv savings		-53.23	x	0.52	=	-27.63	(380)
Total CO ₂ , kg/year					(376)(382) =	733.48	(383)
Dwelling CO ₂ emission rate					(383) ÷ (4) =	10.14	(384)
El value						91.62]
El rating (section 14)						92	(385)
El band						A]
13b. Primary energy - commu	unity heating scheme						
		Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary Energy from communi	ty CHP (space and water heating)						
Power efficiency of CHP unit		28.09					(361)
Heat efficiency of CHP unit		66.01					(362)
Space heating from CHP	(307a) × 100 ÷ (362) =	2116.85	x	1.22	=	2582.56	(363)
less credit energy for electri	icity	-594.61	x	3.07	=	-1825.47	(364)
Water heated by CHP		2444.22	x	1.22	=	2981.95	(365)
less credit energy for electricity	y	-686.57	x	3.07	=	-2107.77	(366)
Primary energy from other sou	rces (space heating)						
Efficiency of boilers		94.00					(367b)
Primary energy from boilers	[(307b)+(310b)] x 100 ÷ (367b) =	1067.65	x	1.22	=	1302.54	(368)
Electrical energy for communit	y heat distribution	40.14	х	3.07	=	123.24	(372)
Total primary energy associate	d with community systems					3057.05	(373)
Total primary energy associate	d with space and water heating					3057.05	(376)
Pumps and fans		45.88	x	3.07	=	140.85	(378)
Electricity for lighting		319.06	x	3.07	=	979.51	(379)
Energy saving/generation tech	nologies						
Electricity generated - PVs		-53.23	x	3.07	=	-163.43	(380)
Primary energy kWh/year						4013.98	(383)
Dwelling primary energy rate k	Wh/m2/year					55.50	(384)



Assessor name		Miss Jayr	na Parmar						Assessor nur	nber	6549		
Client									Last modified	d	25/11	/2016	
Address		B-L00-02	B Centric C	Close, Lond	on, N8								
1. Overall dwellin	ng dimens	sions											
					Þ	area (m²)		Av	erage storey height (m)	1	Vo	lume (m³)	
Lowest occupied						95.27	(1a) x		2.50	(2a) =		238.18	(3a)
Total floor area		(1a)	+ (1b) + (1e	c) + (1d)(1n) =	95.27	(4)						
Dwelling volume								(3	a) + (3b) + (3	3c) + (3d)(3	8n) =	238.18	(5)
2. Ventilation rat	te												
											m³	³ per hour	
Number of chimne	evs								0	x 40 =		0	(6a)
Number of open fl	lues								0	x 20 =		0	(60)
Number of interm	ittent fan	s							0	x 10 =		0] (32)
Number of passive	e vents								0	x 10 =		0] (7b)
Number of flueles	s gas fires								0	x 40 =		0] (7c)
	0										Air o	hanges pe hour	r
Infiltration due to	chimneys	, flues, fans	s, PSVs		(6a)) + (6b) + (7	a) + (7b) + ((7c) =	0	÷ (5) =	: [0.00	(8)
If a pressurisation	test has b	been carried	d out or is ii	ntended, pi	roceed to ((17), otherw	vise continu	e from (9) to (16)				_
Air permeability va	alue <i>,</i> q50,	expressed	in cubic me	etres per h	our per sq	uare metre	of envelope	e area				4.00	(17)
If based on air per	meability	value, ther	n (18) = [(17	7) ÷ 20] + (8	3), otherwi	se (18) = (1	6)					0.20	(18)
Number of sides o	n which t	he dwelling	g is sheltere	ed								2	(19)
Shelter factor									1	- [0.075 x (1	9)] =	0.85	(20)
Infiltration rate inc	corporatir	ng shelter fa	actor							(18) x (2	20) =	0.17	(21)
Infiltration rate mo	odified fo	r monthly v	wind speed	:									
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average v	wind spee	d from Tab	ole U2										
	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22)m	• ÷ 4												
	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
Adjusted infiltratio	on rate (al	llowing for	shelter and	l wind facto	or) (21) x (2	22a)m	_		<u>.</u>	_		- .	_
L	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.20	(22b)
Calculate effective	air chang	ge rate for t	the applical	ble case:									_
If mechanical v	entilation	1: air chang	e rate throu	ugh system								0.50	(23a)
If balanced wit	h heat reo	covery: effi	ciency in %	allowing fo	or in-use fa	ictor from T	Table 4h					N/A	(23c)
c) whole house	extract v	entilation o	or positive i	input venti	ation from	n outside	1	1				1	-
L	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(24c)
Effective air chang	ge rate - e	nter (24a) o	or (24b) or ((24c) or (24	ld) in (25)	-1	1	1					7
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(25)



3. Heat losses a	and heat lo	ss paramet	er										
Element			а	Gross rea, m²	Openings m ²	Net A,	area m²	U-value W/m²K	A x U W	/К к-v kJ,	value, /m².K	Ахк, kJ/K	
Window						27.	.95 x	1.24	= 34.54				(27)
Ground floor						95.	.27 x	0.20	= 19.05				(28a)
External wall						25.	.22 x	0.18	= 4.54				(29a)
Party wall						63.	.29 x	0.00	= 0.00				(32)
Total area of ext	ernal elem	ents ∑A, m²				148	.44						(31)
Fabric heat loss,	W/K = ∑(A	× U)							(26)(30) + (3	32) =	58.13	(33)
Heat capacity Cr	m = ∑(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 Append	dix K								10.27	(36)
Total fabric heat	loss									(33) + (3	36) =	68.41	(37)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat	loss calcula	ted month	ly 0.33 x (2	25)m x (5)									
	39.30	39.30	39.30	39.30	39.30	39.30	39.30	39.30	39.30	39.30	39.30	39.30	(38)
Heat transfer co	efficient, W	//K (37)m +	- (38)m										
	107.70	107.70	107.70	107.70	107.70	107.70	107.70	107.70	107.70	107.70	107.70	107.70	
									Average = ∑	(39)112/	/12 =	107.70] (39)
Heat loss param	eter (HLP),	W/m²K (39	9)m ÷ (4)										
	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	
									Average = ∑	(40)112/	'12 =	1.13	(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	ng energy r	equiremen	t										
Assumed occupa	ancy, N											2.69	(42)
Annual average	hot water ι	isage in litre	es per day V	/d,average	= (25 x N) +	36						98.12	(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	or from Tab	le 1c x (43)						
	107.93	104.00	100.08	96.15	92.23	88.30	88.30	92.23	96.15	100.08	104.00	107.93]
										∑(44)1	12 =	1177.40	(44)
Energy content	of hot wate	r used = 4.1	L8 x Vd,m x	nm x Tm/3	600 kWh/m	onth (see	Tables 1b	o, 1c 1d)					
	160.05	139.98	144.45	125.94	120.84	104.27	96.63	110.88	112.20	130.76	142.74	155.00]
Distribution loss	0 1E x (4E)	Im								∑(45)1	12 =	1543.75] (45)
Distribution loss	24.01	21.00	21.67	18.89	18.13	15.64	14.49	16.63	16.83	19.61	21.41	23.25	(46)
Storage volume	(litres) inclu	uding any so	olar or WW	HRS storag	e within san	ne vessel	_					110.00	(47)
Water storage lo	oss:	5,											_ · ·
b) Manufacturer	r's declared	loss factor	is not knov	vn									
Hot water sto	orage loss f	actor from ⁻	Table 2 (kW	/h/litre/day	()							0.02	(51)
Volume facto	or from Tab	le 2a										1.03	(52)
Temperature	e factor from	n Table 2b										0.60	(53)
Energy lost fr	rom water s	torage (kW	/h/day) (47	') x (51) x (5	52) x (53)							1.03	(54)
Enter (50) or (54	l) in (55)											1.03	(55)
Water storage lo	oss calculate	ed for each	month (55	5) x (41)m									
	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)
						F (

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

	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01 (5	7)
Primary circuit l	oss for each	month fro	m Table 3										
	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26 (5	9)
Combi loss for e	ach month	from Table	3a. 3b or 3	с								(•	-,
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 (6	1)
Total heat requi	red for wat	or beating (o.oo	or each mo	0.00	$(45)m \pm (4)$	$6)m \pm (57)n$	0.00 n ± (59)m ±	(61)m	0.00	0.00	0.00 (0	-,
iotai neat requi										100.04	106.22	210.20 /6	2)
	215.33	189.91	199.73	179.43	176.12	157.77	151.90	166.16	165.70	186.04	196.23	210.28 (6	2)
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 (6	3)
Output from wa	ter heater f	or each mo	nth (kWh/ı	month) (62	2)m + (63)m	1							
	215.33	189.91	199.73	179.43	176.12	157.77	151.90	166.16	165.70	186.04	196.23	210.28	
										∑(64)1	12 = 2	194.59 <mark>(6</mark>	4)
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]				
	97.44	86.49	92.25	84.67	84.40	77.47	76.35	81.09	80.10	87.70	90.26	95.76 <mark>(6</mark>	5)
					-			·					
5. Internal gair	าร												
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains	(Table 5)												
	134.56	134.56	134.56	134.56	134.56	134.56	134.56	134.56	134.56	134.56	134.56	134.56 <mark>(6</mark>	6)
Lighting gains (c	alculated in	Appendix	., equation	L9 or L9a),	also see Ta	able 5							
	22.15	19.67	16.00	12.11	9.05	7.64	8.26	10.74	14.41	18.30	21.35	22.76 <mark>(6</mark>	7)
Appliance gains	(calculated	in Appendi	x L, equatio	on L13 or L1	L3a), also se	ee Table 5							
	248.45	251.02	244.53	230.70	213.24	196.83	185.87	183.29	189.79	203.62	221.08	237.48 (6	8)
Cooking gains (c	alculated in	Appendix	L, equation	L15 or L15	a), also see	Table 5						·	•
	36.46	36.46	36.46	36.46	36.46	36.46	36.46	36.46	36.46	36.46	36.46	36.46 (6	9)
Pump and fan g	ains (Table '	5a)	00110	00110	00110	00110		00.10	00110	00110	00110		-1
			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 (7	0)
	oration (Tal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 (7	0)
Losses e.g. evap			107.05	107.65	107.05	407.05	107.65	107.05	107.05	407.05	407.05		a \
	-107.65	-107.65	-107.65	-107.65	-107.65	-107.65	-107.65	-107.65	-107.65	-107.65	-107.65	-107.65 (/	1)
Water heating g	ains (Table	5)							1				
	130.97	128.70	123.99	117.60	113.44	107.59	102.62	108.99	111.25	117.88	125.35	128.71 <mark>(7</mark>	2)
Total internal ga	ains (66)m -	+ (67)m + (6	8)m + (69)ı	m + (70)m -	+ (71)m + (7	72)m							
	464.93	462.77	447.89	423.77	399.10	375.43	360.12	366.38	378.82	403.16	431.15	452.33 <mark>(7</mark>	3)
6 Solar gains													
			Accors f	iactor	Aroo	Sal	or flux		~			Cainc	
			Table	6d	m ²	- 301 W	//m²	spec	в ific data	specific d	ata	W	
								or T	able 6b	or Table	6c		
SouthWest			0.7	7 X	27.95	x 3	6.79 x	0.9 x 0	0.40 x	0.80	=	228.06 (7	9)
Solar gains in wa	atts ∑(74)m	(82)m											
	228.06	388.46	531.51	658.57	737.65	732.32	706.03	647.03	575.51	429.33	273.16	195.17 (8	3)
Total gains - inte	ernal and so	lar (73)m +	(83)m									· · · ·	,
0	692.99	851.22	979 /10	1082.34	1136 75	1107 75	1066 15	1013 // 2	954 22	832 /10	704 21	647 50 /2	4)
	052.33	051.25	575.40	1002.34	1130.73	1107.75	1000.13	1013.42	554.55	052.45	,04.31	0) 017.50	9
7. Mean intern	al tempera	ture (heati	ng season)										
Temperature du	iring heatin	g periods ir	the living a	area from T	able 9, Th1	.(°C)						21.00 (8	5)
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains f	or living are	ea n1,m (se	e Table 9a)									
	1.00	0.99	0.96	0.90	0.78	0.60	0.44	0.48	0.72	0.93	0.99	1.00 (8	6)
	L								–			(0	

SAP version 9.92

19.90 20.12 20.39 20.68 20.98 21.00 20.99 20.94 20.66 20.21 19.85 (87) Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)
Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)
19.98 19.98 19.98 19.98 19.98 19.98 19.98 19.98 19.98 19.98 19.98 19.98 19.98 19.98 19.98 (88)
Utilisation factor for gains for rest of dwelling n2.m
Magn internal temperature in the rest of dwalling T2 (follow stops 2 to 7 in Table 9s)
18.53 18.83 19.22 19.62 19.87 19.96 19.97 19.97 19.93 19.60 18.97 18.45 (90)
Living area fraction Living area \div (4) = 0.41 (91)
Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2
19.0919.3619.7020.0520.2920.3820.3920.3920.3520.0419.4819.02(92)
Apply adjustment to the mean internal temperature from Table 4e where appropriate
19.09 19.36 19.70 20.05 20.29 20.38 20.39 20.35 20.04 19.48 19.02 (93)
8. Space heating requirement
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Utilisation factor for gains, nm
0.99 0.98 0.95 0.88 0.74 0.55 0.38 0.42 0.67 0.91 0.98 0.99 (94)
Useful gains, ηmGm, W (94)m x (84)m
687.32 832.99 928.54 948.36 840.67 607.37 406.68 426.80 634.95 755.09 691.18 643.60 (95)
Monthly average external temperature from Table U1
4.30 4.90 6.50 8.90 11.70 14.60 16.60 16.40 14.10 10.60 7.10 4.20 (96)
Heat loss rate for mean internal temperature $\lim_{n \to \infty} W[(39)m \times [(93)m - (96)m]$
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
Space nearing requirement, kwn/month 0.024 x [(97)m - (95)m] x (41)m
673.93 486.79 367.03 182.03 62.67 0.00 0.00 0.00 194.46 462.26 708.92
$\Sigma(98)15, 1012 = 3138.08$ (98)
Space heating requirement kWh/m ² /year $(98) \div (4)$ 32.94 (99)
9b. Energy requirements - community heating scheme
Eraction of space heat from secondary/supplementary system (table 11)
Fraction of space heat from secondary supplementary system (table 11) $1/(201) = 1.00$ (302)
Fraction of space feat from community system $1 - (301) = 1.00$ (302)
Fraction of community heat from bollers
Fraction of community heat from CHP 0.75 (303b)
Fraction of total space heat from community CHP(302) x (303a) = 0.75(304a)
Fraction of total space heat from community CHP(302) x (303a) =0.75(304a)Fraction of total space heat from community boilers(302) x (303b) =0.25(304b)
Fraction of total space heat from community CHP(302) x (303a) =0.75(304a)Fraction of total space heat from community boilers(302) x (303b) =0.25(304b)Factor for control and charging method (Table 4c(3)) for community space heating1.00(305)
Fraction of total space heat from community CHP(302) x (303a) =0.75(304a)Fraction of total space heat from community boilers(302) x (303b) =0.25(304b)Factor for control and charging method (Table 4c(3)) for community space heating1.00(305)Factor for charging method (Table 4c(3)) for community water heating1.00(305a)
Fraction of total space heat from community CHP(302) x (303a) =0.75(304a)Fraction of total space heat from community boilers(302) x (303b) =0.25(304b)Factor for control and charging method (Table 4c(3)) for community space heating1.00(305)Factor for charging method (Table 4c(3)) for community water heating1.00(305a)Distribution loss factor (Table 12c) for community heating system1.05(306)
Fraction of total space heat from community CHP(302) x (303a) =0.75(304a)Fraction of total space heat from community boilers(302) x (303b) =0.25(304b)Factor for control and charging method (Table 4c(3)) for community space heating1.00(305)Factor for charging method (Table 4c(3)) for community water heating1.00(305a)Distribution loss factor (Table 12c) for community heating system1.05(306)
Fraction of total space heat from community CHP(302) x (303a) =0.75(304a)Fraction of total space heat from community boilers(302) x (303b) =0.25(304b)Factor for control and charging method (Table 4c(3)) for community space heating1.00(305)Factor for charging method (Table 4c(3)) for community water heating1.00(305a)Distribution loss factor (Table 12c) for community heating system1.05(306)
Fraction of total space heat from community CHP (302) x (303a) = 0.75 (304a) Fraction of total space heat from community boilers (302) x (303b) = 0.25 (304b) Factor for control and charging method (Table 4c(3)) for community space heating 1.00 (305) Factor for charging method (Table 4c(3)) for community water heating 1.00 (305a) Distribution loss factor (Table 12c) for community heating system 1.05 (306)
Fraction of total space heat from community CHP (302) x (303a) = 0.75 (304a) Fraction of total space heat from community boilers (302) x (303b) = 0.25 (304b) Factor for control and charging method (Table 4c(3)) for community space heating 1.00 (305) Factor for charging method (Table 4c(3)) for community water heating 1.00 (305a) Distribution loss factor (Table 12c) for community heating system 1.05 (306) Space heating 3138.08 (98) Space heating requirement (305a) x (306a) = 2471 24 (307a)
Fraction of total space heat from community CHP (302) x (303a) = 0.75 (304a) Fraction of total space heat from community boilers (302) x (303b) = 0.25 (304b) Factor for control and charging method (Table 4c(3)) for community space heating 1.00 (305) Factor for charging method (Table 4c(3)) for community water heating 1.00 (305) Factor for charging method (Table 4c(3)) for community water heating 1.00 (305a) Distribution loss factor (Table 12c) for community heating system 1.05 (306) Space heating 3138.08 (98) Space heat from CHP (98) x (304a) x (305) x (306) = 2471.24 (307a) Space heat from boilors (98) x (304a) x (305) x (306) = 2471.24 (307a)
Fraction of total space heat from community CHP(302) x (303a) =0.75(304a)Fraction of total space heat from community boilers(302) x (303b) =0.25(304b)Factor for control and charging method (Table 4c(3)) for community space heating1.00(305)Factor for charging method (Table 4c(3)) for community water heating1.00(305a)Distribution loss factor (Table 12c) for community heating system1.05(306)Space heating3138.08(98)Space heat from CHP(98) x (304a) x (305) x (306) =2471.24(307a)Space heat from boilers(98) x (304b) x (305) x (306) =823.75(307b)
Fraction of total space heat from community CHP (302) x (303a) = 0.75 (304a) Fraction of total space heat from community boilers (302) x (303b) = 0.25 (304b) Factor for control and charging method (Table 4c(3)) for community space heating 1.00 (305) Factor for charging method (Table 4c(3)) for community water heating 1.00 (305) Distribution loss factor (Table 12c) for community heating system 1.05 (306) Space heating 3138.08 (98) Space heat from CHP (98) x (304a) x (305) x (306) = 2471.24 (307a) Space heat from boilers (98) x (304b) x (305) x (306) = 823.75 (307b)
Fraction of total space heat from community CHP (302) x (303a) = 0.75 (304a) Fraction of total space heat from community boilers (302) x (303b) = 0.25 (304b) Factor for control and charging method (Table 4c(3)) for community space heating 1.00 (305) Factor for charging method (Table 4c(3)) for community water heating 1.00 (305) Distribution loss factor (Table 12c) for community heating system 1.05 (306) Space heating 1.05 (307a) Space heating requirement 3138.08 (98) Space heat from CHP (98) x (304a) x (305) x (306) = 2471.24 (307a) Space heat from boilers (98) x (304b) x (305) x (306) = 823.75 (307b)
Fraction of total space heat from community CHP (302) x (303a) = 0.75 (304a) Fraction of total space heat from community boilers (302) x (303b) = 0.25 (304b) Factor for control and charging method (Table 4c(3)) for community space heating 1.00 (305) Factor for charging method (Table 4c(3)) for community space heating 1.00 (305) Factor for charging method (Table 4c(3)) for community water heating 1.00 (305) Distribution loss factor (Table 12c) for community heating system 1.05 (306) Space heating 3138.08 (98) Space heating requirement (98) x (304a) x (305) x (306) = 2471.24 (307a) Space heat from boilers (98) x (304b) x (305) x (306) = 823.75 (307b) Water heating (2194.59) (64)

						٦
Water heat from boilers			(64) x (303b) x (305a) x (306) =	576.08] (310b)
Electricity used for heat distribution		0.01 × [(307a)(307e) + (33	10a)(310e)] =	55.99	(313)
Electricity for pumps, fans and electric keep-hot (Table 4f)			[]			
mechanical ventilation fans - balanced, extract or positive inpu	t from outside		60.44			(330a)
Total electricity for the above, kWh/year					60.44] (331)]
Electricity for lighting (Appendix L)					391.16	(332)
Energy saving/generation technologies						-
electricity generated by PV (Appendix M)					-53.23	(333)
Total delivered energy for all uses	(307) + (309)	+ (310) + (312)	+ (315) + (331) + (332)(337b) =	5997.67	(338)
10b. Fuel costs - community heating scheme						
	Fuel		Fuel price		Fuel	
	kWh/year				cost £/year	
Space heating from CHP	2471.24] x	2.97	x 0.01 =	73.40	(340a)
Space heating from boilers	823.75] x	4.24	x 0.01 =	34.93	(340b)
Water heating from CHP	1728.24] x	2.97	x 0.01 =	51.33	(342a)
Water heating from boilers	576.08] x	4.24	x 0.01 =	24.43	(342b)
Pumps and fans	60.44] x	13.19	x 0.01 =	7.97	(349)
Electricity for lighting	391.16] x	13.19	x 0.01 =	51.59	(350)
Additional standing charges					120.00	(351)
Energy saving/generation technologies						
pv savings	-53.23] x	13.19	x 0.01 =	0.00	(352)
Total energy cost			(340a)(342e) +	(345)(354) =	363.64	(355)
11b. SAP rating - community heating scheme						
Energy cost deflator (Table 12)					0.42	(356)
Energy cost factor (ECF)					1.09	(357)
SAP value					84.81	
SAP rating (section 13)					85	(358)
SAP band					В	
12b. CO ₂ emissions - community heating scheme						
	Energy		Emission factor		Emissions	
	kWh/year				(kg/year)	
Emissions from community CHP (space and water heating)						
Power efficiency of CHP unit	28.09]				(361)
Heat efficiency of CHP unit	66.01]				(362)
Space heating from CHP (307a) × 100 ÷ (362) =	3743.7107] x	0.2160	=	808.6415	(363)
less credit emissions for electricity	-1051.5916] x	0.5190	=	-545.7760	(364)
Water heated by CHP	2618.1322] x	0.2160	=	565.5165	(365)
less credit emissions for electricity	-735.4216] x	0.5190	=	-381.6838	(366)

Emissions from other sources (space heating)

Efficiency of boilers

CO2 emissions from boilers

Electrical energy for community heat distribution

Total CO2 associated with community systems Total CO2 associated with space and water heating

Pumps and fans

Electricity for lighting

URN: B-L00-02 Be Green version 1 NHER Plan Assessor version 6.1.0 SAP version 9.92

321.66

29.06

797.42

797.42

31.37

203.01

(367b)

(368)

(372)

(373)

(376)

(378)

(379)

94.00

1489.18

55.99

60.44

391.16

х

х

х

х

0.216

0.52

0.52

0.52

=

=

=

=

[(307b)+(310b)] x 100 ÷ (367b) =

Energy saving/generation tech	nologies						
pv savings		-53.23	х	0.52	=	-27.63	(380)
Total CO₂, kg/year					(376)(382) =	1004.17	(383)
Dwelling CO ₂ emission rate					(383) ÷ (4) =	10.54	(384)
EI value						90.41]
El rating (section 14)						90	(385)
El band						В]
13b. Primary energy - commu	inity heating scheme						
		Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary Energy from community	ty CHP (space and water heating)						
Power efficiency of CHP unit		28.09					(361)
Heat efficiency of CHP unit		66.01					(362)
Space heating from CHP	(307a) × 100 ÷ (362) =	3743.71	x	1.22	=	4567.33	(363)
less credit energy for electri	icity	-1051.59	x	3.07	=	-3228.39	(364)
Water heated by CHP		2618.13	x	1.22	=	3194.12	(365)
less credit energy for electricity	1	-735.42	x	3.07	=	-2257.74	(366)
Primary energy from other sou	rces (space heating)						
Efficiency of boilers		94.00					(367b)
Primary energy from boilers	[(307b)+(310b)] x 100 ÷ (367b) =	1489.18	x	1.22	=	1816.80	(368)
Electrical energy for communit	y heat distribution	55.99	х	3.07	=	171.90	(372)
Total primary energy associated	d with community systems					4264.01	(373)
Total primary energy associated	d with space and water heating					4264.01	(376)
Pumps and fans		60.44	x	3.07	=	185.55	(378)
Electricity for lighting		391.16	x	3.07	=	1200.87	(379)
Energy saving/generation tech	nologies						
Electricity generated - PVs		-53.23	x	3.07	=	-163.43	(380)
Primary energy kWh/year						5487.00	(383)
Dwelling primary energy rate k	Wh/m2/year					57.59	(384)



Assessor name	Miss Jay	na Parmar						Assessor nun	nber	6549		
Client								Last modified	t	25/11	/2016	
Address	B-L00-05	5 B Centric (Close, Lond	on, N8								
1. Overall dwelling di	mensions											
				Δ	area (m²)		ŀ	Average storey height (m)	,	Vo	iume (m³)	
Lowest occupied					63.47	<mark>](1a)</mark> x	Ē	2.50] (2a) =		158.68	(3a)
Total floor area	(1a)) + (1b) + (1	c) + (1d)(1n) =	63.47	(4)						
Dwelling volume								(3a) + (3b) + (3	sc) + (3d)(3	in) =	158.68	(5)
2. Ventilation rate												
										m³	per hour	
Number of chimneys							Г	0	x 40 =		0	(6a)
Number of open flues								0	x 20 =		0	(6b)
Number of intermitten	t fans						Ē	0	x 10 =		0	(7a)
Number of passive ven	ts							0	x 10 =		0	(7b)
Number of flueless gas	fires						Ē	0	x 40 =		0	(7c)
C C									_	Air o	hanges per hour	r
Infiltration due to chim	neys, flues, fan	s, PSVs		(6a)) + (6b) + (7	a) + (7b) + (7c) = 🗌	0	÷ (5) =		0.00	(8)
If a pressurisation test	has been carrie	d out or is i	ntended, pi	roceed to ((17), otherw	vise continu	e from	(9) to (16)				
Air permeability value,	q50, expressed	l in cubic m	etres per h	our per squ	uare metre	of envelope	e area				4.00	(17)
If based on air permeat	oility value, the	n (18) = [(1	7) ÷ 20] + (8	3), otherwi	se (18) = (1	6)					0.20	(18)
Number of sides on wh	ich the dwellin	g is sheltere	ed								3	(19)
Shelter factor								1	- [0.075 x (19	9)] =	0.78	(20)
Infiltration rate incorpo	orating shelter f	actor							(18) x (2	20) =	0.16	(21)
Infiltration rate modifie	ed for monthly	wind speed	:									
Jar	n Feb	Mar	Apr	May	Jun	Jul	Au	g Sep	Oct	Nov	Dec	
Monthly average wind	speed from Tal	ole U2										
5.1	0 5.00	4.90	4.40	4.30	3.80	3.80	3.70	0 4.00	4.30	4.50	4.70	(22)
Wind factor (22)m \div 4												
1.2	8 1.25	1.23	1.10	1.08	0.95	0.95	0.93	3 1.00	1.08	1.13	1.18	(22a)
Adjusted infiltration rat	e (allowing for	shelter and	l wind facto	or) (21) x (2	22a)m							_
0.2	0 0.19	0.19	0.17	0.17	0.15	0.15	0.14	4 0.16	0.17	0.17	0.18	(22b)
Calculate effective air c	hange rate for	the applica	ble case:									-
If mechanical ventila	ation: air chang	e rate thro	ugh system								0.50	(23a)
If balanced with hea	at recovery: eff	iciency in %	allowing fo	or in-use fa	ictor from T	able 4h					N/A	(23c)
c) whole house extr	act ventilation	or positive	input venti	lation from	n outside				· · · · · · · · · · · · · · · · · · ·			-
0.5	0 0.50	0.50	0.50	0.50	0.50	0.50	0.50	0 0.50	0.50	0.50	0.50	(24c)
Effective air change rat	e - enter (24a)	or (24b) or	(24c) or (24	1d) in (25)					· · · · ·			٦.
0.5	0 0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(25)



3. Heat losses a	and heat lo	ss paramet	er										
Element			а	Gross irea, m ²	Openings m ²	Net A	t area , m²	U-value W/m²K	A x U V	V/K ĸ-' kJ	value, /m².K	Ахк, kJ/K	
Window						12	2.76 x	1.24	= 15.7	7			(27)
Door						2	.32 x	1.80	= 4.18	;			(26)
Ground floor						63	3.47 x	0.20	= 12.6	9			(28a)
External wall						7	.89 x	0.18	= 1.42	!			(29a)
Party wall						57	7.47 x	0.00	= 0.00)			(32)
Total area of ext	ernal elem	ents ∑A, m²	1			86	5.44						(31)
Fabric heat loss,	W/K = ∑(A	× U)							(2	6)(30) + (32) =	34.06	(33)
Heat capacity Cr	n = ∑(А x к)	1						(28)	(30) + (32)	+ (32a)(3	2e) =	N/A	(34)
Thermal mass pa	arameter (1	「MP) in kJ/n	n²K									250.00	(35)
Thermal bridges	: Σ(L x Ψ) c	alculated us	sing Appen	dix K								5.06	(36)
Total fabric heat	loss									(33) + (36) =	39.11	(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)									
	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	(38)
Heat transfer co	efficient, W	//K (37)m +	- (38)m										
	65.30	65.30	65.30	65.30	65.30	65.30	65.30	65.30	65.30	65.30	65.30	65.30	
									Average =	∑(39)112	/12 =	65.30	(39)
Heat loss param	eter (HLP),	W/m²K (39	9)m ÷ (4)										
	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03]
									Average =	∑(40)112	/12 =	1.03	(40)
Number of days	in month (Table 1a)											
	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)
4 14/-1 h 1 ¹		· · · · · · · · · · · · · · · · · · ·											
4. water neath	ng energy r	requiremen	τ									• • • •	
Assumed occupa	ancy, N					26						2.08	_ (42)
Annual average	not water t	Eab	es per day	vo,average	$e = (25 \times N) +$	30	1.1	A	For	Oct		83.55 Dec	_ (43)
Hot water usage	Jan	rep	Ividi	Api	ividy		2)	Aug	Seh	001	NOV	Dec	
not water usage			05 22			75 10	75 10	70 51	01 00	05.33	00 50	01.00	٦
	91.90	06.50	85.22	81.88	78.54	75.19	75.19	78.54	81.88	5(44)1	12 -	1002 50	
Enormy contont (of hot wate	rusod = 4.1	8 x Vd m y	nm v Tm/	2600 kWb/m	onth (cor	n Tablas 1h	1c 1d)		2(44)1	12 =	1002.59	_ (44)
Lifergy content of	126.20	110.20	122.00	107.24		00 70			05.54	111 25	121 55	121.00	7
	150.29	119.20	125.00	107.24	102.90	00.79	02.20	94.42	95.54	5(AE)1	12 -	1214 55	
Distribution loss	$0.15 \times (45)$	Im								2(45)1	12 –	1514.55	_ (45)
Distribution 1033	20.44	17.88	18.45	16.09	15 / 2	12 27	12.34	14.16	1/ 22	16 70	18.22	10.80	7(46)
Storage volume	(litres) inclu	uding any s	10.45	/HRS stora	ge within san		12.54	14.10	14.55	10.70	10.25	110.00	
Water storage lo		uunig arry so			ge within san	110 103301						110.00](47)
h) Manufacturer	's declared	loss factor	is not know	wn									
Hot water sto	orage loss f	actor from	Table 2 (k)	Nh/litre/da	av)							0.02	7 (51)
Volume facto	or from Tab			vii) iiti c/ uu	·y)							1.03] (51)] (52)
Temperature	factor from	n Table 2h										0.60] (52)] (53)
Energy lost fr	om water		(h/dav) (1	7) x (51) v (52) x (52)							1.03] (57)
Enter (50) or (54) in (55)		, uuy) (4	,,,()+)^(<i>52 N</i> (33)							1.03] (55)
Water storage lo	oss calculat	ed for each	month (5	5) x (41)m							Ĺ	1.05	
	32 01	28.92	32 01	30.98	32 01	30 98	32 01	32.01	30 98	32.01	30 98	32.01	(56)
	52.01	20.52	32.01	50.50	32.01	50.50	52.01	52.01	50.90	52.01	50.50	52.01	

If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56) 32.01 28.92 32.01 30.98 32.01 30.98 32.01 32.01 30.98 32.01 30.98 32.01 (57)Primary circuit loss for each month from Table 3 23.26 21.01 23.26 22.51 23.26 22.51 23.26 23.26 22.51 23.26 22.51 23.26 (59)Combi loss for each month from Table 3a, 3b or 3c 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 (61)Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m 175.04 187.27 191.57 169.13 178.28 160.73 158.17 142.29 137.56 149.69 149.04 166.63 (62)Solar DHW input calculated using Appendix G or Appendix H 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 (63)Output from water heater for each month (kWh/month) (62)m + (63)m 149.04 191.57 169.13 178.28 160.73 158.17 142.29 137.56 149.69 166.63 175.04 187.27 1965.39 ∑(64)1...12 = (64)Heat gains from water heating (kWh/month) 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m] 89.54 79.58 85.12 78.45 78.43 72.32 71.58 75.62 74.56 81.24 83.21 88.11 (65) 5. Internal gains Feb Jan Mar Apr May Jun Jul Aug Sep Oct Nov Dec Metabolic gains (Table 5) 103.89 103.89 103.89 103.89 103.89 103.89 103.89 103.89 103.89 103.89 103.89 103.89 (66)Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 16.19 14.38 11.69 8.85 6.62 5.59 6.04 7.85 10.53 13.37 15.61 16.64 (67)Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 181.61 183.49 178.74 168.63 155.87 135.86 133.98 138.73 148.84 161.60 173.59 143.88 (68)Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 33.39 33.39 33.39 33.39 33.39 33.39 33.39 33.39 33.39 33.39 33.39 33.39 (69)Pump and fan gains (Table 5a) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 (70)Losses e.g. evaporation (Table 5) -83.11 -83.11 -83.11 -83.11 -83.11 -83.11 -83.11 -83.11 -83.11 -83.11 -83.11 -83.11 (71) Water heating gains (Table 5) 120.35 118.42 114.41 108.96 105.42 100.44 96.21 103.56 109.20 115.57 101.63 118.43 (72) Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m 372.31 370.46 359.01 340.61 322.08 304.07 292.28 297.63 306.99 325.58 346.94 362.83 (73) 6. Solar gains Access factor Solar flux FF Gains Area g Table 6d m² W/m² specific data specific data w or Table 6b or Table 6c 0.77 12.76 11.28 0.40 31.93 NorthEast x 0.9 x 0.80 (75) х х _ Solar gains in watts ∑(74)m...(82)m 64.99 117.09 192.29 258.48 275.56 257.79 205.51 142.67 40.17 26.07 31.93 79.42 (83)Total gains - internal and solar (73)m + (83)m 532.91 (84) 404.24 435.44 476.10 580.56 579.64 550.06 503.14 449.66 405.00 387.12 388.90 7. Mean internal temperature (heating season) 21.00 (85) Temperature during heating periods in the living area from Table 9, Th1(°C) Feb Mar Jul Oct Nov Dec Jan Apr May Jun Aug Sep Utilisation factor for gains for living area n1,m (see Table 9a)

	1.00	1.00	0.99	0.96	0.86	0.68	0.52	0.58	0.85	0.98	0.99	1.00	(86)
Mean internal to	emp of livin	g area T1 (s	steps 3 to 7	in Table 90	:)								-
	19.96	20.07	20.28	20.58	20.84	20.97	20.99	20.99	20.89	20.57	20.21	19.93	(87)
Temperature du	iring heating	g periods ir	the rest of	f dwelling f	rom Table 9	9, Th2(°C)							_
	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	(88)
Utilisation facto	r for gains f	or rest of d	welling n2,	m	•		•	•		•		•	_
	1.00	0.99	0.98	0.94	0.82	0.60	0.41	0.47	0.78	0.96	0.99	1.00	(89)
Mean internal to	emperature	in the rest	of dwelling	g T2 (follow	steps 3 to	7 in Table 9	əc)	•				·	
	18.67	18.82	19.14	19.56	19.90	20.04	20.06	20.05	19.97	19.56	19.04	18.62	(90)
Living area fract	ion	•		•	•		•		Liv	ving area ÷	(4) =	0.54	(91)
Mean internal to	emperature	for the wh	ole dwellin	g fLA x T1 +	+(1 - fLA) x ⁻	Т2				-			_
	19.36	19.49	19.75	20.11	20.41	20.54	20.56	20.56	20.47	20.10	19.67	19.32	(92)
Apply adjustme	nt to the me	ean interna	l temperati	ure from Ta	ble 4e whe	ere appropr	iate				1		
	19.36	19.49	19.75	20.11	20.41	20.54	20.56	20.56	20.47	20.10	19.67	19.32	(93)
8. Space heating	ng requirem	ient											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains,	ηm											
	1.00	0.99	0.98	0.95	0.84	0.64	0.47	0.53	0.81	0.96	0.99	1.00	(94)
Useful gains, ηπ	nGm, W (94	l)m x (84)m	ı										
	402.44	432.24	467.92	503.91	486.03	372.52	256.46	267.17	364.79	390.63	383.81	387.50	(95)
Monthly averag	e external t	emperatur	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 for	or mean inte	ernal tempe	erature, Lm	, W [(39)m	ı x [(93)m -	(96)m]							
	983.65	952.79	865.23	731.82	568.56	387.68	258.64	271.44	415.85	620.40	820.56	987.59	(97)
Space heating re	equirement	, kWh/mon	th 0.024 x	[(97)m - (9	5)m] x (41)	m							
	432.42	349.81	295.60	164.09	61.40	0.00	0.00	0.00	0.00	170.95	314.46	446.47]
									∑(98	3)15, 10	12 =	2235.19	(98)
Space heating re	equirement	kWh/m²/y	ear							(98)	÷ (4)	35.22	(99)
					_								
9b. Energy req	uirements -	communit	ty heating s	scheme									7
Fraction of spac	e heat from	secondary	/suppleme	ntary syste	m (table 11	L)				'0' if r	none	0.00] (301)
Fraction of spac	e heat from	communit	y system							1 - (30	01) = [1.00] (302)] .
Fraction of com	munity heat	from boile	ers									0.25] (303a)
Fraction of com	munity heat	from CHP										0.75] (303b)
Fraction of total	space heat	from com	nunity CHP							(302) x (303	3a) =	0.75] (304a)
Fraction of total	space heat	from com	nunity boile	ers						(302) x (303	3b) = [0.25] (304b) ¬
Factor for contr	ol and char	ging metho	d (Table 4c	(3)) for con	nmunity spa	ace heating						1.00] (305) _
Factor for charg	ing method	(Table 4c(3	3)) for comr	nunity wat	er heating							1.00] (305a)
Distribution loss	factor (Tab	le 12c) for	community	heating sy	stem							1.05	(306)
Space heating													
Annual space he	eating requi	rement						2	235.19	J			(98) 7
Space heat from	1 CHP							(98) x (304a) >	(305) x (30	06) =	1760.22	(307a)
Space heat from	boilers							(98) x (304b) >	« (305) x (30	06) =	586.74	(307b)
Water heating										1			
Annual water he	eating requi	rement						1	965.39]			(64)

Water heat from CHP			(64) x (303a) x (305a) x (306) =	1547.75	(310a)
Water heat from boilers			(64) x (303b) x (305a) x (306) =	515.92	(310b)
Electricity used for heat distribution		0.01 × [(307a)(307e) + (3	10a)(310e)] =	44.11	(313)
Electricity for pumps, fans and electric keep-hot (Table 4f)						
mechanical ventilation fans - balanced, extract or positi	ive input from outside		42.78			(330a)
Total electricity for the above, kWh/year					42.78	(331)
Electricity for lighting (Appendix L)					285.93	(332)
Energy saving/generation technologies						
electricity generated by PV (Appendix M)					-53.23	(333)
Total delivered energy for all uses	(307) + (309) +	(310) + (312)) + (315) + (331) + (332)(337b) =	4686.09	(338)
10b. Fuel costs - community heating scheme						
10b. Fuel costs - community heating scheme	Fuel		Fuel price		Fuel	
10b. Fuel costs - community heating scheme	Fuel kWh/year		Fuel price		Fuel cost £/year	
10b. Fuel costs - community heating scheme Space heating from CHP	Fuel kWh/year 1760.22	x	Fuel price 2.97	x 0.01 =	Fuel cost £/year 52.28] (340a)
10b. Fuel costs - community heating scheme Space heating from CHP Space heating from boilers	Fuel kWh/year 1760.22 586.74	x x	Eucl price 2.97 4.24	x 0.01 = x 0.01 =	Fuel cost £/year 52.28 24.88	(340a) (340b)
10b. Fuel costs - community heating scheme Space heating from CHP Space heating from boilers Water heating from CHP	Fuel kWh/year 1760.22 586.74 1547.75	x x x	Evel price 2.97 4.24 2.97	x 0.01 = x 0.01 = x 0.01 =	Fuel cost £/year 52.28 24.88 45.97] (340a)] (340b)] (342a)
10b. Fuel costs - community heating scheme Space heating from CHP Space heating from boilers Water heating from CHP Water heating from boilers	Fuel kWh/year 1760.22 586.74 1547.75 515.92	x x x x x	Euel price 2.97 4.24 2.97 4.24 2.97	x 0.01 = x 0.01 = x 0.01 = x 0.01 =	Fuel cost £/year 52.28 24.88 45.97 21.87] (340a) (340b)] (342a)] (342b)
10b. Fuel costs - community heating scheme Space heating from CHP Space heating from boilers Water heating from CHP Water heating from boilers Pumps and fans	Fuel kWh/year 1760.22 586.74 1547.75 515.92 42.78	x x x x x x	Evel price 2.97 4.24 2.97 4.24 13.19	x 0.01 = x 0.01 = x 0.01 = x 0.01 = x 0.01 =	Fuel cost £/year 52.28 24.88 45.97 21.87 5.64] (340a)] (340b)] (342a)] (342b)] (349)
10b. Fuel costs - community heating scheme Space heating from CHP Space heating from boilers Water heating from CHP Water heating from boilers Pumps and fans Electricity for lighting	Fuel kWh/year 1760.22 586.74 1547.75 515.92 42.78 285.93	x x x x x x x	Eucl price 2.97 4.24 2.97 4.24 13.19 13.19	x 0.01 = x 0.01 = x 0.01 = x 0.01 = x 0.01 = x 0.01 =	Fuel cost £/year 52.28 24.88 45.97 21.87 5.64 37.71] (340a)] (340b)] (342a)] (342b)] (349)] (350)
10b. Fuel costs - community heating scheme Space heating from CHP Space heating from boilers Water heating from CHP Water heating from boilers Pumps and fans Electricity for lighting Additional standing charges	Fuel kWh/year 1760.22 586.74 1547.75 515.92 42.78 285.93	x x x x x x x x	Fuel price 2.97 4.24 2.97 4.24 13.19 13.19	x 0.01 = x 0.01 = x 0.01 = x 0.01 = x 0.01 = x 0.01 =	Fuel cost £/year 52.28 24.88 45.97 21.87 5.64 37.71 120.00) (340a) (340b) (342a) (342b) (349) (350) (351)

Energy saving/generation technologies

pv savings

Total energy cost

11b. SAP rating - community heating scheme		
Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.19	(357)
SAP value	83.34]
SAP rating (section 13)	83	(358)
SAP band	В]

-53.23

х

13.19

x 0.01 =

(340a)...(342e) + (345)...(354) =

0.00

308.36

(352)

(355)

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from community CHP (space and water heating)						
Power efficiency of CHP unit	28.09					(361)
Heat efficiency of CHP unit	66.01					(362)
Space heating from CHP $(307a) \times 100 \div (362) =$	2666.5716	x	0.2160	=	575.9795	(363)
less credit emissions for electricity	-749.0280	x	0.5190	=	-388.7455	(364)
Water heated by CHP	2344.6983	x	0.2160	=	506.4548	(365)
less credit emissions for electricity	-658.6153	x	0.5190	=	-341.8213	(366)
Emissions from other sources (space heating)						
Efficiency of boilers	94.00					(367b)
CO2 emissions from boilers [(307b)+(310b)] x 100 ÷ (367b) =	1173.04	x	0.216	=	253.38	(368)
Electrical energy for community heat distribution	44.11	x	0.52	=	22.89	(372)
Total CO2 associated with community systems					628.13	(373)
Total CO2 associated with space and water heating					628.13	(376)
Pumps and fans	42.78	x	0.52	=	22.20	(378)

Electricity for lighting		285.93	x	0.52	=	148.40	(379)
Energy saving/generation techr	nologies						
pv savings		-53.23	x	0.52	=	-27.63	(380)
Total CO₂, kg/year					(376)(382) =	771.10	(383)
Dwelling CO ₂ emission rate					(383) ÷ (4) =	12.15	(384)
El value						90.47]
El rating (section 14)						90	(385)
EI band						В]
13b. Primary energy - commu	nity heating scheme	_					
		Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary Energy from communit	ty CHP (space and water heating)						
Power efficiency of CHP unit		28.09					(361)
Heat efficiency of CHP unit		66.01					(362)
Space heating from CHP	(307a) × 100 ÷ (362) =	2666.57	x	1.22	=	3253.22	(363)
less credit energy for electri	city	-749.03	x	3.07	=	-2299.52	(364)
Water heated by CHP		2344.70	x	1.22	=	2860.53	(365)
less credit energy for electricity	,	-658.62	×	3.07	=	-2021.95	(366)
Primary energy from other sour	rces (space heating)						
Efficiency of boilers		94.00					(367b)
Primary energy from boilers	[(307b)+(310b)] x 100 ÷ (367b) =	1173.04	x	1.22	=	1431.10	(368)
Electrical energy for community	y heat distribution	44.11	x	3.07	=	135.41	(372)
Total primary energy associated	d with community systems					3358.79	(373)
Total primary energy associated	d with space and water heating					3358.79	(376)
Pumps and fans		42.78	x	3.07	=	131.34	(378)
Electricity for lighting		285.93	x	3.07	=	877.79	(379)
Energy saving/generation techr	nologies						
Electricity generated - PVs		-53.23	x	3.07	=	-163.43	(380)
Primary energy kWh/year						4204.50	(383)

Primary energy kWh/year

Dwelling primary energy rate kWh/m2/year

66.24

(384)



Assessor name		Miss Jayr	na Parmar						Assessor nur	nber	6549		
Client									Last modified	d	25/11,	/2016	
Address		B-L04-26	B Centric (Close, Lond	on, N8								
1. Overall dwell	ing dimen	sions											
					Д	area (m²)		Av	verage storey height (m)	i	Vo	lume (m³)	
Lowest occupied						49.68	<mark>(1a)</mark> x		2.50	(2a) =		124.20	(3a)
Total floor area		(1a)	+ (1b) + (1	c) + (1d)(1n) =	49.68	(4)						
Dwelling volume							_	(3	Ba) + (3b) + (3	3c) + (3d)(3	3n) =	124.20	(5)
2 Ventilation ra	ate									_			
2. Ventilation re											m!	, per hour	
										٦.		per noui	٦
Number of chimr	neys								0	x 40 =	·	0	_ (6a) _
Number of open	flues								0	x 20 =	·	0	(6b)
Number of intern	nittent fan	S							0	x 10 =	:	0	(7a)
Number of passiv	ve vents								0	x 10 =	:	0	(7b)
Number of fluele	ss gas fires	5							0	x 40 =	:	0	(7c)
											Air c	hanges per hour	r
Infiltration due to	o chimneys	s, flues, fan	s, PSVs		(6a)) + (6b) + (7	'a) + (7b) + (7c) =	0	÷ (5) =	-	0.00	(8)
If a pressurisation	n test has l	been carrie	d out or is i	ntended, pi	roceed to ((17), otherw	vise continu	e from (9	9) to (16)	_			_
Air permeability	value, q50,	, expressed	in cubic me	etres per h	our per sq	uare metre	of envelope	e area				4.00	(17)
If based on air pe	ermeability	value, the	n (18) = [(17	7) ÷ 20] + (8	3), otherwi	se (18) = (1	.6)					0.20	(18)
Number of sides	, on which t	he dwelling	z is sheltere	ed		. , .						2	(19)
Shelter factor			,						1	- [0.075 x (1	9)] =	0.85	(20)
Infiltration rate in	ncornoratii	ng shelter f	actor							(18) x (2	20) =	0.17	(21)
Infiltration rate n	nodified fo	r monthly y	wind speed							(10) × (1		0.17	_ (==)
	lan	Feb	Mar	Anr	May	lun	Iul	Διισ	Sen	Oct	Nov	Dec	
Monthly average	wind snee	n co ad from Tab			iviay	Jun	501	748	966	000	Nov	Dee	
	5 10	5.00	4 90	4.40	4 20	2 80	2 80	2 70	4.00	4 20	4.50	4 70	(22)
Wind factor (22)r	5.10	5.00	4.90	4.40	4.30	5.80	5.80	3.70	4.00	4.30	4.50	4.70	_ (22)
	1 20	1.25	1 22	1 10	1.09	0.05	0.05	0.02	1.00	1.09	1 1 2	1 1 0	(222)
Adjusted infiltrat	1.20	1.25	L.25	1.10	1.00	0.95	0.95	0.95	1.00	1.08	1.15	1.10	_ (22d)
							0.10	0.10	0.17	0.40	0.10	0.20	
	0.22	0.21		0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.20	_ (220)
Calculate effectiv	e air chang	ge rate for	the applica	Die Case:									
If mechanical	ventilation	h: air chang	e rate throu	ugh system								0.50	_ (23a)
If balanced wi	ith heat red	covery: effi	ciency in %	allowing fo	or in-use fa	ictor from T	Fable 4h					N/A	(23c)
c) whole hous	e extract v	entilation o	or positive i	input venti	lation from	n outside	1	1		· · · · · · · ·			-
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(24c)
Effective air chan	ige rate - e	nter (24a) (or (24b) or	(24c) or (24	ld) in (25)								_
[0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(25)



3. Heat losses a	and heat los	ss paramet	er										
Element			а	Gross rea, m²	Openings m ²	Net A,	area m²	U-value W/m²K	A x U W	//К к-ч kJ	value, /m².K	Ахк, kJ/K	
Window						15	.15 x	1.24	= 18.72	2			(27)
External wall						11	.17 x	0.18	= 2.01				(29a)
Party wall						44	.15 x	0.00	= 0.00				(32)
Roof						49	.68 x	0.16	= 7.95				(30)
Total area of ext	ernal eleme	ents ∑A, m²				76	.00						(31)
Fabric heat loss,	W/K = ∑(A	× U)							(2	5)(30) + (32) =	28.68	(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	sing Append	dix K								4.30	(36)
Total fabric heat	loss									(33) + (36) =	32.98	(37)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat	loss calcula	ited month	ly 0.33 x (2	25)m x (5)									
	20.49	20.49	20.49	20.49	20.49	20.49	20.49	20.49	20.49	20.49	20.49	20.49	(38)
Heat transfer co	efficient, W	/K (37)m +	- (38)m										
	53.48	53.48	53.48	53.48	53.48	53.48	53.48	53.48	53.48	53.48	53.48	53.48	
									Average = 2	<u>(</u> 39)112	/12 =	53.48	(39)
Heat loss param	eter (HLP),	W/m²K (39	9)m ÷ (4)										
	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08]
									Average = 2	<u>(40)112</u>	/12 =	1.08	(40)
Number of days	in month (1	Table 1a)											_
	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)
4. Water heating	ng energy r	equiremen	t										
Assumed occupa	ancy, N											1.68	(42)
Annual average	hot water u	sage in litre	es per day V	/d,average	= (25 x N) +	36						74.12	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage	e in litres pe	r day for ea	ich month '	Vd,m = fact	tor from Tab	le 1c x (43)						
	81.53	78.56	75.60	72.63	69.67	66.70	66.70	69.67	72.63	75.60	78.56	81.53]
										∑(44)1	.12 =	889.39	(44)
Energy content	of hot wate	r used = 4.1	18 x Vd,m x	nm x Tm/3	3600 kWh/m	onth (see	Tables 1b	o, 1c 1d)					
	120.90	105.74	109.12	95.13	91.28	78.77	72.99	83.76	84.76	98.78	107.82	117.09	
										∑(45)1	.12 =	1166.14	(45)
Distribution loss	0.15 x (45)	im											7
	18.14	15.86	16.37	14.27	13.69	11.82	10.95	12.56	12.71	14.82	16.17	17.56	_ (46) □ (1=)
Storage volume	(litres) inclu	iding any so	olar or WW	HRS storag	e within sam	ne vessel						110.00	_ (47)
Water storage ic	oss:												
b) Manufacturer	r's declared	loss factor	is not knov	vn									
Hot water sto	orage loss fa	actor from	Table 2 (kW	/h/litre/day	y)							0.02	」(51) □ (51)
Volume facto	or from Tabl	e 2a										1.03	」(52) □ (52)
Temperature	e factor fron	n Table 2b										0.60	」(53) □ (= .)
Energy lost fr	rom water s	torage (kW	'h/day) (47	') x (51) x (5	52) x (53)							1.03	_ (54) ┐ ,
Enter (50) or (54	in (55)	al fame -	marth /=-	· · · / / / / ·								1.03	_ (55)
vvater storage lo		ed for each	month (55	o) x (41)m		20.00		22.24	20.00	22.61		22.01	
	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] \div (47), else (56)

	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01 (57)
Primary circuit lo	oss for each	month fror	n Table 3					1			I	
	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26 (59)
Combi loss for e	ach month t	from Table	3a, 3b or 3	с								
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 (61)
Total heat requi	red for wate	er heating c	alculated f	or each mo	onth 0.85 x	(45)m + (40	6)m + (57)r	n + (59)m +	- (61)m			
	176.18	155.67	164.39	148.62	146.56	132.26	128.27	139.03	138.25	154.05	161.32	172.37 (62)
Solar DHW input	calculated	using Appe	ndix G or A	ppendix H				1			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 (63)
Output from wa	ter heater f	or each moi	nth (kWh/r	month) (62	2)m + (63)m	1					1	
	176.18	155.67	164.39	148.62	146.56	132.26	128.27	139.03	138.25	154.05	161.32	172.37
		I IIII								Σ(64)1	12 = 1	.816.98 (64)
Heat gains from	water heat	ing (kWh/m	onth) 0.25	5 × [0.85 ×	(45)m + (61	.)m] + 0.8 ×	[(46)m + (5	57)m + (59)	m]	2(-)		
Ū	84.42	75.10	80.50	- 74.43	74.57	68.99	68.49	72.07	70.98	77.06	78.65	83.15 (65)
5. Internal gain	s										_	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabolic gains	(Table 5)											
	84.03	84.03	84.03	84.03	84.03	84.03	84.03	84.03	84.03	84.03	84.03	84.03 (66)
Lighting gains (ca	alculated in	Appendix L	, equation	L9 or L9a),	also see Ta	ible 5						
	13.05	11.59	9.43	7.14	5.34	4.50	4.87	6.33	8.49	10.78	12.58	13.41 (67)
Appliance gains	(calculated	in Appendix	(L, equatio	on L13 or L1	L3a), also se	ee Table 5						
	146.40	147.92	144.09	135.94	125.66	115.99	109.53	108.01	111.84	119.99	130.27	139.94 (68)
Cooking gains (c	alculated in	Appendix L	, equation	L15 or L15	a), also see	Table 5						
	31.40	31.40	31.40	31.40	31.40	31.40	31.40	31.40	31.40	31.40	31.40	31.40 (69)
Pump and fan ga	ains (Table 5	5a)										
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 (70)
Losses e.g. evap	oration (Tab	ole 5)										
	-67.23	-67.23	-67.23	-67.23	-67.23	-67.23	-67.23	-67.23	-67.23	-67.23	-67.23	-67.23 (71)
Water heating g	ains (Table	5)										
	113.47	111.76	108.20	103.37	100.23	95.81	92.06	96.87	98.58	103.58	109.23	111.77 (72)
Total internal ga	ins (66)m +	- (67)m + (6	8)m + (69)ı	m + (70)m	+ (71)m + (7	72)m		•		•		
	321.14	319.48	309.93	294.66	279.43	264.51	254.66	259.41	267.12	282.56	300.30	313.33 (73)
								4	1	1	1	
6. Solar gains						_						
			Access f	actor	Area	Sola	ar flux //m²		g ific data	FF coocific o	lata	Gains
			Table	bu		v	//111	or T	able 6b	or Table	6C	vv
North			0.7	7 X	2 09	x □ 1	0.63 x	09x (n 40 x	0.80	=	4 93 (74)
NorthFast			0.7		13.06		1 28 x	0.9 x ($\frac{1}{1}$			32.68 (75)
Solar gains in wa	atts 5(74)m	(82)m	0.7		15.00		1.20		<u>, , , , , , , , , , , , , , , , , , , </u>	0.00		(75)
Solar Ballis III We	37.61	75.93	125.8/	222 52	200 18	210 12	208.46	227.80	165.27	92.50	47.20	30.79 (83)
Total gains - inte	ornal and so	73.95 ar (73)m +	(83)m	222.52	299.10	519.12	298.40	237.80	105.27	92.30	47.20	(83)
				F17 10	F79.62	F92 62	FF2 12	407.21	422.20	275.06	247.40	244.12 (94)
	358.74	395.42	445.78	517.18	578.02	583.03	553.12	497.21	432.39	375.00	347.49	344.13 (84)
7. Mean intern	al tempera	ture (heatin	ng season)									
Temperature du	ring heating	g periods in	the living a	area from T	able 9, Th1	(°C)						21.00 (85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor	r for gains fo	or living are	a n1,m (se	e Table 9a)								

	1.00	0.99	0.98	0.92	0.77	0.57	0.42	0.49	0.77	0.96	0.99	1.00	(86)
Mean internal t	emp of livin	g area T1 (steps 3 to 7	in Table 90	c)								_
	19.97	20.10	20.35	20.67	20.90	20.98	21.00	20.99	20.93	20.62	20.24	19.94	(87)
Temperature du	uring heating	g periods ir	the rest of	f dwelling f	rom Table !	9, Th2(°C)	•	•				L	
	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	(88)
Utilisation facto	r for gains f	or rest of d	welling n2,	m									_
	0.99	0.99	0.97	0.89	0.71	0.49	0.33	0.39	0.69	0.94	0.99	0.99	(89)
Mean internal t	emperature	in the rest	of dwelling	g T2 (follow	steps 3 to	7 in Table 9	e)						
	18.66	18.85	19.20	19.65	19.93	20.01	20.02	20.02	19.97	19.59	19.04	18.61	(90)
Living area fract	ion	<u>,</u>				4			Liv	ving area ÷	(4) =	0.47	(91)
Mean internal t	emperature	for the wh	ole dwellin	g fLA x T1 +	+(1 - fLA) x	Т2				-			
	19.28	19.44	19.75	20.13	20.39	20.47	20.48	20.48	20.42	20.08	19.61	19.24	(92)
Apply adjustme	nt to the me	ean interna	l temperati	ure from Ta	ble 4e whe	ere appropr	iate				1	1	
	19.28	19.44	19.75	20.13	20.39	20.47	20.48	20.48	20.42	20.08	19.61	19.24	(93)
] (/
8. Space heating	ng requirem	ient											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains,	ηm											
	0.99	0.99	0.97	0.90	0.74	0.53	0.37	0.44	0.72	0.94	0.98	0.99	(94)
Useful gains, ηn	nGm, W (94	l)m x (84)m	ı										
	355.92	389.95	430.78	463.92	426.52	308.41	206.88	216.62	312.70	351.82	342.22	341.93	(95)
Monthly averag	e external t	emperatur	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	n x [(93)m -	(96)m]							
	801.18	777.60	708.31	600.66	464.76	313.94	207.60	218.19	338.10	506.92	668.85	804.05	(97)
Space heating re	equirement	, kWh/mor	th 0.024 x	[(97)m - (9	5)m] x (41)	m							
	331.27	260.50	206.48	98.46	28.45	0.00	0.00	0.00	0.00	115.39	235.18	343.82	
									Σ(98	3)15, 10	.12 =	1619.54	(98)
Space heating re	equirement	kWh/m²/y	ear							(98)	÷ (4)	32.60	(99)
9b. Energy req	uirements -	communi	ty heating s	scheme									7
Fraction of space	e heat from	secondary	/suppleme	ntary syste	m (table 11	1)				'0' if ı	none	0.00	(301)
Fraction of space	e heat from	communit	y system							1 - (30	01) =	1.00	(302)
Fraction of com	munity heat	t from boile	ers									0.25	(303a)
Fraction of com	munity heat	t from CHP										0.75	(303b)
Fraction of total	space heat	from com	munity CHP	·						(302) x (303	3a) =	0.75	(304a)
Fraction of tota	l space heat	from com	nunity boil	ers						(302) x (303	3b) =	0.25	(304b)
Factor for contr	ol and char	ging metho	d (Table 4c	(3)) for com	nmunity sp	ace heating						1.00	(305)
Factor for charg	ing method	(Table 4c(3)) for com	munity wat	er heating							1.00	(305a)
Distribution loss	s factor (Tab	le 12c) for	community	heating sy	vstem							1.05	(306)
Space heating													
Annual space he	eating requi	rement						1	619.54]			(98)
Space heat from	n CHP							(98	3) x (304a) x	k (305) x (30	06) =	1275.39	(307a)
Space heat from	n boilers							(98	s) x (304b) x	x (305) x (30	06) =	425.13	(307b)
Water heating													
Annual water he	eating requi	rement						1	816.98]			(64)

						-
Water heat from CHP			(64) x (303a) x (3	05a) x (306) =	1430.87	(310a)
Water heat from boilers			(64) x (303b) x (3	805a) x (306) =	476.96	(310b)
Electricity used for heat distribution		0.01 × [(307a)(307e) + (31	0a)(310e)] =	36.08	(313)
Electricity for pumps, fans and electric keep-hot (Table 4f)						
mechanical ventilation fans - balanced, extract or positive inpu	t from outside		33.49			(330a)
Total electricity for the above, kWh/year					33.49	(331)
Electricity for lighting (Appendix L)				[230.50	(332)
Energy saving/generation technologies						
electricity generated by PV (Appendix M)					-53.23	(333)
Total delivered energy for all uses	(307) + (309) +	(310) + (312)	+ (315) + (331) + (3	332)(337b) =	3819.10	(338)
10b. Fuel costs - community heating scheme						
	Fuel		Fuel price		Fuel	
	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from CHP	Fuel kWh/year 1275.39	x	Fuel price	x 0.01 =	Fuel cost £/year 37.88] (340a)
Space heating from CHP Space heating from boilers	Fuel kWh/year 1275.39 425.13	x x	Eucliprice 2.97 4.24	x 0.01 = x 0.01 =	Fuel cost £/year 37.88 18.03] (340a)] (340b)
Space heating from CHP Space heating from boilers Water heating from CHP	Fuel kWh/year 1275.39 425.13 1430.87	x x x	Evel price 2.97 4.24 2.97	x 0.01 = x 0.01 = x 0.01 =	Fuel cost £/year 37.88 18.03 42.50) (340a)) (340b)] (342a)
Space heating from CHP Space heating from boilers Water heating from CHP Water heating from boilers	Fuel kWh/year 1275.39 425.13 1430.87 476.96	x x x x	Eucliprice 2.97 4.24 2.97 4.24	x 0.01 = x 0.01 = x 0.01 = x 0.01 =	Fuel cost £/year 37.88 18.03 42.50 20.22] (340a)] (340b)] (342a)] (342b)
Space heating from CHP Space heating from boilers Water heating from CHP Water heating from boilers Pumps and fans	Fuel kWh/year 1275.39 425.13 1430.87 476.96 33.49	x x x x x x	Eucl price 2.97 4.24 2.97 4.24 13.19	x 0.01 = x 0.01 = x 0.01 = x 0.01 = x 0.01 =	Fuel cost £/year 37.88 18.03 42.50 20.22 4.42] (340a)] (340b)] (342a)] (342b)] (349)
Space heating from CHP Space heating from boilers Water heating from CHP Water heating from boilers Pumps and fans Electricity for lighting	Fuel kWh/year 1275.39 425.13 1430.87 476.96 33.49 230.50	x x x x x x x	Fuel price 2.97 4.24 2.97 4.24 13.19 13.19	x 0.01 = x 0.01 = x 0.01 = x 0.01 = x 0.01 = x 0.01 =	Fuel cost £/year 37.88 18.03 42.50 20.22 4.42 30.40] (340a)] (340b)] (342a)] (342b)] (349)] (350)
Space heating from CHP Space heating from boilers Water heating from CHP Water heating from boilers Pumps and fans Electricity for lighting Additional standing charges	Fuel kWh/year 1275.39 425.13 1430.87 476.96 33.49 230.50	x x x x x x x	Fuel price 2.97 4.24 2.97 4.24 13.19 13.19	x 0.01 = x 0.01 = x 0.01 = x 0.01 = x 0.01 = x 0.01 =	Fuel cost £/year 37.88 18.03 42.50 20.22 4.42 30.40 120.00] (340a)] (340b)] (342a)] (342b)] (349)] (350)] (351)
Space heating from CHP Space heating from boilers Water heating from CHP Water heating from boilers Pumps and fans Electricity for lighting Additional standing charges Energy saving/generation technologies	Fuel kWh/year 1275.39 425.13 1430.87 476.96 33.49 230.50	x x x x x x x	Fuel price 2.97 4.24 2.97 4.24 13.19 13.19	x 0.01 = x 0.01 = x 0.01 = x 0.01 = x 0.01 = x 0.01 =	Fuel cost £/year 37.88 18.03 42.50 20.22 4.42 30.40 120.00] (340a)] (340b)] (342a)] (342b)] (349)] (350)] (351)
Space heating from CHP Space heating from boilers Water heating from CHP Water heating from boilers Pumps and fans Electricity for lighting Additional standing charges Energy saving/generation technologies pv savings	Fuel kWh/year 1275.39 425.13 1430.87 476.96 33.49 230.50	x x x x x x x	Fuel price 2.97 4.24 2.97 4.24 13.19 13.19 13.19	x 0.01 = x 0.01 = x 0.01 = x 0.01 = x 0.01 = x 0.01 = x 0.01 =	Fuel cost £/year 37.88 18.03 42.50 20.22 4.42 30.40 120.00 0.00) (340a) (340b) (342a) (342b) (349) (350) (351) (352)
Space heating from CHP Space heating from boilers Water heating from CHP Water heating from boilers Pumps and fans Electricity for lighting Additional standing charges Energy saving/generation technologies pv savings Total energy cost	Fuel kWh/year 1275.39 425.13 1430.87 476.96 33.49 230.50	x x x x x x	Fuel price 2.97 4.24 2.97 4.24 13.19 13.19 (340a)(342e) +	x 0.01 = x 0.01 = x 0.01 = x 0.01 = x 0.01 = x 0.01 = x 0.01 = (345)(354) =	Fuel cost £/year 37.88 18.03 42.50 20.22 4.42 30.40 120.00 0.00 273.44] (340a) (340b)] (342a)] (342b)] (349)] (350)] (351)] (352)] (355)

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.21	(357)
SAP value	33.08	
SAP rating (section 13)	83	(358)
SAP band	В	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from community CHP (space and water heating)						
Power efficiency of CHP unit	28.09					(361)
Heat efficiency of CHP unit	66.01					(362)
Space heating from CHP $(307a) \times 100 \div (362) =$	1932.1019	x	0.2160	=	417.3340	(363)
less credit emissions for electricity	-542.7188	x	0.5190	=	-281.6710	(364)
Water heated by CHP	2167.6404	x	0.2160	=	468.2103	(365)
less credit emissions for electricity	-608.8805	x	0.5190	=	-316.0090	(366)
Emissions from other sources (space heating)						
Efficiency of boilers	94.00					(367b)
CO2 emissions from boilers [(307b)+(310b)] x 100 ÷ (367b) =	959.67	x	0.216	=	207.29	(368)
Electrical energy for community heat distribution	36.08	x	0.52	=	18.73	(372)
Total CO2 associated with community systems					513.88	(373)
Total CO2 associated with space and water heating					513.88	(376)
Pumps and fans	33.49	x	0.52	=	17.38	(378)

Electricity for lighting		230.50	x	0.52	=	119.63	(379)
Energy saving/generation techn	nologies						
pv savings		-53.23	x	0.52	=	-27.63	(380)
Total CO₂, kg/year					(376)(382) =	623.26	(383)
Dwelling CO ₂ emission rate					(383) ÷ (4) =	12.55	(384)
El value						91.18]
El rating (section 14)						91	(385)
EI band						В]
13b. Primary energy - commu	inity heating scheme	_					
		Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary Energy from community	ty CHP (space and water heating)						
Power efficiency of CHP unit		28.09					(361)
Heat efficiency of CHP unit		66.01					(362)
Space heating from CHP	(307a) × 100 ÷ (362) =	1932.10	×	1.22	=	2357.16	(363)
less credit energy for electri	city	-542.72	x	3.07	=	-1666.15	(364)
Water heated by CHP		2167.64	x	1.22	=	2644.52	(365)
less credit energy for electricity	,	-608.88	×	3.07	=	-1869.26	(366)
Primary energy from other sources (space heating)							
Efficiency of boilers		94.00					(367b)
Primary energy from boilers	[(307b)+(310b)] x 100 ÷ (367b) =	959.67	x	1.22	=	1170.79	(368)
Electrical energy for community	y heat distribution	36.08	x	3.07	=	110.78	(372)
Total primary energy associated	d with community systems					2747.84	(373)
Total primary energy associated	d with space and water heating					2747.84	(376)
Pumps and fans		33.49	x	3.07	=	102.80	(378)
Electricity for lighting		230.50	x	3.07	=	707.64	(379)
Energy saving/generation tech	nologies						
Electricity generated - PVs		-53.23	x	3.07	=	-163.43	(380)
Primary energy kWh/year						3394.86	(383)

Primary energy kWh/year

Dwelling primary energy rate kWh/m2/year

68.33

(384)

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Centric Close_Commercial Space Combined (Be Lean)

As designed

Date: Thu Dec 22 15:42:11 2016

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.5

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.5

BRUKL compliance check version: v5.2.g.3

Owner Details

Name: Name Telephone number: Phone Address: Street Address, City, Postcode

Certifier details

Name: Name Telephone number: Phone Address: Street Address, City, Postcode

Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	18.2
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	18.2
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	15.7
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	Ua-Limit	Ua-Calc	Ui-Calc	Surface where the maximum value occurs*
	0.25	0.10	0.40	
vvali	0.35	0.18	0.18	GF000005:Sun[2]
Floor	0.25	0.2	0.2	BS000000:Surf[0]
Roof	0.25	0.16	0.16	GF000005:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.3	1.3	GF000005:Surf[3]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building
Ua-Limit = Limiting area-weighted average U-values [W	//(m²K)]			
La colo - Calculated area-weighted average LL-values [W//(m ² K)]			Li-Cale - C	alculated maximum individual element U-values [W/(m ² K)]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m³/(h.m²) at 50 Pa	10	4
Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- Commercial Space

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(I/s)]	HR	efficiency
This system	0.94	4.5	0	0	0.8	5
Standard value	0.91*	3.2	N/A	N/A	0.5	
Automatic moni	toring & targeting w	ith alarms for out-of	-range values for thi	is HVAC syster	n	YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting						

efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

"No HWS in project, or hot water is provided by HVAC system"

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
А	Local supply or extract ventilation units serving a single area
В	Zonal supply system where the fan is remote from the zone
С	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
Е	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
н	Fan coil units
Ι	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(I/s)]										
ID of system type	Α	В	С	D	Е	F	G	Н	I	пке	mciency
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Basement_Commercial Space 1_Stor	age	1.2	0	-	-	-	-	-	-	-	N/A
Basement_Commercial Space 1	-	1.2	0	-	-	-	-	-	-	-	N/A
Basement_Commercial Space 2	-	1.2	0	-	-	-	-	-	-	-	N/A
GF_Commercial Space 3	-	1.2	0	-	-	-	-	-	-	-	N/A
GF_Commercial Space 4	-	1.2	0	-	-	-	-	-	-	-	N/A
GF_Commercial Space 2	-	1.2	0	-	-	-	-	-	-	-	N/A
GF_Commercial Space 2	-	1.2	0	-	-	-	-	-	-	-	N/A
GF_Commercial Space 2	-	1.2	0	-	-	-	-	-	-	-	N/A
GF_Commercial Space 2	-	1.2	0	-	-	-	-	-	-	-	N/A
GF_Commercial Space 1	-	1.2	0	-	-	-	-	-	-	-	N/A
GF_Commercial Space 1	-	1.2	0	-	-	-	-	-	-	-	N/A

General lighting and display lighting	Lumino	us effic	acy [lm/W]	
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Basement_Commercial Space 1_Storage	60	-	-	29
Basement_Commercial Space 1	60	-	-	1930
Basement_Commercial Space 2	60	-	-	3283

General lighting and display lighting	Lumino	ous effic	acy [lm/W]	
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
GF_Commercial Space 3	60	-	-	1111
GF_Commercial Space 4	60	-	-	1107
GF_Commercial Space 2	60	-	-	1041
GF_Commercial Space 2	60	-	-	813
GF_Commercial Space 2	60	-	-	221
GF_Commercial Space 2	60	-	-	312
GF_Commercial Space 1	60	-	-	1135
GF_Commercial Space 1	60	-	-	630

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Basement_Commercial Space 1_Storage	N/A	N/A
Basement_Commercial Space 1	N/A	N/A
Basement_Commercial Space 2	NO (-100%)	NO
GF_Commercial Space 3	NO (-83.7%)	YES
GF_Commercial Space 4	NO (-81.4%)	YES
GF_Commercial Space 2	NO (-89%)	YES
GF_Commercial Space 2	NO (-99.9%)	NO
GF_Commercial Space 2	NO (-52.8%)	YES
GF_Commercial Space 2	NO (-83.9%)	YES
GF_Commercial Space 1	NO (-93.9%)	YES
GF_Commercial Space 1	NO (-72.6%)	YES

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	1155.4	1155.4
External area [m ²]	1962.6	1962.6
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	4	3
Average conductance [W/K]	509.06	698.19
Average U-value [W/m ² K]	0.26	0.36
Alpha value* [%]	10	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area Building Type

	A1/A2 Retail/Financial and Professional services A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups B8 Storage or Distribution C1 Hotels C2 Residential Inst : Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst .: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	6.46	10.09
Cooling	2.72	4.95
Auxiliary	4.43	2.06
Lighting	19.04	23.39
Hot water	3.19	3.13
Equipment*	41.6	41.6
TOTAL**	35.84	43.62

* Energy used by equipment does not count towards the total for calculating emissions. ** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	54.42	98.84
Primary energy* [kWh/m ²]	92.18	107.12
Total emissions [kg/m ²]	15.7	18.2

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

0

	TVAC Systems renormance									
Sys	stem Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or m	ulti-split sy	stem, [HS]	LTHW boile	er, [HFT] Na	tural Gas, [CFT] Electr	icity		
	Actual	21.4	33	6.5	2.7	4.4	0.92	3.36	0.94	4.5
	Notional	31.3	67.5	10.1	4.9	2.1	0.86	3.79		
[ST	[ST] No Heating or Cooling									
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0		

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	 Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

= Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U і-Тур	Ui-Min	Surface where the minimum value occurs*
Wall	0.23	0.18	GF000005:Surf[2]
Floor	0.2	0.2	BS000000:Surf[0]
Roof	0.15	0.16	GF000005:Surf[1]
Windows, roof windows, and rooflights	1.5	1.3	GF000005:Surf[3]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building
U _{i-Typ} = Typical individual element U-values [W/(m ² K)]			U _{i-Min} = Minimum individual element U-values [W/(m ² K)]
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	4

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Centric Close_Commercial Space Combined (Be Clean)

As designed

Date: Thu Dec 22 15:45:13 2016

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.5

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.5

BRUKL compliance check version: v5.2.g.3

Owner Details

Name: Name Telephone number: Phone Address: Street Address, City, Postcode

Certifier details

Name: Name Telephone number: Phone Address: Street Address, City, Postcode

Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	18.2
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	18.2
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	14.1
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U a-Limit	Ua-Calc	Ui-Calc	Surface where the maximum value occurs*
Wall**	0.35	0.18	0.18	GF000005:Surf[2]
Floor	0.25	0.2	0.2	BS000000:Surf[0]
Roof	0.25	0.16	0.16	GF000005:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.3	1.3	GF000005:Surf[3]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building
Ua-Limit = Limiting area-weighted average U-values [W	//(m²K)]			
L La cala — Calculated area-weighted average LL-values	$11/1/m^2 k$			alculated maximum individual element LLvalues [\///m²K \]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m³/(h.m²) at 50 Pa	10	4

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	
Whole building electric power factor achieved by power factor correction	>0.95

1- Commercial Space

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(I/s)]	HF	R efficiency	
This system	0.94	4.5	0	0	0.8	35	
Standard value	0.91*	3.2	N/A	N/A	0.5	0.5	
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system YES							
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.							

"No HWS in project, or hot water is provided by HVAC system"

1- CHECK2-CHP

	CHPQA quality index	CHP electrical efficiency
This building	0	0.28
Standard value	Not provided	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
А	Local supply or extract ventilation units serving a single area
В	Zonal supply system where the fan is remote from the zone
С	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
Е	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
Н	Fan coil units
Ι	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(I/s)]										
ID of system type	Α	В	С	D	Е	F	G	н	I	пк епісіенсу	
Standard value 0.3			0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Basement_Commercial Space 1_Stor	age	1.2	0	-	-	-	-	-	-	-	N/A
Basement_Commercial Space 1 -		1.2	0	-	-	-	-	-	-	-	N/A
Basement_Commercial Space 2 -		1.2	0	-	-	-	-	-	-	-	N/A
GF_Commercial Space 3 -		1.2	0	-	-	-	-	-	-	-	N/A
GF_Commercial Space 4 -		1.2	0	-	-	-	-	-	-	-	N/A
GF_Commercial Space 2 -		1.2	0	-	-	-	-	-	-	-	N/A
GF_Commercial Space 2 -		1.2	0	-	-	-	-	-	-	-	N/A
GF_Commercial Space 2 -		1.2	0	-	-	-	-	-	-	-	N/A
GF_Commercial Space 2	-	1.2	0	-	-	-	-	-	-	-	N/A
GF_Commercial Space 1	-	1.2	0	-	-	-	-	-	-	-	N/A
GF_Commercial Space 1	-	1.2	0	-	-	-	-	-	-	-	N/A

General lighting and display lighting	Lumino	us effic		
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Basement_Commercial Space 1_Storage	60	-	-	29

General lighting and display lighting	Lumino	ous effic		
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Basement_Commercial Space 1	60	-	-	1930
Basement_Commercial Space 2	60	-	-	3283
GF_Commercial Space 3	60	-	-	1111
GF_Commercial Space 4	60	-	-	1107
GF_Commercial Space 2	60	-	-	1041
GF_Commercial Space 2	60	-	-	813
GF_Commercial Space 2	60	-	-	221
GF_Commercial Space 2	60	-	-	312
GF_Commercial Space 1	60	-	-	1135
GF_Commercial Space 1	60	-	-	630

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Basement_Commercial Space 1_Storage	N/A	N/A
Basement_Commercial Space 1	N/A	N/A
Basement_Commercial Space 2	NO (-100%)	NO
GF_Commercial Space 3	NO (-83.7%)	YES
GF_Commercial Space 4	NO (-81.4%)	YES
GF_Commercial Space 2	NO (-89%)	YES
GF_Commercial Space 2	NO (-99.9%)	NO
GF_Commercial Space 2	NO (-52.8%)	YES
GF_Commercial Space 2	NO (-83.9%)	YES
GF_Commercial Space 1	NO (-93.9%)	YES
GF_Commercial Space 1	NO (-72.6%)	YES

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	1155.4	1155.4
External area [m ²]	1962.6	1962.6
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	4	3
Average conductance [W/K]	509.06	698.19
Average U-value [W/m ² K]	0.26	0.36
Alpha value* [%]	10	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area Building Type

	A1/A2 Retail/Financial and Professional services A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups B8 Storage or Distribution C1 Hotels C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools C2 Residential Inst.: Universities and colleges C2A Secure Residential Inst. Residential spaces
	D1 Non-residential Inst.: Community/Day Centre D1 Non-residential Inst.: Libraries, Museums, and Galleries D1 Non-residential Inst.: Education D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts D2 General Assembly and Leisure, Night Clubs and Theatres Others: Passenger terminals Others: Emergency services Others: Miscellaneous 24hr activities Others: Car Parks 24 hrs Others. Stand along utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	8.59	10.09
Cooling	2.72	4.95
Auxiliary	4.43	2.06
Lighting	19.04	23.39
Hot water	4.31	3.13
Equipment*	41.6	41.6
TOTAL**	35.4	43.62

* Energy used by equipment does not count towards the total for calculating emissions. ** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	3.69	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	54.42	98.84
Primary energy* [kWh/m ²]	82.81	107.12
Total emissions [kg/m ²]	14.1	18.2

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

IVAC Systems Performan

	Trad Systems renormance									
System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST	[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
	Actual	21.4	33	0.4	2.7	4.4	0.92	3.36	0.94	4.5
	Notional	31.3	67.5	10.1	4.9	2.1	0.86	3.79		
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0		

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

= Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U і-Тур	Ui-Min	Surface where the minimum value occurs*		
Wall	0.23	0.18	GF000005:Surf[2]		
Floor	0.2	0.2	BS000000:Surf[0]		
Roof	0.15	0.16	GF000005:Surf[1]		
Windows, roof windows, and rooflights	1.5	1.3	GF000005:Surf[3]		
Personnel doors	1.5	-	No Personnel doors in building		
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building		
High usage entrance doors	1.5	-	No High usage entrance doors in building		
U _{i-Typ} = Typical individual element U-values [W/(m ² K)]		U _{i-Min} = Minimum individual element U-values [W/(m ² K)]		
* There might be more than one surface where the minimum U-value occurs.					

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	4

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Centric Close_Commercial Space Combined (Be Green)

As designed

Date: Thu Dec 22 16:23:35 2016

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.5

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.5

BRUKL compliance check version: v5.2.g.3

Owner Details

Name: Name Telephone number: Phone Address: Street Address, City, Postcode

Certifier details

Name: Name Telephone number: Phone Address: Street Address, City, Postcode

Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	18.2
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	18.2
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	11.8
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	Ua-Limit	Ua-Calc	Ui-Calc	Surface where the maximum value occurs*
	0.25	0.10	0.40	
vvali	0.35	0.18	0.18	GF000005:Sun[2]
Floor	0.25	0.2	0.2	BS000000:Surf[0]
Roof	0.25	0.16	0.16	GF000005:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.3	1.3	GF000005:Surf[3]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building
Ua-Limit = Limiting area-weighted average U-values [W	//(m²K)]			
Uacale - Calculated area-weighted average U-values	$[W/(m^2K)]$		Li-Cale - C	alculated maximum individual element U-values [W/(m ² K)]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m³/(h.m²) at 50 Pa	10	4

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- Commercial Space

	Heating efficiency	Cooling efficiency	ling efficiency Radiant efficiency SFP [W		HR efficiency		
This system	0.94	4.5	0	0	0.8	35	
Standard value	0.91*	3.2	N/A	N/A	N/A 0.5		
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system YES							
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.							

"No HWS in project, or hot water is provided by HVAC system"

1- CHECK2-CHP

	CHPQA quality index	CHP electrical efficiency
This building	0	0.28
Standard value	Not provided	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
А	Local supply or extract ventilation units serving a single area
В	Zonal supply system where the fan is remote from the zone
С	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
Е	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
Н	Fan coil units
Ι	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(I/s)]				UD officiency							
ID of system type	Α	В	С	D	Е	F	G	н	I	HR efficiency		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard	
Basement_Commercial Space 1_Stor	age	1.2	0	-	-	-	-	-	-	-	N/A	
Basement_Commercial Space 1	-	1.2	0	-	-	-	-	-	-	-	N/A	
Basement_Commercial Space 2	-	1.2	0	-	-	-	-	-	-	-	N/A	
GF_Commercial Space 3	-	1.2	0	-	-	-	-	-	-	-	N/A	
GF_Commercial Space 4	-	1.2	0	-	-	-	-	-	-	-	N/A	
GF_Commercial Space 2	-	1.2	0	-	-	-	-	-	-	-	N/A	
GF_Commercial Space 2	-	1.2	0	-	-	-	-	-	-	-	N/A	
GF_Commercial Space 2	-	1.2	0	-	-	-	-	-	-	-	N/A	
GF_Commercial Space 2	-	1.2	0	-	-	-	-	-	-	-	N/A	
GF_Commercial Space 1	-	1.2	0	-	-	-	-	-	-	-	N/A	
GF_Commercial Space 1	-	1.2	0	-	-	-	-	-	-	-	N/A	

General lighting and display lighting	Lumino	us effic		
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Basement_Commercial Space 1_Storage	60	-	-	29

General lighting and display lighting	Lumino	ous effic		
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Basement_Commercial Space 1	60	-	-	1930
Basement_Commercial Space 2	60	-	-	3283
GF_Commercial Space 3	60	-	-	1111
GF_Commercial Space 4	60	-	-	1107
GF_Commercial Space 2	60	-	-	1041
GF_Commercial Space 2	60	-	-	813
GF_Commercial Space 2	60	-	-	221
GF_Commercial Space 2	60	-	-	312
GF_Commercial Space 1	60	-	-	1135
GF_Commercial Space 1	60	-	-	630

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Basement_Commercial Space 1_Storage	N/A	N/A
Basement_Commercial Space 1	N/A	N/A
Basement_Commercial Space 2	NO (-100%)	NO
GF_Commercial Space 3	NO (-83.7%)	YES
GF_Commercial Space 4	NO (-81.4%)	YES
GF_Commercial Space 2	NO (-89%)	YES
GF_Commercial Space 2	NO (-99.9%)	NO
GF_Commercial Space 2	NO (-52.8%)	YES
GF_Commercial Space 2	NO (-83.9%)	YES
GF_Commercial Space 1	NO (-93.9%)	YES
GF_Commercial Space 1	NO (-72.6%)	YES

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?		
Is evidence of such assessment available as a separate submission?		
Are any such measures included in the proposed design?	NO	

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional	%
Area [m ²]	1155.4	1155.4	
External area [m ²]	1962.6	1962.6	
Weather	LON	LON	10
Infiltration [m ³ /hm ² @ 50Pa]	4	3	
Average conductance [W/K]	509.06	698.19	
Average U-value [W/m ² K]	0.26	0.36	
Alpha value* [%]	10	10	

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area Building Type

	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
00	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst .: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	8.59	10.09
Cooling	2.72	4.95
Auxiliary	4.43	2.06
Lighting	19.04	23.39
Hot water	4.31	3.13
Equipment*	41.6	41.6
TOTAL**	35.4	43.62

* Energy used by equipment does not count towards the total for calculating emissions. ** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	4.42	0
Wind turbines	0	0
CHP generators	3.69	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	54.42	98.84
Primary energy* [kWh/m ²]	82.81	107.12
Total emissions [kg/m ²]	11.8	18.2

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

IVAC Systems Performan

	TVAC Systems renormance									
Sys	stem Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST	[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
	Actual	21.4	33	0.4	2.7	4.4	0.92	3.36	0.94	4.5
	Notional	31.3	67.5	10.1	4.9	2.1	0.86	3.79		
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0		

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

= Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U і-Тур	Ui-Min	Surface where the minimum value occurs*	
Wall	0.23	0.18	GF000005:Surf[2]	
Floor	0.2	0.2	BS000000:Surf[0]	
Roof	0.15	0.16	GF000005:Surf[1]	
Windows, roof windows, and rooflights	1.5	1.3	GF000005:Surf[3]	
Personnel doors	1.5	-	No Personnel doors in building	
Vehicle access & similar large doors 1.5		-	No Vehicle access doors in building	
High usage entrance doors 1.5		-	No High usage entrance doors in building	
U _{i-Typ} = Typical individual element U-values [W/(m ² K)]			U _{i-Min} = Minimum individual element U-values [W/(m ² K)]	
* There might be more than one surface where the minimum U-value occurs.				

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	4