ENERGY STATEMENT



EST 2009

53-55 Station Road, Hayes, UB3 4BE

October 2023

Report Reference: 113256

Revision: -

Author: Tom Holland

UK Building Compliance

Unit 5, Carr House, 8 Hawley Road, Hinckley, Leicestershire, LE10 OPR

www.ukbuildingcompliance.co.uk

TABLE OF CONTENTS

1.0 Executive Summary	-	3
2.0 Policy Framework	-	4
3.0 Baseline	-	7
4.0 Be Lean	-	8
5.0 Be Clean	-	10
6.0 Be Green	-	12
7.0 Cooling and Overheating	-	15
8.0 Water Consumption	-	16
9.0 Sustainable Construction	-	18
10.0 Conclusion	_	19

Appendix 1 – Be Lean SAP Worksheets

Appendix 2 – Be Green SAP Worksheets

Appendix 3 – GLA Conversion Spreadsheet (separate submission)

1.0 EXECUTIVE SUMMARY

- **1.1** UK Building Compliance have been appointed to undertake an Energy Statement on a proposed development in the London Borough of Hillingdon.
- **1.2** The scheme comprises of a proposed three-storey block of flats. The proposed site is to consist of residential use (Use Class C3).
- **1.3** This document has been produced to satisfy:
 - Policy SI2 of the 2021 London Plan by providing at least a 35% improvement in regulated CO2 over Part L of the Building Regulations 2013 through on-site measures & by following the energy hierarchy.
 - Policy 5.6 of the 2020 GLA Energy Assessment Guidance by converting the above figures using the updated SAP 10 carbon emission factors.
- **1.4** This document details how the targets are met via:
 - Low U-Values
 - Low Air Permeability
 - Air Source Heat Pump
- **1.5** This document has been written in adherence to the GLA Guide to Energy Statements.

2.0 POLICY FRAMEWORK

- **2.1** The following section outlines the relevant policy frameworks at national, regional and local level:
- **2.2** In March 2016, the Government confirmed its policy to limit local energy requirements and continue to support low carbon infrastructure. The Mayor has considered the Government's intentions regarding energy performance standards and its support for energy infrastructure and considers his energy targets within his energy hierarchy to be in line with this approach. It encourages developers to make carbon savings on-site, firstly through demand reduction. The remaining energy savings are met through low carbon infrastructure, either on-site or off-site.
- **2.3** Hillingdon Local Plan, reducing carbon dioxide emissions and adapting to future climate change are key considerations, this includes:
 - The local plan: Part 1 Strategic Policies
 - The local plan: Part 2 Development management policies
- **2.4** Other considerations include the Nation Policy Framework (2021) and National Planning Practice Guidance

REGIONAL POLICIES

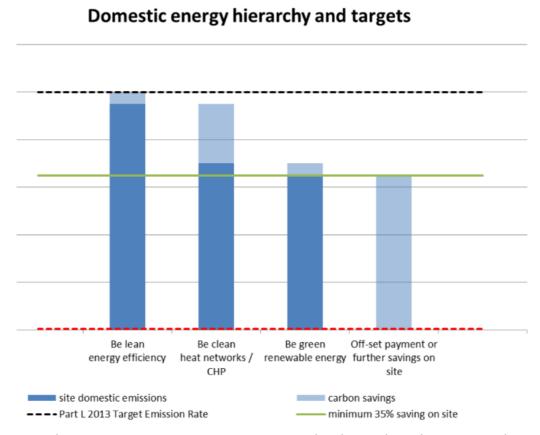
2.3 The London Plan was updated in March 2021. A link to the new version can be found here: https://www.london.gov.uk/sites/default/files/the_london_plan_2021.pdf

Policy SI2 Minimising greenhouse gas emissions;

- A) Major development should be net zero-carbon. This means reducing greenhouse gas emissions in operation and minimising both annual and peak energy demand in accordance with the following energy hierarchy:
- 1) be lean: use less energy and manage demand during operation
- 2) **be clean**: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly
- 3) **be green**: maximise opportunities for renewable energy by producing, storing, and using renewable energy on-site
- 4) be seen: monitor, verify and report on energy performance
 - B) Major development proposals should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the

energy hierarchy.

- C) A minimum on-site reduction of at least 35 per cent beyond Building Regulations is required for major development. Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, in agreement with the borough, either:
- **2.6** To meet the zero-carbon target, an on-site reduction of at least 35 per cent beyond the baseline of Part L of the 2013 Building Regulations is required. The minimum improvement over the Target Emission Rate (TER) will increase over a period of time in order to achieve the zero-carbon London ambition and reflect the costs of more efficient construction methods. This will be reflected in future updates to the London Plan
- **2.7** A visual representation of the GLA Target in relation to Building Regulations where feasible is:



2.8 GLA guidance on preparing energy assessments has been altered to request that

"Planning applicants are encouraged to use updated (SAP 10) carbon emission factors to assess the expected carbon performance of a new development. Applicants should continue to use the current Building Regulations methodology for estimating energy performance against Part L 2013 requirements (as outlined in Section 6) but with the outputs manually

converted for the SAP 10 emission factors. A spreadsheet (version 1.1) has been developed for this purpose which should be submitted alongside an energy assessment. It should be noted that the use of the SAP 10 emission factors in this context is for demonstrating performance against planning policy targets and, as such, is separate to Building Regulation compliance. Applications should therefore ensure that compliance with Building Regulations is maintained."

Source: GLA. 2020. Energy Planning - GLA Guidance on preparing energy assessments. [ONLINE] Available at: https://www.london.gov.uk/sites/default/files/gla_energy <a href="mailto:assessment_ass

3.0 BASELINE

3.1 SAP Calculations have been carried out on a representative sample using the Stroma FSAP Software Version 1.0.5.50 to gain the regulated emissions for the site.

Regulated Emissions are the CO₂ emissions covered under Part L of the Building Regulations and comprise of:

- a) Space Heating and Cooling
- **b)** Hot Water
- c) Lighting
- d) Pumps and Fans

A licensed and OCDEA accredited SAP Assessor has carried out the calculations.

Development emissions at this stage of the hierarchy are as follows:

		SAP 10 Conversion Factor Adjusted Figures	% improvement on TER
Baseline: Part L 2013 of the Building Regulations Compliant Development (TER)	18.74	16.7	
After energy demand reduction 'Be Lean'			
After CHP <i>'Be Clean'</i>			
After renewable energy <i>'Be Green'</i>			

4.0 BE LEAN

4.1 High energy efficiency standards are demonstrated in the table below. Construction Details have been selected to ensure that all fabric U-Values exceed the requirements of Part L of the Building Regulations (2013) and all Heating, Hot Water and Ventilation elements are in compliance with the Domestic Building Services Compliance Guide (2013). The proposed construction details for the residential units are as follows:

Elements	U Value	Development Notes
Ground Floor	0.12 w/m2/k	
Main External Walls	0.24 w/m2/k	
Sheltered Walls	0.11 w/m2/k	
Flat Roof	0.12 w/m2/k	
Windows	1.40 w/m2/k	Argon filled 16mm
External Doors	1.60 w/m2/k	Solid
Air Permeability	5m³/hm²@50Pa	
Ventilation	Natural Ventilation	
Heating	Gas Combi Boilers	
Heating Controls	Time & Temperature Zone Control	
Emitters	Radiators	
Secondary Heating	No	
Thermal Bridging	Constructive Details	
Lighting	100% LED	

A full sample SAP Input Data Sheet and SAP L1A Checklist can be found in Appendix 1 to verify the above inputs.

Following SAP Calculations, CO2 emissions at this stage of the hierarchy are as follows:

	Regulated C02 Emissions – Tonnes per Annum SAP 2012	SAP 10 Conversion Factor : Adjusted Figures	% improvement on SAP 10 adjusted TER
Baseline: Part L 2013 of the Building Regulations Compliant Development (TER)	18.74	16.7	
After energy demand reduction 'Be Lean'	17.51	15.7	10.33%
After CHP <i>'Be Clean'</i>			
After renewable energy 'Be Green'			

5.0 BE CLEAN

5.1 Policy SI3 of the London Plan advises the following:

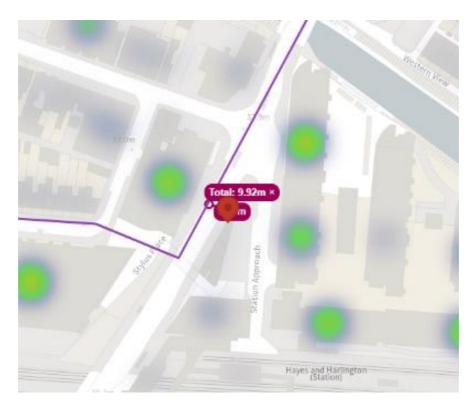
Major development proposals should select energy systems in accordance with the following hierarchy:

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

(Source: Mayor of London. 2021. *The London Plan March 2021*. [ONLINE] Available at: https://www.london.gov.uk/sites/default/files/the_london_plan_2021.pdf) [Accessed November 2021].

HEAT MAP

The site lies outside of any existing decentralised energy networks. There is a proposed heat network 9.92m away from the site.



CONNNECTION TO AREA WIDE LOW CARBON HEAT DISTRIBUTION NETWORKS

EXISTING NETWORKS

5.2 There are no existing heat networks within the site of the development. The possibility of utilising an existing area wide connection is therefore unfeasible.

PLANNED NETWORKS

5.3 There is a proposed heat network within 2km of the development which is a potential option for future development.

6.0 BE GREEN

6.1 The potential renewable energy applicable to this development and its feasibility is investigated below:

Renewable	Advantages	Disadvantages	Feasibility
Photovoltaic Panels	Can have significant impact on carbon by offsetting electricity which has a high carbon footprint. Low maintenance. No noise issues associated with PV. No additional land use from the installation of PV panels.	roof. Solar PV has a reduced carbon reduction effect when incorporating the new SAP 10	The development incorporates a pitched roof which is potentially suited to PV.
Solar Thermal Collectors	No additional land use from the installation of solar thermal collectors. Low maintenance and easy to manage. Low capital cost. No noise issues associated with Solar thermal collectors.	No Grants or Tariffs for new build installations.	Solar thermal collectors are feasible for the development, although it is not possible to meet the required carbon saving as the maximum demand that solar thermal collectors can be designed to meet can be no greater than 50% of the hot water demand.
Biomass Heating	Potential to reduce large component of the total CO2. A biomass boiler would replace a standard gas heating system so some of the cost may be offset through money saved on a traditional boiler.	required. Reliability of fuel may become a problem, therefore limited cost saving for residents. A plant room and fuel store will be required which may	This is a small tight site in a dense urban area. Biomass is not considered feasible for such a development due to the need for space to accommodate fuel storages, access for delivery vehicles and local NOX emissions.

Ground Source Heat Pumps	Low maintenance and easy to	The heat pump has a noise	Limited Space on site and large
Ground Source near rumps	•	level around 45- 60dB so some	
	with under- floor heating	, '	needed would remove and
	systems.		reduce amenity space.
	As heat pumps would replace	located.	
	standard heating systems, some		
	-	Requires electricity to run the	
		pump, therefore limited	
	boiler.	carbon savings in most cases.	
		For communal systems plant	
		room required which may take	
		additional land from the	
		proposed development/	
		surroundings.	
		High payback.	
Air Source Heat Pumps	ASHP systems are cheaper than	The heat pump has a noise	This option is deemed the most
	ground source as there is no	level around 50- 60dB so some	appropriate. There would be
	requirement for long lengths of	attenuation may be required,	space for the outdoor wall
	buried piping.	and it should be sensibly	units to be fitted. This option
	Low maintenance and easy to	located.	previously did not meet a 25%
	manage.	The potential noise from the	reduction alone, but under the
	Optimum efficiency with under-	external unit may mean there	new SAP 10 figures – it
	floor heating systems.	is local opposition to their	becomes more favorable. This
	As heat pumps would replace	installation.	is due to the significant carbon
	standard heating systems, some	Requires electricity to run the	emission reduction associated
	of the cost may offset through	pump, therefore limited	with the updated national grid
	money saved on a traditional	carbon savings in most cases.	figures.
	boiler.	For communal systems, plant	
		room is required which may	
		take additional land from the	
		proposed	
		development/surroundings	
		Potential noise issues.	
	J	l	

- **6.2** The 35% offset has not been achieved without the need for the above renewable technologies.
- **6.3** The required reduction is to be achieved with the provision of an Air Source Heat Pump. Reductions are shown in the table below.

Elements	U Value	Development Notes
Ground Floor	0.12 w/m2/k	
Main External Walls	0.24 w/m2/k	
Sheltered Walls	0.11 w/m2/k	
Flat Roof	0.12 w/m2/k	

Windows	1.40 w/m2/k	Argon filled 16mm
External Doors	1.60 w/m2/k	Solid
Air Permeability	5m³/hm²@50Pa	
Ventilation	Natural Ventilation	
Heating	Air Source Heat Pumps	Vaillant Arotherm
Heating Controls	Time & Temperature Zone Control	
Emitters	Radiators	
Secondary Heating	No	
Thermal Bridging	Constructive Details	
Lighting	100% LED	

6.4 Development emissions at this stage of the hierarchy are as follows:

	Regulated CO2 Emissions – Tonnes per Annum SAP 2012	SAP 10 Conversion Factor : Adjusted Figures	% improvement on SAP 10 adjusted TER
Baseline: Part L 2013 of the Building Regulations Compliant Development (TER)	18.74	16.7	
After energy demand reduction 'Be Lean'	17.51	15.7	10.33%
After CHP 'Be Clean'			
After renewable energy 'Be Green'	23.94	10.7	35.92%

Appendix 2 shows the full breakdown of:

- floor area of each dwelling and respective emission rate.
- the Dwelling Emission Rate (DER) in terms of kg/m²/year.
- the CO2 saved through the proposed use of energy efficient measures.

7.0 COOLING AND OVERHEATING

THE COOLING HIERARCHY

7.1 Pursuant with Policy 5.9 of the London Plan the following measures have been investigated:

Cooling Hierarchy	Measures Undertaken
Minimising internal heat generation through energy efficient design	Individual heating means the associated heat loss associated with communal heat pipes will not apply to this project.
2. Reducing the amount of heat entering the building in summer	Carefully designed shading measures have been considered, including: Specification of blinds.
3. Use of thermal mass and high ceilings to manage the heat within the building	Level of exposed thermal mass has been maximised to help to absorb excess heat within the building.
4. Passive Ventilation	The use of: Openable windows, Dual aspect units, Designing in the 'stack effect.
5. Mechanical Ventilation	N/A

OVERHEATING RISK ANALYSIS

7.2 Criterion 3 of Part L 2013 of the Building Regulations relates to limiting the effects of heat gains in summer - this is implemented for new dwellings as set out in Appendix P of SAP 2012.

The project passes this criterion.

However, the Building Regulations recognises that Criterion 3 does not cover all factors influencing overheating and that there is no guarantee that buildings will not overheat.

- **7.3** CIBSE Guide A Environmental Design (2015) is the reference standard for overheating in the GLA SPG on Sustainability and the current industry standard amongst other CIBSE guides such as CIBSE TM52 "The Limits of Thermal Comfort: Avoiding Overheating in European Buildings" (2013). These set out guidelines on the number of hours a dwelling should not exceed a certain temperature.
- **7.4** The risk of summertime overheating has been assessed as 'slight'.

8.0 WATER CONSUMPTION

8.1 The following section outlines the schemes' requirements and proposal for sustainable water consumption.

8.2 NATIONAL POLICIES

Part G of the 2013 England & Wales Building Regulations outlines the following requirement:

"The estimated consumption of wholesome water of a new dwelling should be no more than 125 liters/person/day or 110 liters/person/day where the optional requirement applies. This includes a fixed factor of water for outdoor use of 5 liters/ person/day."

8.3 WATER PROPOSAL

- **8.4** It is proposed that the 110 liters per person per day target will be achieved through the installment of water efficient appliances.
- **8.5** Table 1 specifies the requirements for the properties water-based appliances and calculates how this demand reduction will lead to water consumption of below 110 litres per person per day.
- **8.6** The various flow rates and capacities of the appliances listed in Table 1 should be adhered to when purchasing items for the properties.

8.7 WATER CALCULATIONS

Installation Type	Unit of Measure	Quantity	Capacity/ Flow Rate	Use factor	Fixed Use	Total L/P/D
WC (single flush)	Flush (L)	0	0.00	4.42	0.00	0.00
NAIC (dual fluab)	Full flush (L)		4.80	1.46	0.00	7.01
WC (dual flush)	Part flush (L)	6	2.40	2.96	0.00	7.10
Taps (excl kitchen/utility)	Flow (L/minute)	1	4.00	1.58	1.58	7.90
Baths	Capacity (L)	1	180.00	0.11	0.00	19.80
Showers	Flow (L/minute)	1	9.00	4.37	0.00	39.33
Kitchen/Utility Room Taps	Flow (L/minute)	1	5.00	0.44	10.36	12.56
Washing Machine	L/kg dry load	1	8.00	2.10	0.00	16.80
Dishwasher	L/place setting	1	1.25	3.60	0.00	4.50
Waste Disposal Unit	L/use	0	0.00	3.08	0.00	0.00
Water Softener	L/P/D	0	0.00	1.00	0.00	0.00
		Total	calculated use	(litres/person	/day)	115.00
		Contributio	on from Greyw	ater (litres/pe	erson/day)	0.00
	Contribution from Rainwater (litres/person/day)				0.00	
	Normalisation factor				0.91	
	Total water consumption				104.65	
			External v	vater use		5.00
		Total Water	Consumption	(Building Reg	ulation 17.K)	109.65

8.8 The water consumption for the site in question is calculated to be 109.65 litres per person per day.

9.0 SUSTAINABLE CONSTRUCTION

9.1 The Developer will monitor and record waste produce from site activities to ensure that the maximum possible will be diverted from landfill and reused in line with the waste hierarchy (below). This may be via a SWMP or via a licensed waste contractor.

WASTE HIERARCHY



- **9.2** All timber will be purchased in line with the Government's Policy for UK Timber Procurement.
- **9.3** Should the developer and client wish to go further than the mandatory requirements, the following voluntary BREEAM options could be considered when sourcing materials;
 - Responsible sourcing certifications e.g. EMS (EMAS, ISO14001).
 - Chain of custody and/or BES6001 for key and supply chain processes.
 - Legally sourced timber: Chain of custody and certificate (FSC, SFI, PEFC, MTCC, SGS, TFT, Verified etc).

10.0 CONCLUSION

- **10.1** This document is written in accordance with the guidelines and requirements of:
 - Policy SI2 of the 2021 London Plan
 - Policy 5.6 of the 2020 GLA Energy Assessment Guidance
- **10.2** The development has CO₂ baseline emissions that are Part L compliant via passive energy efficiency measures alone.
- **10.3** In addition to the passive measures and high energy efficiency standards, an efficient Air Source Heat Pump will be incorporated in order to achieve the required reduction in CO2 emissions.

Appendix 1

Sample SAP Reports – Be Lean

SAP Input

Property Details: GF Flat

Address:

Located in: England Region: Thames valley

UPRN:

Date of assessment: 05 October 2023
Date of certificate: 05 October 2023

Assessment type: New dwelling design stage

Transaction type:

Tenure type:

Related party disclosure:

Thermal Mass Parameter:

New dwelling

Unknown

No related party

Indicative Value Medium

Water use <= 125 litres/person/day: True

PCDF Version: 512

Property description:

Dwelling type: Flat

Detachment:

Year Completed: 2023

Floor Location: Floor area:

Storey height:

Floor 0 60.29 m^2 2.5 m

Living area: 25.32 m² (fraction 0.42)

Front of dwelling faces: South East

Opening types:

Name: Source: Type: Glazing: Argon: Frame:

se Manufacturer Windows low-E, En = 0.05, soft coat Yes nw Manufacturer Windows low-E, En = 0.05, soft coat Yes

Name:Gap:Frame Factor: g-value:U-value:Area:No. of Openings:se16mm or more0.70.631.33.331

nw 16mm or more 0.7 0.63 1.3 6.15 1

Name:Type-Name:Location:Orient:Width:Height:seExt.South East00nwExt.North West00

Overshading: Average or unknown

Onagua Flamonts:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Element	<u>ts</u>						
Ext.	52.77	9.48	43.29	0.24	0	False	N/A
Shel	22.8	0	22.8	0.24	0.43	False	N/A
Flat	8.04	0	8.04	0.12	0		N/A
GF	60.29			0.12			N/A

Internal Elements
Party Elements

Thermal bridges

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0498

Length Psi-value

5.14 0.05 E2 Other lintels (including other steel lintels)

1.42 0.034 E3 Sill

SAP Input

15.06	0.04	E4	Jamb
30.23	0.079	E5	Ground floor (normal)
8.88	0.08	E14	Flat roof
2.5	0.058	E16	Corner (normal)
5	-0.069	E17	Corner (inverted internal area greater than external area)
12.5	0.068	E18	Party wall between dwellings
12.99	0.16	P1	Ground floor
1.81	0.24	P4	Roof (insulation at ceiling level)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Natural ventilation (extract fans)

Number of chimneys:0Number of open flues:0Number of fans:2Number of passive stacks:0Number of sides sheltered:2Pressure test:5

Main heating system

Main heating system: Boiler systems with radiators or underfloor heating

Gas boilers and oil boilers

Fuel: mains gas

Info Source: Manufacturer Declaration

Manufacturer's data

Efficiency: 96.0% (SEDBUK2009)

Condensing combi with automatic ignition

Fuel Burning Type: Systems with radiators

Central heating pump: 2013 or later

Design flow temperature: Design flow temperature $>45\,^{\circ}\text{C}$

Unknown

Boiler interlock: Yes Delayed start

Main heating Control:

Main heating Control: Time and temperature zone control by suitable arrangement of plumbing and electrical

services

Control code: 2110

Secondary heating system:

Secondary heating system: None

Water heating

Water heating: From main heating system

Water code: 901 Fuel :mains gas No hot water cylinder

Flue Gas Heat Recovery System: Database (rev 512, product index)

Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown
Conservatory: No conservatory

Low energy lights: 100%

Terrain type: Low rise urban / suburban

EPC language: English Wind turbine: No

SAP Input

Photovoltaics: None Assess Zero Carbon Home: No

		l lser I	Details:						
Assessor Name: Software Name:	Bethany Robinson Stroma FSAP 2012	- 0 3 C F L	Strom Softwa					036516 on: 1.0.5.60	
	Р	roperty	Address	GF Fla	t				
Address :									
1. Overall dwelling dime	ensions:	Δro	a(m²)		Δν Ηο	ight(m)		Volume(m ³	3)
Ground floor				(1a) x		2.5	(2a) =	150.73	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1r		60.29	(4)]`		
Dwelling volume		′ <u> </u>	00.20)+(3c)+(3c	d)+(3e)+	.(3n) =	150.73	(5)
				(33) (33	, (5.5) (5.5)		(-)	150.75	(0)
2. Ventilation rate:	main secondar	у	other		total			m³ per hou	ır
Number of chimneys	heating heating 0 + 0] + [0] = Г	0	X 4	40 =	0	(6a)
Number of open flues	0 + 0	」	0] ₌ [0	x 2	20 =	0	(6b)
Number of intermittent fa		_ L		J	2	x	10 =	20	(7a)
Number of passive vents				L		x ^	10 =		(7b)
Number of flueless gas f				Ļ	0		40 =	0	= ``
Number of flueless gas in	1165				0		10 -	0	(7c)
							Air ch	nanges per ho	our
Infiltration due to chimne	ys, flues and fans = $(6a)+(6b)+(7a)$	'a)+(7b)+	(7c) =	Γ	20		÷ (5) =	0.13	(8)
	peen carried out or is intended, procee	d to (17),	otherwise o	continue fr	om (9) to	(16)			_
Number of storeys in the Additional infiltration	he dwelling (ns)					[(0)	-1]x0.1 =	0	(9)
	.25 for steel or timber frame or	0.35 fo	r masoni	v constr	uction	[(9)-	-1]XU.1 =	0	(10)
if both types of wall are p	resent, use the value corresponding to			•				0	()
deducting areas of opening	ngs); if equal user 0.35 floor, enter 0.2 (unsealed) or 0	1 (soal	od) olso	ontor O					— (42)
If no draught lobby, en	,	. i (Scai	eu), eise	enter o				0	(12)
•	s and doors draught stripped							0	(14)
Window infiltration	0		0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate			(8) + (10)	+ (11) + (1	12) + (13)	+ (15) =		0	(16)
,	q50, expressed in cubic metre	•	•	•	etre of e	envelope	area	5	(17)
•	lity value, then $(18) = [(17) \div 20] + (18)$. , .	,		0.38	(18)
Number of sides sheltere	es if a pressurisation test has been dor ed	ne or a de	gree air pe	rmeability	is being u	sed		2	(19)
Shelter factor			(20) = 1 -	[0.0 75 x (1	19)] =			0.85	(20)
Infiltration rate incorpora	ting shelter factor		(21) = (18	x (20) =				0.33	(21)
Infiltration rate modified f	for monthly wind speed								
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	peed from Table 7							_	
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (2	2)m ÷ 4								
(22a)m= 1.27 1.25	1.23 1.1 1.08 0.95	0.95	0.92	1	1.08	1.12	1.18		
								ı	

Adjusted infiltra	ation rat	e (allowi	ng for st	nelter an	d wind s	speed) =	(21a) x	(22a)m						
0.41	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.38]		
Calculate effect		•	rate for t	he appli	cable ca	se			•	•				1,00
If exhaust air he			andiv N (2	3h) - (23s	a) v Emy (6	1) aution	NSN othe	rwisa (23h) – (23a)			0		(23a
If balanced with) = (25a)			0](23k
a) If balance		•	•	· ·		`	•	,	2h\m ı (22h) v [1 (220)	0 : 1001		(230
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	$\frac{1-(230)}{0}$	- 100] 		(248
b) If balance												J		
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0	1		(24b
c) If whole h					<u> </u>							J		Ì
,		(23b), t		•	•				.5 × (23b	o)				
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0]		(240
d) If natural	ventilatio	on or wh	ole hous	e positiv	ve input	ventilatio	on from I	oft		!		•		
if (22b)n	n = 1, the	en (24d)	m = (22h	o)m othe	rwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]					
(24d)m= 0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57			(240
Effective air	change	rate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in box	(25)		,				
(25)m= 0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57			(25)
3. Heat losse	s and he	eat loss r	paramete	er:										
ELEMENT	Gros	·	Openin		Net Ar	ea	U-valı	Je	ΑXU		k-value	9	ΑXΙ	k
	area	(m²)	· m	j ²	A ,n	n²	W/m2	K	(W/	K)	kJ/m²-	K	kJ/K	
Windows Type	: 1				3.33	x1/	/[1/(1.3)+	0.04] =	4.12					(27)
Windows Type	2				6.15	x1/	/[1/(1.3)+	0.04] =	7.6					(27)
Floor					60.29) x	0.12	= [7.2348	3 [(28)
Walls Type1	52.7	7	9.48	i	43.29) x	0.24	= [10.39					(29)
Walls Type2	22.8	8	0		22.8	X	0.22	= [4.96					(29)
Roof	8.04	4	0	$\overline{}$	8.04	x	0.12	=	0.96					(30)
Total area of e	lements	, m²			143.9	<u> </u>								- (31)
* for windows and						ated using	formula 1	/[(1/U-valu	ıe)+0.04] a	as given in	paragrapl	3.2		
** include the area				is and part	titions		(0.0)	(22)						,
Fabric heat los		•	U)				(26)(30)					35.2	6	(33)
Heat capacity									(30) + (32	, , ,	(32e) =	72.3	6	(34)
Thermal mass	-								tive Value			250)	(35)
For design assess can be used inste				constructi	on are not	t known pr	ecisely the	: indicative	e values of	'IMP IN I	able 1f			
Thermal bridge	es : S (L	x Y) cal	culated :	using Ap	pendix ł	Κ						7.17	7	(36)
if details of therma	al bridging	are not kn	own (36) =	= 0.05 x (3	1)									1
Total fabric he	at loss							(33) +	(36) =			42.4	.3	(37)
Ventilation hea	at loss ca	alculated	l monthly	/				(38)m	= 0.33 × ((25)m x (5))			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
(38)m= 29.15	28.98	28.82	28.05	27.91	27.24	27.24	27.12	27.5	27.91	28.2	28.5			(38)
Heat transfer o	coefficier	nt, W/K						(39)m	= (37) + (38)m				
(39)m= 71.58	71.41	71.25	70.49	70.34	69.68	69.68	69.55	69.93	70.34	70.63	70.94]		

at loss para	meter (H	HLP), W/	m²K					(40)m	= (39)m ÷	- (4)			
m= 1.19	1.18	1.18	1.17	1.17	1.16	1.16	1.15	1.16	1.17	1.17	1.18		
mber of day	e in moi	oth (Tabl	lo 1a)				•		Average =	Sum(40) ₁	12 /12=	1.17	(4
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
m= 31	28	31	30	31	30	31	31	30	31	30	31		(4
Water heat	ing ener	gy requi	rement:								kWh/yea	ar:	
sumed occu TFA > 13.9 TFA £ 13.9	N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9))2)] + 0.0	0013 x (⁻	TFA -13		99		(4
nual averag luce the annua more that 125	e hot wa I average	hot water	usage by	5% if the a	welling is	designed t			se target c		.46		(4
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
water usage ir	litres per	day for ea	ach month	Vd,m = fa	ctor from	able 1c x	(43)			•			
m= 89.6	86.35	83.09	79.83	76.57	73.31	73.31	76.57	79.83	83.09	86.35	89.6		
rgy content of	hat water	used sel	ouloted me	nthlu — 1	100 v Vd r	n v nm v [Tm / 2600			m(44) ₁₁₂ =		977.5	(
				-					· ·				
m= 132.88	116.22	119.93	104.55	100.32	86.57	80.22	92.05	93.15	108.56	118.5	128.69	1201.66	\neg
stantaneous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46)		10tal = Su	m(45) ₁₁₂ =	L	1281.66	'
m= 19.93	17.43	17.99	15.68	15.05	12.99	12.03	13.81	13.97	16.28	17.78	19.3		(
ter storage	loss:							<u> </u>	ļ	!			
rage volum	e (litres)	includin	g any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(
ommunity h	•			•			` '		(0) ! - (· 4 ¬ \			
erwise if no ter storage		not wate	er (tnis in	ciudes i	nstantar	ieous co	ווטם ומוזונ	ers) ente	er O in ((47)			
If manufact		eclared le	oss facto	or is kno	wn (kWł	n/day):					0		(
nperature fa	actor fro	m Table	2b			• •					0		(
ergy lost fro	m water	storage	, kWh/ye	ear			(48) x (49)) =			0		(
If manufact			-										
water stora community h	•			e 2 (kWl	h/litre/da	ıy)					0		(
ume factor	•		JII 4.3								0		(
nperature fa			2b								0		(
ergy lost fro	m water	storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(
ter (50) or (-	•								0		(
ter storage	loss cal	culated f	or each	month			((56)m = (55) × (41)	m				
m= 0	0	0	0	0	0	0	0	0	0	0	0		(
linder contains	dedicate	d solar sto	rage, (57)r	n = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Appendix	Н	
m= 0	0	0	0	0	0	0	0	0	0	0	0		(
mary circuit	loss (an	nual) fro	m Table	3							0		(
mary circuit	•	•			59)m = ((58) ÷ 36	65 × (41)	m					
modified by	factor fi	om Tabl	le H5 if t	here is s	olar wat	er heatir	ng and a	cylinde	r thermo	stat)			

Combi	loss ca	lculated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m=	45.66	39.74	42.34	39.37	39.02	36.15	37.36	39.02	39.37	42.34	42.58	45.66		(61)
Total h	eat requ	uired for	water he	eating ca	alculated	for eacl	n month	(62)m =	: 0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	178.54	155.96	162.27	143.92	139.34	122.73	117.58	131.07	132.52	150.9	161.09	174.35		(62)
Solar Di	-IW input o	calculated	using App	endix G oı	· Appendix	H (negati	ve quantity	v) (enter 'C	if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix (3)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0		(63) (G2)
Output	from wa	ater hea	ter											
(64)m=	178.54	155.96	162.27	143.92	139.34	122.73	117.58	131.07	132.52	150.9	161.09	174.35		_
		-	-		-	-	-	Out	out from w	ater heate	r (annual)₁	12	1770.27	(64)
Heat g	ains froi	m water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)n	n] + 0.8 x	k [(46)m	+ (57)m	+ (59)m]	
(65)m=	55.6	48.58	50.46	44.61	43.11	37.82	36.01	40.36	40.82	46.68	50.05	54.2		(65)
inclu	ıde (57)ı	m in cald	culation o	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is f	om com	munity h	eating	
5. Int	ternal ga	ains (see	Table 5	and 5a):									
Metabo	olic gain	s (Table	5), Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	119.39	119.39	119.39	119.39	119.39	119.39	119.39	119.39	119.39	119.39	119.39	119.39		(66)
Lightin	g gains	(calcula	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m=	40.52	35.99	29.27	22.16	16.57	13.99	15.11	19.64	26.36	33.48	39.07	41.65		(67)
Applia	nces ga	ins (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5			•	
(68)m=	259.22	261.91	255.13	240.7	222.49	205.37	193.93	191.24	198.02	212.45	230.66	247.78		(68)
Cookir	ng gains	(calcula	ted in A	opendix	L, equat	tion L15	or L15a)	, also s	ee Table	5	-	-	•	
(69)m=	48.93	48.93	48.93	48.93	48.93	48.93	48.93	48.93	48.93	48.93	48.93	48.93		(69)
Pumps	and far	ns gains	(Table 5	5a)	-	-			-	-	-	-	•	
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses	e.g. ev	aporatio	n (negat	ive valu	es) (Tab	le 5)							•	
(71)m=	-79.59	-79.59	-79.59	-79.59	-79.59	-79.59	-79.59	-79.59	-79.59	-79.59	-79.59	-79.59		(71)
Water	heating	gains (T	able 5)		=	-						=	•	
(72)m=	74.73	72.29	67.82	61.95	57.95	52.53	48.4	54.25	56.69	62.74	69.51	72.85		(72)
Total i	nternal	gains =	:			(66)	m + (67)m	+ (68)m ·	+ (69)m +	(70)m + (7	(1)m + (72)	m	•	
(73)m=	466.2	461.92	443.95	416.54	388.72	363.61	349.17	356.86	372.79	400.39	430.97	454.01		(73)
6. So	lar gains	S:							•	•	•			
Solar g	ains are o	alculated	using sola	r flux from	Table 6a	and assoc	ated equa	tions to co	onvert to th	ne applicat	ole orientat	ion.		
Orienta		Access F Table 6d		Area m²		Flu Tal	x ole 6a	Т	g_ able 6b	Т	FF able 6c		Gains (W)	
Southe	_	0.77	x	3.3	13		6.79	x	0.63	 	0.7	=	37.44	7(77)
Southe	<u>L</u>	0.77	x	3.3			2.67	x -	0.63	^	0.7	_	63.78](77)
Southe	<u> </u>	0.77	x	3.3			5.75	^	0.63	^	0.7	= =	87.27](77)
	ast _{0.9x} [0.77	x	3.3		-	06.25	^	0.63		0.7	= -	108.13](77)
	U.JA	0.77	^ ^	3.3	,,	<u>" 10</u>	JU.ZU	ı ^ L	0.03	」 ^ L	0.7		100.13	J(,,)

Southea	ast _{0.9x}	0.77	X	3	.33	x	1	19.01	x	0.63	X	0.7	=	121.12	(77)
Southea	ast _{0.9x}	0.77	X	3	.33	x	1	18.15	x	0.63	x	0.7	=	120.24	(77)
Southea	ast _{0.9x}	0.77	X	3	.33	x	1	13.91	x	0.63	x	0.7	=	115.92	(77)
Southea	ast _{0.9x}	0.77	X	3	.33	x	1	04.39	x	0.63	x	0.7	=	106.24	(77)
Southea	ast _{0.9x}	0.77	x	3	.33	x	9	2.85	x	0.63	×	0.7	_ =	94.49	(77)
Southea	ast _{0.9x}	0.77	×	3	.33	x	6	9.27	x	0.63	×	0.7	=	70.49	(77)
Southea	ast 0.9x	0.77	×	3	.33	x	4	14.07	x	0.63	×	0.7	=	44.85	(77)
Southea	ast _{0.9x}	0.77	X	3	.33	İx	3	31.49	x	0.63	×	0.7	=	32.04	(77)
Northwe	est _{0.9x}	0.77	X	6	5.15	X	1	1.28	x	0.63	×	0.7		21.21	(81)
Northwe	est <u>0.9</u> x	0.77	×	6	5.15	x	2	22.97	x	0.63	×	0.7	=	43.17	(81)
Northwe	est _{0.9x}	0.77	X	-	5.15	j×	4	1.38	x	0.63	×	0.7	_ =	77.77	(81)
Northwe	est _{0.9x}	0.77	X	-	5.15	x	6	67.96	x	0.63	×	0.7		127.72	(81)
Northwe	est _{0.9x}	0.77	x		5.15	x	9	1.35	×	0.63	= x	0.7	-	171.69	(81)
Northwe	est _{0.9x}	0.77	X	-	5.15	j x	9	7.38	x	0.63	×	0.7	_ =	183.04	(81)
Northwe	est _{0.9x}	0.77	X	-	5.15	x		91.1	x	0.63	×	0.7		171.23	(81)
Northwe	est _{0.9x}	0.77	x		5.15	x	7	2.63	×	0.63	= x	0.7	-	136.5	(81)
Northwe	est _{0.9x}	0.77	X	-	5.15	x	5	50.42	x	0.63	×	0.7	-	94.77	(81)
Northwe	est _{0.9x}	0.77	X	-	5.15	x	2	28.07	x	0.63	×	0.7	-	52.75	(81)
Northwe	est _{0.9x}	0.77	X		5.15	X		14.2	x	0.63	= x	0.7	-	26.68	(81)
Northwe	est _{0.9x}	0.77	x		5.15	X		9.21	x	0.63	×	0.7	=	17.32	(81)
	_					J			1						
Solar o	ains in	watts, cal	lculate	d for ea	ch mon	th			(83)m	n = Sum(74)m.	(82)m				
Solar g (83)m=	ains in 58.65	watts, ca 106.95	165.04	235.86		$\overline{}$	03.28	287.15	(83)m 242	n = Sum(74)m74 189.26	<mark>(82)m</mark> 123.2	1	49.36	1	(83)
(83)m=	58.65		165.04	235.86	292.8	3 3			È				49.36]	(83)
(83)m=	58.65	106.95	165.04	235.86	292.8	n + (È	.74 189.26		5 71.53	49.36]]	(83) (84)
(83)m= [Total ga (84)m= [58.65 ains — ir 524.85	106.95 nternal ar 568.87	165.04 nd sola 608.99	235.86 r (84)m 652.4	292.8 = (73)r 681.5	3 n + (3 6	83)m	, watts	242	.74 189.26	123.2	5 71.53	1]	` '
(83)m= Total gases (84)m= 7. Mea	58.65 ains — ir 524.85 an inter	106.95 Internal ar 568.87 Inal temper	165.04 nd sola 608.99 erature	235.86 r (84)m 652.4 (heatin	292.8 = (73)r 681.5	3 3 n + (3 6	83)m 666.88	, watts 636.32	599	.74 189.26 0.6 562.05	123.2	5 71.53	1	21	` '
(83)m= [Total g: (84)m= [7. Mea	58.65 ains — ir 524.85 an inter erature	106.95 nternal ar 568.87 nal tempo	165.04 nd sola 608.99 erature eating p	235.86 r (84)m 652.4 (heatin	292.8 = (73)r 681.5 g seaso in the li	3 3 m + (3 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	83)m 666.88 area	, watts 636.32 from Tab	599	.74 189.26	123.2	5 71.53	1	21	(84)
(83)m= [Total g: (84)m= [7. Mea	58.65 ains — ir 524.85 an inter erature	106.95 Internal ar 568.87 Inal temper	165.04 nd sola 608.99 erature eating p	235.86 r (84)m 652.4 (heatin	292.8 = (73)r 681.5 g seaso in the li	3 3 6 on) ving	83)m 666.88 area	, watts 636.32 from Tab	242 599 ole 9	.74 189.26 9.6 562.05 , Th1 (°C)	123.2	71.53 4 502.5	1	21	(84)
(83)m= [Total g: (84)m= [7. Mea	58.65 ains — in 524.85 an inter erature	106.95 Internal ar 568.87 Inal temperaturing heator for ga	165.04 nd sola 608.99 erature eating pains for	235.86 r (84)m 652.4 (heatin periods living a	292.8 = (73)r 681.5 g seaso in the li	3 3 6 on) ving ,m (s	83)m 66.88 area t	from Table 9a)	242 599 ole 9	.74 189.26 0.6 562.05 , Th1 (°C) ug Sep	123.2	71.53 4 502.5 Nov	503.38	21	(84)
(83)m=	58.65 ains – in 524.85 an inter erature ation fac Jan 0.99	nternal ar 568.87 nal tempe during he tor for ga Feb 0.98	165.04 and sola 608.99 erature eating pains for Mar 0.97	235.86 r (84)m 652.4 (heatir periods living a Apr 0.92	292.8 = (73)r 681.5 g seaso in the li rea, h1, Ma 0.81	3 3 6 on) ving ,m (s	83)m 666.88 area t see Ta Jun 0.64	from Table 9a) Jul 0.48	242 599 ole 9	.74 189.26 0.6 562.05 , Th1 (°C) ug Sep 52 0.76	123.2 523.6 Oct	71.53 4 502.5 Nov	503.38 Dec	21	(84)
(83)m= [Total gate (84)m= [7. Meta Tempo Utilisa (86)m= [58.65 ains – in 524.85 an inter erature tion fac Jan 0.99 interna	nal temperature of the second	nd sola 608.99 erature eating pains for Mar 0.97	235.86 r (84)m 652.4 (heating periods living a Apr 0.92 living a	292.8 = (73)r 681.5 g season in the li rea, h1, Ma 0.81	3 6 n + (3 6 on) ving ,m (s	area to see Ta	, watts 636.32 from Tabble 9a) Jul 0.48 ps 3 to 7	242 599 ole 9 A 0.5	.74 189.26 9.6 562.05 , Th1 (°C) ug Sep 52 0.76 Table 9c)	123.2 523.6 Oct	71.53 4 502.5 Nov 0.98	503.38 Dec 0.99	21	(84)
(83)m= [Total gate (84)m= [7. Meta Tempo Utilisa (86)m= [Mean (87)m= [58.65 ains – in 524.85 an inter erature tion fac Jan 0.99 interna 19.95	nal temperature of the second	nd sola 608.99 erature eating pains for Mar 0.97 ature in 20.31	235.86 r (84)m 652.4 (heating periods living a Apr 0.92 living a 20.61	292.8 = (73)r 681.5 g season in the li rea, h1, Ma 0.81 urea T1 20.85	3 3 6 6 6 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	83)m 666.88 area f see Ta Jun 0.64 ow ste	, watts 636.32 from Tabble 9a) Jul 0.48 ps 3 to 7	2422 599 599 599 6 A 0.5 7 in T 20.	.74 189.26 9.6 562.05 , Th1 (°C) ug Sep 62 0.76 Table 9c) 99 20.92	123.2 523.6 Oct 0.94	71.53 4 502.5 Nov 0.98	503.38 Dec	21	(84)
(83)m= Total games (84)m= Tempor Utilisa (86)m= Mean (87)m= Tempor Tempor Cartesian (87)m= Tempor Cart	58.65 ains – in 524.85 an inter erature ation face Jan 0.99 interna 19.95 erature	nternal ar 568.87 and temperaturing he one of the original temperaturing he of the original temperaturing he original temp	nd sola 608.99 erature eating pains for Mar 0.97 ature in 20.31	235.86 r (84)m 652.4 (heatir periods living a Apr 0.92 living a 20.61	292.8 = (73)r 681.5 g seaso in the li rea, h1, Ma 0.81 crea T1 20.85 in rest o	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	area to see Ta Jun 0.64 ow stee 20.97	, watts 636.32 from Tabble 9a) Jul 0.48 ps 3 to 7 20.99 from Tabble 9a	2422 599 599 A 0.5 7 in T 20.	.74 189.26 0.6 562.05 , Th1 (°C) ug Sep 52 0.76 Table 9c) 99 20.92 9, Th2 (°C)	123.2 523.6 Oct 0.94	71.53 4 502.5 Nov 0.98	Dec 0.99	21	(84) (85) (86) (87)
(83)m= [Total gate (84)m= [7. Mean (86)m= [Mean (87)m= [Tempe (88)m= [58.65 ains – in 524.85 an inter erature ution face Jan 0.99 interna 19.95 erature 19.93	nternal ar 568.87 nal temperator for ga Feb 0.98 I tempera 20.09 during he	nd sola 608.99 erature eating pains for Mar 0.97 ature in 20.31 eating pains	235.86 r (84)m 652.4 (heatir periods living a Apr 0.92 living a 20.61 periods	292.8 = (73)r 681.5 g seaso in the li rea, h1, Ma 0.81 urea T1 20.85 in rest o	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	area face Ta Jun 0.64 ow ste 20.97 velling	, watts 636.32 from Tabble 9a) Jul 0.48 ps 3 to 7 20.99 from Tabble 9a)	2422 599 599 A 0.5 7 in T 20. able 9	.74 189.26 0.6 562.05 , Th1 (°C) ug Sep 52 0.76 Table 9c) 99 20.92 9, Th2 (°C)	123.2 523.6 Oct 0.94	71.53 4 502.5 Nov 0.98	503.38 Dec 0.99	21	(84)
(83)m= Total grade (84)m= (84)m= Utilisa (86)m= Mean (87)m= Tempor (88)m= Utilisa	58.65 ains – in 524.85 an inter erature tion fac Jan 0.99 interna 19.95 erature 19.93	nal temperature of the second	nd sola 608.99 erature eating pains for Mar 0.97 eture in 20.31 eating pains for	235.86 r (84)m 652.4 (heating periods living a Apr 0.92 living a 20.61 periods 19.94 rest of	292.8 = (73)r = (681.5) g seaso in the li rea, h1 Ma 0.81 120.85 in rest (19.95) dwelling	3 3 3 3 6 6 7 7 7 7 7 7 7 7 7 7 7 7 7 7	83)m 666.88 area f see Ta Jun 0.64 ow ste 20.97 velling 19.96 ,m (se	, watts 636.32 from Table 9a) Jul 0.48 ps 3 to 7 20.99 from Table 19.96	2422 599 599 599 599 599 599 599 599 599 5	.74 189.26 9.6 562.05 , Th1 (°C) ug Sep 52 0.76 Table 9c) 99 20.92 9, Th2 (°C) 96 19.95	123.2 523.6 Oct 0.94 20.63	71.53 4 502.5 Nov 0.98 20.24	Dec 0.99 19.93		(84) (85) (86) (87) (88)
(83)m= [Total gate (84)m= [7. Mean (86)m= [Mean (87)m= [Tempe (88)m= [58.65 ains – in 524.85 an inter erature ution face Jan 0.99 interna 19.95 erature 19.93	nternal ar 568.87 nal temperator for ga Feb 0.98 I tempera 20.09 during he	nd sola 608.99 erature eating pains for Mar 0.97 ature in 20.31 eating pains	235.86 r (84)m 652.4 (heatir periods living a Apr 0.92 living a 20.61 periods	292.8 = (73)r 681.5 g seaso in the li rea, h1, Ma 0.81 urea T1 20.85 in rest o	3 3 3 3 6 6 7 7 7 7 7 7 7 7 7 7 7 7 7 7	area face Ta Jun 0.64 ow ste 20.97 velling	, watts 636.32 from Tabble 9a) Jul 0.48 ps 3 to 7 20.99 from Tabble 9a)	2422 599 599 A 0.5 7 in T 20. able 9	.74 189.26 9.6 562.05 , Th1 (°C) ug Sep 52 0.76 Table 9c) 99 20.92 9, Th2 (°C) 96 19.95	123.2 523.6 Oct 0.94	71.53 4 502.5 Nov 0.98	Dec 0.99	21]	(84) (85) (86) (87)
(83)m=	58.65 ains – in 524.85 an inter erature tion fac Jan 0.99 interna 19.95 erature 19.93 tion fac 0.99	nal temperator for garage during here 20.09 during here 19.93 ttor for garage 0.98	nd sola 608.99 erature eating pains for Mar 0.97 eture in 20.31 eating pains for 19.93 ins for 0.96	235.86 r (84)m 652.4 (heating periods living a 20.61 20.61 periods 19.94 rest of 0.9	292.8 = (73)r = 681.5 g seaso in the li rea, h1 Ma 0.81 area T1 20.85 in rest o 19.95 dwelling 0.76	3 3 3 3 6 6 7 7 7 7 7 7 7 7 7 7 7 7 7 7	83)m 666.88 area f see Ta Jun 0.64 ow ste 20.97 velling 19.96 ,m (se 0.55	, watts 636.32 from Table 9a) Jul 0.48 ps 3 to 7 20.99 from Table 19.96 ee Table 0.37	2422 599 599 A A 0.5 7 in T 20. 19. 9a) 0.4	.74 189.26 9.6 562.05 , Th1 (°C) ug Sep 52 0.76 Table 9c) 99 20.92 9, Th2 (°C) 96 19.95	123.2 523.6 Oct 0.94 20.63	71.53 4 502.5 Nov 0.98 20.24	Dec 0.99 19.93	21	(84) (85) (86) (87) (88)
(83)m=	58.65 ains – in 524.85 an inter erature tion fac Jan 0.99 interna 19.95 erature 19.93 tion fac 0.99	nal temperator for garage during here 20.09 during here 19.93 ttor for garage 0.98	nd sola 608.99 erature eating pains for Mar 0.97 eture in 20.31 eating pains for 19.93 ins for 0.96	235.86 r (84)m 652.4 (heating periods living a 20.61 20.61 periods 19.94 rest of 0.9	292.8 = (73)r = 681.5 g seaso in the li rea, h1 Ma 0.81 area T1 20.85 in rest o 19.95 dwelling 0.76	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	83)m 666.88 area f see Ta Jun 0.64 ow ste 20.97 velling 19.96 ,m (se 0.55	, watts 636.32 from Table 9a) Jul 0.48 ps 3 to 7 20.99 from Table 19.96 ee Table 0.37	2422 599 599 A A 0.5 7 in T 20. 19. 9a) 0.4	.74 189.26 9.6 562.05 9.7 7 1 (°C) 1.7 1 (°C) 1.7 2 2 2 2 2 2 2 2 2	123.2 523.6 Oct 0.94 20.63 19.95 0.91 e 9c) 19.54	71.53 4 502.5 Nov 0.98 20.24 0.98	Dec 0.99 19.94 0.99 18.53		(84) (85) (86) (87) (88) (89)
(83)m= [Total gates (84)m= [7. Mean (86)m= [Mean (87)m= [Tempe (88)m= [Utilisa (89)m= [Mean (89)m= [58.65 ains – in 524.85 an inter erature stion face Jan 0.99 interna 19.95 erature 19.93 stion face 0.99 interna	nternal ar 568.87 nal temper during he tor for ga Feb 0.98 I tempera 20.09 during he 19.93 tor for ga	eating pains for 20.31 eating pains for 0.96 ature in 20.96	235.86 r (84)m 652.4 (heatir periods living a 20.61 periods 19.94 rest of 0.9 the res	292.8 = (73)r 681.5 g seaso in the li rea, h1, Ma 0.81 20.85 in rest of dwelling 0.76 t of dwe	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	83)m 666.88 area f see Ta Jun 0.64 ow ste 20.97 velling 19.96 ,m (se 0.55	from Table 9a) Jul 0.48 ps 3 to 7 20.99 from Table 9a 19.96 ee Table 0.37 ollow ste	2422 599	.74 189.26 9.6 562.05 9.7 7 1 (°C) 1.7 1 (°C) 1.7 2 2 2 2 2 2 2 2 2	123.2 523.6 Oct 0.94 20.63 19.95 0.91 e 9c) 19.54	71.53 4 502.5 Nov 0.98 20.24 0.98	Dec 0.99 19.94 0.99 18.53	21	(84) (85) (86) (87) (88)
(83)m= [Total gate (84)m= [7. Mean (86)m= [Mean (87)m= [Tempo (88)m= [Utilisa (89)m= [Mean (90)m= [58.65 ains – in 524.85 an inter erature tion face Jan 0.99 interna 19.95 erature 19.93 tion face 0.99 interna 18.57	106.95 Internal ar 568.87 Inal temporal tor for ga Feb 0.98 I temperal 20.09 during he 19.93 tor for ga 0.98 I temperal 18.76	eating pains for 0.97 ature in 20.31 eating pains for 0.97 ature in 19.93 ature in 0.96 ature in 19.09	235.86 r (84)m 652.4 (heatir periods living a 20.61 periods 19.94 rest of 0.9 the rest 19.5	292.8 = (73)r 681.5 g seaso in the li rea, h1, Ma 0.81 1 20.85 in rest of dwelling 0.76 t of dwe	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	83)m 666.88 area f see Ta Jun 0.64 ow ste 20.97 velling 19.96 ,m (se 0.55 J T2 (fe	, watts 636.32 from Table 9a) Jul 0.48 ps 3 to 7 20.99 from Ta 19.96 ee Table 0.37 ollow ste 19.95	2422 599 ble 9 A 0.5 7 in T 20. 9a) 0.4 eps 3	.74 189.26 9.6 562.05 9.7 7 1 (°C) 1.7 1 (°C) 1.7 2 2 2 2 2 2 2 2 2	123.2 523.6 Oct 0.94 20.63 19.95 0.91 e 9c) 19.54	71.53 4 502.5 Nov 0.98 20.24 0.98	Dec 0.99 19.94 0.99 18.53		(84) (85) (86) (87) (88) (89)
(83)m= [Total gate (84)m= [7. Mean (86)m= [Mean (87)m= [Tempo (88)m= [Utilisa (89)m= [Mean (90)m= [58.65 ains – in 524.85 an inter erature tion face Jan 0.99 interna 19.95 erature 19.93 tion face 0.99 interna 18.57	106.95 Internal ar 568.87 Inal temporal tor for ga Feb 0.98 I temperal 20.09 during he 19.93 tor for ga 0.98 I temperal 18.76	eating pains for 0.97 ature in 20.31 eating pains for 0.97 ature in 19.93 ature in 0.96 ature in 19.09	235.86 r (84)m 652.4 (heatir periods living a 20.61 periods 19.94 rest of 0.9 the rest 19.5	292.8 = (73)r 681.5 g seaso in the li rea, h1, Ma 0.81 1 20.85 in rest of dwelling 0.76 t of dwe	3 3 3 3 m + (3 6 6 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	83)m 666.88 area f see Ta Jun 0.64 ow ste 20.97 velling 19.96 ,m (se 0.55 J T2 (fe	, watts 636.32 from Table 9a) Jul 0.48 ps 3 to 7 20.99 from Ta 19.96 ee Table 0.37 ollow ste 19.95	2422 599 ble 9 A 0.5 7 in T 20. 9a) 0.4 eps 3	.74 189.26 0.6 562.05 . Th1 (°C) ug Sep 62 0.76 Table 9c) 99 20.92 9, Th2 (°C) 96 19.95 10.68 10.68 10.68 10.68 10.68 10.68 10.68 10.68	123.2 523.6 Oct 0.94 20.63 19.95 0.91 e 9c) 19.54	71.53 4 502.5 Nov 0.98 3 20.24 0.98 19 ving area ÷ (-	Dec 0.99 19.94 0.99 18.53		(84) (85) (86) (87) (88) (89)
(83)m= [Total gate (84)m= [7. Mean (86)m= [Mean (87)m= [Tempor (88)m= [Utilisaa (89)m= [Mean (90)m= [Mean (90)m= [58.65 ains – in 524.85 an inter erature tion fac Jan 0.99 interna 19.93 tion fac 0.99 interna 18.57	nal temperator for garage during here 19.93 tor for garage 18.76 temperator for garage 19.93 temperator for garage 19.32 temperator for garage 19.32	erature in 20.31 eating paties for 0.96 eature in 19.09	235.86 r (84)m 652.4 (heating a living	292.8 = (73)r = (81.5) g seaso in the li rea, h1 Ma 0.81 19.95 dwelling 0.76 t of dwe 19.8	3 3 3 3 m + ((33 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	83)m 666.88 area f 666.88 area	, watts , watts , watts 636.32 from Table 9a) Jul 0.48 ps 3 to 7 20.99 from Ta 19.96 ee Table 0.37 ollow ste 19.95 LA × T1 20.39	2422 599 599 60 A 6.5 7 in T 20. 9a) 0.4 4 (1 20.	.74 189.26 0.6 562.05 . Th1 (°C) ug Sep 52 0.76 Table 9c) 99 20.92 9, Th2 (°C) 96 19.95 10.68 10.68 10.68 10.68 10.68 10.68 10.68 10.68 10.68	123.2 523.6 Oct 0.94 20.63 19.95 0.91 e 9c) 19.54 LA = Li	71.53 4 502.5 Nov 0.98 20.24 19.94 0.98 19 ving area ÷ (Dec 0.99 19.94 0.99 18.53 4) =		(84) (85) (86) (87) (88) (89) (90) (91)

(93)m=	19	19.17	19.45	19.82	20.09	20.22	20.24	20.24	20.17	19.84	19.37	18.97		(93)
8. Spa	ace hea	ting requ	uirement											
				•		ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	culate	
the ut			or gains			1	11	Λ	0	0-4	Na	D.,		
Litilion	Jan	Feb	Mar	. Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(94)m=	0.98	0.97	ains, hm _{0.95}	0.89	0.77	0.57	0.4	0.44	0.7	0.91	0.97	0.99		(94)
			, W = (9 ⁴			0.07	0.4	0.44	0.1	0.01	0.07	0.00		(0.7)
(95)m=	515.99	554.01	579.66	582.51	523.11	379.73	252.11	264.41	393.15	475.71	487.72	496.26		(95)
		age exte	rnal tem	perature		<u> </u>								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]			•	
(97)m=	1052.27	1018.91	922.81	769.62	590.31	391.44	253.64	266.99	424.64	650.29	866.59	1047.65		(97)
Space	e heating	g require	ement fo	r each n	nonth, k\	Nh/mon	th = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m=	398.99	312.41	255.31	134.72	50	0	0	0	0	129.88	272.79	410.24		
,			-			-	-	Tota	l per year	(kWh/yeaı	r) = Sum(9	8) _{15,912} =	1964.33	(98)
Space	e heating	g require	ement in	kWh/m²	/year								32.58	(99)
•		• •				vstems i	ncluding	micro-C	;HP)					
	e heatir		ito iriai	Madain	cating 5	y Storris I	ricidaling	TITIOIO C	<i>/</i>					
-		•	at from s	econdar	y/supple	mentary	system						0	(201)
	•		at from m	•		,	•	(202) = 1	- (201) =				1	(202)
	-		ng from	-	` ,			(204) = (2	02) x [1 –	(203)] =			1	(204)
			_	-				(== -) (=		(===/]				╡` ′
	-	-	ace heat				. 0/						96.8	(206)
ETTICIE	ency of s		ry/suppl	ementar	y neating	g systen	ո, % 				•		0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space		<u> </u>	ement (c		· · · · · · · · ·	I			I - I		T	l	ı	
	398.99	312.41	255.31	134.72	50	0	0	0	0	129.88	272.79	410.24		
(211)m		`	4)] } x 1	· ·		1	1	1	ı		T		•	(211)
	412.18	322.73	263.75	139.17	51.65	0	0	0	0	134.18	281.81	423.8		_
								Tota	I (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	2029.27	(211)
•		• '	econdar	• •	month									
			00 ÷ (20											
(215)m=	0	0	0	0	0	0	0	O Tota	0 I (kWh/yea	0	0	0		7(245)
								TOLA	ii (KVVII/yea	ii) =Suiii(2	213) _{15,1012}	Ē	0	(215)
	heating		tor (colo	ulotod ol	hava)									
Output	178.54	155.96	ter (calc 162.27	143.92	139.34	122.73	117.58	131.07	132.52	150.9	161.09	174.35		
Efficier	ncy of w			1 10.02	100.01	122.10	117.00	101.07	102.02	100.0	101.00	17 1.00	87.5	(216)
(217)m=	<u> </u>	93.49	92.96	91.76	89.78	87.5	87.5	87.5	87.5	91.57	93.13	93.83	07.0	(217)
			kWh/mo		1	L 57.0	L 51.0	1	L 51.0	01.07	1 33.10	1 0.00	1	/
) ÷ (217)											
(219)m=		166.82	174.55	156.84	155.21	140.26	134.38	149.8	151.45	164.8	172.98	185.82		
'								Tota	I = Sum(2	19a) ₁₁₂ =			1943.41	(219)
Annua	ıl totals									k'	Wh/year	•	kWh/year	_
Space	heating	fuel use	ed, main	system	1								2029.27	

Water heating fuel used			1943.41
Electricity for pumps, fans and electric keep-ho	nt .		1943.41
central heating pump:	,	30	(230c)
Total electricity for the above, kWh/year	sum of (230	Da)(230g) =	30 (231)
Electricity for lighting	()	, (3)	286.27 (232)
Total delivered energy for all uses (211)(221) + (231) + (232)(237b) =		4288.95 (338)
10a. Fuel costs - individual heating systems:	, - (===,(====,		
, , , , , , , , , , , , , , , , , , ,	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	3.48 × 0.01	= 70.62 (240)
Space heating - main system 2	(213) x	0 x 0.01	= 0 (241)
Space heating - secondary	(215) x	13.19 × 0.01	= 0 (242)
Water heating cost (other fuel)	(219)	3.48 × 0.01	= 67.63 (247)
Pumps, fans and electric keep-hot	(231)	13.19 × 0.01	= 3.96 (249)
(if off-peak tariff, list each of (230a) to (230g) s Energy for lighting	eparately as applicable and ap	ply fuel price according t	
Additional standing charges (Table 12)			120 (251)
Appendix Q items: repeat lines (253) and (254) as needed		
, , , , , , , , , , , , , , , , , , , ,	(247) + (250)(254) =		299.97 (255)
11a. SAP rating - individual heating systems			
Energy cost deflator (Table 12)			0.42 (256)
Energy cost factor (ECF) [(255):	(256)] ÷ [(4) + 45.0] =		1.2 (257)
SAP rating (Section 12)			83.31 (258)
12a. CO2 emissions – Individual heating syst	ems including micro-CHP		
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	438.32 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	419.78 (264)
Space and water heating	(261) + (262) + (263) + (264) =		858.1 (265)
Electricity for pumps, fans and electric keep-ho	ot (231) x	0.519 =	15.57 (267)
Electricity for lighting	(232) x	0.519 =	148.57 (268)
Total CO2, kg/year	Sui	m of (265)(271) =	1022.24 (272)
3.7 · · ·			
CO2 emissions per m ²	(27	72) ÷ (4) =	16.96 (273)
• ,	(27	72) ÷ (4) =	16.96 (273) 87 (274)

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.22	=	2475.71	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	2370.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =			4846.67	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	92.1	(267)
Electricity for lighting	(232) x	0	=	878.84	(268)
'Total Primary Energy	sum	of (265)(271) =		5817.61	(272)
Primary energy kWh/m²/year	(272	2) ÷ (4) =		96.49	(273)

		l lser I	Details:						
Assessor Name: Software Name:	Bethany Robinson Stroma FSAP 2012	- 0 3 C F L	Strom Softwa					036516 on: 1.0.5.60	
	Р	roperty	Address	GF Fla	t				
Address :									
1. Overall dwelling dime	ensions:	Δro	a(m²)		Δν Ηο	ight(m)		Volume(m ³	3)
Ground floor				(1a) x		2.5	(2a) =	150.73	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1r		60.29	(4)]`		
Dwelling volume		′ <u> </u>	00.20)+(3c)+(3c	d)+(3e)+	.(3n) =	150.73	(5)
				(33) (33	, (5.5)		(-)	150.75	(0)
2. Ventilation rate:	main secondar	у	other		total			m³ per hou	ır
Number of chimneys	heating heating 0 + 0] + [0] = Г	0	X 4	40 =	0	(6a)
Number of open flues	0 + 0	」	0] ₌ [0	x 2	20 =	0	(6b)
Number of intermittent fa		_ L		J	2	x	10 =	20	(7a)
Number of passive vents				L		x ^	10 =		(7b)
Number of flueless gas f				Ļ	0		40 =	0	= ``
Number of flueless gas in	1165				0		10 -	0	(7c)
							Air ch	nanges per ho	our
Infiltration due to chimne	ys, flues and fans = $(6a)+(6b)+(7a)$	'a)+(7b)+	(7c) =	Γ	20		÷ (5) =	0.13	(8)
	peen carried out or is intended, procee	d to (17),	otherwise o	continue fr	om (9) to	(16)			_
Number of storeys in the Additional infiltration	he dwelling (ns)					[(0)	-1]x0.1 =	0	(9)
	.25 for steel or timber frame or	0.35 fo	r masoni	v constr	uction	[(9)-	-1]XU.1 =	0	(10)
if both types of wall are p	resent, use the value corresponding to			•				0	()
deducting areas of opening	ngs); if equal user 0.35 floor, enter 0.2 (unsealed) or 0	1 (soal	od) olso	ontor O					— (42)
If no draught lobby, en	,	. i (Scai	eu), eise	enter o				0	(12)
•	s and doors draught stripped							0	(14)
Window infiltration	0		0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate			(8) + (10)	+ (11) + (1	12) + (13)	+ (15) =		0	(16)
,	q50, expressed in cubic metre	•	•	•	etre of e	envelope	area	5	(17)
•	lity value, then $(18) = [(17) \div 20] + (18)$. , .	,		0.38	(18)
Number of sides sheltere	es if a pressurisation test has been dor ed	ne or a de	gree air pe	rmeability	is being u	sed		2	(19)
Shelter factor			(20) = 1 -	[0.0 75 x (1	19)] =			0.85	(20)
Infiltration rate incorpora	ting shelter factor		(21) = (18	x (20) =				0.33	(21)
Infiltration rate modified f	for monthly wind speed								
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	peed from Table 7							_	
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (2	2)m ÷ 4								
(22a)m= 1.27 1.25	1.23 1.1 1.08 0.95	0.95	0.92	1	1.08	1.12	1.18		
								ı	

Adjusted infiltra	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.41	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.38]	
Calculate effect		•	rate for t	he appli	cable ca	se			l				
If mechanica			and N. (O	OI-) (OO-	·		MEN - 11 -		\ (00-)			0	(23a)
If exhaust air he) = (23a)			0	(23b)
If balanced with		•	•	Ū		`		,	.	001) [4 (00.)	0	(23c)
a) If balance					i	- 	, ``	í `	 	, 	' ') ÷ 100] 1	(240)
(24a)m= 0			0	0	0	0	0	0	0	0	0		(24a)
b) If balance					ı	, 	, 	í `	- ´ `	- ´ 	Ι.,	1	(O4b)
(24b)m= 0	0	0	0	0		0	0	0	0	0	0		(24b)
c) If whole h if (22b)n				•	•				.5 × (23b	o)			
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natural if (22b)n				•	•				0.5]		•	-	
(24d)m= 0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57]	(24d)
Effective air	change	rate - er	iter (24a	or (24b	o) or (24	c) or (24	d) in bo	x (25)		!	•	_	
(25)m= 0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57]	(25)
2 Hoot loose	o and he	ot loop r	aramat	~ P.I			•	•		•		-	
3. Heat losse:	s and ne Gros	·	Openin		Net Ar	200	U-val	110	AXU		k-value	0	ΑΧk
ELEMENT	area	_	r		A,r		W/m2		(W/I	K)	kJ/m ² ·		λλ ⟨J/K
Windows Type	: 1				3.33	x1.	/[1/(1.3)+	0.04] =	4.12				(27)
Windows Type	2				6.15	x1	/[1/(1.3)+	0.04] =	7.6				(27)
Floor					60.29	x	0.12	─	7.2348	= [(28)
Walls Type1	52.7	7	9.48		43.29) x	0.24	= i	10.39	Ħ i			(29)
Walls Type2	22.8	3	0		22.8	X	0.22	<u> </u>	4.96				(29)
Roof	8.04	4	0	=	8.04	x	0.12	≓ ₌¦	0.96	≓ ¦		=	(30)
Total area of e					143.9	=							(31)
* for windows and			ffective wi	ndow U-va			g formula 1	/[(1/U-valu	ıe)+0.04] a	as given in	paragrapl	h 3.2	()
** include the area	as on both	sides of in	ternal wal	s and part	titions								
Fabric heat los	ss, W/K =	= S (A x	U)				(26)(30)) + (32) =				35.26	(33)
Heat capacity	Cm = S(Axk)						((28)	(30) + (32	2) + (32a)	(32e) =	72.36	(34)
Thermal mass	parame	ter (TMF	P = Cm -	- TFA) ir	n kJ/m²K	•		Indica	tive Value	: Medium		250	(35)
For design assess can be used instead				constructi	ion are no	t known pr	recisely the	e indicative	values of	TMP in T	able 1f		
Thermal bridge				ısina An	nendix k	<						7.17	(36)
if details of therma	•	•		• .	•	`						7.17	(30)
			()		.,			(33) +	(36) =			42.43	(37)
Total fabric he													
Ventilation hea	at loss	alculated	monthly	/				(38)m	$= 0.33 \times ($	25)m x (5)		
	at loss	alculated Mar	monthly Apr	/ May	Jun	Jul	Aug	(38)m Sep	= 0.33 × (25)m x (5 Nov	Dec]	
Ventilation hea	at loss at loss ca				Jun 27.24	Jul 27.24	Aug 27.12				_]	(38)
Ventilation hea Jan (38)m= 29.15	at loss at loss ca Feb 28.98	Mar 28.82	Apr	May		-	l 	Sep 27.5	Oct	Nov 28.2	Dec]	(38)
Ventilation hea	at loss at loss ca Feb 28.98	Mar 28.82	Apr	May		-	l 	Sep 27.5	Oct 27.91	Nov 28.2	Dec]	(38)

Heat loss para	ameter (I	HLP), W/	m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 1.19	1.18	1.18	1.17	1.17	1.16	1.16	1.15	1.16	1.17	1.17	1.18		
									Average =	Sum(40) ₁ .	12 /12=	1.17	(40)
Number of day	<u> </u>	nth (Tab	le 1a)			·	ı			i			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water hea	ting ene	rgy requi	rement:								kWh/ye	ar:	
Assumed occi if TFA > 13. if TFA £ 13.	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	TFA -13.		99		(42)
Annual average Reduce the annu- not more that 125	al average	hot water	usage by	5% if the a	lwelling is	designed t	` ,		se target o		.46		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage							_						
(44)m= 89.6	86.35	83.09	79.83	76.57	73.31	73.31	76.57	79.83	83.09	86.35	89.6		
									Total = Su	m(44) ₁₁₂ =	= [977.5	(44)
Energy content of	f hot water	used - cal	culated me	onthly = 4.	190 x Vd,r	n x nm x C	Tm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		<u> </u>
(45)m= 132.88	116.22	119.93	104.55	100.32	86.57	80.22	92.05	93.15	108.56	118.5	128.69		_
If instantaneous	vator hooti	na ot noint	of upo (no	hot woto	· otorogol	antar O in	hayaa (16		Total = Su	m(45) ₁₁₂ =	<u> </u>	1281.66	(45)
If instantaneous v	1		,	1	,.	·	` '			1			(40)
(46)m= 19.93 Water storage	17.43	17.99	15.68	15.05	12.99	12.03	13.81	13.97	16.28	17.78	19.3		(46)
Storage volum) includin	g any s	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	neating a	and no ta	nk in dw	elling, e	nter 110	litres in	(47)						
Otherwise if n	o stored	hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
Water storage													
a) If manufac				or is kno	wn (kWł	n/day):					0		(48)
Temperature f											0		(49)
Energy lost fro		_	-				(48) x (49)) =			0		(50)
b) If manufact Hot water stor			-								0		(51)
If community h	•			_ (,,,,,,	-77					<u> </u>		(-1)
Volume factor	from Ta	ble 2a									0		(52)
Temperature f	factor fro	m Table	2b								0		(53)
Energy lost fro		_	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter (50) or	(54) in (55)									0		(55)
Water storage	loss cal	culated f	or each	month			((56)m = (55) × (41)	m				
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contain	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Appendi	x H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit	t loss (ar	nnual) fro	m Table	<u>-</u> -							0		(58)
Primary circuit	,	•			59)m = ((58) ÷ 36	65 × (41)	m					
(modified by	/ factor f	rom Tab	le H5 if t	here is s	olar wat	er heatii	ng and a	cylinde	r thermo	stat)			
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi	loss ca	lculated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m							
(61)m=	45.66	39.74	42.34	39.37	39.02	36.15	37.36	39.0	2 39.3	7	42.34	42.58	45.66]	(61)
Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$															
(62)m=	178.54	155.96	162.27	143.92	139.34	122.73	117.58	131.0	07 132.	52	150.9	161.09	174.35]	(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)															
(add a	(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)														
(63)m=	0	0	0	0	0	0	0	0	0		0	0	0		(63)
FHRS	0	0	0	0	0	0	0	0	0		0	0	0		(63) (G2)
Output from water heater															
(64)m=	178.54	155.96	162.27	143.92	139.34	122.73	117.58	131.	07 132.	52	150.9	161.09	174.35]	
Output from water heater (annual) ₁₁₂ 1770.27 (64)															
Heat gains from water heating, kWh/month 0.25 $(0.85 \times (45))$ m + (61) m] + 0.8 $\times (46)$ m + (57) m + (59) m]		
(65)m=	55.6	48.58	50.46	44.61	43.11	37.82	36.01	40.3	6 40.8	2	46.68	50.05	54.2]	(65)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating															
5. Internal gains (see Table 5 and 5a):															
Metab	olic gain	ıs (Table	e 5), Wat	ts											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Αι	ig Se	p	Oct	Nov	Dec]	
(66)m=	99.49	99.49	99.49	99.49	99.49	99.49	99.49	99.4	9 99.4	.9	99.49	99.49	99.49	1	(66)
Lightin	ig gains	(calcula	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso se	ee Table	5				•	
(67)m=	16.21	14.4	11.71	8.86	6.63	5.59	6.04	7.86		$\overline{}$	13.39	15.63	16.66]	(67)
Applia	nces ga	ins (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), a	lso see	Tab	ole 5			1	
(68)m=	173.68	175.48	170.94	161.27	149.07	137.59	129.93	128.	13 132.	67	142.34	154.54	166.01]	(68)
Cookir	ng gains	(calcula	ted in A	ppendix	L, equa	tion L15	or L15a), also	see Ta	ble	5		l		
(69)m=	32.95	32.95	32.95	32.95	32.95	32.95	32.95	32.9			32.95	32.95	32.95	1	(69)
Pumps	and fai	ns gains	(Table 5	 5a)				!						•	
(70)m=	3	3	3	3	3	3	3	3	3		3	3	3]	(70)
Losses	s e.g. ev	aporatio	n (nega	tive valu	es) (Tab	ole 5)									
(71)m=		-79.59	-79.59	-79.59	-79.59	-79.59	-79.59	-79.5	59 -79.	59	-79.59	-79.59	-79.59	1	(71)
Water	heating	gains (T	able 5)		ı	•	ı	!	•			ı			
(72)m=	74.73	72.29	67.82	61.95	57.95	52.53	48.4	54.2	5 56.6	9	62.74	69.51	72.85	1	(72)
Total i	internal	gains =	!		<u>I</u>	(66)	m + (67)m	ı ı + (68)	m + (69)n	1 + (7	70)m + (7	1)m + (72)	m	J	
(73)m=	320.46	318.01	306.32	287.93	269.49	251.57	240.23	246.	08 255.	75	274.32	295.53	311.38	1	(73)
6. So	lar gains	S:													
Solar g	gains are o	calculated	using sola	r flux from	Table 6a	and assoc	iated equa	itions to	o convert t	o the	e applicab	le orientat	ion.		
Orientation: Access Factor Area Flux g_ FF Table 6d m² Table 6a Table 6b Table 6c												Gains (W)			
Southe	ast _{0.9x} [0.77	x		22] _× [. ,	7(77)
	ast _{0.9x} [^ ^	3.3			6.79]	0.63		」^∟ ヿ _× ┌	0.7	= =	37.44](77)](77)
	ast _{0.9x}	0.77		3.3			2.67	, L	0.63		╡╞	0.7	=	63.78	╡
	<u>L</u>	0.77	×	3.3		-	35.75]	0.63		╛ [╵]	0.7	_ =	87.27	」(77) □ ₍₇₇₎
Southeast $0.9x$ 0.77 x 3.33 x 106.25 x 0.63 x 0.7 = 108.13 (77)												$J^{(II)}$			

		_						,		_			_	_
Southeast 0.9x	0.77	X	3.33		X	119.01		X	0.63	X	0.7	=	121.12	(77)
Southeast _{0.9x}	0.77	X	3.3	3.33		1	118.15		0.63	X	0.7	=	120.24	(77)
Southeast _{0.9x}	0.77	X	3.3	33	X	1	113.91		0.63	X	0.7	=	115.92	(77)
Southeast _{0.9x}	0.77	X	3.3	33	X	1	104.39		0.63	X	0.7	=	106.24	(77)
Southeast 0.9x	0.77	X	3.3	33	X	9	92.85	X	0.63	X	0.7	=	94.49	(77)
Southeast 0.9x	0.77	X	3.3	33	x	6	9.27	x	0.63	X	0.7	=	70.49	(77)
Southeast 0.9x	0.77	X	3.3	33	x		14.07	X	0.63	X	0.7	=	44.85	(77)
Southeast 0.9x	0.77	X	3.3	33	x	3	31.49		0.63	X	0.7	=	32.04	(77)
Northwest 0.9x	0.77	X	6.1	5	x	1	11.28		0.63	X	0.7	=	21.21	(81)
Northwest 0.9x	0.77	X	6.1	5	x	2	22.97	x	0.63	X	0.7	=	43.17	(81)
Northwest 0.9x 0.77		X	6.15		x	4	11.38	x	0.63	X	0.7	=	77.77	(81)
Northwest _{0.9x}	hwest _{0.9x} 0.77 x 6.15		5	x	6	67.96	x	0.63	X	0.7	=	127.72	(81)	
Northwest _{0.9x}	0.77	X	× 6.15		x	9	91.35	x	0.63	x	0.7	=	171.69	(81)
Northwest _{0.9x}	0.77	X	6.15		x	9	97.38	x	0.63	x	0.7	=	183.04	(81)
Northwest _{0.9x}	0.77	X	6.15		x	91.1		x	0.63	x	0.7	=	171.23	(81)
Northwest _{0.9x}	0.77	X	6.15		x	72.63		x	0.63	x	0.7	=	136.5	(81)
Northwest _{0.9x}	0.77	X	6.15		x	5	50.42	x	0.63	×	0.7	_ =	94.77	(81)
Northwest _{0.9x}	0.77	X	6.15		x	2	28.07	x	0.63	x	0.7	_ =	52.75	(81)
Northwest 0.9x 0.77		X	6.1	5	x		14.2	x	0.63	x	0.7	=	26.68	(81)
Northwest 0.9x	0.77	X	6.1	5	x		9.21	х	0.63	x	0.7	=	17.32	(81)
_		_								_				
Solar gains in	watts calcu	lated	for eacl	h mont	h			(83)m	n = Sum(74)m .	(82)m				
(83)m= 58.65	olar gains in watts, calculated for each month 3)m= 58.65 106.95 165.04 235.86 292.8 303.28 287.15							242		123.2		49.36]	(83)
Total gains – internal and solar (84)m = (73)m + (83)m , watts														
(84)m= 379.11]	(84)		
7. Mean inter	nal tempera	ture ((heating	seaso	n)		•		,	•	<u> </u>	•	-	
Temperature	•		`			area	from Tab	ole 9	Th1 (°C)				21	(85)
Utilisation fac	•	•			_				, ,					
		Mar	Apr	May	Ť	Jun	Jul	Α	ug Sep	Oc	t Nov	Dec]	
(86)m= 1			0.73 0.56		0.6		0.98	1	1		(86)			
Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m= 19.74 19.87 20.12 20.46 20.76 20.94 20.99 20.98 20.85 20.47 20.04 19.71 (87)														
Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)														
(88)m= 19.93		.93	19.94	19.95	$\overline{}$	/eiiing 19.96	19.96	19.		19.95	5 19.94	19.94	1	(88)
` ′	L	!						ļ	30 13.33	15.50	7 13.54	10.04]	(00)
Utilisation fac	 				$\overline{}$		·	_	-		1 000	 	7	(00)
(89)m= 1	0.99 0.	.98	0.95	0.85		0.64	0.44	0.	5 0.8	0.97	0.99	1]	(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)														
(90)m= 18.25	18.46 18	3.82	19.31	19.71	1	19.91	19.95	19.		19.32		18.22		(90)
$fLA = Living area \div (4) = 0.42 $ (91)														
Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$														
(92)m= 18.87 19.05 19.36 19.79 20.15 20.34 20.39 20.38 20.26 19.8 19.27 18.85 (92)														
(92)m= 18.87	19.05 19	.36	19.79	20.15	2	20.34	20.39	20.	38 20.26	19.8	19.27	18.85		(92)
(92)m= 18.87 Apply adjustr												18.85]	(92)

г						.	T			1			ı	
(93)m=	18.72	18.9	19.21	19.64	20	20.19	20.24	20.23	20.11	19.65	19.12	18.7		(93)
			uirement							. —				
			ernal ter or gains :	•		ied at ste	ep 11 of	l able 9	b, so tha	t II,m=(/6)m an	d re-calc	ulate	
Γ	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa			ains, hm		,	<u> </u>	<u> </u>		'	<u> </u>				
(94)m=	1	0.99	0.98	0.94	0.85	0.66	0.47	0.53	0.81	0.96	0.99	1		(94)
Useful	l gains,	hmGm	, W = (9 ²	4)m x (84	4)m	•	•		•	•		•		
(95)m=	377.34	421.27	462.06	494.57	476.65	367.26	249.92	260.48	359.63	382.28	363.76	359.41		(95)
	ly avera	age exte	rnal tem	perature	from Ta	able 8							ı	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
г	i		an intern				- ` 	- ` 	<u> </u>			•	1	
` ' L	1032.52	999.93	905.89	757.04	583.85	389.75	253.31	266.42	420.02	636.93	849	1028.32		(97)
· F			ement fo			I	i e		<u> </u>	 	r e	107.00		
(98)m=	487.45	388.85	330.21	188.98	79.75	0	0	0	0	189.46	349.37	497.68		٦,,,,,,
								lota	al per year	(kWh/yeai	r) = Sum(9)8) _{15,912} =	2511.76	(98)
Space	heating	g require	ement in	kWh/m²	/year								41.66	(99)
9a. Ene	ergy req	uiremer	nts – Indi	vidual h	eating sy	ystems i	ncluding	micro-C	CHP)					
•	e heatin	•										,		_
Fraction	on of sp	ace hea	at from se	econdar	y/supple	mentary	system						0	(201)
Fraction	on of sp	ace hea	at from m	nain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fraction	on of to	al heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ncy of r	nain spa	ace heat	ing syste	em 1								96.8	(206)
Efficie	ncy of s	econda	ry/supple	ementar	y heating	g systen	າ, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	heating	g require	ement (c	alculate	d above)								
	487.45	388.85	330.21	188.98	79.75	0	0	0	0	189.46	349.37	497.68		
(211)m	= {[(98])m x (20	(4)] } x 1	00 ÷ (20	06)									(211)
	503.57	401.71	341.12	195.23	82.39	0	0	0	0	195.72	360.92	514.13		
_	-		-			-	-	Tota	l (kWh/yea	ar) =Sum(2	211) _{15,101}		2594.79	(211)
Space	heating	g fuel (s	econdar	y), kWh/	month							'		
= {[(98)]	m x (20	1)]} x 1	00 ÷ (20	8)		г	г	1		Г	ī		ı	
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		_
								Tota	ıl (kWh/yea	ar) =Sum(2	215) _{15,101}	₂ =	0	(215)
Water I	_													
Output			ter (calc			400.70	447.50	404.07	400.50	450.0	404.00	474.05		
	178.54	155.96	162.27	143.92	139.34	122.73	117.58	131.07	132.52	150.9	161.09	174.35	07.5	7(246)
г	<u> </u>	ater hea		00.55	00.07	07.5	07.5		07.5	00.44	00.00		87.5	(216)
(217)m=	94.12	93.94	93.52	92.55	90.67	87.5	87.5	87.5	87.5	92.44	93.66	94.2		(217)
		•	kWh/mo (217) ÷ (
(219)m=		166.02	173.5	155.51	153.68	140.26	134.38	149.8	151.45	163.24	171.99	185.08		
L								Tota	l = Sum(2	19a) ₁₁₂ =	ı	1	1934.61	(219)
Annual	l totals									k'	Wh/yea	r	kWh/year	
Space I	heating	fuel use	ed, main	system	1						-		2594.79	
														_

Materia of a final and					٦
Water heating fuel used				1934.61	
Electricity for pumps, fans and electric keep-hot					
central heating pump:			30]	(230c)
Total electricity for the above, kWh/year	sum of	f (230a)(230g) =		30	(231)
Electricity for lighting				286.27	(232)
Total delivered energy for all uses (211)(221) +	(231) + (232)(237b) =			4845.66	(338)
12a. CO2 emissions – Individual heating systems	s including micro-CHP				
	Energy	Emission fac		Emissions	
	kWh/year	kg CO2/kWh		kg CO2/yea	ar
Space heating (main system 1)	(211) x	0.216	=	560.47	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	417.87	(264)
Space and water heating	(261) + (262) + (263) + (26	64) =		978.35	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	15.57	(267)
Electricity for lighting	(232) x	0.519	=	148.57	(268)
Total CO2, kg/year		sum of (265)(271) =		1142.49	(272)

El rating (section 14)

Address:

England Located in: Region: Thames valley

UPRN:

Date of assessment: 05 October 2023 Date of certificate: 05 October 2023

New dwelling design stage Assessment type:

New dwelling Transaction type: Tenure type: Unknown Related party disclosure: No related party Thermal Mass Parameter: Indicative Value Medium

True Water use <= 125 litres/person/day:

PCDF Version: 512

Flat Dwelling type:

Detachment:

2023 Year Completed:

Floor Location: Floor area:

Storey height:

73.21 m² 2.5 m Floor 0

29.99 m² (fraction 0.41) Living area:

North East Front of dwelling faces:

Name: Source: Type: Glazing: Argon: Frame: Manufacturer Solid Wood ne

Manufacturer Windows low-E, En = 0.05, soft coat Yes se Manufacturer Windows low-E, En = 0.05, soft coat Yes nw

Name:	Gap:	Frame Facto	or: g-value:	U-value:	Area:	No. of Openings:
ne	mm	0.7	0.63	1.6	1.89	1
se	16mm or more	0.7	0.63	1.3	13.33	1
nw	16mm or more	0.7	0.63	1.3	5.64	1

Orient: Width: Height: Type-Name: Location: Name: North East Shel 0 ne se Ext. South East 0 0

nw Ext. North West 0

Average or unknown Overshading:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Element	<u>:S</u>						
Ext.	71.92	18.97	52.95	0.24	0	False	N/A
Shel	13.03	1.89	11.14	0.11	0.43	False	N/A

Internal Elements Party Elements

User-defined (individual PSI-values) Y-Value = 0.0543 Thermal bridges:

> Length Psi-value

Other lintels (including other steel lintels) 10.42 0.05 E2

2.04	0.034	E3	Sill
24.04	0.04	E4	Jamb
10	0.058	E16	Corner (normal)
2.5	-0.069	E17	Corner (inverted internal area greater than external area)
2.5	0.068	E18	Party wall between dwellings
33.98	0.073	E7	Party floor between dwellings (in blocks of flats)
3.39	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Natural ventilation (extract fans)

Number of chimneys: 0
Number of open flues: 0
Number of fans: 3
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Boiler systems with radiators or underfloor heating

Gas boilers and oil boilers

Fuel: mains gas

Info Source: Manufacturer Declaration

Manufacturer's data

Efficiency: 96.0% (SEDBUK2009)

Condensing combi with automatic ignition

Fuel Burning Type: Systems with radiators

Central heating pump: 2013 or later

Design flow temperature: Design flow temperature >45°C

Unknown

Boiler interlock: Yes Delayed start

Main heating Control:

Main heating Control: Time and temperature zone control by suitable arrangement of plumbing and electrical

services

Control code: 2110

Secondary heating system:

Secondary heating system: None

Water heating

Water heating: From main heating system

Water code: 901 Fuel :mains gas No hot water cylinder

Flue Gas Heat Recovery System: Database (rev 512, product index)

Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown
Conservatory: No conservatory

Low energy lights: 100%

Terrain type: Low rise urban / suburban

EPC language: English Wind turbine: No Photovoltaics: None

133C33 ZCIO CAIDOII HOIHE. 110	me: No	ro Carbon Home:	Assess Zero
--------------------------------	--------	-----------------	-------------

		l Iser I	Details:						
Assessor Name: Software Name:	Bethany Robinson Stroma FSAP 2012	<u> </u>	Strom Softwa					0036516 on: 1.0.5.60	
Contware reame.		roperty	Address				101010	71. 7.0.0.00	
Address :									
1. Overall dwelling dime	ensions:								
Ground floor			a(m²)	(1a) v		ight(m)	1(20)	Volume(m ³	<u>^</u>
	a) . (4 b) . (4 a) . (4 a) . (4 a) . (4 a)			(1a) x		2.5	(2a) =	183.02	(3a)
	a)+(1b)+(1c)+(1d)+(1e)+(1	1)	73.21	(4)					_
Dwelling volume				(3a)+(3b)+(3c)+(3c	d)+(3e)+	.(3n) =	183.02	(5)
2. Ventilation rate:	main		other		40401			m3 nor hou	
	main seconda heating heating	· 	otner	, –	total			m³ per hou	ır —
Number of chimneys	0 + 0	+	0	_ = _	0	X 4	40 =	0	(6a)
Number of open flues	0 + 0	+	0] = [0	x 2	20 =	0	(6b)
Number of intermittent fa	ins				3	x 1	10 =	30	(7a)
Number of passive vents	3			Ī	0	x 1	10 =	0	(7b)
Number of flueless gas fi	ires			Ē	0	x 4	40 =	0	(7c)
				<u> </u>					
							Air ch	nanges per ho	our
	ys, flues and fans = $(6a)+(6b)+(7a)$				30		÷ (5) =	0.16	(8)
If a pressurisation test has be Number of storeys in the	peen carried out or is intended, procee he dwelling (ns)	d to (17),	otherwise (continue fr	om (9) to	(16)			(9)
Additional infiltration	ne aweiling (113)					[(9)-	-1]x0.1 =	0	(10)
	.25 for steel or timber frame or	0.35 fo	r masoni	y constr	ruction	1(-)		0	(11)
	resent, use the value corresponding to	the grea	ter wall are	a (after					
deducting areas of openii	^{ngs); if equal user 0.35 floor, enter 0.2 (unsealed) or 0}	1 (seal	ed) else	enter ()				0	(12)
If no draught lobby, en	,	. r (50an	ou), 0.00	critor o				0	(13)
	s and doors draught stripped							0	(14)
Window infiltration			0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate			(8) + (10)	+ (11) + (1	12) + (13)	+ (15) =		0	(16)
•	q50, expressed in cubic metre	•	•	•	etre of e	envelope	area	5	(17)
•	lity value, then $(18) = [(17) \div 20] + ($							0.41	(18)
Number of sides sheltere	es if a pressurisation test has been do ed	ne or a de	gree air pe	rmeability	is being u	sea		2	(19)
Shelter factor	, ,		(20) = 1 -	[0.0 75 x (1	19)] =			0.85	(20)
Infiltration rate incorporate	ting shelter factor		(21) = (18) x (20) =				0.35	(21)
Infiltration rate modified f	or monthly wind speed								
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	peed from Table 7								
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (2.	2)m <i>÷ 1</i>								
	2)m ÷ 4 1.23	0.95	0.92	1	1.08	1.12	1.18	1	
1.20	1.10 0.93	L 0.00	1 0.02		1	1.12	Lo	J	

Adjusted infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.33	0.35	0.38	0.4	0.41]	
Calculate effe		_	rate for t	he appli	cable ca	se						- -	
If mechanical If exhaust air h			endix N (2	3h) = (23a	a) × Fmv (e	equation (1	N5)) othe	rwise (23h) = (23a)			0	(23
If balanced with) — (20 0)			0	(23
a) If balance		•	•	ŭ		`		,	Dh\m ı (23h) v [4	1 (220)	0	(23
24a)m= 0	0	0	0	0	0	0	0	0	0	0	0] - 100j	(24
b) If balance												J	(_
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(24
c) If whole h					<u> </u>		<u> </u>					J	(-
,	n < 0.5 ×			•	•				5 × (23b	o)			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(24
d) If natural	ventilatio	n or wh	ole hous	e positiv	/e input	ventilatio	n from I	oft	<u> </u>	<u> </u>	<u> </u>	J	
,	n = 1, th								0.5]				
24d)m= 0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59]	(24
Effective air	change	rate - er	nter (24a	or (24b	o) or (24	c) or (24	d) in box	(25)				-	
25)m= 0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59]	(25
3. Heat losse	s and he	at loce i	aramata	or:								_	
	S and ne		Openin		Net Ar	00	U-valı	10	AXU		k-value	2	ΑΧk
LEMENT	area	-	operiiri m		A,r		W/m2		(W/	K)	kJ/m ² ·	-	kJ/K
Doors					1.89	X	1.6	_ [3.024				(26
Vindows Type	e 1				13.33	x1.	/[1/(1.3)+	0.04] =	16.47	=			(27
Vindows Type	e 2				5.64	x1	/[1/(1.3)+	0.04] =	6.97	=			(27
Valls Type1	71.9	12	18.9	7	52.95	_	0.24		12.71	=		\neg	(29
Valls Type2	13.0		1.89	=	11.14	=	0.11		1.17	터 ¦		╡	(29
otal area of e			1.08			=	0.11		1.17				
for windows and		•	offective wi	ndow I I-vs	84.95		ı formula 1	/[(1/ -valu	د 0.41 (مر	as aiven in	naragrani	h 32	(3
* include the are						atou using	nonnula 1	/[((C)+0.0+j c	is given in	paragrapi	7 3.2	
abric heat lo	ss, W/K :	= S (A x	U)				(26)(30)	+ (32) =				40.34	1 (3:
leat capacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	0	(34
hermal mass	parame	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(3
or design asses	sments wh	ere the de	tails of the	construct	ion are no	known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
an be used inste													
hermal bridg	,	,		٠.	•	<						4.61	(30
details of therma otal fabric he		are not kn	own (36) =	= 0.05 x (3	11)			(22) 1	(36) =				- 1/0
		alaulataa	المعمدال	,						0E\m v (E)		44.9	(3.
entilation hea	i	i			1, ,	1, ,1	۸			25)m x (5)	T _	1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1	(38
38)m= 36.28	36.04	35.81	34.72	34.52	33.57	33.57	33.4	33.94	34.52	34.93	35.36]	(3)
leat transfer	1				ı		ı	- ` 	= (37) + (·	1	
39)m= 81.23	80.99	80.76	79.68	79.47	78.53	78.53	78.35	78.89	79.47	79.88	80.31		
										Sum(39) ₁		79.68	3 (3

Jan 1966 P	oarame	eter (H	ILP), W/	m²K		T		1	(40)m	= (39)m ÷	(4)	,		
0)m= 1.1	11 '	1.11	1.1	1.09	1.09	1.07	1.07	1.07	1.08	1.09	1.09	1.1		
umber of	dave i	in mor	oth (Tabi	lo 1a)						Average =	Sum(40) ₁	12 /12=	1.09	(
	Ť	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
1)m= 3	_	28	31	30	31	30	31	31	30	31	30	31		(
/···														Ì
. Water h	neating	g ener	gy requi	rement:								kWh/ye	ear:	
sumed of if TFA > if TFA £	13.9, 1	N = 1 -		[1 - exp	(-0.0003	349 x (TF	FA -13.9))2)] + 0.0	0013 x (⁻	ΓFA -13.		32		(
nual ave duce the a	nnual a	verage i	hot water	usage by	5% if the a	lwelling is	designed t			se target o		.33		(
Ja	an	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
t water usa	age in lit	res per	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)	•		•			
)m= 98.	.27 9	94.69	91.12	87.55	83.97	80.4	80.4	83.97	87.55	91.12	94.69	98.27		_
erav conte	nt of ho	t water	used - cali	culated mo	onthly – 4	190 x Vd r	n x nm x F	OTm / 3600		Total = Su	` '	L	1072.02	
)m= 145		27.46	131.52	114.66	110.02	94.94	87.98	100.96	102.16	119.06	129.96	141.13		
140			101.02	114.00	110.02	04.04	07.00	100.50		Total = Su		L .	1405.59	
stantaneo	us wate	r heatin	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46			(12/112	L		
)m= 21.		9.12	19.73	17.2	16.5	14.24	13.2	15.14	15.32	17.86	19.49	21.17		
iter stora	•		. , ,						•					
•	•			•			_	within sa	ame ves	sei		0		
	-	-	nd no ta hot wate		•			(47) ombi boil	ers) ente	er 'O' in <i>(</i>	47)			
ater stora				(4.1.6 1.1					0.0, 0	· · · · · ·	,			
If manu	facture	er's de	eclared lo	oss facto	or is kno	wn (kWł	n/day):					0		
mperatu	re fact	or fror	m Table	2b								0		
ergy los	t from	water	storage	, kWh/ye	ear			(48) x (49)) =			0		
If manu				-										
	-		factor fr		e 2 (kW	h/litre/da	ıy)					0		
lume fac	-	_	ee sectio	311 4.3								0		
			m Table	2b							-	0		
•			storage		ar			(47) x (51)) x (52) x (53) =				
nter (50)			_	, IXVVII/ y C	Zai			(11) X (01))	00) –		0		
, ,	,	, ,	oulated f	or each	month			((56)m = ((55) × (41)	m				
	-	0	0	0	0	0	0	0	0	0	0	0		
\m_ (-	·				_	_			_	хН	
					0	0	0	0	0	0	0	0		
ylinder con	<u>, T</u>	0 I		()					. ~					
ylinder con	!_	0	0	0					!		l			
/linder con)m= 0 mary cir	cuit los	ss (an	nual) fro	m Table	3	<u> </u>	(EQ) + QQ	SE (44)	<u> </u>			0		
ylinder con)m= 0 mary cir mary cir	cuit los	ss (an	nual) fro culated f	m Table or each	3 month (59)m = (. ,	65 × (41)		r thermo		0		

Combi	loss ca	lculated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m=	50.08	43.59	46.43	43.17	42.79	39.65	40.97	42.7	9 43.17	46.43	46.7	50.08	1	(61)
Total h	eat req	uired for	water h	eating ca	alculated	for eac	h month	(62)n	า = 0.85 ×	(45)m +	(46)m +	(57)m +	· (59)m + (61)m	
(62)m=	195.81	171.04	177.96	157.84	152.82	134.59	128.95	143.7	75 145.34	165.49	176.66	191.21		(62)
Solar DH	W input	calculated	using App	endix G o	· Appendix	ι κ Η (negati	ve quantity	/) (ente	r '0' if no sola	r contribu	tion to wate	er heating)	•	
(add a	dditiona	I lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendi	x G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	•	(63) (G2)
Output	from w	ater hea	ter											
(64)m=	195.81	171.04	177.96	157.84	152.82	134.59	128.95	143.7	75 145.34	165.49	176.66	191.21		_
·			-	-	-		-	C	Output from w	ater heate	er (annual)	12	1941.45	(64)
Heat g	ains fro	m water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m] + 0.8	x [(46)m	+ (57)m	+ (59)m	١]	
(65)m=	60.97	53.28	55.34	48.92	47.28	41.48	39.5	44.2	7 44.76	51.2	54.89	59.45]	(65)
inclu	de (57)	m in cald	culation of	of (65)m	only if c	ylinder i	s in the	dwellir	ng or hot w	ater is f	rom com	munity h	neating	
5. Int	ernal ga	ains (see	e Table 5	and 5a):									
		ns (Table			,									
Motab	Jan	Feb	Mar	Apr	May	Jun	Jul	Au	g Sep	Oct	Nov	Dec]	
(66)m=	139.29	139.29	139.29	139.29	139.29	139.29	139.29	139.2	* 	139.29	139.29	139.29	1	(66)
Liahtin	u aains	(calcula	ted in Ar	ppendix	L. equat	ion L9 o	 r L9a). a	lso se	ee Table 5	!	Į		1	
(67)m=	45.62	40.52	32.95	24.95	18.65	15.74	17.01	22.1		37.68	43.98	46.88	1	(67)
Appliar	nces da	ins (calc	ulated ir	n Append	dix L. ea	uation L	13 or L1	ı 3а). а	lso see Ta	ble 5	<u> </u>		ı	
(68)m=	305.48	308.65	300.66	283.65	262.19	242.01	228.53	225.3		250.36	271.82	292]	(68)
	a gains	(calcula	ted in A	npendix	L. egua	tion L15	or L15a	L), also	see Table	. 5	<u>I</u>		1	
(69)m=	51.25	51.25	51.25	51.25	51.25	51.25	51.25	51.2		51.25	51.25	51.25	1	(69)
Pumns		ns gains	/Table !	L 5a)				<u> </u>				!	1	
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	1	(70)
		/aporatio	l	l		l							J	, ,
(71)m=	-92.86	-92.86	-92.86	-92.86	-92.86	-92.86	-92.86	-92.8	36 -92.86	-92.86	-92.86	-92.86	1	(71)
, ,		gains (T	<u> </u>	02.00	02.00	1 02.00	02.00		32.00	1 02.00	1 02.00	02.00	J	,
(72)m=	81.95	79.28	74.38	67.94	63.55	57.61	53.09	59.5	62.17	68.81	76.23	79.9	1	(72)
		gains =		07.54	00.00	<u> </u>			m + (69)m +	<u> </u>	<u> </u>		J	()
(73)m=	533.73	529.12	508.67	477.22	445.06	416.05	399.31	407.6		457.53	492.72	519.46	1	(73)
	ar gains		300.07	477.22	443.00	410.03	399.51	407.0	423.00	437.33	432.72	313.40		(10)
			using sola	r flux from	Table 6a	and assoc	iated equa	itions to	convert to the	ne applical	ble orientat	tion.		
•		Access F	•	Area		Flu			g_		FF		Gains	
0		Table 6d		m ²			ole 6a		Table 6b	Т	able 6c		(W)	
Southe	ast _{0.9x}	0.77	X	13.	33	x 3	6.79	x	0.63	x	0.7	=	149.89	(77)
Souther	ast _{0.9x}	0.77	X	13.	33	x 6	2.67	x	0.63	X	0.7	=	255.32	(77)
Southe	ast _{0.9x} [0.77	X	13.	33	x 8	5.75	x	0.63	x	0.7	=	349.34	(77)
Southe	ast _{0.9x}	0.77	х	13.	33	x 1	06.25	x	0.63	x	0.7	=	432.85	(77)
	L		•	•										_

Southeast 0.9x														
Southeast 0.9x	0.77	X	13.3	33	x	11	9.01	X	0.63	X	0.7	=	484.83	(77)
	0.77	X	13.3	33	x	11	8.15	X	0.63	X	0.7	=	481.32	(77)
Southeast 0.9x	0.77	X	13.3	33	x	11	3.91	X	0.63	X	0.7	=	464.05	(77)
Southeast 0.9x	0.77	X	13.3	33	x	10	4.39	x	0.63	X	0.7	=	425.27	(77)
Southeast 0.9x	0.77	X	13.3	33	x	92	2.85	X	0.63	X	0.7	=	378.26	(77)
Southeast 0.9x	0.77	X	13.3	33	x	69	9.27	X	0.63	x	0.7	=	282.18	(77)
Southeast 0.9x	0.77	X	13.3	33	x	44	4.07	x	0.63	x	0.7	=	179.54	(77)
Southeast 0.9x	0.77	X	13.3	33	x	3	1.49	x	0.63	x	0.7	_ =	128.28	(77)
Northwest _{0.9x}	0.77	X	5.6	4	x	11	1.28	x	0.63	X	0.7	=	19.45	(81)
Northwest 0.9x	0.77	X	5.6	4	x	22	2.97	x	0.63	x	0.7	=	39.59	(81)
Northwest _{0.9x}	0.77	X	5.6	4	x	4	1.38	x	0.63	x	0.7	_ =	71.32	(81)
Northwest 0.9x	0.77	X	5.6	4	x	67	7.96	x	0.63	x	0.7	_ =	117.13	(81)
Northwest 0.9x	0.77	x	5.6	4	x	9	1.35	x	0.63	x	0.7		157.45	(81)
Northwest 0.9x	0.77	X	5.6	4	x	97	7.38	x	0.63	x	0.7	=	167.86	(81)
Northwest 0.9x	0.77	x	5.6	4	x	9	1.1	x	0.63	x	0.7	=	157.03	(81)
Northwest 0.9x	0.77	x	5.6	4	x	72	2.63	х	0.63	x	0.7	=	125.18	(81)
Northwest 0.9x	0.77	x	5.6	4	x	50	0.42	x	0.63	x	0.7	=	86.91	(81)
Northwest 0.9x	0.77	x	5.6	4	x	28	3.07	x	0.63	x	0.7	=	48.38	(81)
Northwest _{0.9x}	0.77	X	5.6	4	x	1	4.2	х	0.63	x	0.7	=	24.47	(81)
Northwest _{0.9x}	0.77	X	5.6	4	x	9	.21	x	0.63	x	0.7	=	15.88	(81)
_					!									
Solar gains in v	watts, cal	culated	for each	n month	า			(83)m	n = Sum(74)m .	(82)m				
(83)m= 169.34	294.91	420.66	549.98	642.28	64	49.18	621.07	550	.45 465.17	330.56	204.01	144.16		(83)
Total gains – ir	nternal an	d solar	(84)m =	(73)m	+ (8	33)m ,	watts		•		•		•	
(84)m= 703.07	824.03	929.33	1027.21	1087.34	10	65.23	1020.38	958	891.05	788.09	696.72	663.62		(84)
7. Mean intern	nal tempe	rature (heating	seasor	n)									
Temperature	during he	ating pe	eriods in	the liv										
Litiliaatian faa	tor for gai	• .			ing .	area ti	rom lab	ole 9,	, Th1 (°C)				21	(85)
Utilisation factor for gains for living area, h1,m (see Table 9a)													21	(85)
Jan	Feb	ns for li Mar	ving are Apr		n (s				, Th1 (°C)	Oct	Nov	Dec	21	(85)
F	Ť			a, h1,n	n (s	ee Tal	ole 9a)		ug Sep	Oct	Nov 0.97	Dec 0.99	21	(85)
(86)m= Jan 0.98	Feb 0.96	Mar 0.92	Apr 0.81	a, h1,n May 0.65	n (s	ee Tal Jun 0.47	Jul 0.34	A:	ug Sep 37 0.59	-	+		21	
Jan	Feb 0.96	Mar 0.92	Apr 0.81	a, h1,n May 0.65	n (se	ee Tal Jun 0.47	Jul 0.34	A:	ug Sep 37 0.59 Table 9c)	-	0.97		21	
(86)m=	Feb 0.96 ltemperar 20.34	Mar 0.92 ture in 1 20.59	Apr 0.81 iving are 20.83	0.65 ea T1 (f	n (se	Jun 0.47 w step	ole 9a) Jul 0.34 os 3 to 7 21	0.3 in T	ug Sep 87 0.59 Table 9c) 1 20.98	0.86	0.97	0.99	21	(86)
Jan (86)m= 0.98 Mean internal (87)m= 20.14 Temperature	Feb 0.96 I temperate 20.34 during he	Mar 0.92 ture in li 20.59 ating pe	Apr 0.81 iving are 20.83 eriods in	ea, h1,n May 0.65 ea T1 (f 20.96 rest of	n (se	ee Tal Jun 0.47 w ster 0.99 relling	ole 9a) Jul 0.34 os 3 to 7 21 from Ta	Au 0.3 ' in T	ug Sep 37 0.59 Table 9c) 1 20.98 9, Th2 (°C)	20.81	20.43	0.99	21	(86)
Jan (86)m= 0.98	Feb 0.96 I temperat 20.34 during he	Mar 0.92 ture in li 20.59 ating pe	Apr 0.81 iving are 20.83 eriods in 20.01	may 0.65 ea T1 (for 20.96 rest of 20.01	follo f dw	Jun 0.47 w step 0.99 celling 0.02	ole 9a) Jul 0.34 os 3 to 7 21 from Ta 20.02	Ai 0.3 7 in T 2 9	ug Sep 37 0.59 Table 9c) 1 20.98 9, Th2 (°C)	0.86	20.43	0.99	21	(86)
Jan (86)m= 0.98 Mean internal (87)m= 20.14 Temperature (88)m= 19.99 Utilisation fac	Feb 0.96 tempera 20.34 during he 20 tor for gain	Mar 0.92 ture in li 20.59 ating per 20 ns for re	Apr 0.81 iving are 20.83 eriods in 20.01 est of dv	a, h1,n May 0.65 ea T1 (f 20.96 rest of 20.01 velling,	follo f dw	Jun 0.47 w step 0.99 relling 0.02 m (se	ole 9a) Jul 0.34 os 3 to 7 21 from Ta 20.02 e Table	Ai 0.37 in T 2.18 ble 9 20.49 20.49	ug Sep 37 0.59 Table 9c) 1 20.98 9, Th2 (°C) 03 20.02	20.81	20.43	20.1	21	(86) (87) (88)
Jan (86)m= 0.98	Feb 0.96 I temperat 20.34 during he	Mar 0.92 ture in li 20.59 ating pe	Apr 0.81 iving are 20.83 eriods in 20.01	may 0.65 ea T1 (for 20.96 rest of 20.01	follo f dw	Jun 0.47 w step 0.99 celling 0.02	ole 9a) Jul 0.34 os 3 to 7 21 from Ta 20.02	Ai 0.3 7 in T 2 9	ug Sep 37 0.59 Table 9c) 1 20.98 9, Th2 (°C) 03 20.02	20.81	20.43	0.99	21	(86)
Jan (86)m= 0.98 Mean internal (87)m= 20.14 Temperature (88)m= 19.99 Utilisation fac (89)m= 0.98 Mean internal	Feb 0.96 I temperate 20.34 during he 20 tor for gain 0.95 I temperate	Mar 0.92 ture in li 20.59 ating pe 20 ns for r 0.9 ture in t	Apr 0.81 iving are 20.83 eriods in 20.01 est of dv 0.77 he rest of	ea, h1,n May 0.65 ea T1 (f 20.96 rest of 20.01 velling, 0.59	follo 2 f dw 2 h2,	w step 0.99 elling 0.02 m (se 0.4	Jul 0.34 0.34 0.35 3 to 7 21 from Ta 20.02 e Table 0.26	Ai 0.33	ug Sep 37 0.59 Table 9c) 1 20.98 9, Th2 (°C) 03 20.02 to 7 in Table	0.86 20.81 20.01 0.82 e 9c)	20.43	0.99 20.1 20 0.98		(86) (87) (88) (89)
Jan (86)m= 0.98 Mean internal (87)m= 20.14 Temperature (88)m= 19.99 Utilisation fact (89)m= 0.98	Feb 0.96 temperate 20.34 during he 20 tor for gain 0.95	Mar 0.92 ture in li 20.59 ating per 20 ns for re 0.9	Apr 0.81 iving are 20.83 eriods in 20.01 est of dv 0.77	a, h1,n May 0.65 ea T1 (f 20.96 rest of 20.01 velling, 0.59	follo 2 f dw 2 h2,	Jun 0.47 w step 0.99 relling 0.02 m (second	ole 9a) Jul 0.34 os 3 to 7 21 from Ta 20.02 e Table 0.26	Ai 0.37 in T 2° ble 9 20.49 9a) 0.5	ug Sep 37 0.59 Table 9c) 1 20.98 9, Th2 (°C) 03 20.02 to 7 in Table 02 20.01	0.86 20.81 20.01 0.82 le 9c) 19.82	0.97 20.43 20.01 0.95	0.99 20.1 20 0.98		(86) (87) (88) (89)
Jan (86)m= 0.98 Mean internal (87)m= 20.14 Temperature (88)m= 19.99 Utilisation fac (89)m= 0.98 Mean internal	Feb 0.96 I temperate 20.34 during he 20 tor for gain 0.95 I temperate	Mar 0.92 ture in li 20.59 ating pe 20 ns for r 0.9 ture in t	Apr 0.81 iving are 20.83 eriods in 20.01 est of dv 0.77 he rest of	ea, h1,n May 0.65 ea T1 (f 20.96 rest of 20.01 velling, 0.59	follo 2 f dw 2 h2,	w step 0.99 elling 0.02 m (se 0.4	Jul 0.34 0.34 0.35 3 to 7 21 from Ta 20.02 e Table 0.26	Ai 0.33	ug Sep 37 0.59 Table 9c) 1 20.98 9, Th2 (°C) 03 20.02 to 7 in Table 02 20.01	0.86 20.81 20.01 0.82 le 9c) 19.82	20.43	0.99 20.1 20 0.98	21]]] 0.41	(86) (87) (88) (89)
Jan (86)m= 0.98 Mean internal (87)m= 20.14 Temperature (88)m= 19.99 Utilisation fact (89)m= 0.98 Mean internal	Feb 0.96 I temperate 20.34 during he 20 tor for gain 0.95 I temperate 19.17	Mar 0.92 ture in li 20.59 ating per 20 ns for re 0.9 ture in t	Apr 0.81 iving are 20.83 eriods in 20.01 est of dv 0.77 he rest of 19.83	a, h1,n May 0.65 ea T1 (f 20.96 rest of 20.01 velling, 0.59 of dwel 19.98	follo follo follo follo follo follo follo general filter h2, h2, general filter gen	w step 0.47 w step 0.99 elling 0.02 m (second) T2 (focond)	ole 9a) Jul 0.34 os 3 to 7 21 from Ta 20.02 e Table 0.26 ollow ste 20.02	Ai 0.3 ' in T 2 ble 9 20. 9a) 0.3	ug Sep 67 0.59 Table 9c) 1 20.98 9, Th2 (°C) 03 20.02 to 7 in Table 02 20.01	0.86 20.81 20.01 0.82 le 9c) 19.82	0.97 20.43 20.01 0.95	0.99 20.1 20 0.98		(86) (87) (88) (89)
Jan (86)m= 0.98 Mean internal (87)m= 20.14 Temperature (88)m= 19.99 Utilisation fact (89)m= 0.98 Mean internal (90)m= 18.88	Feb 0.96 I temperate 20.34 during he 20 tor for gain 0.95 I temperate 19.17	Mar 0.92 ture in li 20.59 ating per 20 ns for re 0.9 ture in t	Apr 0.81 iving are 20.83 eriods in 20.01 est of dv 0.77 he rest of 19.83	a, h1,n May 0.65 ea T1 (f 20.96 rest of 20.01 velling, 0.59 of dwel 19.98	f dw ling 2	w step 0.47 w step 0.99 elling 0.02 m (second) T2 (focond)	ole 9a) Jul 0.34 os 3 to 7 21 from Ta 20.02 e Table 0.26 ollow ste 20.02	Ai 0.3 ' in T 2 ble 9 20. 9a) 0.3	ug Sep 87 0.59 Table 9c) 1 20.98 9, Th2 (°C) 03 20.02 to 7 in Table 02 20.01 - fLA) × T2	0.86 20.81 20.01 0.82 le 9c) 19.82	0.97 20.43 20.01 0.95 19.31 ring area ÷ (-	0.99 20.1 20 0.98		(86) (87) (88) (89)

													_	
(93)m=	19.25	19.5	19.8	20.09	20.23	20.27	20.27	20.27	20.25	20.07	19.62	19.2		(93)
8. Spa	ace heat	ing requ	uirement											
				•		ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	culate	
tne uti	Jan	Feb	or gains Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
l Itilisa			ains, hm	•	iviay	Juli	Jui	Aug	Sep	Oct	INOV	Dec		
(94)m=	0.97	0.95	0.89	0.78	0.6	0.42	0.28	0.32	0.53	0.82	0.95	0.98		(94)
L	I gains,	hmGm .	, W = (94	1)m x (84	4)m									
(95)m=	684.91	781.01	829.77	796.5	655.32	442.62	288.16	303.04	476.43	646.61	661.26	650.04		(95)
Month	ly avera	ige exte	rnal tem	perature	from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
г			an intern				=[(39)m	x [(93)m	– (96)m				•	
` ′ L	1214.23		1074.45	891.82	677.66	445.13	288.41	303.5	485.5	752.73	1000.27	1204.93		(97)
. г	i	•	1			ī	ı	24 x [(97	<u> </u>	<u> </u>	r	1	1	
(98)m=	393.81	269.74	182.05	68.63	16.62	0	0	0	0	78.95	244.09	412.84		7,55
								Tota	l per year	(kWh/yeaı	r) = Sum(9	8) _{15,912} =	1666.73	(98)
Space	e heating	g require	ement in	kWh/m²	/year								22.77	(99)
9a. Ene	ergy req	uiremer	nts – Indi	vidual h	eating sy	ystems i	ncluding	micro-C	CHP)					
-	e heatin	•												_
Fraction	on of sp	ace hea	it from se	econdar	y/supple	mentary	system						0	(201)
Fraction	on of sp	ace hea	at from m	nain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fraction	on of tot	al heatii	ng from	main sys	stem 1			(204) = (2	02) x [1 –	(203)] =			1	(204)
Efficie	ency of n	nain spa	ace heat	ing syste	em 1								96.8	(206)
Efficie	ency of s	econda	ry/supple	ementar	y heating	g system	າ, %						0	(208)
ſ	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	 ar
Space	e heating	g require	ement (c	alculate	d above))								
	393.81	269.74	182.05	68.63	16.62	0	0	0	0	78.95	244.09	412.84		
(211)m	= {[(98)	m x (20	4)] } x 1	00 ÷ (20	06)									(211)
[406.83	278.66	188.07	70.9	17.17	0	0	0	0	81.56	252.15	426.49		
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	<u></u>	1721.83	(211)
•			econdar	• •	month									
i i	<u> </u>		00 ÷ (20			Γ	Ι		I		Г	Ι	1	
(215)m=	0	0	0	0	0	0	0	0 	0	0	0	0		7,
								Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}	F	0	(215)
	heating		tor (oolo	ام امداداد										
Output	195.81	171.04	ter (calc	157.84	152.82	134.59	128.95	143.75	145.34	165.49	176.66	191.21		
L Efficien	ncy of wa												87.5	(216)
(217)m=		92.97	91.97	90.12	88.33	87.5	87.5	87.5	87.5	90.3	92.66	93.65		(217)
L			kWh/mo											
			÷ (217)			•	•		•				•	
(219)m=	209.42	183.98	193.5	175.14	173	153.82	147.37	164.28	166.1	183.27	190.65	204.17		_
								Tota	I = Sum(2				2144.7	(219)
Annua		- امنگ	''	a e. t	4					k'	Wh/year	•	kWh/year	¬
Space	neating	tuel use	ed, main	system	1								1721.83	

Water heating fuel used			2144.7
Electricity for pumps, fans and electric keep-ho	nt.		2144.7
central heating pump:	Si .	30	(230c
Total electricity for the above, kWh/year	sum of (23)	0a)(230g) =	30 (231)
Electricity for lighting	,	, , ,	322.24 (232)
Total delivered energy for all uses (211)(221) + (231) + (232)(237b) =		4218.76 (338)
10a. Fuel costs - individual heating systems:	, (= , (= , , (= = , ,		
Ŭ,	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	3.48 × 0.01	= 59.92 (240)
Space heating - main system 2	(213) x	0 x 0.01	= 0 (241)
Space heating - secondary	(215) x	13.19 × 0.01	= 0 (242)
Water heating cost (other fuel)	(219)	3.48 × 0.01	= 74.64 (247)
Pumps, fans and electric keep-hot	(231)	13.19 × 0.01	3.96 (249)
(if off-peak tariff, list each of (230a) to (230g) s Energy for lighting	eparately as applicable and ap	oply fuel price according t	
Additional standing charges (Table 12)		161.16	120 (251)
Appendix Q items: repeat lines (253) and (254) as needed		
• • • • • • • • • • • • • • • • • • • •	.(247) + (250)(254) =		301.02 (255)
11a. SAP rating - individual heating systems			
Energy cost deflator (Table 12)			0.42 (256)
Energy cost factor (ECF) [(255)	(256)] ÷ $[(4) + 45.0]$ =		1.07 (257)
SAP rating (Section 12)			85.08 (258)
12a. CO2 emissions – Individual heating syst	ems including micro-CHP		
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	371.92 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	463.25 (264)
Space and water heating	(261) + (262) + (263) + (264) =		835.17 (265)
Electricity for pumps, fans and electric keep-ho	ot (231) x	0.519 =	15.57 (267)
Electricity for lighting	(232) x	0.519 =	167.24 (268)
Total CO2, kg/year	su	m of (265)(271) =	1017.98 (272)
CO2 emissions per m²	(2)	72) ÷ (4) =	13.9 (273)
EI rating (section 14)			88 (274)

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.22	=	2100.63	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	2616.53	(264)
Space and water heating	(261) + (262) + (263) + (264) =			4717.16	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	92.1	(267)
Electricity for lighting	(232) x	0	=	989.27	(268)
'Total Primary Energy	sum	of (265)(271) =		5798.53	(272)
Primary energy kWh/m²/year	(272	2) ÷ (4) =		79.2	(273)

		User D	Details: _						
Assessor Name: Software Name:	Bethany Robinson Stroma FSAP 2012		Strom Softwa					0036516 on: 1.0.5.60	
Address :	F	Property	Address	: FF Flat	t				
1. Overall dwelling dime	ensions:								
		Area	a(m²)	-	Av. He	ight(m)	_	Volume(m	3)
Ground floor		7	73.21	(1a) x		2.5	(2a) =	183.02	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1	n) 7	73.21	(4)					
Dwelling volume				(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	183.02	(5)
2. Ventilation rate:									
	main seconda heating heating	ry 	other		total			m³ per hou	ır
Number of chimneys	0 + 0	+	0	=	0	X	40 =	0	(6a)
Number of open flues	0 + 0	+	0] = [0	X :	20 =	0	(6b)
Number of intermittent fa	ans				3	X	10 =	30	(7a)
Number of passive vents	3			Γ	0	x	10 =	0	(7b)
Number of flueless gas f	ires			Ī	0	X 4	40 =	0	(7c)
				_			A ! I		
1 696 - 21 - 1 - 2 - 1 - 2	(0-)-(0)-(1	7 -) - (7 1-) - ((7 -)	_				nanges per ho	_
	eys, flues and fans = (6a)+(6b)+(6b)+(6b)+(6b)+(6b)+(6b)+(6b)+(6b			continue fi	30 rom (9) to		÷ (5) =	0.16	(8)
Number of storeys in t					o (o) to	(1.0)		0	(9)
Additional infiltration						[(9)	-1]x0.1 =	0	(10)
	0.25 for steel or timber frame of			•	ruction			0	(11)
if both types of wall are p deducting areas of openi	resent, use the value corresponding to ings); if equal user 0.35	o the great	ter wall are	ea (atter					
If suspended wooden	floor, enter 0.2 (unsealed) or 0	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, en								0	(13)
Percentage of window Window infiltration	s and doors draught stripped		0.25 - [0.2) v (14) · 4	1001 -			0	(14)
Infiltration rate			(8) + (10)		_	+ (15) =		0	(15)
	q50, expressed in cubic metre	es per ho					area	5	(17)
•	lity value, then $(18) = [(17) \div 20] + (18)$		•	•		'		0.41	(18)
	es if a pressurisation test has been do	ne or a de	gree air pe	rmeability	is being u	sed			
Number of sides sheltere Shelter factor	ed		(20) = 1 -	[0 075 x (19)1 =			2	(19)
Infiltration rate incorpora	ting shelter factor		(21) = (18)					0.85	(20)
Infiltration rate modified	•		() (-	, (-,				0.33	(21)
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
Monthly average wind sp				•	•		•	•	
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7]	
Wind Easter (22a) == (2	2)m · 4								
Wind Factor $(22a)m = (2(22a)m = 1.27)$ 1.25	2)m ÷ 4 1.23	0.95	0.92	1	1.08	1.12	1.18	1	
(-24)	0 0.90	1 3.33	1 5.52	<u> </u>	L	12	10	J	

Adjusted infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.33	0.35	0.38	0.4	0.41]	
Calculate effe		_	rate for t	he appli	cable ca	se						- -	
If mechanical If exhaust air h			endix N (2	3h) = (23a	a) × Fmv (e	equation (1	N5)) othe	rwise (23h) = (23a)			0	(23
If balanced with) — (20 0)			0	(23
a) If balance		•	•	ŭ		`		,	Dh\m ı (23h) v [4	1 (220)	0	(23
24a)m= 0	0	0	0	0	0	0	0	0	0	0	0] - 100j	(24
b) If balance												J	(_
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(24
c) If whole h					<u> </u>		<u> </u>					J	(-
,	n < 0.5 ×			•	•				5 × (23b	o)			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(24
d) If natural	ventilatio	n or wh	ole hous	e positiv	/e input	ventilatio	n from I	oft	<u> </u>	<u> </u>	<u> </u>	J	
,	n = 1, th								0.5]				
24d)m= 0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59]	(24
Effective air	change	rate - er	nter (24a	or (24b	o) or (24	c) or (24	d) in box	(25)				-	
25)m= 0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59]	(25
3. Heat losse	s and he	at loce i	aramata	or:								_	
	S and ne		Openin		Net Ar	00	U-valı	10	AXU		k-value	2	ΑΧk
LEMENT	area	-	operiiri m		A,r		W/m2		(W/	K)	kJ/m ² ·	-	kJ/K
Doors					1.89	X	1.6	_ [3.024				(26
Vindows Type	e 1				13.33	x1.	/[1/(1.3)+	0.04] =	16.47	=			(27
Vindows Type	e 2				5.64	x1	/[1/(1.3)+	0.04] =	6.97	=			(27
Valls Type1	71.9	12	18.9	7	52.95	_	0.24		12.71	=		\neg	(29
Valls Type2	13.0		1.89	=	11.14	=	0.11		1.17	터 ¦		╡	(29
otal area of e			1.08			=	0.11		1.17				
for windows and		•	offective wi	ndow I I-vs	84.95		ı formula 1	/[(1/ -valu	د 0.41 (مر	as aiven in	naragrani	h 32	(3
* include the are						atou using	nonnula 1	/[((C)+0.0+j c	is given in	paragrapi	7 3.2	
abric heat lo	ss, W/K :	= S (A x	U)				(26)(30)	+ (32) =				40.34	1 (3:
leat capacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	0	(34
hermal mass	parame	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(3
or design asses	sments wh	ere the de	tails of the	construct	ion are no	known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
an be used inste													
hermal bridg	,	,		٠.	•	<						4.61	(30
details of therma otal fabric he		are not kn	own (36) =	= 0.05 x (3	11)			(22) 1	(36) =				- 1/0
		alaulataa	المعمدال	,						0E\m v (E)		44.9	(3.
entilation hea	i	i			1, ,	1, ,1	۸			25)m x (5)	T _	1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1	(38
38)m= 36.28	36.04	35.81	34.72	34.52	33.57	33.57	33.4	33.94	34.52	34.93	35.36	J	(3)
leat transfer	1				ı		ı	- ` 	= (37) + (·	1	
39)m= 81.23	80.99	80.76	79.68	79.47	78.53	78.53	78.35	78.89	79.47	79.88	80.31		
										Sum(39) ₁		79.68	3 (3

Heat loss para	ımeter (I	HLP). W/	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 1.11	1.11	1.1	1.09	1.09	1.07	1.07	1.07	1.08	1.09	1.09	1.1		
	ļ	!		ļ		ļ	ļ		L Average =	Sum(40) ₁	12 /12=	1.09	(40)
Number of day	/s in mo	nth (Tab	le 1a)	1				1	1	1			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water hea	ting ene	rgy requi	rement:								kWh/ye	ear:	
Assumed occupancy, N													
Annual average Reduce the annual not more that 125	, al average	hot water	usage by	5% if the α	lwelling is	designed t	` ,		se target o		.33		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage i	n litres pe	r day for ea			ctor from	Table 1c x			!	!			
(44)m= 98.27	94.69	91.12	87.55	83.97	80.4	80.4	83.97	87.55	91.12	94.69	98.27		
	•	•				!	!			m(44) ₁₁₂ =		1072.02	(44)
Energy content of	hot water	used - cal	culated m	onthly = 4.	190 x Vd,r	n x nm x C	OTm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 145.73	127.46	131.52	114.66	110.02	94.94	87.98	100.96	102.16	119.06	129.96	141.13		_
If instantaneous v	vater heati	na at noint	of use (no	n hot water	· storage)	enter∩in	hoves (46		Total = Su	m(45) ₁₁₂ =	-	1405.59	(45)
			,		, , , , , , , , , , , , , , , , , , ,		, ,	, , , -	17.00	1 40 40	04.47		(46)
(46)m= 21.86 Water storage	19.12 loss:	19.73	17.2	16.5	14.24	13.2	15.14	15.32	17.86	19.49	21.17		(46)
Storage volum) includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	neating a	and no ta	nk in dw	velling, e	nter 110	litres in	(47)						
Otherwise if no	o stored	hot wate	er (this in	ncludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in ((47)			
Water storage					4.144	<i>,</i> , , ,							
a) If manufact				or is kno	wn (kVVI	n/day):					0		(48)
Temperature f											0		(49)
Energy lost from b) If manufact		_	-		or io not		(48) x (49)) =			0		(50)
Hot water stor			-								0		(51)
If community h	•			•		,					<u> </u>		, ,
Volume factor	from Ta	ble 2a									0		(52)
Temperature f	actor fro	m Table	2b								0		(53)
Energy lost fro		_	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter (50) or	` , ` `	,									0		(55)
Water storage	loss cal	culated f	or each	month			((56)m = ((55) × (41)	m				
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contains	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where ((H11) is fro	m Append	ix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit	loss (ar	nnual) fro	m Table	e 3							0		(58)
Primary circuit	•	•			59)m = ((58) ÷ 36	65 × (41)	m		_			
(modified by	factor f	rom Tab	le H5 if t	here is s	olar wat	ter heatii	ng and a	cylinde	r thermo	stat)			
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$ $(61)m = \begin{bmatrix} 50.08 & 43.59 & 46.43 & 43.17 & 42.79 & 39.65 & 40.97 & 42.79 & 43.17 & 46.43 & 46.7 & 50.08 \end{bmatrix}$ $(61)m = \begin{bmatrix} 50.08 & 43.59 & 46.43 & 43.17 & 42.79 & 39.65 & 40.97 & 42.79 & 43.17 & 46.43 & 46.7 & 50.08 \end{bmatrix}$ $(61)m = \begin{bmatrix} 50.08 & 43.59 & 46.43 & 43.17 & 42.79 & 39.65 & 40.97 & 42.79 & 43.17 & 46.43 & 46.7 & 50.08 \end{bmatrix}$ $(61)m = \begin{bmatrix} 50.08 & 43.59 & 46.43 & 43.17 & 42.79 & 39.65 & 40.97 & 42.79 & 43.17 & 46.43 & 46.7 & 50.08 \end{bmatrix}$ $(61)m = \begin{bmatrix} 50.08 & 43.59 & 46.43 & 43.17 & 42.79 & 39.65 & 40.97 & 42.79 & 43.17 & 46.43 & 46.7 & 50.08 \end{bmatrix}$ $(61)m = \begin{bmatrix} 50.08 & 43.59 & 46.43 & 43.17 & 42.79 & 39.65 & 40.97 & 42.79 & 43.17 & 46.43 & 46.7 & 50.08 \end{bmatrix}$
Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m
(62)m= 195.81 171.04 177.96 157.84 152.82 134.59 128.95 143.75 145.34 165.49 176.66 191.21 (62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (63)
FHRS 0 0 0 0 0 0 0 0 0 0 0 0 0 0 (63) (G2)
Output from water heater
(64)m= 195.81 171.04 177.96 157.84 152.82 134.59 128.95 143.75 145.34 165.49 176.66 191.21
Output from water heater (annual) ₁₁₂ 1941.45 (64)
Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]
(65)m= 60.97 53.28 55.34 48.92 47.28 41.48 39.5 44.27 44.76 51.2 54.89 59.45 (65)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating
5. Internal gains (see Table 5 and 5a):
Metabolic gains (Table 5), Watts
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
(66)m= 116.07 116.07 116.07 116.07 116.07 116.07 116.07 116.07 116.07 116.07 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
(68)m= 204.67 206.79 201.44 190.05 175.67 162.15 153.12 150.99 156.35 167.74 182.12 195.64 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
(69)m= 34.61 34.61 34.61 34.61 34.61 34.61 34.61 34.61 34.61 (69)
Pumps and fans gains (Table 5a)
(70)m= 3 3 3 3 3 3 3 3 3 3 3 (70)
Losses e.g. evaporation (negative values) (Table 5)
(71)m= -92.86 -92.86 -92.86 -92.86 -92.86 -92.86 -92.86 -92.86 -92.86 -92.86 -92.86 (71)
Water heating gains (Table 5)
(72)m= 81.95 79.28 74.38 67.94 63.55 57.61 53.09 59.5 62.17 68.81 76.23 79.9 (72)
Total internal gains = $(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$
(73)m= 365.69 363.1 349.83 328.79 307.5 286.88 273.83 280.16 291.21 312.45 336.77 355.11 (73)
6. Solar gains:
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.
Orientation: Access Factor Area Flux g_ FF Gains
Table 6d m ² Table 6a Table 6b Table 6c (W)
Southeast 0.9x 0.77 x 13.33 x 36.79 x 0.63 x 0.7 = 149.89 (77)
Southeast 0.9x 0.77 x 13.33 x 62.67 x 0.63 x 0.77 = 255.32 (77)
Southeast 0.9x 0.77 x 13.33 x 85.75 x 0.63 x 0.7 = 349.34 (77)
Southeast 0.9x 0.77 x 13.33 x 106.25 x 0.63 x 0.77 = 432.85 (77)

Southeast 0.9x 0.77 x 13.33 x 119.01 x 0.63 x 0.7 = Southeast 0.9x 0.77 x 13.33 x 118.15 x 0.63 x 0.7 = Southeast 0.9x 0.77 x 13.33 x 113.91 x 0.63 x 0.7 = Southeast 0.9x 0.77 x 13.33 x 104.39 x 0.63 x 0.7 =	484.83	(77)
Southeast 0.9x 0.77 x 13.33 x 113.91 x 0.63 x 0.7 =	707.00	(77)
Operational Contract	481.32	(77)
Southeast 0.9x 0.77 x 13.33 x 104.39 x 0.63 x 0.7 =	464.05	(77)
0.77	425.27	(77)
Southeast 0.9x 0.77 x 13.33 x 92.85 x 0.63 x 0.7 =	378.26	(77)
Southeast 0.9x 0.77 x 13.33 x 69.27 x 0.63 x 0.7 =	282.18	(77)
Southeast 0.9x 0.77 x 13.33 x 44.07 x 0.63 x 0.7 =	179.54	(77)
Southeast 0.9x 0.77 x 13.33 x 31.49 x 0.63 x 0.7 =	128.28	(77)
Northwest 0.9x 0.77 x 5.64 x 11.28 x 0.63 x 0.7 =	19.45	(81)
Northwest 0.9x 0.77 x 5.64 x 22.97 x 0.63 x 0.7 =	39.59	(81)
Northwest 0.9x 0.77 x 5.64 x 41.38 x 0.63 x 0.7 =	71.32	(81)
Northwest 0.9x 0.77 x 5.64 x 67.96 x 0.63 x 0.7 =	117.13	(81)
Northwest 0.9x 0.77 x 5.64 x 91.35 x 0.63 x 0.7 =	157.45	(81)
Northwest 0.9x 0.77 x 5.64 x 97.38 x 0.63 x 0.7 =	167.86	(81)
Northwest 0.9x 0.77 x 5.64 x 91.1 x 0.63 x 0.7 =	157.03	(81)
Northwest 0.9x 0.77 x 5.64 x 72.63 x 0.63 x 0.7 =	125.18	(81)
Northwest 0.9x 0.77 x 5.64 x 50.42 x 0.63 x 0.7 =	86.91	(81)
Northwest 0.9x 0.77 x 5.64 x 28.07 x 0.63 x 0.7 =	48.38	(81)
Northwest 0.9x 0.77 x 5.64 x 14.2 x 0.63 x 0.7 =	24.47	(81)
	15.88	(81)
Northwest 0.9x 0.77 x 5.64 x 9.21 x 0.63 x 0.7 =		_
Northwest 0.9x 0.77		
Northwest 0.9x 0.77 x 5.64 x 9.21 x 0.63 x 0.7 = Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m= 169.34 294.91 420.66 549.98 642.28 649.18 621.07 550.45 465.17 330.56 204.01 144.16		(83)
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m		(83)
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m= 169.34 294.91 420.66 549.98 642.28 649.18 621.07 550.45 465.17 330.56 204.01 144.16		(83)
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m = 169.34 294.91 420.66 549.98 642.28 649.18 621.07 550.45 465.17 330.56 204.01 144.16 Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m = 535.03 658.01 770.49 878.77 949.77 936.06 894.9 830.61 756.38 643.01 540.77 499.27		
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m = 169.34 294.91 420.66 549.98 642.28 649.18 621.07 550.45 465.17 330.56 204.01 144.16 Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m = 535.03 658.01 770.49 878.77 949.77 936.06 894.9 830.61 756.38 643.01 540.77 499.27 7. Mean internal temperature (heating season)	21	(84)
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m = 169.34 294.91 420.66 549.98 642.28 649.18 621.07 550.45 465.17 330.56 204.01 144.16 Total gains – internal and solar (84)m = (73) m + (83) m , watts (84)m = 535.03 658.01 770.49 878.77 949.77 936.06 894.9 830.61 756.38 643.01 540.77 499.27 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C)	21	
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m = 169.34 294.91 420.66 549.98 642.28 649.18 621.07 550.45 465.17 330.56 204.01 144.16 Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m = 535.03 658.01 770.49 878.77 949.77 936.06 894.9 830.61 756.38 643.01 540.77 499.27 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) Utilisation factor for gains for living area, h1,m (see Table 9a)	21	(84)
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m = 169.34 294.91 420.66 549.98 642.28 649.18 621.07 550.45 465.17 330.56 204.01 144.16 Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m = 535.03 658.01 770.49 878.77 949.77 936.06 894.9 830.61 756.38 643.01 540.77 499.27 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) Utilisation factor for gains for living area, h1,m (see Table 9a)	21	(84)
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m = 169.34 294.91 420.66 549.98 642.28 649.18 621.07 550.45 465.17 330.56 204.01 144.16 Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m = 535.03 658.01 770.49 878.77 949.77 936.06 894.9 830.61 756.38 643.01 540.77 499.27 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) Utilisation factor for gains for living area, h1,m (see Table 9a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (86)m = 1 0.99 0.96 0.88 0.72 0.53 0.38 0.43 0.68 0.93 0.99 1	21	(84)
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m = 169.34 294.91 420.66 549.98 642.28 649.18 621.07 550.45 465.17 330.56 204.01 144.16 Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m = 535.03 658.01 770.49 878.77 949.77 936.06 894.9 830.61 756.38 643.01 540.77 499.27 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) Utilisation factor for gains for living area, h1,m (see Table 9a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (86)m = 1 0.99 0.96 0.88 0.72 0.53 0.38 0.43 0.68 0.93 0.99 1 Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)	21	(84)
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m = 169.34 294.91 420.66 549.98 642.28 649.18 621.07 550.45 465.17 330.56 204.01 144.16 Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m = 535.03 658.01 770.49 878.77 949.77 936.06 894.9 830.61 756.38 643.01 540.77 499.27 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) Utilisation factor for gains for living area, h1,m (see Table 9a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (86)m = 1 0.99 0.96 0.88 0.72 0.53 0.38 0.43 0.68 0.93 0.99 1 Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m = 19.93 20.15 20.44 20.75 20.93 20.99 21 21 20.96 20.7 20.25 19.9	21	(84)
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m = 169.34	21	(84) (85) (86) (87)
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m = 169.34 294.91 420.66 549.98 642.28 649.18 621.07 550.45 465.17 330.56 204.01 144.16 Total gains – internal and solar (84)m = (73)m + (83)m, watts (84)m = 535.03 658.01 770.49 878.77 949.77 936.06 894.9 830.61 756.38 643.01 540.77 499.27 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) Utilisation factor for gains for living area, h1,m (see Table 9a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (86)m = 1 0.99 0.96 0.88 0.72 0.53 0.38 0.43 0.68 0.93 0.99 1 Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m = 19.93 20.15 20.44 20.75 20.93 20.99 21 21 20.96 20.7 20.25 19.9 Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m = 19.99 20 20 20.01 20.01 20.02 20.02 20.03 20.02 20.01 20.01 20.01 20	21	(84)
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m = 169.34	21	(84) (85) (86) (87) (88)
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m = 169.34 294.91 420.66 549.98 642.28 649.18 621.07 550.45 465.17 330.56 204.01 144.16 Total gains – internal and solar (84)m = (73)m + (83)m, watts (84)m = 535.03 658.01 770.49 878.77 949.77 936.06 894.9 830.61 756.38 643.01 540.77 499.27 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) Utilisation factor for gains for living area, h1,m (see Table 9a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (86)m = 1 0.99 0.96 0.88 0.72 0.53 0.38 0.43 0.68 0.93 0.99 1 Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m = 19.93 20.15 20.44 20.75 20.93 20.99 21 21 20.96 20.7 20.25 19.9 Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m = 19.99 20 20 20.01 20.01 20.02 20.02 20.03 20.02 20.01 20.01 20.01 20	21	(84) (85) (86) (87)
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m = 169.34	21	(84) (85) (86) (87) (88)
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m= 169.34	21	(84) (85) (86) (87) (88) (89)
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m = 169.34	0.41	(84) (85) (86) (87) (88) (89)
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m= 169.34 294.91 420.66 549.98 642.28 649.18 621.07 550.45 465.17 330.56 204.01 144.16 Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m= 535.03 658.01 770.49 878.77 949.77 936.06 894.9 830.61 756.38 643.01 540.77 499.27 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) Utilisation factor for gains for living area, h1,m (see Table 9a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (86)m= 1 0.99 0.96 0.88 0.72 0.53 0.38 0.43 0.68 0.93 0.99 1 Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m= 19.93 20.15 20.44 20.75 20.93 20.99 21 21 20.96 20.7 20.25 19.9 Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m= 19.99 20 20 20.01 20.01 20.02 20.02 20.03 20.02 20.01 20.01 20.01 20 Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) (89)m= 0.99 0.98 0.95 0.84 0.66 0.45 0.3 0.34 0.6 0.9 0.98 1 Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m= 18.59 18.9 19.31 19.74 19.95 20.02 20.02 20.02 19.99 19.69 19.06 18.54		(84) (85) (86) (87) (88) (89)
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m 169.34		(84) (85) (86) (87) (88) (89)

F					1		1						ı	
(93)m=	18.99	19.26	19.62	20	20.2	20.26	20.27	20.27	20.24	19.95	19.4	18.94		(93)
			uirement											
			ernal ter or gains			ed at ste	ep 11 of	Table 9	b, so tha	t Ti,m=(76)m an	d re-calc	culate	
Г	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
L Utilisat			ains, hm		Iviay	Juli	Jui	Aug	Seb	Oct	INOV	Dec		
(94)m=	0.99	0.98	0.94	0.84	0.67	0.47	0.32	0.36	0.62	0.89	0.98	0.99		(94)
_	gains.	hmGm .	, W = (9 ²	1)m x (84	L 4)m	l	<u> </u>	<u> </u>	l		<u> </u>			
	530.34	642.67	723.93	740.63	638.76	440.32	287.9	302.52	466.78	575.19	529.89	496.08		(95)
∟ Monthl	ly avera	age exte	rnal tem	perature	e from Ta	able 8	ļ				<u> </u>	ļ	l	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat Id	oss rate	for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m	x [(93)m	– (96)m]			l	
(97)m=	1193.16	1163.44	1059.96	884.47	675.56	444.83	288.37	303.42	484.26	743.19	982.46	1184.2		(97)
Space	heating	g require	ement fo	r each n	nonth, k\	Wh/mon	th = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m=	493.14	349.96	250.01	103.56	27.38	0	0	0	0	125	325.86	511.96		
			_		-	-	-	Tota	l per year	(kWh/yeaı	r) = Sum(9	8) _{15,912} =	2186.87	(98)
Space	heating	g require	ement in	kWh/m²	² /year								29.87	(99)
•	`	•				veteme i	ncluding	micro-C	'HDI					
	heatin		ito — iriui	viduai 11	calling s	ysterns i	ricidaling	, IIIIGIO-C) II <i>)</i>					
-		•	nt from s	econdar	y/supple	mentary	system						0	(201)
			nt from m			·	•	(202) = 1	- (201) =				1	(202)
			ng from	-	` '			(204) = (2	02) x [1 –	(203)] =			1	(204)
			_	-				(== -) (=	,	(/]				(206)
	•		ace heat				. 0/						96.8	╣`
ETTICIE	ncy of s	econda	ry/suppl	ementar	y neatin _i	g systen	ո, % 						0	(208)
_ L	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ır
Space	- i	•	ement (c		·	<u> </u>							1	
L	493.14	349.96	250.01	103.56	27.38	0	0	0	0	125	325.86	511.96		
` ´ r	í		4)] } x 1				ı	1			ı		ı	(211)
L	509.44	361.53	258.27	106.99	28.29	0	0	0	0	129.13	336.63	528.89		7
								Tota	ıl (kWh/yea	ar) =Sum(2	211) _{15,1012}	F	2259.16	(211)
•		•	econdar		month									
			00 ÷ (20					Ι .			Ι ,		ı	
(215)m=	0	0	0	0	0	0	0	O Tota	0 II (kWh/yea	0	0	0		1,045)
								TOTA	ii (KVVII/yea	ar) =Surri(2	213) _{15,1012}	<i>[</i> =	0	(215)
Water h	_		to = (oolo	ام امداداد	h a a \									
	195.81	171.04	ter (calc 177.96	157.84	152.82	134.59	128.95	143.75	145.34	165.49	176.66	191.21		
L Efficien				107.01	102.02	101.00	120.00	1 10.70	1 10.01	100.10	170.00	101.21	87.5	(216)
(217)m=	93.96	93.54	92.7	90.96	88.8	87.5	87.5	87.5	87.5	91.27	93.31	94.08	07.0	(217)
· · L			kWh/mo		1	L 37.5	L 37.0	L 37.5	L 37.5	V1.21	1 00.01	J 54.00		()
		•) ÷ (217)											
(219)m=		182.86	191.97	173.52	172.1	153.82	147.37	164.28	166.1	181.32	189.32	203.24		
_								Tota	I = Sum(2	19a) ₁₁₂ =			2134.28	(219)
Annual										k'	Wh/year	•	kWh/year	-
Space h	neating	fuel use	ed, main	system	1								2259.16	
												•		

Water heating fuel used				2134.28]			
Electricity for pumps, fans and electric keep-hot								
central heating pump:			30]	(230c)			
Total electricity for the above, kWh/year	sum of (23	80a)(230g) =		30	(231)			
Electricity for lighting		322.24	(232)					
Total delivered energy for all uses $(211)(221) + (231) + (232)(237b) =$ $4745.68 (338)$								
12a. CO2 emissions – Individual heating systems including micro-CHP								
	Energy kWh/year	Emission fac kg CO2/kWh		Emissions kg CO2/yea	ır			
Space heating (main system 1)	(211) x	0.216	=	487.98	(261)			
Space heating (secondary)	(215) x	0.519	=	0	(263)			
Water heating	(219) x	0.216	=	461	(264)			
Space and water heating	(261) + (262) + (263) + (264) =	=		948.98	(265)			
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	15.57	(267)			
Electricity for lighting	(232) x	0.519	=	167.24	(268)			
Total CO2, kg/year	1131.79	(272)						
	SU			1101110				

El rating (section 14)

Property Details: SF Flat

Address:

Located in: England Region: Thames valley

UPRN:

Date of assessment: 05 October 2023
Date of certificate: 05 October 2023

Assessment type: New dwelling design stage

Transaction type:

Tenure type:

Related party disclosure:

Thermal Mass Parameter:

New dwelling

Unknown

No related party

Indicative Value Medium

Water use <= 125 litres/person/day: True

PCDF Version: 512

Property description:

Dwelling type: Flat

Detachment:

Year Completed: 2023

Floor Location: Floor area:

Storey height:

Floor 0 59.71 m² 2.5 m

Living area: 20.52 m² (fraction 0.344)

Front of dwelling faces: South East

Opening types:

Name: Source: Type: Glazing: Argon: Frame:

se Manufacturer Solid

nw Manufacturer Windows low-E, En = 0.05, soft coat Yes

Gap: Frame Factor: g-value: **U-value:** Area: No. of Openings: Name: se mm 0.7 0.63 1.6 1.89 16mm or more 0.7 0.63 1.3 12.93 nw

Name: Type-Name: Location: Orient: Width: Height: se Shel South East 0 0

nw Ext. North West 0 0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Element	<u>S</u>						
Ext.	29.43	12.93	16.5	0.24	0	False	N/A
Shel	25.2	1.89	23.31	0.11	0.43	False	N/A
Flat Roof	59.71	0	59.71	0.12	0		N/A
Internal Floment	6						

Internal Elements

Party Elements

Thermal bridges

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0696

Length	Psi-value		
6.71	0.05	E2	Other lintels (including other steel lintels)
21.94	0.04	E4	Jamb
7.5	0.058	E16	Corner (normal)

5	-0.069	E17	Corner (inverted internal area greater than external area)
7.5	0.068	E18	Party wall between dwellings
21.85	0.073	E7	Party floor between dwellings (in blocks of flats)
21.85	0.08	E14	Flat roof
11.69	0	P3	Intermediate floor between dwellings (in blocks of flats)
11.69	0.24	P4	Roof (insulation at ceiling level)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Natural ventilation (extract fans)

Number of chimneys: 0
Number of open flues: 0
Number of fans: 3
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Boiler systems with radiators or underfloor heating

Gas boilers and oil boilers

Fuel: mains gas

Info Source: Manufacturer Declaration

Manufacturer's data

Efficiency: 97.0% (SEDBUK2009)

Condensing combi with automatic ignition

Fuel Burning Type: Systems with radiators

Central heating pump: 2013 or later

Design flow temperature: Design flow temperature >45°C

Unknown

Boiler interlock: Yes Delayed start

Main heating Control:

Main heating Control: Time and temperature zone control by suitable arrangement of plumbing and electrical

services

Control code: 2110

Secondary heating system:

Secondary heating system: None

Water heating:

Water heating: From main heating system

Water code: 901
Fuel :mains gas
No hot water cylinder

Flue Gas Heat Recovery System: Database (rev 512, product index)

Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown
Conservatory: No conservatory

Low energy lights: 100%

Terrain type: Low rise urban / suburban

EPC language: English Wind turbine: No Photovoltaics: None Assess Zero Carbon Home: No

		User D	etails:						
Assessor Name:	Pothony Pohinson	USEI L	Strom	o Num	hor		STD○	036516	
Software Name:	Bethany Robinson Stroma FSAP 2012		Softwa					n: 1.0.5.60	
		Property	Address						
Address :									
1. Overall dwelling dime	ensions:		(0)						
Ground floor			a(m²) 59.71	(1a) x		ight(m) 2.5	(2a) =	Volume(m³	(3a)
	a)+(1b)+(1c)+(1d)+(1e)+(1		59.71	(4)			(==)	140.21	
	a)	,	9.71	l)+(3c)+(3c	d)+(3e)+	(3n) =	440.07	7(5)
Dwelling volume				(3a)+(3b)+(30)+(30	1)+(36)+	.(311) =	149.27	(5)
2. Ventilation rate:	main seconda	ry	other		total			m³ per hou	r
Number of chimneys	heating heating 0 + 0	□ + □	0	7 = [0	x 4	40 =	0	(6a)
Number of open flues	0 + 0	╡╻╞	0	」	0	x	20 =	0	(6b)
Number of intermittent fa						x	10 =		(7a)
Number of passive vents				L	3		10 =	30	= ' '
·				L	0		40 =	0	(7b)
Number of flueless gas fi	iles				0	^		0	(7c)
							Air ch	anges per ho	our
Infiltration due to chimne	ys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	Γ	30		÷ (5) =	0.2	(8)
	peen carried out or is intended, procee	ed to (17),	otherwise (continue fi	rom (9) to	(16)			<u> </u>
Number of storeys in the Additional infiltration	he dwelling (ns)					[(0)	11v0 1 -	0	(9)
	.25 for steel or timber frame o	r 0 35 fo	r masoni	ry consti	ruction	[(9)	-1]x0.1 =	0	(10)
	resent, use the value corresponding t			•	action.			0	(/
deducting areas of openii		1 (000)	مطا مامم	ontor O			i		7(40)
If no draught lobby, en	floor, enter 0.2 (unsealed) or (ter 0.05, else enter 0	. i (Seale	eu), eise	enter 0				0	(12)
• ,	s and doors draught stripped							0	(14)
Window infiltration			0.25 - [0.2	2 x (14) ÷ 1	100] =			0	(15)
Infiltration rate			(8) + (10)	+ (11) + (12) + (13)	+ (15) =		0	(16)
Air permeability value,	q50, expressed in cubic metro	es per ho	our per s	quare m	etre of e	envelope	area	5	(17)
If based on air permeabil	lity value, then $(18) = [(17) \div 20] +$	(8), otherw	ise (18) = ((16)				0.45	(18)
	es if a pressurisation test has been do	ne or a de	gree air pe	rmeability	is being u	sed			_
Number of sides sheltere Shelter factor	ed		(20) = 1 -	[0 075 x (19)] =			2	(19)
Infiltration rate incorporat	ting shelter factor		(21) = (18		. •/]			0.85	(20)
Infiltration rate modified f	•		()	, (==,				0.38	(21)
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	peed from Table 7								
$(22)m = \begin{bmatrix} 5.1 & 5 \end{bmatrix}$	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (00-) (0)	2)m : 4							-	
Wind Factor $(22a)m = (22a)m = 1.27$ 1.25	2)m ÷ 4 1.23	0.95	0.92	1	1.08	1.12	1.18]	
1.20	1.30 0.33	1 0.00	1 0.02	<u> </u>	1	12	15	l	

0.49	0.48	0.47	ng for sh	0.41	0.36	0.36	0.35	0.38	0.41	0.43	0.45	1	
alculate effec		-	· ·	-			0.55	0.50	0.41	0.40	0.40	J	
If mechanica	ıl ventila	tion:										0	(2
If exhaust air he) = (23a)			0	(2
If balanced with	heat reco	very: effici	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =				0	(2
a) If balance	d mecha	anical ve	ntilation	with he	at recove	ery (MVI	HR) (24a	a)m = (22)	2b)m + (23b) × [1 – (23c)	; ÷ 100]	
4a)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(2
b) If balance							r ``	i `		- 	ı	1	
1b)m= 0	0	0	0	0	0	0	0	0	0	0	0	J	(2
c) If whole he				•	•				F (22h	.\			
if (22b)m lc)m= 0	0.5 x	(23b), t	nen (240	(230) = (230)	o); otner	wise (24	C) = (220)	0) m + 0.	5 × (230	0	0	1	(
,									U	0		J	(
d) If natural v if (22b)m									0.5]				
ld)m= 0.62	0.61	0.61	0.59	0.58	0.57	0.57	0.56	0.57	0.58	0.59	0.6]	(
Effective air	change	rate - er	 nter (24a	or (24k	o) or (24	c) or (24	d) in box	x (25)			•	•	
5)m= 0.62	0.61	0.61	0.59	0.58	0.57	0.57	0.56	0.57	0.58	0.59	0.6	1	(
Hoot loose	ond be	ot loop r	acromet	~ *!	•			•				•	
. Heat losses	_	·			Not Ar	00	Havoli	110	AXU		k volu		ΑΧk
EMENT	Gros area	-	Openin m		Net Ar A ,r		U-valı W/m2		(W/I	()	k-value kJ/m²-		kJ/K
oors					1.89	x	1.6		3.024				(
indows					12.93	x1.	/[1/(1.3)+	0.04] =	15.98				(
alls Type1	29.4	3	12.93	3	16.5	x	0.24	i	3.96	<u> </u>		\neg	(
alls Type2	25.2	\equiv	1.89	=	23.31	x	0.11	≓ <u>-</u> i	2.45	=		i i	(
oof	59.7	〓	0	=	59.71	x	0.12	≓ <u>-</u> i	7.17	=		i i	
tal area of e					114.3	=	02						\` (
or windows and			effective wi	ndow U-va			ı formula 1	/[(1/U-valu	ıe)+0.04] a	ns given in	paragraph	h 3.2	(
nclude the area						· ·			, ,	J	, , ,		
bric heat los	s, W/K =	= S (A x	U)				(26)(30)) + (32) =				32.5	8
eat capacity (Cm = S(Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	537.3	39 (
ermal mass	parame	ter (TMF	o = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	Medium		250	(
r design assess				construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
n be used instea ermal bridge				icina Ar	nondiy l	(7.00	<u> </u>
etails of therma	•	,		Ο.	•	`						7.96	<u>, </u>
tal fabric hea		crar	(30) -	2.30 A (O	,			(33) +	(36) =			40.5	4 (
ntilation hea	t loss ca	alculated	l monthly	/				(38)m	= 0.33 × (25)m x (5)			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
)m= 30.51	30.29	30.06	29.01	28.81	27.9	27.9	27.73	28.25	28.81	29.21	29.63		(
	oefficier	 nt \/\/K			•		•	(39)m	= (37) + (37)	38)m			
eat transfer o	OCHIU	IL. VV/!\											
eat transfer of 71.05	70.82	70.6	69.55	69.35	68.43	68.43	68.26	68.79	69.35	69.75	70.16	1	

eat loss para	meter (F	HLP), W/	m²K					(40)m	= (39)m ÷	- (4)			
0)m= 1.19	1.19	1.18	1.16	1.16	1.15	1.15	1.14	1.15	1.16	1.17	1.18		_
umber of day	rs in mor	nth (Tahl	le 1a)						Average =	Sum(40) _{1.}	12 /12=	1.16	(40
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
1)m= 31	28	31	30	31	30	31	31	30	31	30	31		(4
									!	!			
. Water heat	ing ener	gy requi	rement:								kWh/ye	ar:	
ssumed occu	nancy I	N									07		(4
if TFA > 13.9	0, N = 1		[1 - exp	(-0.0003	849 x (TF	A -13.9)2)] + 0.0	0013 x (TFA -13		97		(4
if TFA £ 13.9	•	tor upon	va in litra	o nor da	\/d o	0.000	(OE v NI)	. 26					
nnual averageduce the annua									se target o		.07		(4
t more that 125	litres per µ	oerson per	day (all w	ater use, l	hot and co	ld)							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
nt water usage ii	litres per	day for ea	ach month	Vd,m = fa	ctor from 7	Table 1c x	(43)						
4)m= 89.18	85.93	82.69	79.45	76.2	72.96	72.96	76.2	79.45	82.69	85.93	89.18		
orgy contant of	hot water	used sel	aulated me	onthly — 1	100 v Vd r	n v nm v [Tm / 2600			m(44) ₁₁₂ =	L	972.83	(4
ergy content of													
5)m= 132.24	115.66	119.35	104.05	99.84	86.16	79.84	91.61	92.71	108.04	117.94	128.07	4075 50	(₍
nstantaneous w	ater heatir	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46		rotal = Su	m(45) ₁₁₂ =	· L	1275.53	(
6)m= 19.84	17.35	17.9	15.61	14.98	12.92	11.98	13.74	13.91	16.21	17.69	19.21		(4
ater storage													Ì
orage volum	e (litres)	includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(-
community h													
therwise if no		hot wate	er (this in	cludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in ((47)			
ater storage) If manufact		eclared l	nss facto	nr is kno	wn (k\//h	n/day).					0		(-
emperature f) 13 KHO	vvii (icvvi	ı, day).					0		(-
nergy lost fro				aar			(48) x (49)	· –					
) If manufact		•	-		or is not		(40) X (40)	_			0		(
ot water stora			-								0		(
community h	_		on 4.3										
olume factor			O.L.								0		(
emperature fa								,,			0		(
nergy lost fro nter (50) or (-	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(
` ' '	, ,	•	or oach	month			((EG)m - (EE) ~ (41)	m		0		(
ater storage					Г		((56)m = (1				
6)m= 0	0	0	0	0	0	0	0	0 (50)	0	0	0		(
cylinder contains	dedicated	d solar sto	rage, (57)i	n = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	/)m = (56)	m where (H11) is fro	m Appendi	XН	
7)m= 0	0	0	0	0	0	0	0	0	0	0	0		(
imary circuit	loss (an	nual) fro	m Table	3							0		(
imary circuit	•	•			59)m = ((58) ÷ 36	65 × (41)	m					
(modified by	factor fr	om Tabl	le H5 if t	here is s	solar wat	er heatii	ng and a	cylinde	r thermo	stat)			

Combi	Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$													
(61)m=	45.44	39.55	42.14	39.18	38.83	35.98	37.18	38.83	3 39.18	42.14	42.38	45.44		(61)
Total h	eat requ	uired for	water he	eating ca	alculated	for eacl	h month	(62)m	n = 0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	177.69	155.21	161.49	143.23	138.68	122.14	117.02	130.4	5 131.89	150.18	160.32	173.52		(62)
Solar DH	HW input	calculated	using App	endix G or	· Appendix	H (negati	ve quantity	/) (ente	r '0' if no sola	r contribut	ion to wate	er heating)	1	
(add a	dditiona	I lines if	FGHRS	and/or V	WWHRS	applies	, see Ap	pendi	x G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0		(63) (G2)
Output	from w	ater hea	ter											
(64)m=	177.69	155.21	161.49	143.23	138.68	122.14	117.02	130.4	5 131.89	150.18	160.32	173.52		_
		-	-		-	-	-	0	utput from w	ater heate	r (annual)₁	12	1761.81	(64)
Heat g	ains fro	m water	heating,	kWh/mo	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m] + 0.8	x [(46)m	+ (57)m	+ (59)m]	
(65)m=	55.33	48.35	50.22	44.39	42.91	37.64	35.84	40.17	7 40.62	46.46	49.81	53.94		(65)
inclu	de (57)	m in cald	culation of	of (65)m	only if c	ylinder i	s in the o	dwellir	ng or hot w	ater is f	om com	munity h	neating	
5. Int	ernal ga	ains (see	Table 5	and 5a):									
Metabo	olic gain	ıs (Table	5), Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Au	g Sep	Oct	Nov	Dec		
(66)m=	118.41	118.41	118.41	118.41	118.41	118.41	118.41	118.4	1 118.41	118.41	118.41	118.41		(66)
Lightin	g gains	(calcula	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso se	e Table 5	-	-	-		
(67)m=	38.42	34.12	27.75	21.01	15.7	13.26	14.33	18.62	2 24.99	31.74	37.04	39.49		(67)
Applia	nces ga	ins (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), a	lso see Ta	ble 5			•	
(68)m=	257.04	259.7	252.98	238.67	220.61	203.64	192.29	189.6	3 196.35	210.66	228.72	245.7		(68)
Cookin	g gains	(calcula	ted in A	opendix	L, equat	tion L15	or L15a)	, also	see Table	5	•		•	
(69)m=	48.81	48.81	48.81	48.81	48.81	48.81	48.81	48.8	1 48.81	48.81	48.81	48.81		(69)
Pumps	and fai	ns gains	(Table 5	<u></u> ба)	•	•	•		•	•	•	•	•	
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses	e.g. ev	aporatio	n (nega	ive valu	es) (Tab	le 5)			•	•			•	
(71)m=	-78.94	-78.94	-78.94	-78.94	-78.94	-78.94	-78.94	-78.9	4 -78.94	-78.94	-78.94	-78.94		(71)
Water	heating	gains (T	able 5)						•	•	•		•	
(72)m=	74.37	71.94	67.5	61.66	57.67	52.28	48.17	53.99	56.42	62.44	69.18	72.51		(72)
Total i	nternal	gains =			•	(66)	m + (67)m	ı + (68)ı	m + (69)m +	(70)m + (7	1)m + (72)	m	•	
(73)m=	461.11	457.05	439.52	412.62	385.27	360.46	346.08	353.5	2 369.04	396.12	426.22	448.97		(73)
6. Sol	ar gains	S:												
Solar g	ains are o	calculated	using sola	r flux from	Table 6a	and assoc	iated equa	tions to	convert to the	ne applicat	ole orientat	ion.		
Orienta		Access F		Area		Flu			g_ a	_	FF		Gains	
	_	Table 6d		m²		l al	ole 6a		Table 6b	_	able 6c		(W)	_
Northwe	est _{0.9x}	0.77	Х	12.	93	x 1	1.28	×	0.63	x	0.7	=	44.59	(81)
Northwe	est _{0.9x}	0.77	X	12.	93	x 2	2.97	×	0.63	Х	0.7	=	90.75	(81)
Northwe	<u> </u>	0.77	х	12.	93	X 4	1.38	x	0.63	x	0.7	=	163.51	(81)
Northwe	est _{0.9x}	0.77	Х	12.	93	x 6	7.96	x	0.63	x	0.7	=	268.53	(81)

Northwe	est _{0.9x}	0.77	X	12.	93	x	9	1.35	x		0.63	x	0.7	=	360.96	(81)
Northwe	est _{0.9x}	0.77	x	12.	93	x	9	7.38	x		0.63	х	0.7		384.82	(81)
Northwe	est _{0.9x}	0.77	X	12.	93	x	Ç	91.1	X		0.63	х	0.7	=	359.99	(81)
Northwe	est _{0.9x}	0.77	х	12.	93	x	7	2.63	X		0.63	x	0.7	=	286.99	(81)
Northwe	est _{0.9x}	0.77	X	12.	93	x	5	0.42	x		0.63	x	0.7	=	199.24	(81)
Northwe	est _{0.9x}	0.77	X	12.	93	x	2	8.07	x		0.63	x	0.7		110.91	(81)
Northwe	est _{0.9x}	0.77	X	12.	93	x	,	14.2	x		0.63	x	0.7	=	56.1	(81)
Northwe	est _{0.9x}	0.77	x	12.	93	x	9	9.21	x		0.63	x	0.7		36.41	(81)
	_				_											
Solar g	ains in	watts, ca	alculated	I for eac	h month				(83)m	ı = Sı	um(74)m .	(82)m				
(83)m=	44.59	90.75	163.51	268.53	360.96	38	34.82	359.99	286	.99	199.24	110.91	56.1	36.41	7	(83)
Total g	ains – iı	nternal a	nd solai	(84)m =	= (73)m	+ (8	33)m	, watts	•	•				•	-	
(84)m=	505.7	547.81	603.03	681.16	746.23	74	15.28	706.07	640	.51	568.28	507.03	482.32	485.38		(84)
7. Me:	an inter	nal temp	erature	(heating	season)							_		_	
		during h		`		<i>′</i>	area f	from Tab	ole 9.	. Th′	1 (°C)				21	(85)
•		tor for g	•			-				,	. (-)					` ′
	Jan	Feb	Mar	Apr	May	r	Jun	Jul	Α	ug	Sep	Oct	Nov	Dec	7	
(86)m=	0.99	0.99	0.97	0.91	0.77	_).57	0.42	0.4		0.75	0.94	0.98	0.99	╡	(86)
Moon	intorno	l tompor	oturo in	livina or	00 T1 /f/	مالد	w oto	no 2 to 7	l 7 in T	- L	. 00)		Į.	<u>!</u>	_	
(87)m=	19.93	l temper	20.31	20.65	20.89	_	w ste	ps 3 to 7	20.	-	20.92	20.62	20.22	19.91	٦	(87)
` ′ [<u> </u>			<u> </u>	!		20.02	20.22	19.91		(01)
· .		during h				_	Ť			-	<u> </u>			1	7	4
(88)m=	19.93	19.93	19.93	19.95	19.95	1	9.96	19.96	19.	97	19.96	19.95	19.95	19.94		(88)
Utilisa	tion fac	tor for g	ains for	rest of d	welling,	h2,	m (se	e Table	9a)				_	_	_	
(89)m=	0.99	0.98	0.96	0.88	0.71	().49	0.33	0.3	88	0.67	0.92	0.98	0.99		(89)
Mean	interna	l temper	ature in	the rest	of dwell	ing	T2 (fc	ollow ste	ps 3	to 7	in Tabl	e 9c)				
(90)m=	18.53	18.72	19.08	19.56	19.85	Ť	9.95	19.96	19.	\neg	19.9	19.53	18.97	18.51	7	(90)
L						_			!	!	f	LA = Liv	ing area ÷ (4) =	0.34	(91)
Moon	intorna	l temper	oturo (fo	r tho wh	ala dwa	llin	م/ _ fl	Λ ν Τ1	. (1	fl	۸) ی T2					
(92)m=	19.01	19.18	19.51	19.93	20.2	_	20.3	20.32	20.	$\overline{}$	20.25	19.9	19.4	18.99	٦	(92)
		nent to the							<u> </u>				10	10.00	_	(/
(93)m=	18.86	19.03	19.36	19.78	20.05	_	0.15	20.17	20.	$\overline{}$	20.1	19.75	19.25	18.84	7	(93)
	ace hea	ting requ	uirement													
					e obtair	ned	at ste	ep 11 of	Tabl	e 9b	o, so tha	t Ti.m=	:(76)m an	id re-ca	culate	
		factor fo		•							.,	,			_	
	Jan	Feb	Mar	Apr	May		Jun	Jul	Α	ug	Sep	Oct	Nov	Dec		
Utilisa	tion fac	tor for g	ains, hm	:											_	
(94)m=	0.98	0.98	0.95	0.87	0.71		0.5	0.34	0.4	4	0.68	0.91	0.97	0.99		(94)
Usefu	l gains,	hmGm ,	W = (9	4)m x (8	4)m								_		_	
(95)m=	497.78	534.53	573.26	594.84	532.39	37	73.75	243.38	255	.61	386.38	462.02	469.21	479		(95)
r	nly aver	age exte			from T	able	e 8							ī	7	
(96)m=	4.3	4.9	6.5	8.9	11.7	_	14.6	16.6	16		14.1	10.6	7.1	4.2	_	(96)
r		e for mea		·		_		- ,		Ť	<u> </u>			i	7	
(97)m=	1034.65	1001.02	907.66	756.87	579.42	38	30.12	244.14	257	.15	413.03	634.77	847.58	1027.24	<u> </u>	(97)

08)m= 399.43 313.48	248.79	116.67	34.99	0	0	0	0	128.52	272.43	407.89		
	•					Tota	l per year	(kWh/year) = Sum(9	8) _{15,912} =	1922.21	(98
Space heating requirer	ment in	kWh/m²	/year								32.19	(99
a. Energy requirements	s – Indi	vidual h	eating sy	/stems i	ncluding	micro-C	HP)					
Space heating:	.		/I-							Г		7,00
Fraction of space heat			• • •	mentary	•	(202) = 1 -	(201) -			F	0	(20
Fraction of space heat		-	, ,			` ,	- (201) = 02) × [1 – ((203)] =		L	1	(20
Fraction of total heating	•	-				(204) = (20	02) x [1 –	(203)] =		L	1	(20
Efficiency of main spac		-		- avatam	. 0/					L	97.8	(20
Efficiency of secondary										L	0	(20
Jan Feb Space heating requirer	Mar Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
·	248.79	116.67	34.99	0	0	0	0	128.52	272.43	407.89		
11)m = {[(98)m x (204)] } x 1	——— 00 ÷ (20	l6)									(2
·	254.39	119.29	35.77	0	0	0	0	131.41	278.56	417.07		•
	•					Tota	l (kWh/yea	ar) =Sum(2	211),15,1012	=	1965.45	(2
Space heating fuel (see	•	,	month									_
$\begin{cases} [(98)m \times (201)] \\ x = 10 \\ 15)m = 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0$	$\frac{100 \div (208)}{0}$	B) 0	0	0	0	0	0	0	0	0		
15)111= 0 0		0	U	0	0	_	I (kWh/yea		_		0	_(2
ater heating								, ,	715,1012	L		
utput from water heate	er (calcı	ulated al	oove)									
	161.49	143.23	138.68	122.14	117.02	130.45	131.89	150.18	160.32	173.52		_
fficiency of water heate											88.5	<u></u> (2
17)m= 94.73 94.51	93.92	92.45	90.23	88.5	88.5	88.5	88.5	92.56	94.14	94.83		(2
	(yyn/mo	ntn										
uel for water heating, k		m					149.03	162.25	170.3	182.98		
$(19)m = (64)m \times 100$		m 154.94	153.69	138.01	132.22	147.4				1		(2
(64)m = (64) m x (64)	÷ (217)ṛ		153.69	138.01	132.22		I = Sum(2 ⁻	19a) ₁₁₂ =		L	1914.58	┛`
219)m = (64)m x 100 · 19)m = 187.56 164.23 nnual totals	÷ (217)r 171.95	154.94		138.01	132.22				Nh/year	L	kWh/yeaı	
219)m = (64)m x 100 - 19)m = 187.56 164.23 nnual totals pace heating fuel used	÷ (217)1 171.95	154.94		138.01	132.22				Nh/year	L	kWh/yea ı 1965.45	
nnual totals pace heating fuel used	÷ (217)r 171.95 d, main s	154.94 system	1		132.22				Wh/year		kWh/yeaı	
nnual totals pace heating fuel used	÷ (217)r 171.95 d, main s	154.94 system	1		132.22				Wh/year		kWh/yea ı 1965.45	
nnual totals pace heating fuel used attrictive for pumps, far	÷ (217)r 171.95 d, main s	154.94 system	1		132.22				Wh/year	30	kWh/yea ı 1965.45	
19)m = (64)m x 100 · 19)m = 187.56 164.23 190 · 10	÷ (217)r 171.95 d, main : I ns and 6	system	1 keep-ho		132.22	Tota		k)	-]] 	kWh/yea ı 1965.45	(2
nnual totals pace heating fuel used detricity for pumps, far central heating pump:	÷ (217)r 171.95 d, main : I ns and 6	system	1 keep-ho		132.22	Tota	I = Sum(2 ⁻	k)	-]] 	1965.45 1914.58	

Fuel

kWh/year

Fuel Cost

£/year

Fuel Price

(Table 12)

Space heating - main system 1	(211) x	3.48 x 0.01 =	68.4 (24)	0)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (24	1)
Space heating - secondary	(215) x	13.19 × 0.01 =	0 (24)	2)
Water heating cost (other fuel)	(219)	3.48 × 0.01 =	66.63 (24	7)
Pumps, fans and electric keep-hot	(231)	13.19 × 0.01 =	3.96 (24)	9)
(if off-peak tariff, list each of (230a) to (23 Energy for lighting	(232) separately as applicable and			0)
Additional standing charges (Table 12)	(202)	13.19 X 0.01 =	33.6	
			120 (25	')
Appendix Q items: repeat lines (253) and	(254) as needed (245)(247) + (250)(254) =		294.78 (25	E \
Total energy cost 11a. SAP rating - individual heating syst			294.78 (25	<i>3)</i>
	GIIIS			
Energy cost deflator (Table 12)	((255) v (256)] · ((4) · 45 0] -		0.42 (25)	
Energy cost factor (ECF) SAP rating (Section 12)	$[(255) \times (256)] \div [(4) + 45.0] =$		1.18 (25)	
12a. CO2 emissions – Individual heating	a systems including micro-CHP		83.51 (25)	0)
12a. CO2 emissions – muividual neating	g systems including micro-or in			
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	424.54 (26	1)
Space heating (secondary)	(215) x	0.519 =	0 (263	3)
Water heating	(219) x	0.216 =	413.55 (264	4)
Space and water heating	(261) + (262) + (263) + (264	4) =	838.08 (26	5)
Electricity for pumps, fans and electric ke	ep-hot (231) x	0.519 =	15.57 (26	7)
Electricity for lighting	(232) x	0.519 =	140.86 (268	8)
Total CO2, kg/year		sum of (265)(271) =	994.51 (27)	2)
CO2 emissions per m²		(272) ÷ (4) =	16.66 (27)	3)
EI rating (section 14)			87 (274	4)
13a. Primary Energy				
	Energy kWh/year	Primary factor	P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.22	2397.84 (26)	1)
Space heating (secondary)	(215) x	3.07	0 (263	3)
Energy for water heating	(219) x	1.22 =	2335.78 (264	4)
Space and water heating	(261) + (262) + (263) + (264	(+) =	4733.63 (26	5)
Electricity for pumps, fans and electric ke	ep-hot (231) x	3.07 =	92.1 (26	7)
Electricity for lighting	(232) x	0 =	833.2 (268	8)
'Total Primary Energy		sum of (265)(271) =	5658.92 (27)	2)

Primary energy	kWh/	/m²/yea	ır
----------------	------	---------	----

 $(272) \div (4) =$

94.77

(273)

		l Iser I	Details:						
Assessor Name: Software Name:	Bethany Robinson Stroma FSAP 2012	<u> </u>	Strom Softwa					0036516 on: 1.0.5.60	
Contware Hame.		roperty	Address				VOIOIC	71. 1.0.0.00	
Address :									
1. Overall dwelling dime	ensions:								
Ground floor			a(m²)	(1a) v		ight(m)	1(20)	Volume(m ³	<u>^</u>
	a) . (4 la) . (4 a) . (4 a) (4 a)			(1a) x		2.5	(2a) =	149.27	(3a)
	a)+(1b)+(1c)+(1d)+(1e)+(1i	י) [59.71	(4)					_
Dwelling volume				(3a)+(3b)+(3c)+(3c	d)+(3e)+	.(3n) =	149.27	(5)
2. Ventilation rate:	main		other		40401			m3 nor hou	
	main seconda heating heating	· 	otner	, –	total			m³ per hou	ır —
Number of chimneys	0 + 0	+	0	_ = _	0	X 4	40 =	0	(6a)
Number of open flues	0 + 0	+	0] = [0	x 2	20 =	0	(6b)
Number of intermittent fa	ins				3	X '	10 =	30	(7a)
Number of passive vents	3			Ī	0	x '	10 =	0	(7b)
Number of flueless gas fi	ires			Ē	0	X 4	40 =	0	(7c)
				<u> </u>					
							Air ch	nanges per ho	our
	ys, flues and fans = $(6a)+(6b)+(7a)$				30		÷ (5) =	0.2	(8)
If a pressurisation test has be Number of storeys in the	peen carried out or is intended, procee he dwelling (ns)	d to (17),	otherwise (continue fr	om (9) to	(16)			(9)
Additional infiltration	ne aweiling (113)					[(9)	-1]x0.1 =	0	(10)
	.25 for steel or timber frame or	0.35 fo	r masoni	y constr	ruction	1(-)	1	0	(11)
	resent, use the value corresponding to	the grea	ter wall are	a (after					
deducting areas of openii	^{ngs); if equal user 0.35 floor, enter 0.2 (unsealed) or 0}	1 (seal	ed) else	enter ()				0	(12)
If no draught lobby, en	,	. r (ocan	ou), 0.00	critor o				0	(13)
	s and doors draught stripped							0	(14)
Window infiltration			0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate			(8) + (10)	+ (11) + (1	12) + (13)	+ (15) =		0	(16)
•	q50, expressed in cubic metre	•	•	•	etre of e	envelope	area	5	(17)
•	lity value, then $(18) = [(17) \div 20] + ($							0.45	(18)
Number of sides sheltere	es if a pressurisation test has been dor ed	ne or a de	gree air pe	rmeability	is being u	sed		2	(19)
Shelter factor	, u		(20) = 1 -	[0.0 75 x (1	19)] =			0.85	(20)
Infiltration rate incorporate	ting shelter factor		(21) = (18) x (20) =				0.38	(21)
Infiltration rate modified f	or monthly wind speed								
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
Monthly average wind sp	peed from Table 7								
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Easter (22a)m (2	2)m · 1								
Wind Factor $(22a)m = (2(22a)m = 1.27 1.25)$	2)m ÷ 4 1.23	0.95	0.92	1	1.08	1.12	1.18]	
(ΔΔα)111- 1.20	1.20 1.11 1.00 0.95	1 0.90	0.92		1.00	1.12	1.10	J	

Adjusted infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
0.49	0.48	0.47	0.42	0.41	0.36	0.36	0.35	0.38	0.41	0.43	0.45]	
Calculate effe If mechanic		_	rate for t	he appli	cable ca	se		-	-	-	-	-	(23
If exhaust air h			endix N. (2	3b) = (23a	a) × Fmv (e	eguation (I	N5)) . othe	rwise (23b) = (23a)			0	(23
If balanced with									, (===,			0	(23
a) If balance		•	•	ŭ		`		,	2h\m + (23h) 🗴 [¹	1 <i>– (23c</i>)		(20
24a)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24
b) If balance	ed mech	ı anical v∈	ntilation	without	heat red	coverv (N	иV) (24b)m = (22	2b)m + (1 23b)		1	
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24
c) If whole h	ouse ex n < 0.5 ×			•	•				5 × (23b))	!	1	
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24
d) If natural if (22b)r	ventilation ventilation			•	•				0.5]	!	!	1	
24d)m= 0.62	0.61	0.61	0.59	0.58	0.57	0.57	0.56	0.57	0.58	0.59	0.6]	(24
Effective air	change	rate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in box	x (25)				-	
25)m= 0.62	0.61	0.61	0.59	0.58	0.57	0.57	0.56	0.57	0.58	0.59	0.6]	(25
3. Heat losse	s and he	at loss i	naramete	or.								_	
LEMENT	Gros area	SS	Openin m	gs	Net Ar A ,r		U-valı W/m2		A X U (W/l	K)	k-value kJ/m²-	-	A X k kJ/K
Doors					1.89	х	1.6	=	3.024				(26
Vindows					12.93	x1	/[1/(1.3)+	0.04] =	15.98				(27
Valls Type1	29.4	13	12.93	3	16.5	x	0.24	i i	3.96				(29
Valls Type2	25.2	2	1.89		23.31	X	0.11	<u> </u>	2.45	T i			(29
Roof	59.7		0	=	59.71	x	0.12	= i	7.17	₹ i		7 F	(30
otal area of e	lements	 , m²			114.3	4							(3
for windows and * include the area					alue calcul		g formula 1	/[(1/U-valu	ie)+0.04] a	as given in	paragrapl	h 3.2	
abric heat los	ss, W/K =	= S (A x	U)				(26)(30)) + (32) =				32.58	(3:
leat capacity	Cm = S((A x k)						((28)	.(30) + (32	2) + (32a).	(32e) =	537.39	(34
hermal mass	parame	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(3
or design asses: an be used inste				construct	ion are no	t known pr	recisely the	e indicative	values of	TMP in Ta	able 1f		
hermal bridge				using Ap	pendix l	<						7.96	(36
details of therma	,	•		• .	•								`
otal fabric he	at loss							(33) +	(36) =			40.54	(3
entilation hea	at loss ca	alculated	monthly	/				(38)m	= 0.33 × ((25)m x (5)		-	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
38)m= 30.51	30.29	30.06	29.01	28.81	27.9	27.9	27.73	28.25	28.81	29.21	29.63]	(3
	nofficial	nt W/K						(39)m	= (37) + (37)	38)m			
leat transfer o	Joennoiei	,						()	(- / (/			
leat transfer (39)m= 71.05	70.82	70.6	69.55	69.35	68.43	68.43	68.26	68.79	69.35	69.75	70.16		

Heat loss para	matar (l	JI D) \\//	m2k					(40)m	= (39)m ÷	- (A)			
(40)m= 1.19	1.19	1.18	1.16	1.16	1.15	1.15	1.14	1.15	1.16	1.17	1.18		
(40)1112 1.119	1.13	1.10	1.10	1.10	1.15	1.15	1.14			Sum(40) ₁ .		1.16	(40)
Number of days	s in mo	nth (Tabl	e 1a)					,	Average =	3um(40)1.	12 / 12=	1.10	(40)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
		!							!	!			
4 \\/\-t==\-t==											1-10/1- /		
4. Water heati	ing ene	rgy requi	rement:								kWh/ye	ear:	
Assumed occur if TFA > 13.9 if TFA £ 13.9	N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9))2)] + 0.0	0013 x (⁻	TFA -13		97		(42)
Annual average Reduce the annual	l average	hot water	usage by	5% if the a	welling is	designed t			se target o		.07		(43)
not more that 125	ilites per j	person per T			ioi and co				1			ı	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in	i litres pei	r day for ea	ch month	Vd,m = fa	ctor from T	Table 1c x	(43)					1	
(44)m= 89.18	85.93	82.69	79.45	76.2	72.96	72.96	76.2	79.45	82.69	85.93	89.18		
Energy content of I	hot water	used - cal	culated mo	onthly = 4 .	190 x Vd,r	n x nm x D)Tm / 3600			m(44) ₁₁₂ = ables 1b, 1		972.83	(44)
(45)m= 132.24	115.66	119.35	104.05	99.84	86.16	79.84	91.61	92.71	108.04	117.94	128.07		
		<u> </u>				l		<u> </u>	I Total = Su	m(45) ₁₁₂ =		1275.53	(45)
If instantaneous wa	ater heati	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46)) to (61)		, ,			
(46)m= 19.84	17.35	17.9	15.61	14.98	12.92	11.98	13.74	13.91	16.21	17.69	19.21		(46)
Water storage	loss:							I					
Storage volume	e (litres)) includin	g any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community he	eating a	and no ta	nk in dw	elling, e	nter 110	litres in	(47)						
Otherwise if no		hot wate	er (this in	cludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in ((47)			
Water storage					(1.54/1	/ L \						1	
a) If manufactu				or is kno	wn (kvvr	n/day):					0		(48)
Temperature fa	actor fro	m Table	2b								0		(49)
Energy lost from		_	-				(48) x (49)) =			0		(50)
b) If manufactuHot water stora			-										(E1)
If community he	-			C Z (KVVI	ii/iiti e/ua	iy <i>)</i>					0		(51)
Volume factor f	•		311 1.0								0		(52)
Temperature fa			2b								0		(53)
Energy lost from	m water	storage	kWh/ve	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter (50) or (•	,				`		,		0		(55)
Water storage	, ,	,	or each	month			((56)m = (55) × (41):	m				
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contains			-								-	ix H	(30)
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit	loss (ar	nnual) fro	m Table	3							0		(58)
Primary circuit	loss cal	culated f	or each	month (59)m = ((58) ÷ 36	55 × (41)	m					
(modified by	factor f	rom Tabl	e H5 if t	here is s	olar wat	er heatir	ng and a	cylinde	r thermo	stat)		1	
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi	Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m														
(61)m=	45.44	39.55	42.14	39.18	38.83	35.98	37.18	38.	83	39.18	42.14	42.38	45.44	1	(61)
								<u> </u>						J · (59)m + (61)m	,
(62)m=	177.69	155.21	161.49	143.23	138.68	122.14	117.02	130	_	131.89	150.18	160.32	173.52	(33)	(62)
, ,												tion to wate]	,
						applies					· commod	ion to wat	or modung,		
(63)m=	0	0	0	0	0	0	0	0	_	0	0	0	0	1	(63)
FHRS	0	0	0	0	0	0	0	0)	0	0	0	0	ı	(63) (G2)
Output	t from wa	ater hea	ter												
(64)m=	177.69	155.21	161.49	143.23	138.68	122.14	117.02	130	.45	131.89	150.18	160.32	173.52]	
								<u> </u>	Outp	ut from wa	ter heate	ı er (annual)₁	12	1761.81	(64)
Heat g	ains froi	m water	heating,	kWh/mo	onth 0.2	5 ´ [0.85	× (45)m	+ (6	1)m	ı] + 0.8 x	([(46)m	+ (57)m	+ (59)m	 .]	-
(65)m=	55.33	48.35	50.22	44.39	42.91	37.64	35.84	40.		40.62	46.46	49.81	53.94]	(65)
inclu	ude (57)ı	m in calc	culation of	of (65)m	only if c	vlinder is	s in the	dwell	ing	or hot w	ater is f	rom com	munity h	ı neating	
	. ,	ains (see		. ,		,							,	<u> </u>	
		s (Table			, .										
Metab	Jan	Feb	Mar	Apr	May	Jun	Jul	A	ug	Sep	Oct	Nov	Dec]	
(66)m=	98.67	98.67	98.67	98.67	98.67	98.67	98.67	98.	Ť	98.67	98.67	98.67	98.67	1	(66)
Liahtin	a gains	(calculat	ted in Ar	pendix l	L. equat	ion L9 o	r L9a). a	lso s	ee T	LEE 5	<u> </u>	ļ.		J	
(67)m=	15.37	13.65	11.1	8.4	6.28	5.3	5.73	7.4		10	12.69	14.82	15.79	1	(67)
Applia	nces gai	ins (calc	ulated ir	Append	dix L. ea	uation L	13 or L1	3a). a	also	see Tal	ble 5	Į.	<u> </u>	J	
(68)m=	172.21	174	169.5	159.91	147.81	136.44	128.84	127	_	131.55	141.14	153.24	164.62]	(68)
Cookir	ng gains	(calcula	ted in A	ppendix	L, equa	tion L15	or L15a	i), als	o se	e Table	5	!	!	J	
(69)m=	32.87	32.87	32.87	32.87	32.87	32.87	32.87	32.		32.87	32.87	32.87	32.87]	(69)
Pumps	and far	ns gains	(Table 5	 Ба)		!		I			<u>I</u>	·	!	J	
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	3]	(70)
Losses	s e.a. ev	aporatio	n (nega	tive valu	es) (Tab	le 5)		I						1	
(71)m=	-78.94	-78.94	-78.94	-78.94	-78.94	-78.94	-78.94	-78.	.94	-78.94	-78.94	-78.94	-78.94]	(71)
Water	heating	gains (T	able 5)					!							
(72)m=	74.37	71.94	67.5	61.66	57.67	52.28	48.17	53.	99	56.42	62.44	69.18	72.51]	(72)
Total i	nternal	gains =				(66)	m + (67)m	ı + (68	3)m +	· (69)m + ((70)m + (7	71)m + (72))m	J	
(73)m=	317.56	315.2	303.7	285.57	267.36	249.62	238.34	244	.09	253.57	271.88	292.84	308.52]	(73)
6. So	lar gains	S:													
Solar	gains are c	alculated	using sola	r flux from	Table 6a	and associ	ated equa	tions	to co	nvert to th	e applica	ble orienta	tion.		
Orienta		Access F		Area		Flu				g_		FF		Gains	
	T	able 6d		m²		Tal	ole 6a		Т	able 6b	Т	able 6c		(W)	
Northw	est _{0.9x}	0.77	X	12.	93	x 1	1.28	X		0.63	X	0.7	=	44.59	(81)
Northw	est _{0.9x}	0.77	X	12.	93	x 2	2.97	X		0.63	X	0.7	=	90.75	(81)
Northw	est _{0.9x}	0.77	X	12.	93	x 4	1.38	x		0.63	x	0.7	=	163.51	(81)
Northw	est _{0.9x}	0.77	X	12.	93	x 6	7.96	X		0.63	x	0.7	=	268.53	(81)

Northwest	0.9x	0.77	X	12.93		x	y 91.35		x		0.63	x	0.7	=	360.96	(81)
Northwest	west 0.9x 0.77		X	12.93		x	9	7.38	x		0.63	×	0.7	_ =	384.82	(81)
Northwest	nwest _{0.9x} 0.77		X	12.	93	x	91.1		x		0.63	x	0.7	=	359.99	(81)
Northwest	Northwest 0.9x 0.77		X	12.	93	x	72.63		x		0.63	×	0.7	_ =	286.99	(81)
Northwest 0.9x 0.77		x	12.9	93	x	50.42		x		0.63	= x [0.7	<u> </u>	199.24	(81)	
Northwest 0.9x 0.77		х	12.	93	x	2	28.07			0.63	= x [0.7	<u> </u>	110.91	(81)	
Northwest	Northwest 0.9x 0.77		x	12.	93	x	,	14.2	x		0.63	= x [0.7	=	56.1	(81)
Northwest 0.9x 0.77		x	12.9	93	x	9.21		x		0.63	_ x [0.7		36.41	(81)	
5 5 5 5 5 5 5 5 5 5																
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m																
<u> </u>	Ť		163.51	268.53 360.96		384.82		359.99	286	.99	199.24	110.91	56.1	36.41	7	(83)
Total gair	gains – internal and solar (84)m = (73)m + (83)m , watts															
(84)m= 36	362.14 405.95 467.2		467.21	554.11	628.32		634.44 598.34		531	.08	452.81	382.79	348.94	344.93	7	(84)
7. Mean	7. Mean internal temperature (heating season)															
Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)															(85)	
Utilisation factor for gains for living area, h1,m (see Table 9a)																
	Jan Feb Mar			Apr May		Jun		Jul	Aug		Sep	Oct	Nov	Dec	٦	
(86)m=	1	1	0.99	0.95	0.84	+	0.65	0.5	 		0.85	0.98	1	1	╡	(86)
															(==)	
	Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)															(07)
(87)m= 1	17)m= 19.71 19.85 20.12 20.51 20.82 20.96 20.99 20.99 20.86 20.46 20.02 19.69													(87)		
Tempera	Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)															
(88)m= 1	19.93 19.93 19.95 19.95 19.96 19.96							19.96	19.	97	19.96	19.95	19.95	19.94		(88)
Utilisatio	Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)															
(89)m=	1	0.99 0.98 0.94 0.79 0.56 0.38		0.38	0.4	15	0.78	0.97	0.99	1	7	(89)				
Mean int	ternal t	empera	ture in t	he rest	of dwell	ina	T2 (fd	ollow ste	ns 3	to 7	' in Tahl	e 9c)	•	•	-	
	internal temperature in the rest of dwelling T2 (follow structure) 18.21 18.42 18.82 19.37 19.78 19.94 19.96							19.	-	19.85	19.31	18.69	18.2	٦	(90)	
` /							<u> </u>	!			 ng area ÷ (Į	0.34	(91)		
									,,							` ′
Mean int		_	<u> </u>			_	-		r È	-		40.74	10.45	10.74	7	(02)
` ′		18.91	19.26	19.76	20.14	<u> </u>	0.29	20.32	20.		20.19	19.71	19.15	18.71	J	(92)
Apply ac		18.76	e mean 19.11	19.61	19.99	_	0.14	m Table 20.17	20.		20.04	19.56	19	18.56	٦	(93)
` '				19.01	19.99		.0.14	20.17	20.	10	20.04	19.50	19	10.50		(55)
8. Space Set Ti to				oporotuu	o obtoir	204	ot ot	op 11 of	Tobl	la Oh	oo tha	t Ti m	(76)m on	d ro oo	louloto	
the utilis				•		ieu	al Sit	эр гтог	ıabı	ie ar), 50 illa	t 11,111=	(70)III ali	u ie-ca	culate	
	Jan	Feb	Mar	Apr	May		Jun	Jul	Α	ug	Sep	Oct	Nov	Dec	7	
Utilisatio		r for gai			,	_			<u> </u>		•		_	!	_	
(94)m=	1	0.99	0.98	0.93	0.79		0.58	0.41	0.4	18	0.79	0.96	0.99	1	7	(94)
Useful g	ains, h	mGm , \	W = (94)	l)m x (84	4)m	-									_	
(95)m= 360.63 402.8 457.68 514.88 498.71 367.29 242.41 253.39 357.11 368.87 346.18 343.79 (95)m=													(95)			
Monthly	averag	je exteri	nal tem	perature	from T	abl	e 8			'					_	
(96)m=	4.3 4.9 6.5 8.9 11.7 14.6 16.6				16.6	16	.4	14.1	10.6	7.1	4.2		(96)			
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m- (96)m]																
(97)m= 10	14.53	981.65	890.53	745.15	574.69	37	79.23	243.99	256	.82	408.91	621.1	829.69	1007.64	Į.	(97)

Space heating re	equire	ment fo	r each n	nonth, k\	Wh/mon	th = 0.02	24 x [(97))m – (95)m] x (4	1)m			
(98)m= 486.51 38	8.99	322.04	165.8	56.53	0	0	0	0	187.65	348.13	493.9		_
							Tota	l per year	(kWh/year) = Sum(98	8) _{15,912} =	2449.54	(98)
Space heating re	equire	ment in	kWh/m²	² /year								41.02	(99)
9a. Energy require	emen	ts – Indi	vidual h	eating sy	ystems i	ncluding	micro-C	HP)					
Space heating:				/							Г		7(004)
Fraction of space					mentary			(204)			Ĺ	0	(201)
Fraction of space			-	` '			(202) = 1 -		(202)]		Ĺ	1	(202)
Fraction of total h		_	•				(204) = (20	02) x [1 –	(203)] =		Ĺ	1	(204)
Efficiency of mai	•					. 0/					Ĺ	97.8	(206)
Efficiency of second					g systen			_	_			0	(208)
L	Feb	Mar mant (a	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ear
Space heating re	8.99	322.04	165.8	56.53	0	0	0	0	187.65	348.13	493.9		
(211)m = {[(98)m					<u> </u>			-					(211)
`	7.74	329.29	169.53	57.8	0	0	0	0	191.87	355.96	505.01		(211)
L					l		Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	2504.64	(211
Space heating fu	•		, , .	month							L		
$= \{ [(98)m \times (201)] \\ (215)m = 0 $	0 T	0 + (20	0	0	0	0	0	0	0	0	0		
						Ů			_	215) _{15.1012} :		0	(215
Nater heating											L		
Output from water		er (calc	ulated a										
	5.21	161.49	143.23	138.68	122.14	117.02	130.45	131.89	150.18	160.32	173.52		_
Efficiency of water						00.5	-0.5	00.5	00.44	04.00	25.0	88.5	(216
(217)m= 95.13 94 Fuel for water hea	4.95	94.48	93.26	91.01	88.5	88.5	88.5	88.5	93.44	94.66	95.2		(217)
(219)m <u>= (64)m</u>	•												
219)m= 186.79 16	3.46	170.92	153.59	152.38	138.01	132.22	147.4	149.03	160.73	169.35	182.27		
							Tota	I = Sum(2	19a) ₁₁₂ =			1906.15	(219
Annual totals	al ugo	d main	ovetem	1					k\	Wh/year	Г	kWh/yea	r
Space heating fue			system	1							Ĺ	2504.64	╡
Vater heating fue	l used	d									L	1906.15	
Electricity for pum	ıps, fa	ins and	electric	keep-ho	t								
	ump:										30		(230
central heating p		ahovo k	(Wh/vea	ır			sum	of (230a).	(230g) =		Ī	30	(231
•	r the a	abuve, r											
central heating p Fotal electricity for Electricity for light		above, r	,								Γ	271.4	(232
Total electricity fo	ing		·)(221)	+ (231)	+ (232).	(237b)	=			[[271.4 4712.2	(232

Energy

kWh/year

Stroma FSAP 2012 Version: 1.0.5.60 (SAP 9.92) - http://www.stroma.com

Emissions

kg CO2/year

Emission factor

kg CO2/kWh

Space heating (main system 1)	(211) x	0.216	=	541	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	411.73	(264)
Space and water heating	(261) + (262) + (263) + (264) =			952.73	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	15.57	(267)
Electricity for lighting	(232) x	0.519	=	140.86	(268)
Total CO2, kg/year	sum	of (265)(271) =		1109.16	(272)
Dwelling CO2 Emission Rate	(272)) ÷ (4) =		18.58	(273)
EI rating (section 14)				86	(274)

Appendix 2

Sample SAP Reports – Be Green

Property Details: GF Flat

Address:

Located in: England Region: Thames valley

UPRN:

Date of assessment: 05 October 2023
Date of certificate: 05 October 2023

Assessment type: New dwelling design stage

Transaction type:

Tenure type:

Related party disclosure:

Thermal Mass Parameter:

New dwelling

Unknown

No related party

Indicative Value Medium

Water use <= 125 litres/person/day: True

PCDF Version: 512

Property description

Dwelling type: Flat

Detachment:

Year Completed: 2023

Floor Location: Floor area:

Storey height:

Floor 0 60.29 m^2 2.5 m

Living area: 25.32 m² (fraction 0.42)

Front of dwelling faces: South East

Opening types:

Name: Source: Type: Glazing: Argon: Frame:

se Manufacturer Windows low-E, En = 0.05, soft coat Yes nw Manufacturer Windows low-E, En = 0.05, soft coat Yes

Name: Gap: Frame Factor: g-value: **U-value:** Area: No. of Openings: se 16mm or more 0.7 0.63 1.3 3.33 16mm or more 0.7 0.63 1.3 6.15 nw

Name: Type-Name: Location: Orient: Width: Height:

se Ext. South East 0 0 0 nw Ext. North West 0 0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elemen	<u>its</u>						
Ext.	52.77	9.48	43.29	0.24	0	False	N/A
Shel	22.8	0	22.8	0.11	0.43	False	N/A
Flat	8.04	0	8.04	0.12	0		N/A
GF	60.29			0.12			N/A

Internal Elements
Party Elements

Thermal bridges

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0498

Length Psi-value

5.14 0.05 E2 Other lintels (including other steel lintels)

1.42 0.034 E3 Sill

15.06	0.04	E4	Jamb
30.23	0.079	E5	Ground floor (normal)
8.88	0.08	E14	Flat roof
2.5	0.058	E16	Corner (normal)
5	-0.069	E17	Corner (inverted internal area greater than external area)
12.5	0.068	E18	Party wall between dwellings
12.99	0.16	P1	Ground floor
1.81	0.24	P4	Roof (insulation at ceiling level)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Natural ventilation (extract fans)

Number of chimneys:0Number of open flues:0Number of fans:2Number of passive stacks:0Number of sides sheltered:2Pressure test:5

Main heating system

Main heating system: Heat pumps with radiators or underfloor heating

Electric heat pumps Fuel: Electricity

Info Source: Boiler Database

Database: (rev 512, product index 101403, SEDBUK 216%):

Brand name: Vaillant Model: aroTHERM

Model qualifier: VWL 85/2 - Underfloor

(provides DHW all year) Systems with radiators

Central heating pump: 2013 or later

Design flow temperature: Design flow temperature >45°C

Unknown

Boiler interlock: Yes

Main heating Control:

Main heating Control: Time and temperature zone control by suitable arrangement of plumbing and electrical

services

Control code: 2207

Secondary heating system:

Secondary heating system: None

Water heating

Water heating: From main heating system

Water code: 901 Fuel :Electricity Hot water cylinder Cylinder volume: 90 litres

Cylinder insulation: Measured loss, 0.85kWh/day

Primary pipework insulation: True

Cylinderstat: True

Cylinder in heated space: True Flue Gas Heat Recovery System: Database (rev 512, product index)

Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

Conservatory: No conservatory

Low energy lights: 100%

Low rise urban / suburban

Terrain type: EPC language: English Wind turbine: No None Photovoltaics: No Assess Zero Carbon Home:

		l lser I	Details:						
Assessor Name: Software Name:	Bethany Robinson Stroma FSAP 2012	- 0 3 C F L	Strom Softwa					036516 on: 1.0.5.60	
	Р	roperty	Address	GF Fla	t				
Address :									
1. Overall dwelling dime	ensions:	Δro	a(m²)		Δν Ηο	ight(m)		Volume(m ³	3)
Ground floor				(1a) x		2.5	(2a) =	150.73	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1r		60.29	(4)]`		
Dwelling volume		′	00.20)+(3c)+(3c	d)+(3e)+	.(3n) =	150.73	(5)
				(33) (33	, (5.5)		(-)	150.75	(0)
2. Ventilation rate:	main secondar	у	other		total			m³ per hou	ır
Number of chimneys	heating heating 0 + 0] + [0] = Г	0	X 4	40 =	0	(6a)
Number of open flues	0 + 0	」	0] ₌ [0	x 2	20 =	0	(6b)
Number of intermittent fa		_ L		J	2	x	10 =	20	(7a)
Number of passive vents				L		x ^	10 =		(7b)
Number of flueless gas f				Ļ	0		40 =	0	= ' '
Number of flueless gas in	1165				0		10 -	0	(7c)
							Air ch	nanges per ho	our
Infiltration due to chimne	ys, flues and fans = $(6a)+(6b)+(7a)$	'a)+(7b)+	(7c) =	Γ	20		÷ (5) =	0.13	(8)
	peen carried out or is intended, procee	d to (17),	otherwise o	continue fr	om (9) to	(16)			_
Number of storeys in the Additional infiltration	he dwelling (ns)					[(0)	-1]x0.1 =	0	(9)
	.25 for steel or timber frame or	0.35 fo	r masoni	v constr	uction	[(9)-	-1]XU.1 =	0	(10)
if both types of wall are p	resent, use the value corresponding to			•				0	()
deducting areas of opening	ngs); if equal user 0.35 floor, enter 0.2 (unsealed) or 0	1 (soal	od) olso	ontor O					— (42)
If no draught lobby, en	,	. i (Scai	eu), eise	enter o				0	(12)
•	s and doors draught stripped							0	(14)
Window infiltration	0		0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate			(8) + (10)	+ (11) + (1	12) + (13)	+ (15) =		0	(16)
,	q50, expressed in cubic metre	•	•	•	etre of e	envelope	area	5	(17)
•	lity value, then $(18) = [(17) \div 20] + (18)$. , .	,		0.38	(18)
Number of sides sheltere	es if a pressurisation test has been dor ed	ne or a de	gree air pe	rmeability	is being u	sed		2	(19)
Shelter factor			(20) = 1 -	[0.0 75 x (1	19)] =			0.85	(20)
Infiltration rate incorpora	ting shelter factor		(21) = (18	x (20) =				0.33	(21)
Infiltration rate modified f	for monthly wind speed								
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	peed from Table 7							_	
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (2	2)m ÷ 4								
(22a)m= 1.27 1.25	1.23 1.1 1.08 0.95	0.95	0.92	1	1.08	1.12	1.18		
								ı	

Adjusted infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.41	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.38]	
Calculate effect If mechanica		_	rate for t	he appli	cable ca	se	-	-	-	-	-		
If exhaust air he			endix N. (2	3b) = (23a	a) × Fmv (e	eguation (N	N5)) . othe	rwise (23b) = (23a)			0	(23
If balanced with		0 11	, ,	, (, ,	• •	,, ,	`) = (20 0)			0	(23
a) If balance		•	•	J		,		,	2h\m + ((23h) ~ [1 _ (23c)	0	(23
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24
b) If balance	L ed mech:	L anical ve	L entilation	without	heat red	coverv (N	//\/) (24h)m = (22	2b)m + (23b)	<u> </u>	J	
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24
c) If whole h	ouse ex	tract ver	tilation o	r positiv	re input v	ventilatio	n from o	utside	<u> </u>	!	!	J	
if (22b)n					•				5 × (23b	o)			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24
d) If natural				•	•								
if (22b)n		`					- `					1	(0
24d)m= 0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57]	(24
Effective air						· · · · ·	·		0.50		0.57	1	(2)
25)m= 0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57]	(2
3. Heat losse	s and he	eat loss p	oaramet	er:									
ELEMENT	Gros	-	Openin		Net Ar		U-val		AXU		k-value		AXk
Mindowa Twa	area	(m²)	m	12	A ,r		W/m2		(W/	K)	kJ/m²-	K	kJ/K
Vindows Type					3.33	=	/[1/(1.3)+		4.12	=			(2)
Vindows Type 	2				6.15	X1	/[1/(1.3)+	0.04] = [7.6	ᆗ ,			(2
Floor					60.29	_	0.12	=	7.2348	<u> </u>		_	(2
Valls Type1	52.7	7	9.48		43.29	x	0.24	=	10.39	_		_	(2
Walls Type2	22.8	8	0		22.8	X	0.11	=	2.39	_		_	(2
Roof	8.04		0		8.04	X	0.12	=	0.96				(3
otal area of e					143.9								(3
for windows and * include the area						ated using	formula 1	/[(1/U-valu	ie)+0.04] á	as given in	paragraph	h 3.2	
Fabric heat los				o ana pan			(26)(30)	+ (32) =				32.7	(3
Heat capacity	•	•	,					((28)	(30) + (3	2) + (32a).	(32e) =	72.36	(3
hermal mass		,	P = Cm -	- TFA) ir	n kJ/m²K				tive Value	, , ,	, ,	250	(3:
or design assess	•	`		,			ecisely the	indicative	values of	TMP in Ta	able 1f		
an be used inste													
Thermal bridge	•	,			•	<						7.17	(3
details of therma otal fabric he		are not kn	own (36) =	= 0.05 x (3	1)			(33) 1	(36) =				
		alaulataa	l manthl	,						(25)m v (5)	\	39.87	(3:
/entilation hea	Feb	Mar		May	Jun	Jul	Aug	Sep	Oct	(25)m x (5) Nov	Dec	1	
38)m= 29.15	28.98	28.82	Apr 28.05	27.91	27.24	27.24	27.12	27.5	27.91	28.2	28.5	1	(38
·	<u> </u>	<u> </u>	20.00	21.31	21.24	21.24	21.12	<u> </u>	<u> </u>	ļ	1 20.0	J	(3)
Heat transfer o			67.00	67.70	67.44	67.44	60.00		= (37) + (60.07	1	
39)m= 69.02	68.85	68.69	67.92	67.78	67.11	67.11	66.99	67.37	67.78	68.07	68.37	67.00	(39
								,	Average =	: Sum(39)₁	12 / 12=	67.92	(3

Heat loss para	ameter (I	HLP), W	/m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 1.14	1.14	1.14	1.13	1.12	1.11	1.11	1.11	1.12	1.12	1.13	1.13		
							ı		Average =	: Sum(40) ₁	12 /12=	1.13	(40)
Number of day	<u> </u>	nth (Tab	le 1a)	1	1	1		1					
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water hea	ting ene	rgy requi	irement:								kWh/ye	ear:	
Assumed occurring TFA > 13.1 if TFA £ 13.1	9, N = 1		[1 - exp	0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	TFA -13		99		(42)
Annual average Reduce the annual not more that 125	al average	hot water	usage by	5% if the a	lwelling is	designed			se target o		.46		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage i	in litres pe	r day for ea				Table 1c x		<u>'</u>	!	!	<u>!</u>		
(44)m= 89.6	86.35	83.09	79.83	76.57	73.31	73.31	76.57	79.83	83.09	86.35	89.6		
_										im(44) ₁₁₂ =		977.5	(44)
Energy content of) kWh/mor		1	c, 1d)		
(45)m= 132.88	116.22	119.93	104.55	100.32	86.57	80.22	92.05	93.15	108.56	118.5	128.69		— ,
If instantaneous v	vater heati	ina at point	of use (no	o hot water	r storage).	enter 0 in	boxes (46		Total = Su	ım(45) ₁₁₂ =	=	1281.66	(45)
(46)m= 19.93	17.43	17.99	15.68	15.05	12.99	12.03	13.81	13.97	16.28	17.78	19.3		(46)
Water storage		17.55	10.00	10.00	12.00	12.00	10.01	10.07	10.20	17.70	15.5		(1.5)
Storage volum	ne (litres)) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		90		(47)
If community h	neating a	and no ta	ınk in dw	velling, e	nter 110) litres in	(47)						
Otherwise if no		hot wate	er (this in	ncludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in ((47)			
Water storage		oolorod l	ooo foot	or io kno		2/d0x/):							(40)
a) If manufact				or is kno	wn (Kvvi	i/day):					.85		(48)
Temperature f							(40) (40)	\			.54		(49)
Energy lost from b) If manufact		•			or is not		(48) x (49)) =		0.	.46		(50)
Hot water stor			-								0		(51)
If community h	•		on 4.3										
Volume factor			Ol-								0		(52)
Temperature f											0		(53)
Energy lost fro Enter (50) or		_	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Water storage	` , ` `	,	for each	month			((56)m - ((55) × (41)	m	0.	.46		(55)
		1			40.77		. , ,	·	1	10.77	1 1		(EC)
(56)m= 14.23 If cylinder contain	12.85	14.23	13.77	14.23 m = (56)m	13.77	14.23	14.23	13.77 7)m = (56)	14.23	13.77 (H11) is fro	14.23	iv H	(56)
	·			· · ·	1					· ·		A 11	(57)
(57)m= 14.23	12.85	14.23	13.77	14.23	13.77	14.23	14.23	13.77	14.23	13.77	14.23		(57)
Primary circuit	,	•									0		(58)
Primary circuit				,	•		, ,		r thorns -	otot)			
(modified by (59)m= 23.26	21.01	1	ı —		ı —			<u> </u>	1	- 	22.26		(59)
(59)m= 23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(38)

Combi	loss ca	lculated	for each	month (61)m =	(60) ÷ 36	65 × (41))m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	eat requ	uired for	water he	eating ca	alculated	for eacl	h month	(62)m	= 0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	170.37	150.08	157.42	140.84	137.81	122.85	117.71	129.55	129.44	146.05	154.79	166.18]	(62)
Solar DH	HW input	calculated	using App	endix G or	Appendix	H (negati	ve quantity	/) (enter	'0' if no sola	r contribut	ion to wate	er heating)	1	
(add a	dditiona	l lines if	FGHRS	and/or V	VWHRS	applies	, see Ap	pendix	G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0		(63) (G2)
Output	from w	ater hea	ter											
(64)m=	170.37	150.08	157.42	140.84	137.81	122.85	117.71	129.55	129.44	146.05	154.79	166.18		_
		-				-	-	Οι	itput from wa	ater heate	r (annual)₁	12	1723.09	(64)
Heat g	ains fro	m water	heating,	kWh/mo	onth 0.2	5 ´ [0.85	× (45)m	+ (61)	m] + 0.8 x	k [(46)m	+ (57)m	+ (59)m	1	
(65)m=	74.18	65.73	69.87	63.79	63.35	57.81	56.67	60.6	60	66.09	68.43	72.78		(65)
inclu	de (57)	m in cald	culation of	of (65)m	only if c	ylinder i	s in the o	dwellin	g or hot w	ater is fr	om com	munity h	neating	
5. Int	ernal ga	ains (see	Table 5	and 5a)):									
Metabo	olic gain	s (Table	5), Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	119.39	119.39	119.39	119.39	119.39	119.39	119.39	119.39	119.39	119.39	119.39	119.39		(66)
Lightin	g gains	(calcula	ted in Ap	pendix l	L, equat	ion L9 o	r L9a), a	lso see	Table 5	-	-	-		
(67)m=	40.52	35.99	29.27	22.16	16.57	13.99	15.11	19.64	26.36	33.48	39.07	41.65		(67)
Appliar	nces ga	ins (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), als	so see Ta	ble 5			•	
(68)m=	259.22	261.91	255.13	240.7	222.49	205.37	193.93	191.24	198.02	212.45	230.66	247.78		(68)
Cookin	g gains	(calcula	ted in A	opendix	L, equat	tion L15	or L15a)	, also	see Table	5			•	
(69)m=	48.93	48.93	48.93	48.93	48.93	48.93	48.93	48.93	48.93	48.93	48.93	48.93		(69)
Pumps	and fai	ns gains	(Table 5	 āa)		•							•	
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(70)
Losses	e.g. ev	aporatio	n (nega	ive valu	es) (Tab	le 5)		•					•	
(71)m=	-79.59	-79.59	-79.59	-79.59	-79.59	-79.59	-79.59	-79.59	-79.59	-79.59	-79.59	-79.59		(71)
Water	heating	gains (T	able 5)			•							•	
(72)m=	99.7	97.82	93.91	88.6	85.15	80.29	76.16	81.45	83.33	88.83	95.04	97.82]	(72)
Total i	nternal	gains =				(66)	m + (67)m	+ (68)m	n + (69)m + ((70)m + (7	1)m + (72)	m	•	
(73)m=	488.17	484.45	467.04	440.18	412.92	388.37	373.93	381.06	396.44	423.48	453.5	475.98		(73)
6. Sol	ar gains	S:												
Solar g	ains are o	calculated	using sola	r flux from	Table 6a	and assoc	iated equa	tions to	convert to th	e applicat	ole orientat	ion.		
Orienta		ccess F		Area		Flu			_ g	-	FF		Gains	
		Table 6d		m²		l al	ole 6a		Table 6b		able 6c		(W)	_
Southe	ast _{0.9x}	0.77	Х	3.3	3	x 3	6.79	х	0.63	x	0.7	=	37.44	(77)
Southe	ast _{0.9x}	0.77	Х	3.3	3	x 6	2.67	х	0.63	x	0.7	=	63.78	(77)
Southe	L	0.77	х	3.3	3	x 8	5.75	x	0.63	x	0.7	=	87.27	(77)
Souther	ast _{0.9x}	0.77	Х	3.3	3	x 1	06.25	X	0.63	х	0.7	=	108.13	(77)

Southea	ast _{0.9x}	0.77	X	3.3	33	x	1	19.01	X	0.63	X	0.7	=	121.12	(77)
Southea	ast _{0.9x}	0.77	X	3.3	33	x	1	18.15	X	0.63	X	0.7	=	120.24	(77)
Southea	ast _{0.9x}	0.77	x	3.3	33	x	1	13.91	X	0.63	X	0.7	=	115.92	(77)
Southea	ast _{0.9x}	0.77	х	3.3	33	x	10	04.39	X	0.63	X	0.7	=	106.24	(77)
Southea	ast _{0.9x}	0.77	x	3.3	33	x	9	2.85	x	0.63	x	0.7	_ =	94.49	(77)
Southea	ast _{0.9x}	0.77	x	3.3	33	x	6	9.27	х	0.63	x	0.7	=	70.49	(77)
Southea	ast 0.9x	0.77	x	3.3	33	х	4	4.07	x	0.63	x	0.7	=	44.85	(77)
Southea	ast _{0.9x}	0.77	x	3.3	33	x	3	1.49	x	0.63	x	0.7		32.04	(77)
Northwe	est _{0.9x}	0.77	x	6.	15	х	1	1.28	x	0.63	x	0.7	=	21.21	(81)
Northwe	est 0.9x	0.77	x	6.	15	х	2	2.97	x	0.63	x	0.7	=	43.17	(81)
Northwe	est _{0.9x}	0.77	x	6.	15	x	4	1.38	X	0.63	×	0.7	_ =	77.77	(81)
Northwe	est _{0.9x}	0.77	x	6.	15	x	6	7.96	x	0.63	×	0.7	_ =	127.72	(81)
Northwe	est _{0.9x}	0.77	x	6.	15	x	9	1.35	x	0.63	×	0.7	=	171.69	(81)
Northwe	est _{0.9x}	0.77	x	6.	15	x	9	7.38	x	0.63	×	0.7	_ =	183.04	(81)
Northwe	est _{0.9x}	0.77	x	6.	15	x	9	91.1	x	0.63	×	0.7	_ =	171.23	(81)
Northwe	est _{0.9x}	0.77	x	6.	15	х	7	2.63	x	0.63	×	0.7	=	136.5	(81)
Northwe	est _{0.9x}	0.77	x	6.	15	x	5	0.42	x	0.63	×	0.7		94.77	(81)
Northwe	est _{0.9x}	0.77	x	6.	15	x	2	8.07	x	0.63	×	0.7	_ =	52.75	(81)
Northwe	est _{0.9x}	0.77	x	6.	15	х	<u> </u>	14.2	X	0.63	×	0.7	=	26.68	(81)
Northwe	est _{0.9x}	0.77	x	6.	15	х		9.21	X	0.63	×	0.7	=	17.32	(81)
	_														
Solar o	ains in	watts, cal	lculated	l for eac	h mon	h			(83)m	n = Sum(74)m	(82)m				
Solar g	ains in 58.65	watts, cal	lculated 165.04	for eac 235.86	h mon	\neg	03.28	287.15	(83)m 242	n = Sum(74)m 2.74 189.26	(<mark>82</mark>)m	1	49.36	1	(83)
(83)m =	58.65		165.04	235.86	292.8	3			ì		- ` 	1	49.36]	(83)
(83)m =	58.65	106.95	165.04	235.86	292.8	3 1 + (ì	.74 189.26	- ` 	5 71.53	49.36 525.35]	(83) (84)
(83)m= [Total ga (84)m= [58.65 ains — ir 546.82	106.95 nternal ar 591.39	165.04 nd solar 632.08	235.86 (84)m = 676.04	292.8 = (73)n 705.7	3 1 + (3 6	83)m	, watts	242	.74 189.26	123.2	5 71.53	<u> </u>]	, ,
(83)m= [Total ga (84)m= [7. Mea	58.65 ains — ii 546.82 an inter	106.95 Internal ar 591.39 Inal tempe	165.04 nd solar 632.08 erature	235.86 (84)m = 676.04 (heating	292.8 = (73)n 705.73	3 n + (B 6	83)m 91.64	, watts 661.08	623		123.2	5 71.53	<u> </u>	21	, ,
(83)m= [Total ga (84)m= [7. Mea	58.65 ains — ir 546.82 an inter erature	106.95 nternal ar 591.39 nal tempe	165.04 nd solar 632.08 erature eating p	235.86 (84)m = 676.04 (heating	292.8 = (73)n 705.73 season the li	3 n + (3 6 on) ving	83)m 91.64 area 1	, watts 661.08 from Tab	623	.74 189.26	123.2	5 71.53	<u> </u>	21	(84)
(83)m= [Total ga (84)m= [7. Mea	58.65 ains — ir 546.82 an inter erature	106.95 Internal ar 591.39 Inal tempe	165.04 nd solar 632.08 erature eating p	235.86 (84)m = 676.04 (heating	292.8 = (73)n 705.73 season the li	3 n + (3 6 on) ving m (s	83)m 91.64 area 1	, watts 661.08 from Tab	242 623 ole 9	.74 189.26 3.8 585.7 , Th1 (°C)	123.2	5 71.53 2 525.03	<u> </u>	21	(84)
(83)m= [Total ga (84)m= [7. Mea	58.65 ains — in 546.82 an inter erature tion fac	106.95 Internal ar 591.39 Inal temper during heator for ga	165.04 nd solar 632.08 erature eating p	235.86 (84)m = 676.04 (heating eriods in iving are	292.8 = (73)n 705.73 season the lives, h1,	3 n + (3 6 on) ving m (s	83)m 91.64 area t ee Ta	watts 661.08 from Tabble 9a)	242 623 ole 9	.74 189.26 3.8 585.7 , Th1 (°C)	123.2	71.53 2 525.03 t Nov	525.35	21	(84)
(83)m= Total gas (84)m= Total gas (84)m= Utilisa	58.65 ains – in 546.82 an inter erature tion fac Jan 0.99	106.95 Internal ar 591.39 Inal temper during heator for ga Feb 0.98	165.04 nd solar 632.08 erature eating p ins for l Mar 0.96	235.86 (84)m = 676.04 (heating eriods in iving are Apr 0.91	292.8 = (73)n 705.73 season the linea, h1, May 0.79	3 6 (s)	83)m 91.64 area f ee Ta Jun 0.6	from Tabble 9a) Jul 0.44	242 623 ole 9 A	.74 189.26 3.8 585.7 , Th1 (°C) ug Sep 49 0.73	123.2 546.7	71.53 2 525.03	525.35 Dec	21	(84)
(83)m= [Total ga (84)m= [7. Mea Tempo Utilisa (86)m= [Mean	58.65 ains – in 546.82 an inter erature tion fac Jan 0.99 interna	106.95 Internal ar 591.39 Inal temperal tor for ga Feb 0.98 I temperal	nd solar 632.08 erature eating p ins for l Mar 0.96	235.86 (84)m = 676.04 (heating eriods in iving are 0.91 living are 1.91	292.8 = (73)n	3 6 (s)	91.64 area f ee Ta Jun 0.6	, watts 661.08 from Tab ble 9a) Jul 0.44 ps 3 to 7	242 623 cole 9 A 0.4	.74 189.26 3.8 585.7 , Th1 (°C) ug Sep 49 0.73 Table 9c)	123.2 546.7	71.53 2 525.03	525.35 Dec 0.99	21	(84)
(83)m= [Total ga (84)m= [7. Mea Tempo Utilisa (86)m= [Mean (87)m= [58.65 ains – in 546.82 an interestion factor Jan 0.99 interna 21	106.95 nternal ar 591.39 nal tempera 21	165.04 nd solar 632.08 erature eating p ins for l Mar 0.96 ature in 21	235.86 (84)m = 676.04 (heating eriods in iving are 0.91 living are 21	292.8 = (73)n	33 66 000) ving m (s	area free Ta Jun 0.6 ow ste	, watts 661.08 from Tab ble 9a) Jul 0.44 ps 3 to 7	242 623 cole 9 A 0.4 7 in T 2	.74 189.26 3.8 585.7 , Th1 (°C) ug Sep 49 0.73 Table 9c) 1 21	123.2 546.7 Oc: 0.92	71.53 2 525.03 t Nov 0.98	525.35 Dec	21	(84)
(83)m= Total games (84)m= Tempor Utilisa (86)m= Mean (87)m= Tempor Tempor Carrow (87)m= Tempo	58.65 ains – in 546.82 an inter erature tion fac Jan 0.99 interna 21 erature	106.95 Internal ar 591.39 Inal temper during he tor for ga Feb 0.98 I tempera 21 during he	nd solar 632.08 erature eating p ins for l Mar 0.96 eture in 21 eating p	235.86 (84)m = 676.04 (heating eriods in iving are 0.91 living are 21 eriods in eriods	292.8 = (73)n	3 6 6 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	area from the second of the se	watts 661.08 from Table 9a) Jul 0.44 ps 3 to 7 21 from Ta	242 242 623 ble 9 A 0.4 7 in T 2	.74 189.26 3.8 585.7 , Th1 (°C) ug Sep 49 0.73 Table 9c) 1 21 9, Th2 (°C)	123.2 546.7 Oc 0.92	71.53 2 525.03 t Nov 0.98	Dec 0.99	21	(84) (85) (86) (87)
(83)m= [Total gate (84)m= [7. Mean (86)m= [Mean (87)m= [Tempe (88)m= [58.65 ains – in 546.82 an inter erature tion fac Jan 0.99 interna 21 erature 19.96	106.95 Internal ar 591.39 Inal temper during he tor for ga Feb 0.98 I tempera 21 during he 19.97	nd solar 632.08 erature eating p ins for l Mar 0.96 ature in 21 eating p	235.86 (84)m = 676.04 (heating eriods in iving are Apr 0.91 living are 21 eriods in 19.98	292.8 = (73)n	3 3 6 6 7 7 7 7 7 7 7 7	area face Ta Jun 0.6 w ste 21 velling	, watts 661.08 from Table 9a) Jul 0.44 ps 3 to 7 21 from Ta	242 242 623 ble 9 A 0.4 7 in T 2 able 9	.74 189.26 3.8 585.7 , Th1 (°C) ug Sep 49 0.73 Table 9c) 1 21 9, Th2 (°C)	123.2 546.7 Oc: 0.92	71.53 2 525.03 t Nov 0.98	525.35 Dec 0.99	21]	(84)
(83)m= Total gas (84)m= Total gas (84)m= Mean (87)m= Tempo (88)m= Utilisa	58.65 ains – in 546.82 an inter erature tion fac Jan 0.99 interna 21 erature 19.96 tion fac	106.95 Internal ar 591.39 Inal temper during he tor for ga Feb 0.98 I tempera 21 during he 19.97 tor for ga	nd solar 632.08 erature eating p ins for l Mar 0.96 eture in 21 eating p 19.97	235.86 (84)m = 676.04 (heating eriods in iving are 0.91 living are 21 eriods in 19.98 rest of d	292.8 = (73)n	3 6 6 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	area free Ta Jun 0.6 w ste 21 velling 9.99 ,m (se	from Table 9a) Jul 0.44 ps 3 to 7 21 from Ta 19.99	242 623 bole 9 A 0.4 7 in T 2 able 9 19.	.74 189.26 3.8 585.7 , Th1 (°C) ug Sep 49 0.73 Table 9c) 1 21 9, Th2 (°C) 99 19.99	123.2 546.7 Oc: 0.92 21	71.53 2 525.03 1 Nov 0.98 21 3 19.98	Dec 0.99	21	(84) (85) (86) (87) (88)
(83)m= [Total gate (84)m= [7. Mean (86)m= [Mean (87)m= [Tempe (88)m= [58.65 ains – in 546.82 an inter erature tion fac Jan 0.99 interna 21 erature 19.96	106.95 Internal ar 591.39 Inal temper during he tor for ga Feb 0.98 I tempera 21 during he 19.97	nd solar 632.08 erature eating p ins for l Mar 0.96 ature in 21 eating p	235.86 (84)m = 676.04 (heating eriods in iving are Apr 0.91 living are 21 eriods in 19.98	292.8 = (73)n	3 6 6 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	area face Ta Jun 0.6 w ste 21 velling	, watts 661.08 from Table 9a) Jul 0.44 ps 3 to 7 21 from Ta	242 242 623 ble 9 A 0.4 7 in T 2 able 9	.74 189.26 3.8 585.7 , Th1 (°C) ug Sep 49 0.73 Table 9c) 1 21 9, Th2 (°C) 99 19.99	123.2 546.7 Oc 0.92	71.53 2 525.03 1 Nov 0.98 21 3 19.98	Dec 0.99	21]	(84) (85) (86) (87)
(83)m= [Total ga (84)m= [7. Mea Tempo Utilisa (86)m= [Mean (87)m= [Tempo (88)m= [Utilisa (89)m= [58.65 ains – in 546.82 an inter erature tion fac Jan 0.99 interna 21 erature 19.96 tion fac 0.98 interna	106.95 Internal ar 591.39 Inal temper during he tor for ga Feb 0.98 I tempera 21 during he 19.97 tor for ga	nd solar 632.08 erature eating p ins for l Mar 0.96 eture in 21 eating p 19.97 ins for l	235.86 (84)m = 676.04 (heating eriods in iving are 0.91 living are 21 eriods in 19.98 rest of d 0.88 the rest	292.8 = (73)n	3 6 6 6 7 7 7 7 8 7 8 7 9 7 9 9 9 9 9 9 9 9 9 9	83)m 91.64 area f ee Ta Jun 0.6 w ste 21 velling 9.99 ,m (se 0.51	from Table 9a) Jul 0.44 ps 3 to 7 21 from Ta 19.99 ee Table 0.34	242 623 ble 9 A 0.4 7 in T 2 19. 9a) 0.3	.74 189.26 3.8 585.7 , Th1 (°C) ug Sep 49 0.73 Table 9c) 1 21 9, Th2 (°C) 99 19.99	123.2 546.7 Oc: 0.92 21 19.98	71.53 2 525.03 1 Nov 0.98 21 3 19.98	Dec 0.99		(84) (85) (86) (87) (88)
(83)m= [Total ga (84)m= [7. Mea Tempo Utilisa (86)m= [Mean (87)m= [Tempo (88)m= [Utilisa (89)m= [58.65 ains – in 546.82 an interestion factor Jan 0.99 interna 21 erature 19.96 tion factor 0.98	106.95 Internal ar 591.39 Inal temper during he tor for ga Feb 0.98 I tempera 21 during he 19.97 tor for ga	nd solar 632.08 erature eating p ins for l Mar 0.96 eture in 21 eating p 19.97 ins for l	235.86 (84)m = 676.04 (heating eriods in iving are 0.91 living are 21 eriods in 19.98 rest of d 0.88	292.8 = (73)n	3 3 6 6 6 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	83)m 91.64 area f ee Ta Jun 0.6 w ste 21 velling 9.99 ,m (se 0.51	from Table 9a) Jul 0.44 ps 3 to 7 21 from Ta 19.99 ee Table 0.34	242 623 ble 9 A 0.4 7 in T 2 19. 9a) 0.3	.74 189.26 3.8 585.7 , Th1 (°C) ug Sep 49 0.73 Table 9c) 1 21 9, Th2 (°C) 99 19.99 38 0.64 3 to 7 in Tab 99 19.99	123.2 546.7 Oc: 0.92 21 19.98 0.89 le 9c)	71.53 2 525.03 2 525.03 4 Nov 0.98 21 3 19.98 0.97	Dec 0.99 21 19.97 0.99	21	(84) (85) (86) (87) (88) (89)
(83)m= [Total gate (84)m= [7. Mean (86)m= [Mean (87)m= [Tempe (88)m= [Utilisa (89)m= [Mean (87)m= [58.65 ains – in 546.82 an inter erature tion fac Jan 0.99 interna 21 erature 19.96 tion fac 0.98 interna	106.95 Internal ar 591.39 Inal temper during he tor for ga Feb 0.98 I tempera 21 during he 19.97 tor for ga 0.97 I tempera	165.04 nd solar 632.08 erature eating p ins for l Mar 0.96 atture in 21 eating p 19.97 ins for l 0.95	235.86 (84)m = 676.04 (heating eriods in iving are 0.91 living are 21 eriods in 19.98 rest of d 0.88 the rest	292.8 = (73)n	3 3 6 6 6 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	83)m 91.64 area f ee Ta Jun 0.6 w ste 21 velling 19.99 ,m (se 0.51	from Table 9a) Jul 0.44 ps 3 to 7 21 from Ta 19.99 ee Table 0.34 ollow ste	242 242 623 623 623 623 7 in T 2 44 19. 9a) 0.3	.74 189.26 3.8 585.7 , Th1 (°C) ug Sep 49 0.73 Table 9c) 1 21 9, Th2 (°C) 99 19.99 38 0.64 3 to 7 in Tab 99 19.99	123.2 546.7 Oc: 0.92 21 19.98 0.89 le 9c)	71.53 2 525.03 1 Nov 0.98 21 3 19.98	Dec 0.99 21 19.97 0.99	21	(84) (85) (86) (87) (88)
(83)m= [Total ga (84)m= [7. Mea Tempo Utilisa (86)m= [Mean (87)m= [Tempo (88)m= [Utilisa (89)m= [Mean (90)m= [58.65 ains – in 546.82 an inter erature tion face Jan 0.99 interna 21 erature 19.96 tion face 0.98 interna 19.96	106.95 Internal ar 591.39 Inal temper during he tor for ga Feb 0.98 I tempera 21 during he 19.97 Itempera 19.97 I tempera	165.04 nd solar 632.08 erature eating p ins for l 0.96 eture in 21 eating p 19.97 ins for l 0.95 eture in 19.97	235.86 (84)m = 676.04 (heating eriods in iving are 0.91 living are 21 eriods in 19.98 rest of d 0.88 the rest 19.98	292.8 = (73)n 705.73 season the livea, h1, May 0.79 ea T1 or rest or 19.98 welling 0.73 of dwe	3 3 6 6 6 6 6 6 6 6	83)m 91.64 area f ee Ta Jun 0.6 w ste 21 velling 9.99 ,m (se 0.51 T2 (fd	from Table 9a) Jul 0.44 ps 3 to 7 21 from Ta 19.99 ee Table 0.34 ollow ste 19.99	242 242 242 242 242 242 242 242 242 242	.74 189.26 3.8 585.7 , Th1 (°C) ug Sep 49 0.73 Table 9c) 1 21 9, Th2 (°C) 99 19.99 38 0.64 3 to 7 in Tab 99 19.99	123.2 546.7 546.7 0.92 21 19.98 0.89 19.98 fLA = Li	71.53 2 525.03 2 525.03 4 Nov 0.98 21 3 19.98 0.97	Dec 0.99 21 19.97 0.99		(84) (85) (86) (87) (88) (89)
(83)m= [Total ga (84)m= [7. Mea Tempo Utilisa (86)m= [Mean (87)m= [Tempo (88)m= [Utilisa (89)m= [Mean (90)m= [58.65 ains – in 546.82 an inter erature tion face Jan 0.99 interna 21 erature 19.96 tion face 0.98 interna 19.96	106.95 Internal ar 591.39 Inal temper during he tor for ga Feb 0.98 I tempera 21 during he 19.97 Itempera 19.97 I tempera	165.04 nd solar 632.08 erature eating p ins for l 0.96 eture in 21 eating p 19.97 ins for l 0.95 eture in 19.97	235.86 (84)m = 676.04 (heating eriods in iving are 0.91 living are 21 eriods in 19.98 rest of d 0.88 the rest 19.98	292.8 = (73)n 705.73 season the livea, h1, May 0.79 ea T1 or rest or 19.98 welling 0.73 of dwe	3 1 + (3 6 6 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	83)m 91.64 area f ee Ta Jun 0.6 w ste 21 velling 9.99 ,m (se 0.51 T2 (fd	from Table 9a) Jul 0.44 ps 3 to 7 21 from Table 19.99 ee Table 0.34 ollow steen 19.99	242 242 242 242 242 242 242 242 242 242	.74 189.26 3.8 585.7 , Th1 (°C) ug Sep 49 0.73 Table 9c) 1 21 9, Th2 (°C) 99 19.99 38 0.64 3 to 7 in Tab 99 19.99 - fLA) × T2	123.2 546.7 546.7 0.92 21 19.98 0.89 19.98 fLA = Li	5 71.53 2 525.03 2 Nov 0.98 21 3 19.98 0.97 3 19.98 ving area ÷ (Dec 0.99 21 19.97 0.99		(84) (85) (86) (87) (88) (89)
(83)m= [Total gate (84)m= [7. Mean (86)m= [Mean (87)m= [Tempe (88)m= [Utilisa (89)m= [Mean (90)m= [Mean (90)m= [58.65 ains – in 546.82 an inter erature tion fac Jan 0.99 interna 21 erature 19.96 tion fac 0.98 interna 19.96 interna 20.4	106.95 Internal ar 591.39 Inal temper during he tor for ga Feb 0.98 I tempera 21 during he 19.97 tor for ga 0.97 I tempera 19.97 I tempera 20.4	165.04 nd solar 632.08 erature eating p ins for l Mar 0.96 eture in 21 eating p 19.97 ins for l 0.95 eture in 19.97 eture in 20.4	235.86 (84)m = 676.04 (heating eriods in iving are 0.91 living are 21 eriods in 19.98 rest of d 0.88 the rest 19.98 r the wh 20.41	292.8 = (73)n	3 6 6 7 7 7 9 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	83)m 91.64 area f ee Ta Jun 0.6 w ste 21 velling 9.99 T2 (fc 19.99 g) = fl 20.41	from Table 9a) Jul 0.44 ps 3 to 7 21 from Table 0.34 ce Table 0.34 collow stee 19.99 -A × T1 20.41	2422 242 242 242 242 242 242 242 242 24	.74 189.26 3.8 585.7 , Th1 (°C) ug Sep 49 0.73 Table 9c) 1 21 9, Th2 (°C) 99 19.99 38 0.64 3 to 7 in Tab 99 19.99 - fLA) × T2	123.2 546.7 Occ 0.92 21 19.98 0.89 le 9c) 19.98 fLA = Li 20.4	71.53 2 525.03 2 525.03 2 Nov 0.98 21 3 19.98 0.97 3 19.98 ving area ÷ (Dec 0.99 21 19.97 0.99 19.97 4) =		(84) (85) (86) (87) (88) (89) (90) (91)

(93)m=	20.4	20.4	20.4	20.41	20.41	20.41	20.41	20.42	20.41	20.41	20.41	20.4		(93)
8. Spa	ace hea	ting requ	uirement											
				•		ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	culate	
the ut			or gains			1	11	I A	0	0-4	N.			
Litilion	Jan	Feb	Mar ains, hm	. Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(94)m=	0.99	0.98	0.95	0.89	0.75	0.55	0.39	0.43	0.68	0.91	0.97	0.99		(94)
			, W = (9 ⁴			0.00	0.00	0.40	0.00	0.01	0.07	0.00		(= 1)
(95)m=	538.94	577.66	603.27	602.05	532.06	381.06	254.8	266.98	399.14	495.57	510.85	519.05		(95)
		age exte	rnal tem			L able 8	<u> </u>	!		<u> </u>	<u> </u>			
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m	x [(93)m	– (96)m]	<u> </u>			
(97)m=	1111.1	1067.21	954.87	781.63	590.28	390.21	255.98	268.97	425.25	664.84	905.76	1107.9		(97)
Space	e heating	g require	ement fo	r each n	nonth, k\	Wh/mon	th = 0.02	24 x [(97)m – (95)m] x (4	1)m	•		
(98)m=	425.69	328.97	261.6	129.3	43.32	0	0	0	0	125.93	284.34	438.11		
,			-			-	-	Tota	l per year	(kWh/yeaı	r) = Sum(9	8)15,912 =	2037.25	(98)
Space	e heating	g require	ement in	kWh/m²	/year							'	33.79	(99)
•		•				vetome i	neludina	micro-C	'UD/					
	e heatin		ilo – iliui	Muuai II	calling s	ysterns i	ncidaling	, micro-c)					
-		•	nt from so	econdar	v/supple	mentary	system						0	(201)
	•		at from m	•		,	•	(202) = 1	- (201) =				1	(202)
			ng from	-	` ,			(204) = (2		(203)] =			1	(204)
			_	-				() (-	,	(/1				╡` ′
	-	•	ace heat	-			0.4						216.37	(206)
ETTICIE	ency of s		ry/suppi	ementar	y neating	g system	า, % 						0	(208)
_	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space		•	ement (c					Ι .					1	
	425.69	328.97	261.6	129.3	43.32	0	0	0	0	125.93	284.34	438.11		
(211)m		•	4)] } x 1				ı			ı	ı		ı	(211)
	196.74	152.04	120.9	59.76	20.02	0	0	0	0	58.2	131.41	202.48		-
								Lota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	<u>_</u>	941.57	(211)
•		`	econdar	• , .	month									
	i i	01)] } x 1	00 ÷ (20		_			Ι ο	0					
(215)m=	0	U	0	0	0	0	0	0 Tota	l (kWh/yea	0 ar) =Sum(1	0	0		(215)
147.4								Tota	ii (KVVII/yea	ar) =50m(2	213) _{15,1012}	2	0	(213)
	heating		ter (calc	ulated al	hovo)									
Output	170.37	150.08	157.42	140.84	137.81	122.85	117.71	129.55	129.44	146.05	154.79	166.18		
Efficier	ncy of w	ater hea	ıter			l	<u> </u>	<u> </u>			<u> </u>		116.16	(216)
İ	116.16	116.16	116.16	116.16	116.16	116.16	116.16	116.16	116.16	116.16	116.16	116.16		(217)
` ′			kWh/mo					1						` ,
		-) ÷ (217)											
(219)m=	146.67	129.2	135.52	121.24	118.64	105.76	101.34	111.52	111.43	125.73	133.25	143.06		
'								Tota	I = Sum(2	19a) ₁₁₂ =			1483.37	(219)
	al totals									k'	Wh/year	,	kWh/year	 _
Space	heating	fuel use	ed, main	system	1								941.57	

	J			
Water heating fuel used			1483.37	7
Electricity for pumps, fans and electric keep-hot				_
Total electricity for the above, kWh/year	sum of (230	a)(230g) =	0	(231)
Electricity for lighting			286.27	(232)
Total delivered energy for all uses (211)(221) +	(231) + (232)(237b) =		2711.22	(338)
10a. Fuel costs - individual heating systems:				
	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year	
Space heating - main system 1	(211) x	13.19 x 0.01 =	124.19	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	13.19 x 0.01 =	195.66	(247)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	0	(249)
(if off-peak tariff, list each of (230a) to (230g) sepa Energy for lighting	arately as applicable and app (232)	poly fuel price according to $13.19 x 0.01 =$	Table 12a 37.76	(250)
Additional standing charges (Table 12)			0	(251)
Appendix Q items: repeat lines (253) and (254) as	s needed			
	7) + (250)(254) =		357.61	(255)
11a. SAP rating - individual heating systems				
Energy cost deflator (Table 12)			0.42	(256)
Energy cost factor (ECF) [(255) x (25	56)] ÷ [(4) + 45.0] =		1.43	(257)
SAP rating (Section 12)			80.1	(258)
12a. CO2 emissions – Individual heating system	s including micro-CHP			
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/yea	
Space heating (main system 1)	(211) x	0.519 =	488.68	(261)
Space heating (secondary)	(215) x	0.519 =	0	(263)
Water heating	(219) x	0.519 =	769.87	(264)
Space and water heating	(261) + (262) + (263) + (264) =		1258.55	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	0	(267)
Electricity for lighting	(232) x	0.519 =	148.57	(268)
Total CO2, kg/year	sum	n of (265)(271) =	1407.12	(272)
CO2 emissions per m ²	(27)	2) ÷ (4) =	23.34	(273)
EI rating (section 14)			82	(274)
13a. Primary Energy				
	Energy	Primary	P. Energy	
	kWh/year	factor	kWh/year	

Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	4553.96	(264)
Space and water heating	(261) + (262) + (263) + (26	4) =		7444.59	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	0	(267)
Electricity for lighting	(232) x	0	=	878.84	(268)
'Total Primary Energy		sum of (265)(271) =		8323.43	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		138.06	(273)

		l lser I	Details:						
Assessor Name: Software Name:	Bethany Robinson Stroma FSAP 2012	- 0 3 C F L	Strom Softwa					036516 on: 1.0.5.60	
	Р	roperty	Address	GF Fla	t				
Address :									
1. Overall dwelling dime	ensions:	Δro	a(m²)		Δν Ηο	ight(m)		Volume(m ³	3)
Ground floor				(1a) x		2.5	(2a) =	150.73	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1r		60.29	(4)]`		
Dwelling volume		′ <u> </u>	00.20)+(3c)+(3c	d)+(3e)+	.(3n) =	150.73	(5)
				(33) (33	, (5.5)		(-)	150.75	(0)
2. Ventilation rate:	main secondar	у	other		total			m³ per hou	ır
Number of chimneys	heating heating 0 + 0] + [0] = Г	0	X 4	40 =	0	(6a)
Number of open flues	0 + 0	」	0] ₌ [0	x 2	20 =	0	(6b)
Number of intermittent fa		_ L		J	2	x	10 =	20	(7a)
Number of passive vents				L		x ^	10 =		(7b)
Number of flueless gas f				Ļ	0		40 =	0	= ' '
Number of flueless gas in	1165				0		10 -	0	(7c)
							Air ch	nanges per ho	our
Infiltration due to chimne	ys, flues and fans = $(6a)+(6b)+(7a)$	'a)+(7b)+	(7c) =	Γ	20		÷ (5) =	0.13	(8)
	peen carried out or is intended, procee	d to (17),	otherwise o	continue fr	om (9) to	(16)			_
Number of storeys in the Additional infiltration	he dwelling (ns)					[(0)	-1]x0.1 =	0	(9)
	.25 for steel or timber frame or	0.35 fo	r masoni	v constr	uction	[(9)-	-1]XU.1 =	0	(10)
if both types of wall are p	resent, use the value corresponding to			•				0	()
deducting areas of opening	ngs); if equal user 0.35 floor, enter 0.2 (unsealed) or 0	1 (soal	od) olso	ontor O					— (42)
If no draught lobby, en	,	. i (Scai	eu), eise	enter o				0	(12)
•	s and doors draught stripped							0	(14)
Window infiltration	0		0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate			(8) + (10)	+ (11) + (1	12) + (13)	+ (15) =		0	(16)
,	q50, expressed in cubic metre	•	•	•	etre of e	envelope	area	5	(17)
•	lity value, then $(18) = [(17) \div 20] + (18)$. , .	,		0.38	(18)
Number of sides sheltere	es if a pressurisation test has been dor ed	ne or a de	gree air pe	rmeability	is being u	sed		2	(19)
Shelter factor			(20) = 1 -	[0.0 75 x (1	19)] =			0.85	(20)
Infiltration rate incorpora	ting shelter factor		(21) = (18	x (20) =				0.33	(21)
Infiltration rate modified f	for monthly wind speed								
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	peed from Table 7							_	
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (2	2)m ÷ 4								
(22a)m= 1.27 1.25	1.23 1.1 1.08 0.95	0.95	0.92	1	1.08	1.12	1.18		
								ı	

Adjusted infiltra	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.41	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.38]	
Calculate effect		•	rate for t	he appli	cable ca	se			•	•			
If exhaust air he			andiv N (2	3h) - (23a	a) × Fmv (e	Aguation (1	JS)) other	rwisa (23h) – (23a)			0	(23a
If balanced with		•		, ,	,	• •	,,	,) = (25a)			0	(23b
a) If balance		•	•	Ū		`		,	2h\m ı (22h) v [1 (220)	0	(230
(24a)m= 0	0	o 0	0	0	0	0	0	0	0	0	0] - 100j	(24a
b) If balance						<u> </u>	<u> </u>					J	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(24t
c) If whole h		<u> </u>	<u> </u>			<u> </u>	<u> </u>	<u> </u>				J	`
if (22b)n				•	•				.5 × (23b	o)			
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(240
d) If natural	ventilatio	on or wh	ole hous	e positiv	e input	ventilatio	on from l	oft				•	
if (22b)n	n = 1, the	en (24d)	m = (22l)m othe	rwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]				
(24d)m= 0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57		(240
Effective air	change	rate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in box	(25)					
(25)m= 0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57		(25)
3. Heat losse	s and he	eat loss r	paramete	er:									
ELEMENT	Gros	·	Openin		Net Ar	ea	U-valı	ıe	AXU		k-value	Э	ΑΧk
	area	(m²)	· m	2	A ,r	n²	W/m2	K .	(W/	K)	kJ/m²•	K	kJ/K
Windows Type	: 1				3.33	x1.	/[1/(1.3)+	0.04] =	4.12				(27)
Windows Type	2				6.15	х1.	/[1/(1.3)+	0.04] =	7.6				(27)
Floor					60.29) X	0.12	=	7.2348				(28)
Walls Type1	52.7	7	9.48		43.29) x	0.24	= [10.39				(29)
Walls Type2	22.8	8	0		22.8	Х	0.11	=	2.39				(29)
Roof	8.04	4	0		8.04	х	0.12	=	0.96				(30)
Total area of e	lements	, m²			143.9)							(31)
* for windows and						ated using	formula 1	/[(1/U-valu	ıe)+0.04] a	as given in	paragrapl	1 3.2	
** include the area				ls and part	titions		(2.2)	(2.5)					
Fabric heat los		•	U)				(26)(30)					32.7	(33)
Heat capacity		,							(30) + (32	, , ,	(32e) =	72.36	(34)
Thermal mass	•	`		,					tive Value			250	(35)
For design assess can be used inste				constructi	ion are not	t known pr	ecisely the	indicative	e values of	IMP IN I	able 1f		
Thermal bridge	es : S (L	x Y) cal	culated (using Ap	pendix ł	<						7.17	(36)
if details of therma	ıl bridging	are not kn	own (36) =	= 0.05 x (3	1)								`
Total fabric he	at loss							(33) +	(36) =			39.87	(37)
Ventilation hea	t loss ca	alculated	monthly	/				(38)m	= 0.33 × ((25)m x (5))		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
(38)m= 29.15	28.98	28.82	28.05	27.91	27.24	27.24	27.12	27.5	27.91	28.2	28.5		(38)
Heat transfer o	oefficier	nt, W/K						(39)m	= (37) + (38)m			
(39)m= 69.02	68.85	68.69	67.92	67.78	67.11	67.11	66.99	67.37	67.78	68.07	68.37		
									A	Sum(39) ₁	/4.0	67.92	(39)

Heat loss para	ameter (I	HLP), W	/m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 1.14	1.14	1.14	1.13	1.12	1.11	1.11	1.11	1.12	1.12	1.13	1.13		
							ı		Average =	: Sum(40) ₁	12 /12=	1.13	(40)
Number of day	<u> </u>	nth (Tab	le 1a)	1	1	1		1					
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water hea	ting ene	rgy requi	irement:								kWh/ye	ear:	
Assumed occurring TFA > 13.1 if TFA £ 13.1	9, N = 1		[1 - exp	0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	TFA -13		99		(42)
Annual average Reduce the annual not more that 125	al average	hot water	usage by	5% if the a	lwelling is	designed i			se target o		.46		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage i	in litres pe	r day for ea				Table 1c x		<u>'</u>	!	!	<u>!</u>		
(44)m= 89.6	86.35	83.09	79.83	76.57	73.31	73.31	76.57	79.83	83.09	86.35	89.6		
_										im(44) ₁₁₂ =		977.5	(44)
Energy content of) kWh/mor		1	c, 1d)		
(45)m= 132.88	116.22	119.93	104.55	100.32	86.57	80.22	92.05	93.15	108.56	118.5	128.69		— ,
If instantaneous v	vater heati	ina at point	of use (no	o hot water	r storage).	enter 0 in	boxes (46		Total = Su	ım(45) ₁₁₂ =	=	1281.66	(45)
(46)m= 19.93	17.43	17.99	15.68	15.05	12.99	12.03	13.81	13.97	16.28	17.78	19.3		(46)
Water storage		17.55	10.00	10.00	12.00	12.00	10.01	10.07	10.20	17.70	15.5		(1.5)
Storage volum	ne (litres)) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		90		(47)
If community h	neating a	and no ta	ınk in dw	velling, e	nter 110) litres in	(47)						
Otherwise if no		hot wate	er (this in	ncludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in ((47)			
Water storage		oolorod l	ooo foot	or io kno		2/d0x/):							(40)
a) If manufact				or is kno	wn (Kvvi	i/day):					.85		(48)
Temperature f							(40) (40)	\			.54		(49)
Energy lost from b) If manufact		•			or is not		(48) x (49)) =		0.	.46		(50)
Hot water stor			-								0		(51)
If community h	•		on 4.3										
Volume factor			Ol-								0		(52)
Temperature f											0		(53)
Energy lost fro Enter (50) or		_	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Water storage	` , ` `	,	for each	month			((56)m - ((55) × (41)	m	0.	.46		(55)
		1			40.77		. , ,	·	1	10.77	1 1		(EC)
(56)m= 14.23 If cylinder contain	12.85	14.23	13.77	14.23 m = (56)m	13.77	14.23	14.23	13.77 7)m = (56)	14.23	13.77 (H11) is fro	14.23	iv H	(56)
	·			· · ·	1					· ·		A 11	(57)
(57)m= 14.23	12.85	14.23	13.77	14.23	13.77	14.23	14.23	13.77	14.23	13.77	14.23		(57)
Primary circuit	,	•									0		(58)
Primary circuit				,	•		, ,		r thorns -	otot)			
(modified by (59)m= 23.26	21.01	1	ı —		ı —			<u> </u>	1	- 	22.26		(59)
(59)m= 23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(38)

Combi	loss ca	lculated	for each	month ((61)m =	(60) ÷ 30	65 × (41))m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(61)
Total h	eat requ	uired for	water h	eating ca	alculated	for eac	h month	(62)m =	0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	170.37	150.08	157.42	140.84	137.81	122.85	117.71	129.55	129.44	146.05	154.79	166.18]	(62)
Solar DH	HW input	calculated	using App	endix G oı	· Appendix	H (negati	ve quantity	/) (enter '0)' if no sola	r contribut	ion to wate	er heating)	•	
(add a	dditiona	l lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix (G)				_	
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0		(63) (G2)
Output	from w	ater hea	ter											
(64)m=	170.37	150.08	157.42	140.84	137.81	122.85	117.71	129.55	129.44	146.05	154.79	166.18		
·		-	-	-	-		-	Out	put from w	ater heate	r (annual)₁	12	1723.09	(64)
Heat g	ains fro	m water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)n	n] + 0.8 x	x [(46)m	+ (57)m	+ (59)m]	
(65)m=	74.18	65.73	69.87	63.79	63.35	57.81	56.67	60.6	60	66.09	68.43	72.78]	(65)
inclu	de (57)	m in cald	culation	of (65)m	only if c	ylinder i	s in the	dwelling	or hot w	ater is fr	om com	munity h	neating	
5. Int	ernal ga	ains (see	Table 5	and 5a):									
Metabo	olic gain	ıs (Table	5). Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
(66)m=	99.49	99.49	99.49	99.49	99.49	99.49	99.49	99.49	99.49	99.49	99.49	99.49	1	(66)
Lightin	g gains	(calcula	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5				•	
(67)m=	16.21	14.4	11.71	8.86	6.63	5.59	6.04	7.86	10.55	13.39	15.63	16.66]	(67)
Appliar	nces ga	ins (calc	ulated ir	Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5			•	
(68)m=	173.68	175.48	170.94	161.27	149.07	137.59	129.93	128.13	132.67	142.34	154.54	166.01]	(68)
Cookin	ıg gains	(calcula	ted in A	ppendix	L, equa	tion L15	or L15a	, also s	ee Table	5	l	l	1	
(69)m=	32.95	32.95	32.95	32.95	32.95	32.95	32.95	32.95	32.95	32.95	32.95	32.95]	(69)
Pumps	and fai	ns gains	(Table	.——. 5а)										
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(70)
Losses	e.a. ev	aporatio	n (nega	tive valu	es) (Tab	le 5)	!		•				1	
(71)m=	-79.59	-79.59	-79.59	-79.59	-79.59	-79.59	-79.59	-79.59	-79.59	-79.59	-79.59	-79.59	1	(71)
Water	heating	gains (T	able 5)	ļ		<u> </u>	<u> </u>		<u> </u>		l	l	J	
(72)m=	99.7	97.82	93.91	88.6	85.15	80.29	76.16	81.45	83.33	88.83	95.04	97.82	1	(72)
		gains =	<u> </u>	<u> </u>			l)m + (67)m	1 + (68)m	+ (69)m +	(70)m + (7	1)m + (72)	<u> </u>	J	
(73)m=	342.43	340.54	329.4	311.58	293.69	276.33	264.99	270.29	279.4	297.41	318.06	333.35	1	(73)
	ar gains	S:												
			using sola	r flux from	Table 6a	and assoc	iated equa	tions to co	onvert to th	ne applicat	ole orientat	ion.		
Orienta	ation: A	Access F	actor	Area		Flu	IX		g_		FF		Gains	
	٦	Table 6d		m²		Tal	ble 6a	7	able 6b	T	able 6c		(W)	
Southea	ast _{0.9x}	0.77	х	3.3	33	x 3	36.79	x	0.63	х	0.7	=	37.44	(77)
Southea	ast _{0.9x}	0.77	x	3.3	33	x 6	62.67	х	0.63	_ x [0.7	=	63.78	(77)
Southea	ast _{0.9x}	0.77	x	3.3	33	x 8	35.75	x	0.63	_ x [0.7		87.27	(77)
Southea	ast _{0.9x}	0.77	x	3.3	33	x 1	06.25	x	0.63	- x -	0.7	=	108.13	(77)
	L													-

Southeast $0.9x$ 0.7 Southeast $0.9x$ 0.7												
Southeast 0.9x 0.7	7 X	3.33	3	X	119.01	X	0.63	X	0.7	=	121.12	(77)
	7 X	3.33	3	x	118.15	x	0.63	X	0.7	=	120.24	(77)
Southeast 0.9x 0.7	7 X	3.33	3	x	113.91	x	0.63	x	0.7	=	115.92	(77)
Southeast 0.9x 0.7	7 X	3.33	3	x	104.39	x	0.63	x	0.7	=	106.24	(77)
Southeast 0.9x 0.7	7 X	3.33	3	x [92.85	x	0.63	x	0.7	_ =	94.49	(77)
Southeast 0.9x 0.7	7 X	3.33	3	x	69.27	х	0.63	×	0.7	=	70.49	(77)
Southeast 0.9x 0.7	7 X	3.33	3	x [44.07	x	0.63	×	0.7	=	44.85	(77)
Southeast 0.9x 0.7	7 X	3.33	3	x [31.49	x	0.63	×	0.7	=	32.04	(77)
Northwest 0.9x 0.7	7 X	6.15	5	x [11.28	x	0.63	x	0.7	=	21.21	(81)
Northwest 0.9x 0.7	7 X	6.15	5	x	22.97	x	0.63	×	0.7	=	43.17	(81)
Northwest 0.9x 0.7	7 X	6.15	5	x	41.38	х	0.63	×	0.7	=	77.77	(81)
Northwest 0.9x 0.7	7 X	6.15	5	x	67.96	х	0.63	x	0.7	=	127.72	(81)
Northwest 0.9x 0.7	7 X	6.15	5	x	91.35	x	0.63	X	0.7	=	171.69	(81)
Northwest 0.9x 0.7	7 X	6.15	5	x	97.38	х	0.63	X	0.7	=	183.04	(81)
Northwest 0.9x 0.7	7 X	6.15	5	x	91.1	х	0.63	×	0.7	=	171.23	(81)
Northwest 0.9x 0.7	7 X	6.15	5	x [72.63	x	0.63	×	0.7	=	136.5	(81)
Northwest 0.9x 0.7	7 X	6.15	5	x [50.42	х	0.63	x	0.7	=	94.77	(81)
Northwest 0.9x 0.7	7 X	6.15	5	x [28.07	x	0.63	X	0.7	=	52.75	(81)
Northwest 0.9x 0.7	7 X	6.15	5	× [14.2	x	0.63	×	0.7	=	26.68	(81)
Northwest 0.9x 0.7	7 X	6.15	5	x [9.21	x	0.63	×	0.7		17.32	(81)
				_				_				
		fa., aaab				(00)	Cum(74)m	(00)				
Solar gains in watts.	calculated	ior each	montn			(83)m	i = Sum(74)m	.(82)m				
Solar gains in watts, (83)m= 58.65 106.95		235.86	292.8	_	3.28 287.15	(83)m 242	.74 189.26	.(82)m 123.2	5 71.53	49.36]	(83)
<u> </u>	165.04	235.86	292.8	303		ÈΈ	- 		5 71.53	49.36]	(83)
(83)m= 58.65 106.95	165.04	235.86	292.8	300 + (80		ÈΈ	.74 189.26		<u> </u>	49.36]]	(83) (84)
(83)m= 58.65 106.95 Total gains – internal (84)m= 401.08 447.49	165.04 and solar 494.45	235.86 (84)m = 547.43	292.8 (73)m - 586.49	300 + (80 57	3)m , watts	242	.74 189.26	123.2]	` ,
(83)m= 58.65 106.95 Total gains – internal (84)m= 401.08 447.49 7. Mean internal tem	and solar 494.45	235.86 (84)m = 547.43 (heating s	292.8 (73)m - 586.49 season	303 + (83 57	3)m , watts '9.6 552.14	513	.74 189.26	123.2			21	` ,
(83)m= 58.65 106.95 Total gains – internal (84)m= 401.08 447.49	165.04 and solar 494.45 perature heating p	235.86 (84)m = 547.43 (heating a periods in	292.8 (73)m - 586.49 season the livir	303 + (83 57)	3)m , watts '9.6 552.14 urea from Tak	513	.74 189.26	123.2			21	(84)
(83)m= 58.65 106.95 Total gains – internal (84)m= 401.08 447.49 7. Mean internal tem Temperature during	165.04 and solar 494.45 perature heating p	235.86 (84)m = 547.43 (heating a periods in	292.8 (73)m - 586.49 season the livir	303 + (83 57) ng a (se	3)m , watts '9.6 552.14 urea from Tak	513	.74 189.26	123.2	5 389.59		21	(84)
(83)m= 58.65 106.95 Total gains – internal (84)m= 401.08 447.49 7. Mean internal tem Temperature during Utilisation factor for	and solar 494.45 perature heating p	235.86 (84)m = 547.43 (heating area)	292.8 (73)m - 586.49 season the living a, h1,m	303 + (83 57) ng a (se	3)m , watts 9.6 552.14 area from Table Table 9a)	513	.74 189.26 .03 468.66 , Th1 (°C) ug Sep	123.29	5 389.59	382.71	21	(84)
(83)m= 58.65 106.95 Total gains – internal (84)m= 401.08 447.49 7. Mean internal tem Temperature during Utilisation factor for Jan Feb (86)m= 1 0.99	and solar 494.45 perature heating p gains for I Mar 0.99	235.86 (84)m = 547.43 (heating seriods in iving area Apr 0.95	292.8 (73)m - 586.49 season the livir a, h1,m May 0.87	300 + (80 57) ing a (se 0.	3)m , watts 79.6 552.14 area from Table Table 9a) Jun Jul 69 0.52	242 513 ole 9 A	.74 189.26 .03 468.66 , Th1 (°C) ug Sep 8 0.83	123.25 420.65	5 389.59 Nov	382.71	21	(84)
(83)m= 58.65 106.95 Total gains – internal (84)m= 401.08 447.49 7. Mean internal tem Temperature during Utilisation factor for Jan Feb (86)m= 1 0.99 Mean internal temperature	and solar 494.45 perature heating p gains for I Mar 0.99	235.86 (84)m = 547.43 (heating seriods in iving area Apr 0.95	292.8 (73)m - 586.49 season the livir a, h1,m May 0.87	303 + (8:57) ng a (se J 0.	3)m , watts 79.6 552.14 area from Table Table 9a) Jun Jul 69 0.52	242 513 ole 9 A	.74 189.26 .03 468.66 , Th1 (°C) ug Sep .68 0.83 Table 9c)	123.25 420.65	5 389.59 Nov	382.71	21	(84)
(83)m= 58.65 106.95 Total gains – internal (84)m= 401.08 447.49 7. Mean internal tem Temperature during Utilisation factor for Jan Feb (86)m= 1 0.99 Mean internal temperature during 1 0.99	and solar 494.45 perature heating p gains for I Mar 0.99 rature in I 21	235.86 (84)m = 547.43 (heating area Apr 0.95 iving area 21	292.8 (73)m - 586.49 season the livir a, h1,m May 0.87 a T1 (fc	3000 3000 3000 3000 3000 3000 3000 300	3)m , watts 79.6 552.14 area from Table (Pa) Iun Jul 69 0.52 v steps 3 to 7	242 513 ole 9 A 0.5	.74 189.26 .03 468.66 , Th1 (°C) ug Sep 68 0.83 Table 9c) 1 21	123.24 420.69 Oct 0.97	Nov 0.99	382.71 Dec 1	21	(84)
(83)m= 58.65 106.95 Total gains – internal (84)m= 401.08 447.49 7. Mean internal tem Temperature during Utilisation factor for Jan Feb (86)m= 1 0.99 Mean internal temperature during 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	and solar 494.45 perature heating p gains for I Mar 0.99 rature in I 21 heating p	235.86 (84)m = 547.43 (heating seriods in iving area	292.8 (73)m - 586.49 season the livir a, h1,m May 0.87 a T1 (fc 21 rest of	303 + (8: 577)) nng a (se 0. bllow	3)m , watts 79.6 552.14 area from Table Table 9a) Jun Jul 69 0.52 v steps 3 to 7 21 21 elling from Table	242 513 518 519 519 619 619 619 619 619 619 619 619 619 6	.74 189.26 .03 468.66 , Th1 (°C) ug Sep 68 0.83 Table 9c) 1 21 9, Th2 (°C)	123.24 420.66 Oct 0.97	Nov 0.99	382.71 Dec 1 21	21	(84) (85) (86) (87)
(83)m= 58.65 106.95 Total gains – internal (84)m= 401.08 447.49 7. Mean internal terr Temperature during Utilisation factor for Jan Feb (86)m= 1 0.99 Mean internal temperature during (87)m= 21 21 Temperature during (88)m= 19.96 19.97	and solar 494.45 perature heating p gains for I Mar 0.99 rature in I 21 heating p 19.97	235.86 (84)m = 547.43 (heating seriods in 19.98 (heating seriods in 19	292.8 (73)m - 586.49 season the livir a, h1,m May 0.87 a T1 (fc 21 rest of 19.98	303 + (8: 57) ng a (se J 0. bllow 2 dwe	3)m , watts 79.6 552.14 area from Table Table 9a) Jun Jul 69 0.52 v steps 3 to 7 21 21 elling from Table 9a)	242 513 513 518 519 619 62 63 64 64 65 65 66 66 67 67 67 67 67 67 67 67 67 67 67	.74 189.26 .03 468.66 , Th1 (°C) ug Sep 68 0.83 Table 9c) 1 21 9, Th2 (°C)	123.24 420.69 Oct 0.97	Nov 0.99	382.71 Dec 1	21	(84)
Total gains – internal (84)m= 401.08 447.49 7. Mean internal tem Temperature during Utilisation factor for Jan Feb (86)m= 1 0.99 Mean internal tempe (87)m= 21 21 Temperature during (88)m= 19.96 19.97 Utilisation factor for	nd solar 494.45 perature heating p gains for I Mar 0.99 rature in 21 heating p 19.97 gains for r	235.86 (84)m = 547.43 (heating area area area area area area area are	292.8 (73)m - 586.49 season the livin a, h1,m May 0.87 a T1 (fo 21 rest of 19.98 velling, l	300 + (8: 57)) ng a (se 0. Use 19 dwee 19	3)m , watts 79.6 552.14 area from Table (Panal) 1 Jule (Panal) 2 0.52 v steps 3 to 7 2 21 elling from Table (Panal) 3 19.99 m (see Table (Panal) 4 19.99 m (see Table (Panal) 4 19.99	242 513 513 513 513 513 513 513 513 513 513	.74 189.26 .03 468.66 .Th1 (°C) ug Sep .68 0.83 Table 9c) 1 21 9, Th2 (°C) 99 19.99	123.24 420.69 Oct 0.97 21	Nov 0.99 21 19.98	382.71 Dec 1 21 19.97	21	(84) (85) (86) (87) (88)
(83)m= 58.65 106.95 Total gains – internal (84)m= 401.08 447.49 7. Mean internal terr Temperature during Utilisation factor for Jan Feb (86)m= 1 0.99 Mean internal temperature during (87)m= 21 21 Temperature during (88)m= 19.96 19.97	and solar 494.45 perature heating p gains for I Mar 0.99 rature in I 21 heating p 19.97	235.86 (84)m = 547.43 (heating seriods in 19.98 (heating seriods in 19	292.8 (73)m - 586.49 season the livir a, h1,m May 0.87 a T1 (fc 21 rest of 19.98	300 + (8: 57)) ng a (se 0. Use 19 dwee 19	3)m , watts 79.6 552.14 area from Table Table 9a) Jun Jul 69 0.52 v steps 3 to 7 21 21 elling from Table 9a)	242 513 513 518 519 619 62 63 64 64 65 65 66 66 67 67 67 67 67 67 67 67 67 67 67	.74 189.26 .03 468.66 .Th1 (°C) ug Sep .88 0.83 Table 9c) .1 21 .9, Th2 (°C) .99 19.99	123.24 420.66 Oct 0.97	Nov 0.99	382.71 Dec 1 21	21]	(84) (85) (86) (87)
Total gains – internal (84)m= 401.08 447.49 7. Mean internal tem Temperature during Utilisation factor for Jan Feb (86)m= 1 0.99 Mean internal temperature during (87)m= 21 21 Temperature during (88)m= 19.96 19.97 Utilisation factor for (89)m= 1 0.99 Mean internal temperature during	and solar 494.45 perature heating p gains for I 0.99 rature in I 21 heating p 19.97 gains for r 0.98	235.86 (84)m = 547.43 (heating seriods in iving area 21 eriods in 19.98 eest of dw 0.94 the rest of	292.8 (73)m - 586.49 season the livir a, h1,m May 0.87 a T1 (fc 21 rest of 19.98 velling, I 0.82 of dwelli	30% + (8: 57) ng a (se	3)m , watts 79.6 552.14 Area from Table Pa) Jun Jul 69 0.52 V steps 3 to 7 21 21 Elling from Table Pa) 9.99 19.99 m (see Table Pa) 1.6 0.41	242 513 518 A 0.5 7 in T 2 4able 9 19. 9a) 0.4	.74 189.26 .03 468.66 .7h1 (°C) ug Sep .8 0.83 .7able 9c) .1 21 .9, Th2 (°C) .99 19.99 .16 0.76 .174 189.26 .185 189.26 .	123.24 420.63 Oct 0.97 21 19.98	Nov 0.99 21 19.98	382.71 Dec 1 21 19.97	21]	(84) (85) (86) (87) (88)
(83)m= 58.65 106.95 Total gains – internal (84)m= 401.08 447.49 7. Mean internal term Temperature during Utilisation factor for Jan Feb (86)m= 1 0.99 Mean internal temperature during (87)m= 21 21 Temperature during (88)m= 19.96 19.97 Utilisation factor for (89)m= 1 0.99	nd solar 494.45 perature heating p gains for I Mar 0.99 rature in 21 heating p 19.97 gains for r 0.98	235.86 (84)m = 547.43 (heating area area area area area area area are	292.8 (73)m - 586.49 season the livin a, h1,m May 0.87 a T1 (fo 21 rest of 19.98 velling, l 0.82	30% + (8: 57) ng a (se	3)m , watts 79.6 552.14 area from Table (Panal) 3 552.14 area from Table (Panal) 4 552.14 area from Table (Panal) 5 552.14 area from Table (Panal) 5 552.14 area from Table (Panal) 5 552.14 area from Table (Panal) 6 19.99 area from Table (Pa	242 513 513 ble 9 A 0.5 7 in T 2 19. 9a) 0.4	.74 189.26 .03 468.66 .7h1 (°C) .09 Sep .08 0.83 .09 Color .09 19.99 .09 19.99 .09 19.99 .09 19.99 .09 19.99 .09 19.99 .00 19.99	123.24 420.63 Oct 0.97 21 19.98 0.96 9c) 19.98	Nov 0.99 21 19.98 0.99	382.71 Dec 1 19.97		(84) (85) (86) (87) (88) (89)
Total gains – internal (84)m= 401.08 447.49 7. Mean internal tem Temperature during Utilisation factor for Jan Feb (86)m= 1 0.99 Mean internal temperature during (87)m= 21 21 Temperature during (88)m= 19.96 19.97 Utilisation factor for (89)m= 1 0.99 Mean internal temperature during	and solar 494.45 perature heating p gains for I 0.99 rature in I 21 heating p 19.97 gains for r 0.98	235.86 (84)m = 547.43 (heating seriods in iving area 21 eriods in 19.98 eest of dw 0.94 the rest of	292.8 (73)m - 586.49 season the livir a, h1,m May 0.87 a T1 (fc 21 rest of 19.98 velling, I 0.82 of dwelli	30% + (8: 57) ng a (se J 0. dwee 19 h2,n 0	3)m , watts 79.6 552.14 Area from Table Pa) Jun Jul 69 0.52 V steps 3 to 7 21 21 Elling from Table Pa) 9.99 19.99 m (see Table Pa) 1.6 0.41	242 513 518 A 0.5 7 in T 2 4able 9 19. 9a) 0.4	.74 189.26 .03 468.66 .7h1 (°C) .09 Sep .08 0.83 .09 Color .09 19.99 .09 19.99 .09 19.99 .09 19.99 .09 19.99 .09 19.99 .00 19.99	123.24 420.63 Oct 0.97 21 19.98 0.96 9c) 19.98	Nov 0.99 21 19.98	382.71 Dec 1 19.97	21	(84) (85) (86) (87) (88)
Total gains – internal (84)m= 401.08 447.49 7. Mean internal tem Temperature during Utilisation factor for Jan Feb (86)m= 1 0.99 Mean internal temperature during (87)m= 21 21 Temperature during (88)m= 19.96 19.97 Utilisation factor for (89)m= 1 0.99 Mean internal temperature during	nd solar 494.45 perature heating p gains for I 0.99 rature in I 21 heating p 19.97 gains for r 0.98 rature in I 19.97	235.86 (84)m = 547.43 (heating seriods in iving area 21 eriods in 19.98 est of dw 0.94 che rest of 19.98	292.8 (73)m - 586.49 season the livir a, h1,m May 0.87 a T1 (fo 21 rest of 19.98 velling, l 0.82 of dwelli 19.98	303 + (8: 57) ng a (see	3)m , watts 79.6 552.14 area from Table (Pa) Jun Jul (Pa) Jun Jun (Pa) Jun Jun (Pa) Jun Jun (Pa) Jun Jun (Pa) Jun Jun (Pa) Jun Jun (Pa)	2422	.74 189.26 .03 468.66 .7h1 (°C) ug Sep .68 0.83 .7able 9c) .1 21 .9, Th2 (°C) .99 19.99 .60 0.76 .to 7 in Table .99 19.99 .ft	123.24 420.63 Oct 0.97 21 19.98 0.96 9c) 19.98	Nov 0.99 21 19.98 0.99	382.71 Dec 1 19.97		(84) (85) (86) (87) (88) (89)
(83)m= 58.65 106.95 Total gains – internal (84)m= 401.08 447.49 7. Mean internal term Temperature during Utilisation factor for Jan Feb (86)m= 1 0.99 Mean internal temperature during (87)m= 21 21 Temperature during (88)m= 19.96 19.97 Utilisation factor for (89)m= 1 0.99 Mean internal temperature 1 0.99 Mean internal temperature 1 0.99	nd solar 494.45 perature heating p gains for I 0.99 rature in I 21 heating p 19.97 gains for r 0.98 rature in I 19.97	235.86 (84)m = 547.43 (heating seriods in iving area 21 eriods in 19.98 est of dw 0.94 che rest of 19.98	292.8 (73)m - 586.49 season the livir a, h1,m May 0.87 a T1 (fo 21 rest of 19.98 velling, l 0.82 of dwelli 19.98	303 + (8: 57) ng a (se J 0. 19 h2,n 19 Illing	3)m , watts 79.6 552.14 area from Table (Pa) Jun Jul (Pa) Jun Jun (Pa) Jun Jun (Pa) Jun Jun (Pa) Jun Jun (Pa) Jun Jun (Pa) Jun Jun (Pa)	2422	.74 189.26 .03 468.66 .7h1 (°C) .09 Sep .08 0.83 .09 Color .09 19.99 .09 19.99 .09 19.99 .09 19.99 .09 19.99 .09 19.99 .00 19.90 .00 1	123.24 420.63 Oct 0.97 21 19.98 0.96 9c) 19.98	Nov 0.99 21 19.98 ving area ÷ (-	382.71 Dec 1 19.97		(84) (85) (86) (87) (88) (89)

(00)	.	1										1	(02)
(93)m= 20		20.4	20.41	20.41	20.41	20.41	20.42	20.41	20.41	20.41	20.4		(93)
	neating req					44 -4	Table O	41	4 T: /	70)	-11-		
	he mean in				ied at ste	ep 11 of	rable 9i	o, so tha	t 11,m=(76)m an	d re-caid	culate	
Ja	n Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	factor for g	ains, hm): 									•	
(94)m= 1		0.98	0.95	0.84	0.64	0.46	0.52	0.79	0.96	0.99	1		(94)
	ns, hmGm	`	ŕ	r			1	1		1		İ	(05)
(95)m= 399		485.77	517.45	492.2	372.06	253.36	264.34	372.11	404.85	386.57	381.58		(95)
	verage ext	1		r	r	40.0	1 40 4	444	40.0	7.4	1.0	1	(06)
(96)m= 4.3		6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
(97)m= 111	rate for me	1	781.63	590.28	390.21	=[(39)m 255.98	268.97	- (96)m	J 664.84	905.76	1107.9	1	(97)
` '	ating requir	Į	l	l	l	l	l			l .	1107.9		(37)
(98)m= 529	Ť	349.01	190.22	72.97	0	0.02	0	0	193.43	373.82	540.38		
(30)111= 323	.57 410.02	040.01	100.22	12.01				l per year				2667.82	(98)
				.,			Tota	li pei yeai	(KVVII/yeai) = Sum(9	0)15,912 =	2007.02	╡``
Space he	ating requir	ement in	kVVh/m²	² /year								44.25	(99)
9a. Energy	requireme	nts – Indi	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Space he	_												_
Fraction o	f space he	at from s	econdar	y/supple	mentary	system						0	(201)
Fraction of	f space he	at from m	nain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fraction of	f total heat	ing from	main sys	stem 1			(204) = (2	02) x [1 –	(203)] =			1	(204)
Efficiency	of main sp	ace heat	ing syste	em 1								216.37	(206)
Efficiency	of seconda	ary/supple	ementar	y heating	g system	າ, %						0	(208)
Ja	n Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space he	ating requir	ement (c	alculate	d above))							•	
529	.37 418.62	349.01	190.22	72.97	0	0	0	0	193.43	373.82	540.38		
(211)m = {[(98)m x (20	04)] } x 1	00 ÷ (20	06)									(211)
244	.66 193.48	161.3	87.91	33.73	0	0	0	0	89.4	172.77	249.75		
			-		-	-	Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}		1233.01	(211)
Space hea	ating fuel (s	secondar	y), kWh/	month							'		_
$= \{[(98)m x]\}$	(201)] } x 1	100 ÷ (20	8)									•	
(215)m= 0	0	0	0	0	0	0	0	0	0	0	0		_
							Tota	I (kWh/yea	ar) =Sum(2	215) _{15,1012}	<u>=</u>	0	(215)
Water hea	ting												
Output fron					1	1						ı	
170		157.42	140.84	137.81	122.85	117.71	129.55	129.44	146.05	154.79	166.18		٦
Efficiency of										1	1	116.16	(216)
(217)m= 116	.16 116.16	116.16	116.16	116.16	116.16	116.16	116.16	116.16	116.16	116.16	116.16		(217)
Fuel for wa	_												
(219)m = (219)m = 146		0 ÷ (217) 135.52	m 121.24	118.64	105.76	101.34	111.52	111.43	125.73	133.25	143.06		
(= 15)		1	L	L	L	L		I = Sum(2		L	1	1483.37	(219)
Annual tot	als							`		Wh/year	•	kWh/year	⊣ `
Space hear		ed, main	system	1					r.	y cai		1233.01	7
•	-		-									<u> </u>	

Water heating fuel used			1483.37	
Electricity for pumps, fans and electric keep-hot				_
Total electricity for the above, kWh/year	sum of (230	a)(230g) =	0	(231)
Electricity for lighting			286.27	(232)
Total delivered energy for all uses (211)(221) +	(231) + (232)(237b) =		3002.65	(338)
12a. CO2 emissions – Individual heating system	s including micro-CHP			
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/yea	
Space heating (main system 1)	(211) x	0.519 =	639.93	(261)
Space heating (secondary)	(215) x	0.519 =	0	(263)
Water heating	(219) x	0.519 =	769.87	(264)
Space and water heating	(261) + (262) + (263) + (264) =		1409.8	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	0	(267)
Electricity for lighting	(232) x	0.519 =	148.57	(268)
Total CO2, kg/year	sun	n of (265)(271) =	1558.38	(272)

 $(272) \div (4) =$

Dwelling CO2 Emission Rate

El rating (section 14)

(273)

(274)

25.85

80

Address:

England Located in: Region: Thames valley

UPRN:

Date of assessment: 05 October 2023 Date of certificate: 05 October 2023

New dwelling design stage Assessment type:

New dwelling Transaction type: Tenure type: Unknown Related party disclosure: No related party Thermal Mass Parameter: Indicative Value Medium

True Water use <= 125 litres/person/day:

PCDF Version: 512

Flat Dwelling type:

Detachment:

2023 Year Completed:

Floor Location: Floor area:

Storey height:

73.21 m² 2.5 m Floor 0

29.99 m² (fraction 0.41) Living area:

North East Front of dwelling faces:

Name: Source: Type: Glazing: Argon: Frame: Manufacturer Solid Wood ne

Manufacturer Windows low-E, En = 0.05, soft coat Yes se Manufacturer Windows low-E, En = 0.05, soft coat Yes nw

Name:	Gap:	Frame Facto	or: g-value:	U-value:	Area:	No. of Openings:
ne	mm	0.7	0.63	1.6	1.89	1
se	16mm or more	0.7	0.63	1.3	13.33	1
nw	16mm or more	0.7	0.63	1.3	5.64	1

Orient: Width: Height: Type-Name: Location: Name: North East Shel 0 ne se Ext. South East 0 0

nw Ext. North West 0

Average or unknown Overshading:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Element	<u>:S</u>						
Ext.	71.92	18.97	52.95	0.24	0	False	N/A
Shel	13.03	1.89	11.14	0.11	0.43	False	N/A

Internal Elements Party Elements

User-defined (individual PSI-values) Y-Value = 0.0543 Thermal bridges:

> Length Psi-value

Other lintels (including other steel lintels) 10.42 0.05 E2

2.04	0.034	E3	Sill
24.04	0.04	E4	Jamb
10	0.058	E16	Corner (normal)
2.5	-0.069	E17	Corner (inverted internal area greater than external area)
2.5	0.068	E18	Party wall between dwellings
33.98	0.073	E7	Party floor between dwellings (in blocks of flats)
3.39	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Natural ventilation (extract fans)

Number of chimneys:0Number of open flues:0Number of fans:3Number of passive stacks:0Number of sides sheltered:2Pressure test:5

Main heating system:

Main heating system: Heat pumps with radiators or underfloor heating

Electric heat pumps Fuel: Electricity

Info Source: Boiler Database

Database: (rev 512, product index 101403, SEDBUK 250%):

Brand name: Vaillant Model: aroTHERM

Model qualifier: VWL 85/2 - Underfloor

(provides DHW all year) Systems with radiators

Central heating pump: 2013 or later

Design flow temperature: Design flow temperature $>45\,^{\circ}\text{C}$

Unknown

Boiler interlock: Yes

Main heating Control:

Main heating Control: Time and temperature zone control by suitable arrangement of plumbing and electrical

services

Control code: 2207

Secondary heating system:

Secondary heating system: None

Water heating

Water heating: From main heating system

Water code: 901 Fuel :Electricity Hot water cylinder Cylinder volume: 90 litres

Cylinder insulation: Measured loss, 0.85kWh/day

Primary pipework insulation: True

Cylinderstat: True

Cylinder in heated space: True Flue Gas Heat Recovery System: Database (rev 512, product index)

Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown
Conservatory: No conservatory

100%

Low rise urban / suburban

Low energy lights: Terrain type: EPC language: English Wind turbine: No None Photovoltaics: No Assess Zero Carbon Home:

		l Iser I	Details:						
Assessor Name: Software Name:	Bethany Robinson Stroma FSAP 2012	<u> </u>	Strom Softwa					0036516 on: 1.0.5.60	
Contware reame.		roperty	Address				101010	71. 1.0.0.00	
Address :									
1. Overall dwelling dime	ensions:								
Ground floor			a(m²)	(1a) v		ight(m)	1(20)	Volume(m ³	<u>^</u>
	a) . (4 b) . (4 a) . (4 a) . (4 a) . (4 a)			(1a) x		2.5	(2a) =	183.02	(3a)
	a)+(1b)+(1c)+(1d)+(1e)+(1	1)	73.21	(4)					_
Dwelling volume				(3a)+(3b)+(3c)+(3c	d)+(3e)+	.(3n) =	183.02	(5)
2. Ventilation rate:	main		other		40401			m3 nor hou	
	main seconda heating heating	· 	otner	, –	total			m³ per hou	ır —
Number of chimneys	0 + 0	+	0	_ = _	0	X 4	40 =	0	(6a)
Number of open flues	0 + 0	+	0] = [0	x 2	20 =	0	(6b)
Number of intermittent fa	ins				3	x 1	10 =	30	(7a)
Number of passive vents	3			Ī	0	x 1	10 =	0	(7b)
Number of flueless gas fi	ires			Ē	0	x 4	40 =	0	(7c)
				<u> </u>					
							Air ch	nanges per ho	our
	ys, flues and fans = $(6a)+(6b)+(7a)$				30		÷ (5) =	0.16	(8)
If a pressurisation test has be Number of storeys in the	peen carried out or is intended, procee he dwelling (ns)	d to (17),	otherwise (continue fr	om (9) to	(16)			(9)
Additional infiltration	ne aweiling (113)					[(9)-	-1]x0.1 =	0	(10)
	.25 for steel or timber frame or	0.35 fo	r masoni	y constr	ruction	1(-)		0	(11)
	resent, use the value corresponding to	the grea	ter wall are	a (after					
deducting areas of openii	^{ngs); if equal user 0.35 floor, enter 0.2 (unsealed) or 0}	1 (seal	ed) else	enter ()				0	(12)
If no draught lobby, en	,	. r (ocan	ou), 0.00	critor o				0	(13)
	s and doors draught stripped							0	(14)
Window infiltration			0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate			(8) + (10)	+ (11) + (1	12) + (13)	+ (15) =		0	(16)
•	q50, expressed in cubic metre	•	•	•	etre of e	envelope	area	5	(17)
•	lity value, then $(18) = [(17) \div 20] + ($							0.41	(18)
Number of sides sheltere	es if a pressurisation test has been do ed	ne or a de	gree air pe	rmeability	is being u	sea		2	(19)
Shelter factor	, ,		(20) = 1 -	[0.0 75 x (1	19)] =			0.85	(20)
Infiltration rate incorporate	ting shelter factor		(21) = (18) x (20) =				0.35	(21)
Infiltration rate modified f	or monthly wind speed								
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	peed from Table 7								
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (2.	2)m <i>÷ 1</i>								
	2)m ÷ 4 1.23	0.95	0.92	1	1.08	1.12	1.18	1	
1.20	1.10 0.93	L 0.00	1 0.02		1	1.12	Lo	J	

Adjusted infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.33	0.35	0.38	0.4	0.41]	
Calculate effe		_	rate for t	he appli	cable ca	se						- -	
If mechanical If exhaust air h			endix N (2	3h) = (23a	a) × Fmv (e	equation (1	N5)) othe	rwise (23h) = (23a)			0	(23
If balanced with) — (20 0)			0	(23
a) If balance		•	•	ŭ		`		,	Dh\m ı (23h) v [4	1 (220)	0	(23
24a)m= 0	0	0	0	0	0	0	0	0	0	0	0] - 100j	(24
b) If balance												J	(_
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(24
c) If whole h					<u> </u>		<u> </u>					J	(-
,	n < 0.5 ×			•	•				5 × (23b	o)			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(24
d) If natural	ventilatio	n or wh	ole hous	e positiv	/e input	ventilatio	n from I	oft	<u> </u>	<u> </u>	<u> </u>	J	
,	n = 1, th								0.5]				
24d)m= 0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59]	(24
Effective air	change	rate - er	nter (24a	or (24b	o) or (24	c) or (24	d) in box	(25)				-	
25)m= 0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59]	(25
3. Heat losse	s and he	at loce i	aramata	or:								_	
	S and ne		Openin		Net Ar	00	U-valı	10	AXU		k-value	2	ΑΧk
LEMENT	area	-	operiiri m		A,r		W/m2		(W/	K)	kJ/m ² ·	-	kJ/K
Doors					1.89	X	1.6	_ [3.024				(26
Vindows Type	e 1				13.33	x1.	/[1/(1.3)+	0.04] =	16.47	=			(27
Vindows Type	e 2				5.64	x1	/[1/(1.3)+	0.04] =	6.97	=			(27
Valls Type1	71.9	12	18.9	7	52.95	_	0.24		12.71	=		\neg	(29
Valls Type2	13.0		1.89	=	11.14	=	0.11		1.17	터 ¦		╡	(29
otal area of e			1.08			=	0.11		1.17				
for windows and		•	offective wi	ndow I I-vs	84.95		ı formula 1	/[(1/ -valu	د 0.41 (مر	as aiven in	naragrani	h 32	(3
* include the are						atou using	nonnula 1	/[((C)+0.0+j c	is given in	paragrapi	7 3.2	
abric heat lo	ss, W/K :	= S (A x	U)				(26)(30)	+ (32) =				40.34	1 (3:
leat capacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	0	(34
hermal mass	parame	ter (TMF	c = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(3
or design asses	sments wh	ere the de	tails of the	construct	ion are no	known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
an be used inste													
hermal bridg	,	,		٠.	•	<						4.61	(30
details of therma otal fabric he		are not kn	own (36) =	= 0.05 x (3	11)			(22) 1	(36) =				- 1/0
		alaulataa	المعمدال	,						0E\m v (E)		44.9	(3.
entilation hea	i	i			1, ,	1, ,1	۸	· · · · ·		25)m x (5)	T _	1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1	(38
38)m= 36.28	36.04	35.81	34.72	34.52	33.57	33.57	33.4	33.94	34.52	34.93	35.36]	(3)
leat transfer	1				ı		ı	- ` 	= (37) + (·	1	
39)m= 81.23	80.99	80.76	79.68	79.47	78.53	78.53	78.35	78.89	79.47	79.88	80.31		
										Sum(39) ₁		79.68	3 (3

Heat loss para	meter (H	HLP), W/	m²K					(40)m	= (39)m ÷	- (4)			
40)m= 1.11	1.11	1.1	1.09	1.09	1.07	1.07	1.07	1.08	1.09	1.09	1.1		
Number of day	e in moi	oth (Tabl	(د ۱ م		•			,	Average =	Sum(40) ₁ .	12 /12=	1.09	(40)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water heat	ing ener	gy requi	rement:								kWh/yea	ar:	
Assumed occu if TFA > 13.9 if TFA £ 13.9	N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9))2)] + 0.0	0013 x (¯	TFA -13.		32		(42)
Annual averago Reduce the annua not more that 125	l average	hot water	usage by	5% if the a	lwelling is	designed t			se target o		.33		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
lot water usage in	i litres per	day for ea	ch month	Vd,m = fa	ctor from T	able 1c x	(43)						
44)m= 98.27	94.69	91.12	87.55	83.97	80.4	80.4	83.97	87.55	91.12	94.69	98.27		— (40)
Energy content of	hot water	used - cald	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x D	Tm / 3600			m(44) ₁₁₂ = ables 1b, 1	<u>L</u>	1072.02	(44)
45)m= 145.73	127.46	131.52	114.66	110.02	94.94	87.98	100.96	102.16	119.06	129.96	141.13		
f instantaneous w	otor booti	na ot noint	of upo /no	hot woto	r otorogo)	antar O in	havea (16		Total = Su	m(45) ₁₁₂ =		1405.59	(45
f instantaneous wa	19.12	19.73	17.2		14.24	13.2			17.86	19.49	21.17		(46
46)m= 21.86 Vater storage		19.73	17.2	16.5	14.24	13.2	15.14	15.32	17.00	19.49	21.17		(40
Storage volume	e (litres)	includin	g any so	olar or W	/WHRS	storage	within sa	ame ves	sel		90		(47
f community h	-			-			` '	\	(O) : ((47)			
Otherwise if no Vater storage		not wate	er (unis ir	iciudes i	nstantar	ieous co	יווטט וטוויו	ers) ente	er o in (47)			
a) If manufacto		eclared lo	oss facto	or is kno	wn (kWh	n/day):				0.	85		(48
emperature fa	actor fro	m Table	2b							0.	54		(49
Energy lost from		•	•		:_		(48) x (49)) =		0.	46		(50
b) If manufactors Hot water stora	age loss	factor fr	om Tabl								0		(51
f community h	_		on 4.3								0		(52
emperature fa			2b							—	0		(52
Energy lost from	m water	storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54
Enter (50) or (54) in (5	55)								0.	46		(55
Vater storage	loss cal	culated f	or each	month	_		((56)m = (55) × (41)ı	m				
cylinder contains	12.85 dedicate	14.23 d solar sto	13.77 rage, (57)ı	14.23 n = (56)m	13.77 x [(50) – (14.23 H11)] ÷ (5	14.23 0), else (5	13.77 7)m = (56)	14.23 m where (13.77 H11) is fro	14.23 m Appendix	:H	(56
57)m= 14.23	12.85	14.23	13.77	14.23	13.77	14.23	14.23	13.77	14.23	13.77	14.23		(57
ــــــــــ rimary circuit	loss (an	nual) fro	m Table	3					•		0		(58
Primary circuit	loss cal	culated f	or each	month (•	. ,	, ,						
(modified by	factor f	om Taki	∠ □ E : f +	hara ia a	olor	or hoosi.	~~ ~~~	و مدانه ما د	r tharma	ctat)			

Combi I	loss cal	lculated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total he	eat requ	uired for	water h	eating ca	alculated	d for eac	h month	(62)m :	= 0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	183.22	161.32	169.01	150.95	147.51	131.22	125.47	138.45	138.44	156.55	166.24	178.62		(62)
Solar DH	W input o	calculated	using App	endix G o	Appendix	κ Η (negati	ve quantity	/) (enter '	0' if no sola	r contribut	ion to wate	er heating)	•	
(add ad	lditiona	l lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix	G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0		(63) (G2)
Output	from wa	ater hea	ter										_	
(64)m=	183.22	161.32	169.01	150.95	147.51	131.22	125.47	138.45	138.44	156.55	166.24	178.62		_
								Ou	tput from w	ater heate	r (annual) ₁	12	1847.02	(64)
Heat ga	ains fro	m water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)	m] + 0.8 x	x [(46)m	+ (57)m	+ (59)m]	
(65)m=	78.45	69.47	73.72	67.15	66.58	60.59	59.25	63.56	62.99	69.58	72.24	76.92		(65)
includ	de (57)	m in cal	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is f	om com	munity h	eating	
5. Inte	ernal ga	ains (see	e Table 5	and 5a):									
Metabo	lic gain	s (Table	e 5), Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	139.29	139.29	139.29	139.29	139.29	139.29	139.29	139.29	139.29	139.29	139.29	139.29		(66)
Lighting	gains	(calcula	ted in Ap	pendix	L, equat	tion L9 o	r L9a), a	lso see	Table 5	-	-	-	•	
(67)m=	45.62	40.52	32.95	24.95	18.65	15.74	17.01	22.11	29.68	37.68	43.98	46.88		(67)
Applian	ces gai	ins (calc	ulated ir	Append	dix L, eq	uation L	13 or L1	3a), als	o see Ta	ble 5			•	
(68)m=	305.48	308.65	300.66	283.65	262.19	242.01	228.53	225.36	233.35	250.36	271.82	292		(68)
Cooking	g gains	(calcula	ted in A	ppendix	L, equa	tion L15	or L15a)	, also s	ee Table	5	•		•	
(69)m=	51.25	51.25	51.25	51.25	51.25	51.25	51.25	51.25	51.25	51.25	51.25	51.25		(69)
Pumps	and far	ns gains	(Table 5	Ба)		•	•	•	•	•	•	•	•	
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0		(70)
Losses	e.g. ev	aporatio	n (nega	tive valu	es) (Tab	ole 5)			•	•	•		•	
(71)m=	-92.86	-92.86	-92.86	-92.86	-92.86	-92.86	-92.86	-92.86	-92.86	-92.86	-92.86	-92.86		(71)
Water h	neating	gains (T	able 5)											
(72)m=	105.44	103.38	99.09	93.27	89.48	84.16	79.63	85.43	87.49	93.52	100.33	103.39		(72)
Total in	nternal	gains =	!	!		(66)	m + (67)m	ı + (68)m	+ (69)m +	(70)m + (7	1)m + (72)	m	•	
(73)m=	554.21	550.22	530.38	499.54	468	439.59	422.85	430.58	448.2	479.24	513.81	539.95		(73)
6. Sola	ar gains	S:												
Solar ga	ains are c	alculated	using sola	r flux from	Table 6a	and assoc	iated equa	tions to o	onvert to th	ne applicat	ole orientat	ion.		
Orienta		Access F		Area		Flu			g_	_	FF		Gains	
	1	able 6d		m²		Tal	ole 6a		Table 6b	Т	able 6c		(W)	
Southea	st 0.9x	0.77	X	13.	33	x 3	6.79	X	0.63	х	0.7	=	149.89	(77)
Southea	ıst _{0.9x}	0.77	X	13.	33	x 6	2.67	x	0.63	х	0.7	=	255.32	(77)
Southea	ıst _{0.9x}	0.77	X	13.	33	x 8	5.75	x	0.63	x	0.7	=	349.34	(77)
Southea	st _{0.9x}	0.77	X	13.	33	x 1	06.25	х	0.63	х	0.7	=	432.85	(77)

Southeast 0.9x	0.77	x	13.3	33	x	119.01	x	0.63	x	0.7	=	484.83	(77)
Southeast 0.9x	0.77	X	13.3	33	X	118.15	X	0.63	x	0.7	=	481.32	(77)
Southeast 0.9x	0.77	X	13.3	33	X	113.91	X	0.63	x	0.7	=	464.05	(77)
Southeast 0.9x	0.77	x	13.3	33	x	104.39	x	0.63	x	0.7	=	425.27	(77)
Southeast 0.9x	0.77	х	13.3	33	X	92.85	X	0.63	x	0.7	=	378.26	(77)
Southeast _{0.9x}	0.77	x	13.3	33	x	69.27	X	0.63	x	0.7	=	282.18	(77)
Southeast 0.9x	0.77	x	13.3	33	x	44.07	X	0.63	x	0.7	=	179.54	(77)
Southeast _{0.9x}	0.77	x	13.3	3	x	31.49	x	0.63	×	0.7	_ =	128.28	(77)
Northwest 0.9x	0.77	x	5.64	4	x	11.28	X	0.63	x	0.7	=	19.45	(81)
Northwest 0.9x	0.77	x	5.64	4	x	22.97	X	0.63	x	0.7	=	39.59	(81)
Northwest 0.9x	0.77	x	5.64	4	x	41.38	x	0.63	×	0.7	_ =	71.32	(81)
Northwest 0.9x	0.77	x	5.64	4	x	67.96	X	0.63	x	0.7		117.13	(81)
Northwest 0.9x	0.77	x	5.64	4	x	91.35	X	0.63	x	0.7	=	157.45	(81)
Northwest 0.9x	0.77	x	5.64	4	x	97.38	x	0.63	×	0.7	_ =	167.86	(81)
Northwest 0.9x	0.77	x	5.64	4	x	91.1	X	0.63	x	0.7	=	157.03	(81)
Northwest 0.9x	0.77	x	5.64	4	x	72.63	x	0.63	x	0.7	=	125.18	(81)
Northwest 0.9x	0.77	x	5.64	4	x	50.42	x	0.63	x	0.7	=	86.91	(81)
Northwest 0.9x	0.77	x	5.64	4	x	28.07	X	0.63	x	0.7	=	48.38	(81)
Northwest 0.9x	0.77	x	5.64	4	x	14.2	x	0.63	×	0.7	=	24.47	(81)
Northwest 0.9x	0.77	x	5.64	4	x	9.21	x	0.63	x	0.7	=	15.88	(81)
•							_						
Solar gains in watts, calculated for each month (83)m = Sum/74)m (82)m													
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m= 169.34 294.91 420.66 549.98 642.28 649.18 621.07 550.45 465.17 330.56 204.01 144.16 (83)													
Solar gains in (83) m= 169.34		420.66	549.98	642.28	$\overline{}$	19.18 621.07	Ť		330.5	1	144.16]	(83)
Ť	294.91	420.66	549.98	642.28	64		Ť				144.16]	(83)
(83)m= 169.34	294.91 4	420.66 d solar	549.98	642.28 (73)m -	64 + (8		550	.45 465.17		6 204.01	144.16]]	(83) (84)
(83)m= 169.34 Total gains –	294.91 4 internal and 845.13 9	420.66 d solar 951.04	549.98 (84)m = 1049.53	642.28 (73)m - 1110.27	64 + (8 10	33)m , watts	550	.45 465.17	330.5	6 204.01	I]	
(83)m= 169.34 Total gains – (84)m= 723.55	294.91 4 internal and 845.13 9 rnal tempel	420.66 d solar 951.04 rature (549.98 (84)m = 1049.53 heating	642.28 (73)m - 1110.27 season	64 + (8 10	33)m , watts 88.77 1043.93	981	.04 913.37	330.5	6 204.01	I	21	
(83)m= 169.34 Total gains – (84)m= 723.55 7. Mean inte	294.91 4 internal and 845.13 9 rnal temper	d solar 951.04 rature (549.98 (84)m = 1049.53 heating eriods in	642.28 (73)m - 1110.27 season the livir	64 + (8 10)	33)m , watts 88.77 1043.93 area from Ta	981	.04 913.37	330.5	6 204.01	I	21	(84)
(83)m= 169.34 Total gains – (84)m= 723.55 7. Mean inte	294.91 4 internal and 845.13 9 rnal temper	d solar 951.04 rature (549.98 (84)m = 1049.53 heating eriods in	642.28 (73)m - 1110.27 season the livir	64 + (8 10) ng a	33)m , watts 88.77 1043.93 area from Ta	981 ble 9	.04 913.37	330.5	6 204.01	I	21	(84)
(83)m= 169.34 Total gains – (84)m= 723.55 7. Mean inte Temperature Utilisation fac	294.91 4 internal and 845.13 9 rnal temper during heator for gain Feb	d solar 951.04 rature (ating pe	549.98 (84)m = 1049.53 heating eriods in ving are.	642.28 (73)m - 1110.27 season the living a, h1,m	64 + (8 10) ng a (se	33)m , watts 88.77 1043.93 area from Ta ee Table 9a)	981 ble 9	.45 465.17 .04 913.37 , Th1 (°C) ug Sep	330.5	6 204.01	684.11	21	(84)
(83)m= 169.34 Total gains – (84)m= 723.55 7. Mean inte Temperature Utilisation factors Jan (86)m= 0.98	294.91 4 internal and 845.13 9 rnal temper during heat ctor for gain Feb 0.96	d solar rature (ating pens for li Mar 0.91	549.98 (84)m = 1049.53 (heating eriods in ving are Apr 0.8	642.28 (73)m - 1110.27 season the living a, h1,m May 0.64	64+ (8 10 10 10 10 10 10 10 10	33)m , watts 88.77 1043.93 area from Ta ee Table 9a) Jun Jul 0.46 0.33	981 ble 9	.45 465.17 .04 913.37 , Th1 (°C) ug Sep 37 0.58	330.5 809.8	6 204.01 3 717.82 : Nov	684.11 Dec	21	(84)
(83)m= 169.34 Total gains – (84)m= 723.55 7. Mean inte Temperature Utilisation fac	294.91 4 internal and 845.13 9 rnal temper during heat ctor for gain Feb 0.96	d solar rature (ating pens for li Mar 0.91	549.98 (84)m = 1049.53 (heating eriods in ving are Apr 0.8	642.28 (73)m - 1110.27 season the living a, h1,m May 0.64	64+ (8 10)) mg a ((Se c)	33)m , watts 88.77 1043.93 area from Ta ee Table 9a) Jun Jul 0.46 0.33	981 ble 9	.45 465.17 .04 913.37 , Th1 (°C) ug Sep 37 0.58 Table 9c)	330.5 809.8	6 204.01 3 717.82 : Nov	684.11 Dec	21	(84)
(83)m= 169.34 Total gains – (84)m= 723.55 7. Mean inte Temperature Utilisation fact Jan (86)m= 0.98 Mean internation (87)m= 21	294.91 4 internal and 845.13 9 rnal temper during heator for gain Feb 0.96 al temperate 21	d solar rature (ating pens for li Mar 0.91 ure in li	549.98 (84)m = 1049.53 heating eriods in ving are 0.8 iving are 21	642.28 (73)m - 1110.27 season the livin a, h1,m May 0.64 ea T1 (fo	64+ (8 10))))nng a (se collor)	33)m , watts 88.77 1043.93 area from Ta ee Table 9a) Jun Jul 0.46 0.33 w steps 3 to 21 21	981 ble 9 A 0.3 7 in 1	.45 465.17 .04 913.37 , Th1 (°C) ug Sep .058 	330.5 809.8 Oct 0.85	6 204.01 3 717.82 Nov 0.96	Dec 0.99	21	(84)
(83)m= 169.34 Total gains – (84)m= 723.55 7. Mean inte Temperature Utilisation fact Jan (86)m= 0.98 Mean interna (87)m= 21 Temperature	294.91 4 internal and 845.13 9 rnal temper during heat ctor for gain Feb 0.96 al temperate 21 e during heat	d solar rature (ating pens for li Mar 0.91 ure in li 21 ating pe	549.98 (84)m = 1049.53 (heating eriods in ving are Apr 0.8 iving are 21 eriods in	642.28 (73)m - 1110.27 season the livin a, h1,m May 0.64 ea T1 (fc 21 rest of	64+ (8 10 10 10 10 10 10 10 10 10 10 10 10 10	33)m , watts 88.77 1043.93 area from Ta ee Table 9a) Jun Jul 0.46 0.33 w steps 3 to 21 21 elling from Ta	981 ble 9 A 0.3 7 in 1 2 able 9	.45 465.17 .04 913.37 , Th1 (°C) ug Sep 37 0.58 Table 9c) 1 21 9, Th2 (°C)	330.5 809.8 Oct 0.85	8 717.82 Nov 0.96	Dec 0.99	21	(84)
(83)m= 169.34 Total gains – (84)m= 723.55 7. Mean inte Temperature Utilisation face Jan (86)m= 0.98 Mean interna (87)m= 21 Temperature (88)m= 19.99	294.91 4 internal and 845.13 9 rnal temper during heat ctor for gain Feb 0.96 al temperate 21 during heat 22	d solar rature (ating pens for li Mar 0.91 ure in li 21 ating pe	549.98 (84)m = 1049.53 (heating eriods in ving are 21 eriods in 20.01	642.28 (73)m - 1110.27 season the livin a, h1,m May 0.64 ea T1 (fc 21 rest of 20.01	64+ (8 10))))))))))))))))))))))))))))))))))))	33)m , watts 88.77 1043.93 area from Ta ee Table 9a) Jun Jul 0.46 0.33 w steps 3 to 21 21 elling from Ta 0.02 20.02	981 ble 9 A 0.3 7 in 1 2 able 9	.45 465.17 .04 913.37 , Th1 (°C) ug Sep 37 0.58 Table 9c) 1 21 9, Th2 (°C)	330.5 809.8 Oct 0.85	8 717.82 Nov 0.96	Dec 0.99	21	(84)
(83)m= 169.34 Total gains – (84)m= 723.55 7. Mean inte Temperature Utilisation face (86)m= 0.98 Mean internations (87)m= 21 Temperature (88)m= 19.99 Utilisation face	294.91 2 Internal and 845.13 S Internal temper during heat ctor for gain Feb 0.96 at temperate 21 during heat 20 ctor for gain	d solar rature (ating pens for li Mar 0.91 ure in li 21 ating pens for re	549.98 (84)m = 1049.53 heating eriods in ving are Apr 0.8 iving are 21 eriods in 20.01 est of dw	642.28 (73)m - 1110.27 season the living a, h1,m May 0.64 ea T1 (for 21 rest of 20.01 velling,	62 + (8 10)) nng 3 1 (se collor dw 2 h2,	33)m , watts 88.77 1043.93 area from Ta ee Table 9a) Jun	981 ble 9 A 0.3 7 in 1 2 able 9 20.	.45 465.17 .04 913.37 , Th1 (°C) ug Sep 37 0.58 Table 9c) 1 21 9, Th2 (°C) 03 20.02	330.5 809.8 Oct 0.85 21	6 204.01 8 717.82 1 Nov 0.96 21 20.01	Dec 0.99	21	(84) (85) (86) (87) (88)
(83)m= 169.34 Total gains – (84)m= 723.55 7. Mean inte Temperature Utilisation face (86)m= 0.98 Mean internations (87)m= 21 Temperature (88)m= 19.99 Utilisation face (89)m= 0.98	294.91 2 Internal and 845.13 S Internal temper during heat ctor for gain Feb 0.96 at temperate 21 ctor for gain 20 ctor for gain 0.95	d solar rature (ating pens for li Mar 0.91 ure in li 21 ating pens for re 0.89	549.98 (84)m = 1049.53 heating eriods in ving are Apr 0.8 iving are 21 eriods in 20.01 est of dw 0.76	642.28 (73)m - 1110.27 season the living a, h1,m May 0.64 ea T1 (for 21 rest of 20.01 velling, liveling, l	62 + (8 10)) ng (se collor dw 2 h2,	33)m , watts 88.77 1043.93 area from Ta ee Table 9a) Jun Jul 0.46 0.33 w steps 3 to 21 21 elling from Ta 0.02 20.02 m (see Table 0.39 0.26	981 ble 9 A 0.3 7 in 1 2 able 9 0.2	.45 465.17 .04 913.37 , Th1 (°C) ug Sep .058 Table 9c) 1 21 .09, Th2 (°C) .03 20.02	330.5 809.8 Oct 0.85 21 20.01	8 717.82 Nov 0.96	Dec 0.99	21	(84)
(83)m= 169.34 Total gains – (84)m= 723.55 7. Mean inte Temperature Utilisation face [S6)m= 0.98 Mean internation (87)m= 21 Temperature (88)m= 19.99 Utilisation face (89)m= 0.98 Mean internation face (89)m= 0.98	294.91 2 Internal and 845.13 9 Internal temper during head tor for gain Feb 0.96 It temperate 21 20 Internal and temperate 21 20 Internal temperate 20 20 Internal temperate 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 20 Internal temp	d solar rature (ating pens for li Mar 0.91 ure in li ating pe	549.98 (84)m = 1049.53 (heating eriods in ving are 21 eriods in 20.01 est of dw 0.76 he rest of	642.28 (73)m - 1110.27 season the livir a, h1,m May 0.64 ea T1 (fc 21 rest of 20.01 velling, l 0.58 of dwelli	62 + (8 10)) ng a 1 (se collo dw 2 h2,	33)m , watts 88.77 1043.93 area from Ta ee Table 9a) Jun	981 ble 9 A 0.3 7 in 1 2 able 9 0.2 eps 3	.45 465.17 .04 913.37 , Th1 (°C) ug Sep 37 0.58 Table 9c) 1 21 9, Th2 (°C) 03 20.02 29 0.5 5 to 7 in Tabl	330.5 809.8 809.8 Oct 0.85 21 20.01 0.81 e 9c)	8 717.82 Nov 0.96 21 20.01	Dec 0.99 21 20 0.98	21	(84) (85) (86) (87) (88) (89)
(83)m= 169.34 Total gains – (84)m= 723.55 7. Mean inte Temperature Utilisation face (86)m= 0.98 Mean internations (87)m= 21 Temperature (88)m= 19.99 Utilisation face (89)m= 0.98	294.91 2 Internal and 845.13 S Internal temper during heat ctor for gain Feb 0.96 at temperate 21 ctor for gain 20 ctor for gain 0.95	d solar rature (ating pens for li Mar 0.91 ure in li 21 ating pens for re 0.89	549.98 (84)m = 1049.53 heating eriods in ving are Apr 0.8 iving are 21 eriods in 20.01 est of dw 0.76	642.28 (73)m - 1110.27 season the living a, h1,m May 0.64 ea T1 (for 21 rest of 20.01 velling, liveling, l	62 + (8 10)) ng a 1 (se collo dw 2 h2,	33)m , watts 88.77 1043.93 area from Ta ee Table 9a) Jun Jul 0.46 0.33 w steps 3 to 21 21 elling from Ta 0.02 20.02 m (see Table 0.39 0.26	981 ble 9 A 0.3 7 in 1 2 able 9 0.2	.45 465.17 .04 913.37 , Th1 (°C) ug Sep 37 0.58 Table 9c) 1 21 9, Th2 (°C) 03 20.02 29 0.5 3 to 7 in Table 03 20.02	330.5 809.8 809.8 0.85 21 20.01 0.81 e 9c) 20.01	204.01 3 717.82 Nov 0.96 21 20.01	Dec 0.99 21 20 0.98		(84) (85) (86) (87) (88) (89)
(83)m= 169.34 Total gains – (84)m= 723.55 7. Mean inte Temperature Utilisation face [S6)m= 0.98 Mean internation (87)m= 21 Temperature (88)m= 19.99 Utilisation face (89)m= 0.98 Mean internation face (89)m= 0.98	294.91 2 Internal and 845.13 9 Internal temper during head tor for gain Feb 0.96 It temperate 21 20 Internal and temperate 21 20 Internal temperate 20 20 Internal temperate 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 21 20 Internal temperate 21 20 Internal temp	d solar rature (ating pens for li Mar 0.91 ure in li ating pe	549.98 (84)m = 1049.53 (heating eriods in ving are 21 eriods in 20.01 est of dw 0.76 he rest of	642.28 (73)m - 1110.27 season the livir a, h1,m May 0.64 ea T1 (fc 21 rest of 20.01 velling, l 0.58 of dwelli	62 + (8 10)) ng a 1 (se collo dw 2 h2,	33)m , watts 88.77 1043.93 area from Ta ee Table 9a) Jun	981 ble 9 A 0.3 7 in 1 2 able 9 0.2 eps 3	.45 465.17 .04 913.37 , Th1 (°C) ug Sep 37 0.58 Table 9c) 1 21 9, Th2 (°C) 03 20.02 29 0.5 3 to 7 in Table 03 20.02	330.5 809.8 809.8 0.85 21 20.01 0.81 e 9c) 20.01	8 717.82 Nov 0.96 21 20.01	Dec 0.99 21 20 0.98	21	(84) (85) (86) (87) (88) (89)
(83)m= 169.34 Total gains – (84)m= 723.55 7. Mean inte Temperature Utilisation face [S7)m= 21 Temperature (88)m= 19.99 Utilisation face (89)m= 0.98 Mean internation	294.91 4 internal and 845.13 9 rnal temper during head ctor for gain Feb 0.96 at temperate 21 ctor for gain 0.95 at temperate 20 ctor for gain 0.95 at temperate 20	d solar rature (ating persons for li 21 ating persons for re 20 ns for re 0.89 ure in to 20	549.98 (84)m = 1049.53 (heating eriods in ving are 21 eriods in 20.01 est of dw 0.76 he rest of 20.01	642.28 (73)m - 1110.27 season the livin a, h1,m May 0.64 ea T1 (for 21 rest of 20.01 velling, l 0.58 of dwelli 20.01	62 + (8 10)) ng a 1 (se 2 dw 2 h2,	33)m , watts 88.77 1043.93 area from Ta ee Table 9a) Jun	981 ble 9 A 0.5 7 in 1 2 able 9 0.2 eps 3 20.	.45 465.17 .04 913.37 , Th1 (°C) ug Sep 37 0.58 Table 9c) 1 21 9, Th2 (°C) 03 20.02 29 0.5 5 to 7 in Table 03 20.02	330.5 809.8 809.8 0.85 21 20.01 0.81 e 9c) 20.01	204.01 3 717.82 Nov 0.96 21 20.01	Dec 0.99 21 20 0.98		(84) (85) (86) (87) (88) (89)
(83)m= 169.34 Total gains – (84)m= 723.55 7. Mean interpretation factors (86)m= 0.98 Mean internation (87)m= 21 Temperature (88)m= 19.99 Utilisation factors (89)m= 0.98 Mean internation factors (90)m= 19.99	294.91 2 Internal and 845.13 S Internal temper during head ctor for gain Feb 0.96 al temperate 20 ctor for gain 0.95 al temperate 20 ctor for gain 0.95 al temperate 20 al temperate 20 al temperate 20 al temperate	d solar rature (ating persons for li 21 ating persons for re 20 ns for re 0.89 ure in to 20	549.98 (84)m = 1049.53 (heating eriods in ving are 21 eriods in 20.01 est of dw 0.76 he rest of 20.01	642.28 (73)m - 1110.27 season the livin a, h1,m May 0.64 ea T1 (for 21 rest of 20.01 velling, l 0.58 of dwelli 20.01	62 + (8 10)) ng (3 (0) c) llo dw 2 h2, (0) ing 2	33)m , watts 88.77 1043.93 area from Ta ee Table 9a) Jun	981 ble 9 A 0.5 7 in 1 2 able 9 0.2 eps 3 20.	.45 465.17 .04 913.37 , Th1 (°C) ug Sep 37 0.58 Table 9c) 1 21 9, Th2 (°C) 03 20.02 29 0.5 10 7 in Table 10 03 20.02 11 03 03 03 03 03 03 03	330.5 809.8 809.8 0.85 21 20.01 0.81 e 9c) 20.01	6 204.01 8 717.82 1 Nov 0.96 21 20.01 20.01 ving area ÷ (-	Dec 0.99 21 20 0.98		(84) (85) (86) (87) (88) (89)

(00)	00.44	00.44	00.44	00.40	00.40	00.40	00.40	L 00 40	00.40	00.40	00.44	00.44	l	(93)
(93)m=	20.41	20.41	20.41	20.42	20.42	20.42	20.42	20.42	20.42	20.42	20.41	20.41		(93)
			uirement				44 £	Table O	41	4 T: /	70)	-11-	late	
			or gains	•		ed at ste	ep 11 of	rable 9	b, so tha	t 11,m=(76)m an	a re-caic	culate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	1									•	
(94)m=	0.98	0.95	0.9	0.78	0.6	0.42	0.29	0.32	0.54	0.82	0.95	0.98		(94)
Usefu	ıl gains,	hmGm	W = (94)	4)m x (8	4)m								•	
(95)m=	708.04	806.34	855.63	817.36	669.83	454.64	299.95	314.82	489.28	667.54	685.33	672.61		(95)
Montl	nly aver	age exte	rnal tem	perature	from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]			1	
(97)m=	1308.25	1255.98	1123.3	917.53	692.78	457.29	300.24	315.33	498.67	780.2	1063.61	1302.02		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k\	Wh/mon	th = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m=	446.55	302.16	199.14	72.12	17.07	0	0	0	0	83.82	272.36	468.28		
			-	-			-	Tota	l per year	(kWh/yea	r) = Sum(9	8) _{15,912} =	1861.5	(98)
Space	e heatin	a reauire	ement in	kWh/m²	² /vear								25.43	(99)
•		• •				:		:	NID)				20.10	J` ′
	· · · · · · · · · · · · · · · · · · ·		nts – Indi	ividuai n	eating sy	ystems i	nciuaing	micro-C	HP)					
•	e heatir	•	at from s	acondar	u/eunnla	mentary	evetam						0	(201)
						memary	•	(202) = 1	_ (201) _					╣ .
	•		at from m	-	. ,				, ,	(000)1			1	(202)
			ng from	-				(204) = (2	02) x [1 –	(203)] =			1	(204)
Efficie	ency of r	nain spa	ace heat	ing syste	em 1								249.86	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g system	າ, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	e heatin	g require	ement (c	alculate	d above))								
	446.55	302.16	199.14	72.12	17.07	0	0	0	0	83.82	272.36	468.28		
(211)m	n = {[(98)m x (20	(4)] } x 1	00 ÷ (20	06)									(211)
	178.72	120.93	79.7	28.87	6.83	0	0	0	0	33.55	109.01	187.42		
				•			•	Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	745.03	(211)
Space	e heatin	a fuel (s	econdar	v). kWh/	month									
•		• '	00 ÷ (20	• •										
(215)m=		0	0	0	0	0	0	0	0	0	0	0		
								Tota	ıl (kWh/yea	ar) =Sum(2	215) _{15,1012}	<u> </u>	0	(215)
Water	heating	ı										ļ		_
	_		ter (calc	ulated a	bove)									
	183.22	161.32	169.01	150.95	147.51	131.22	125.47	138.45	138.44	156.55	166.24	178.62		
Efficie	ncy of w	ater hea	ıter										116.16	(216)
(217)m=	116.16	116.16	116.16	116.16	116.16	116.16	116.16	116.16	116.16	116.16	116.16	116.16		」 (217)
. ,		heating	kWh/mo				ļ	<u> </u>	<u> </u>		<u> </u>	<u> </u>	l	
		•) ÷ (217)											
(219)m=	157.73	138.88	145.5	129.95	126.99	112.97	108.01	119.19	119.18	134.77	143.12	153.77		
								Tota	I = Sum(2	19a) ₁₁₂ =			1590.06	(219)
Annua	al totals									k'	Wh/year	•	kWh/year	_
Space	heating	fuel use	ed, main	system	1						-		745.03]
														_

	Energy kWh/year	Primary factor	P. Energy kWh/year	
13a. Primary Energy				
El rating (section 14)			84	(274)
CO2 emissions per m ²	(27)	2) ÷ (4) =	18.84	(273)
Total CO2, kg/year		n of (265)(271) =	1379.15	(272)
Electricity for lighting	(232) x	0.519 =	167.24	(268)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	0	(267)
Space and water heating	(261) + (262) + (263) + (264) =		1211.91	(265)
Water heating	(219) x	0.519	825.24	(264)
Space heating (secondary)	(215) x	0.519 =	0	(263)
Space heating (main system 1)	(211) x	0.519 =	386.67	(261)
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/yea	
12a. CO2 emissions – Individual heating system	s including micro-CHP			
SAP rating (Section 12)			82.63	(258)
Energy cost factor (ECF) [(255) x (25	56)] ÷ [(4) + 45.0] =		1.25	(257)
Energy cost deflator (Table 12)			0.42	(256)
11a. SAP rating - individual heating systems				
Appendix Q items: repeat lines (253) and (254) as Total energy cost (245)(247)	s needed 7) + (250)(254) =		350.5	(255)
Additional standing charges (Table 12)			0	(251)
Energy for lighting	(232)	13.19 × 0.01 =	42.5	(250)
(if off-peak tariff, list each of (230a) to (230g) sepa		ply fuel price according to	Table 12a	_
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	0	(249)
Water heating cost (other fuel)	(219)	13.19 x 0.01 =	209.73	(247)
Space heating - secondary	(215) x	13.19 × 0.01 =	0](242)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - main system 1	kWh/year (211) x	(Table 12)	£/year	(240)
	Fuel	Fuel Price	Fuel Cost	
10a. Fuel costs - individual heating systems:				
Total delivered energy for all uses (211)(221) +	(231) + (232)(237b) =		2657.33	(338)
Electricity for lighting			322.24] (232)
Total electricity for the above, kWh/year	sum of (230	ra)(230g) =	0	(231)
Electricity for pumps, fans and electric keep-hot			1330.00	
Water heating fuel used			1590.06	7

Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	4881.49	(264)
Space and water heating	(261) + (262) + (263) + (26	(4) =		7168.72	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	0	(267)
Electricity for lighting	(232) x	0	=	989.27	(268)
'Total Primary Energy		sum of (265)(271) =		8157.99	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		111.43	(273)

		User D	Notaile:						
A No	Dath and Dahinaan	USELL		- NI	l		CTDO	000540	
Assessor Name: Software Name:	Bethany Robinson Stroma FSAP 2012		Strom Softwa					036516 on: 1.0.5.60	
Continuito Humo.		Property	Address				101010	11010100	
Address :									
1. Overall dwelling dime	ensions:								
Ground floor			a(m²)	(1a) x		ight(m)	(2a) =	Volume(m³	(3a)
	a) · (4b) · (4 a) · (4 d) · (4 a) ·					2.5	(2a) =	183.02	(3a)
·	a)+(1b)+(1c)+(1d)+(1e)+(1	n) <u>7</u>	73.21	(4)	\	I) (O)	(0.)		_
Dwelling volume				(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	183.02	(5)
2. Ventilation rate:	main seconda	rv	other		total			m³ per hou	r
Number of objection	heating heating	., □ + □		7 = [40 =		_
Number of chimneys		⊣	0	亅	0			0	(6a)
Number of open flues	0 + 0	+	0] = [0		20 =	0	(6b)
Number of intermittent fa					3		10 =	30	(7a)
Number of passive vents				Ĺ	0		10 =	0	(7b)
Number of flueless gas fi	res				0	X	40 =	0	(7c)
							Air ch	nanges per ho	ur
Infiltration due to chimne	ys, flues and fans = $(6a)+(6b)+(6b)$	7a)+(7b)+(7c) =	Г	30		÷ (5) =	0.16	(8)
•	peen carried out or is intended, procee			continue fr			. (-)	0.10	(-/
Number of storeys in the	he dwelling (ns)							0	(9)
Additional infiltration	27					[(9)	-1]x0.1 =	0	(10)
	.25 for steel or timber frame o resent, use the value corresponding t			•	ruction			0	(11)
deducting areas of opening		o ino groui	or wan are	a (ano					
•	floor, enter 0.2 (unsealed) or 0).1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, en								0	(13)
J	s and doors draught stripped		0.05 [0.0	(4.4)4	1001			0	(14)
Window infiltration			0.25 - [0.2] (8) + (10)			. (15) –		0	(15)
Infiltration rate	q50, expressed in cubic metro	oo nor he					oroo	0	(16)
	lity value, then $(18) = [(17) \div 20] +$	•	-	•	elle ol e	rivelope	alea	5	(17)
•	es if a pressurisation test has been do				is being u	sed		0.41	(10)
Number of sides sheltere		·	,	·	J			2	(19)
Shelter factor			(20) = 1 -	[0.075 x ([*]	19)] =			0.85	(20)
Infiltration rate incorporat	ting shelter factor		(21) = (18) x (20) =				0.35	(21)
Infiltration rate modified f	or monthly wind speed							-	
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	eed from Table 7							_	
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (2	2)m ÷ 4								
	1.23 1.1 1.08 0.95	0.95	0.92	1	1.08	1.12	1.18		
								ı	

Adjusted infiltr	ation rat	e (allowi	ing for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.33	0.35	0.38	0.4	0.41]	
Calculate effe		_	rate for t	he appli	cable ca	se						<u>-</u>	
If mechanic If exhaust air h			endix N (2	3h) = (23a	a) × Fmv (e	equation (1	N5)) othe	rwise (23h) = (23a)			0	(23
If balanced wit) — (20 0)			0	(23
a) If balance		•	•	J		`		,	Dh\m ı (23b) v [4	1 (226)	0	(23
24a)m= 0	0	0	0	0	0	0	0	0	0	0	$\frac{1-(230)}{0}$) - 100]]	(24
b) If balance												J	(-
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(24
c) If whole h		<u> </u>			<u> </u>		<u> </u>					J	(_
,			then (24		•				5 × (23b	o)			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(24
d) If natural	ventilatio	n or wh	ole hous	L nositiv	/e input	ventilatio	n from I	oft	<u> </u>			J	
,			m = (22l)	•					0.5]				
24d)m= 0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59		(24
Effective air	change	rate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in box	(25)				-	
25)m= 0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59]	(25
3. Heat losse	s and he	nat lace i	aramata	or:								_	
	S and ne		Openin		Net Ar	00	U-valı	10	AXU		k-valu	0	ΑΧk
LEMENT	area	_	operiiri m		A,r		W/m2		(W/	K)	kJ/m ² ·	-	kJ/K
Doors					1.89	X	1.6	_ [3.024				(26
Vindows Type	e 1				13.33	x1.	/[1/(1.3)+	0.04] =	16.47	=			(27
Vindows Type	e 2				5.64	x1	/[1/(1.3)+	0.04] =	6.97	=			(27
Valls Type1	71.9	12	18.9	7	52.95	_	0.24		12.71	=		\neg	(29
Valls Type2	13.0		1.89	=	11.14	=	0.11		1.17	ᆿ ¦		-	(29
otal area of			1.08			=	0.11		1.17				
for windows and		•	affective wi	ndow I I-vs	84.95		ı formula 1	/[(1/ -valu	د 0.41 (مر	as aiven in	naragrani	h 3 2	(3
* include the are						atou using	nonnula 1	/[((C)+0.0+j c	is given in	paragrapi	10.2	
abric heat lo	ss, W/K :	= S (A x	U)				(26)(30)	+ (32) =				40.3	4 (3:
leat capacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	0	(34
hermal mass	parame	ter (TMF	c = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(3
or design asses	sments wh	ere the de	tails of the	construct	ion are no	known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
an be used inste													
hermal bridg	,	,		• .	•	<						4.61	(30
details of thermotorial fabric he		are not kn	own (36) =	= 0.05 x (3	11)			(22) 1	(36) =				- 7(2)
		alaulataa	المعمدال							'0E\m v (E)		44.9	2 (3.
entilation he	i				1, ,	1, ,1	۸	· · · · ·		(25)m x (5)		1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1	(38
38)m= 36.28	36.04	35.81	34.72	34.52	33.57	33.57	33.4	33.94	34.52	34.93	35.36	J	(3)
leat transfer	1	·			ı		ı	- ` 	= (37) + (1	
39)m= 81.23	80.99	80.76	79.68	79.47	78.53	78.53	78.35	78.89	79.47	79.88	80.31		
										Sum(39) ₁		79.68	3 (39

Heat loss para	ımeter (l	HLP). W	′m²K					(40)m	= (39)m ÷	· (4)			
(40)m= 1.11	1.11	1.1	1.09	1.09	1.07	1.07	1.07	1.08	1.09	1.09	1.1		
L	ļ	!		ļ.		<u> </u>	ļ		L Average =	Sum(40) ₁ .	12 /12=	1.09	(40)
Number of day	/s in mo	nth (Tab	le 1a)					1	1	1			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water hea	ting ene	rgy requi	rement:								kWh/ye	ear:	
Assumed occu if TFA > 13.9 if TFA £ 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (¯	TFA -13		32		(42)
Annual average Reduce the annual not more that 125	al average	hot water	usage by	5% if the a	lwelling is	designed i			se target c		.33		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage i	n litres pe	r day for ea			ctor from	Table 1c x			!	ļ.			
(44)m= 98.27	94.69	91.12	87.55	83.97	80.4	80.4	83.97	87.55	91.12	94.69	98.27		
		•		!		!	!			m(44) ₁₁₂ =		1072.02	(44)
Energy content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x E	OTm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 145.73	127.46	131.52	114.66	110.02	94.94	87.98	100.96	102.16	119.06	129.96	141.13		_
If instantaneous v	vater heati	na at noint	of use (no	n hot water	storage)	enter () in	hoxes (46		Total = Su	m(45) ₁₁₂ =	-	1405.59	(45)
(46)m= 21.86	19.12	19.73	17.2	16.5	14.24	13.2	15.14	15.32	17.86	19.49	21.17		(46)
Water storage	1	19.73	17.2	10.5	14.24	13.2	15.14	15.52	17.00	19.49	21.17		(40)
Storage volum	ne (litres)) includir	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		90		(47)
If community h	neating a	and no ta	nk in dw	velling, e	nter 110	litres in	(47)						
Otherwise if no		hot water	er (this in	ncludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
Water storage		المصمام	ft-	مینامانیم	/1.\^/L	- /-l -> -\ .							(40)
a) If manufact				or is kno	wn (Kvvr	1/day):					85		(48)
Temperature f							(40) (40)			0.	54		(49)
Energy lost from b) If manufact		•			or is not		(48) x (49)) =		0.	46		(50)
Hot water stor			-								0		(51)
If community h	•		on 4.3										
Volume factor			0.1								0		(52)
Temperature f											0		(53)
Energy lost fro		_	, kWh/ye	ear			(47) x (51)) x (52) x (53) =	-	0		(54)
Enter (50) or	` , ` `	,	or ooob	manth			//EC\m /	'EE\ (44).		0.	46		(55)
Water storage							. , ,	(55) × (41)		ī			(=0)
(56)m= 14.23	12.85	14.23	13.77	14.23	13.77	14.23	14.23	13.77	14.23	13.77	14.23	51.1	(56)
If cylinder contains			rage, (57)		x [(50) – (<i>r</i>)iii = (56)		· ·		IX II	
(57)m= 14.23	12.85	14.23	13.77	14.23	13.77	14.23	14.23	13.77	14.23	13.77	14.23		(57)
Primary circuit	,	•									0		(58)
Primary circuit				,		` '	, ,		(1.	-1-1			
(modified by								<u> </u>		<u> </u>	00.00		(EO)
(59)m= 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 cal	culated	for each	month ((61)m =	(60) ÷ 36	65 x (41))m							
(61)m=	0	0	0	0	0	0	0	0		0	0	0	0]	(61)
	eat requ	uired for	water he	eating ca	alculated	l for eac	n month	(62)ı	—— m =	0.85 × (′45)m +	(46)m +	(57)m +	ı · (59)m + (61)m	
(62)m=	183.22	161.32	169.01	150.95	147.51	131.22	125.47	138	_	138.44	156.55	166.24	178.62]	(62)
Solar Di		calculated	using App	endix G or	· Appendix	ι κ Η (negati	ve quantity	/) (ent	er '0'	if no sola	r contribu	tion to wate	r heating)	ı	
						applies							•		
(63)m=	0	0	0	0	0	0	0	0		0	0	0	0]	(63)
FHRS	0	0	0	0	0	0	0	0	,	0	0	0	0	•	(63) (G2)
Output	from wa	ater hea	ter												
(64)m=	183.22	161.32	169.01	150.95	147.51	131.22	125.47	138	.45	138.44	156.55	166.24	178.62]	
									Outp	ut from wa	ater heate	er (annual)	12	1847.02	(64)
Heat g	ains fror	n water	heating,	kWh/mo	onth 0.2	5 ´ [0.85	× (45)m	+ (6	1)m	ı] + 0.8 x	([(46)m	+ (57)m	+ (59)m]	
(65)m=	78.45	69.47	73.72	67.15	66.58	60.59	59.25	63.	56	62.99	69.58	72.24	76.92]	(65)
inclu	de (57)r	m in calc	culation of	of (65)m	only if c	ylinder i	s in the	dwell	ing	or hot w	ater is f	rom com	munity h	neating	
5. Int	ternal ga	ains (see	Table 5	and 5a):									_	
		s (Table													
Wiotab	Jan	Feb	Mar	Apr	May	Jun	Jul	Aı	ug	Sep	Oct	Nov	Dec]	
(66)m=	116.07	116.07	116.07	116.07	116.07	116.07	116.07	116	.07	116.07	116.07	116.07	116.07	1	(66)
Lightin	g gains	(calculat	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso s	ee ∃	гable 5				•	
(67)m=	18.25	16.21	13.18	9.98	7.46	6.3	6.8	8.8	_	11.87	15.07	17.59	18.75]	(67)
Applia	nces gai	ins (calc	ulated in	Append	dix L, eq	uation L	 13 or L1	3a), a	also	see Tal	ble 5	<u> </u>	<u> </u>	J	
(68)m=	204.67	206.79	201.44	190.05	175.67	162.15	153.12	150.	_	156.35	167.74	182.12	195.64]	(68)
Cookir	ng gains	(calcula	ted in A	ppendix	L, equa	tion L15	or L15a), als	o se	e Table	5	ļ	!	J	
(69)m=	34.61	34.61	34.61	34.61	34.61	34.61	34.61	34.0		34.61	34.61	34.61	34.61]	(69)
Pumps	and far	ns gains	(Table 5	 5а)				<u> </u>			<u> </u>			J	
(70)m=	0	0	0	0	0	0	0	0		0	0	0	0	1	(70)
Losses	s e.a. ev	aporatio	n (negat	tive valu	es) (Tab	ole 5)								J	
(71)m=	-92.86	-92.86	-92.86	-92.86	-92.86	-92.86	-92.86	-92.	.86	-92.86	-92.86	-92.86	-92.86	1	(71)
	heating	gains (T	able 5)					<u> </u>	!					J	
(72)m=	105.44	103.38	99.09	93.27	89.48	84.16	79.63	85.4	43	87.49	93.52	100.33	103.39]	(72)
		gains =				ļ		1 + (68	3)m +	- (69)m + (<u> </u>	1 71)m + (72)	l)m	J	
(73)m=	386.18	384.2	371.54	351.11	330.43	310.43	297.37	303.	_	313.53	334.16	357.87	375.6	1	(73)
	lar gains	S:						<u> </u>							
			using sola	r flux from	Table 6a	and assoc	ated equa	tions 1	to co	nvert to th	e applica	ble orienta	tion.		
Orienta		Access F		Area		Flu	Х			g_		FF		Gains	
	Т	able 6d		m²		Tal	ole 6a		T	able 6b	Т	able 6c		(W)	
Southe	ast _{0.9x}	0.77	X	13.	33	x 3	6.79	x		0.63	x	0.7	=	149.89	(77)
Southe	ast _{0.9x}	0.77	X	13.	33	x 6	2.67	x		0.63	×	0.7	=	255.32	(77)
Southe	ast _{0.9x}	0.77	x	13.	33	x 8	5.75	x		0.63	_ x [0.7	=	349.34	(77)
Southe	ast _{0.9x}	0.77	x	13.	33	x 1	06.25	x		0.63	x [0.7	=	432.85	(77)

										_				_
Southeast 0.9x	0.77	X	13.	33	X	1	19.01	X	0.63	X	0.7	=	484.83	(77)
Southeast 0.9x	0.77	X	13.	33	X	1	18.15	X	0.63	X	0.7	=	481.32	(77)
Southeast 0.9x	0.77	Х	13.3	33	X	1	13.91	X	0.63	X	0.7	=	464.05	(77)
Southeast _{0.9x}	0.77	X	13.3	33	x	1	04.39	X	0.63	X	0.7	=	425.27	(77)
Southeast 0.9x	0.77	X	13.3	33	x	9	92.85	x	0.63	х	0.7	=	378.26	(77)
Southeast 0.9x	0.77	X	13.3	33	x	6	9.27	x	0.63	x	0.7	=	282.18	(77)
Southeast 0.9x	0.77	X	13.3	33	x	4	14.07	x	0.63	x	0.7	=	179.54	(77)
Southeast _{0.9x}	0.77	x	13.3	33	x	3	31.49	x	0.63	X	0.7	=	128.28	(77)
Northwest _{0.9x}	0.77	x	5.6	64	x	1	1.28	x	0.63	X	0.7	=	19.45	(81)
Northwest 0.9x	0.77	Х	5.6	64	x	2	22.97	X	0.63	x	0.7	=	39.59	(81)
Northwest _{0.9x}	0.77	x	5.6	64	x	4	11.38	x	0.63	X	0.7	=	71.32	(81)
Northwest _{0.9x}	0.77	x	5.6	64	x	6	67.96	X	0.63	X	0.7	=	117.13	(81)
Northwest _{0.9x}	0.77	x	5.6	64	x	9	91.35	x	0.63	x	0.7	=	157.45	(81)
Northwest _{0.9x}	0.77	x	5.6	64	x	9	97.38	x	0.63	X	0.7	=	167.86	(81)
Northwest _{0.9x}	0.77	x	5.6	64	x	9	91.1	X	0.63	X	0.7	=	157.03	(81)
Northwest _{0.9x}	0.77	x	5.6	64	x	7	72.63	x	0.63	x	0.7	=	125.18	(81)
Northwest _{0.9x}	0.77	x	5.6	64	x	5	50.42	x	0.63	x	0.7	=	86.91	(81)
Northwest _{0.9x}	0.77	x	5.6	64	x	2	28.07	x	0.63	x	0.7	=	48.38	(81)
Northwest _{0.9x}	0.77	x	5.6	64	x		14.2	x	0.63	x	0.7	=	24.47	(81)
Northwest _{0.9x}	0.77	X	5.6	64	x	,	9.21	x	0.63	х	0.7	<u>=</u>	15.88	(81)
Solar gains in	watts, cal	lculated	for eacl	h montl	h			(83)m	ı = Sum(74)m .	(82)m				
					$\overline{}$					- ` 		i e	1	
(83)m= 169.34	294.91	420.66	549.98	642.28		49.18	621.07	550	.45 465.17	330.5		144.16]	(83)
(83)m= 169.34 Total gains – i	294.91 nternal ar	420.66 nd solar	549.98 (84)m =	(73)m	+ (8	83)m	, watts			330.5	6 204.01]	, ,
(83)m= 169.34	294.91	420.66	549.98	l	+ (8			550 853			6 204.01	144.16 519.76]	(83) (84)
(83)m= 169.34 Total gains – i	294.91 nternal ar 679.11	420.66 nd solar 792.2	549.98 (84)m = 901.1	= (73)m 972.71	+ (8	83)m	, watts			330.5	6 204.01			, ,
(83)m= $169.34Total gains – i (84)m= 555.52$	294.91 nternal ar 679.11	420.66 nd solar 792.2 erature (549.98 (84)m = 901.1 (heating	972.71 seaso	+ (8 9 n)	83)m 959.6	918.45	853	.54 778.7	330.5	6 204.01		21	` '
(83)m= 169.34 Total gains – i (84)m= 555.52 7. Mean inter	294.91 nternal ar 679.11 mal temper during he	420.66 and solar 792.2 erature (eating po	549.98 (84)m = 901.1 (heating eriods in	972.71 season the liv	+ (8	83)m 959.6 area	, watts 918.45 from Tal	853	.54 778.7	330.5	6 204.01		21	(84)
(83)m= 169.34 Total gains – i (84)m= 555.52 7. Mean inter Temperature	294.91 nternal ar 679.11 mal temper during he	420.66 and solar 792.2 erature (eating po	549.98 (84)m = 901.1 (heating eriods in	972.71 season the liv	+ (8 n) ring n (se	83)m 959.6 area	, watts 918.45 from Tal	853 ole 9	.54 778.7	330.5	204.01		21	(84)
(83)m= 169.34 Total gains – i (84)m= 555.52 7. Mean inter Temperature Utilisation fac	294.91 nternal ar 679.11 cnal temperaturing heater for ga	420.66 and solar 792.2 erature (erature points for limits 549.98 (84)m = 901.1 (heating eriods in iving are	= (73)m 972.71 season the livea, h1,n	+ (8	83)m 959.6 area t	yatts 918.45 from Tal	853 ole 9	.54 778.7 , Th1 (°C)	330.5 664.7	2 561.87 Nov	519.76	21	(84)	
(83)m= 169.34 Total gains – i (84)m= 555.52 7. Mean inter Temperature Utilisation fac	294.91 nternal ar 679.11 cmal tempe during he ctor for ga Feb 0.98	420.66 Ind solar 792.2 Perature (Peating points for li Mar 0.95	549.98 (84)m = 901.1 (heating eriods in iving are Apr 0.87	972.71 season the livea, h1,n May	+ (8	83)m 959.6 area t ee Ta Jun 0.52	yatts 918.45 from Talable 9a) Jul 0.37	853 cole 9	.54 778.7 , Th1 (°C) ug Sep	330.5i	2 561.87 Nov	519.76 Dec	21	(84)
(83)m= 169.34 Total gains – i (84)m= 555.52 7. Mean inter Temperature Utilisation fact Jan (86)m= 0.99	294.91 nternal ar 679.11 cmal tempe during he ctor for ga Feb 0.98	420.66 Ind solar 792.2 Perature (Peating points for li Mar 0.95	549.98 (84)m = 901.1 (heating eriods in iving are Apr 0.87	972.71 season the livea, h1,n May	+ (8	83)m 959.6 area t ee Ta Jun 0.52	yatts 918.45 from Talable 9a) Jul 0.37	853 cole 9	.54 778.7 Th1 (°C) ug Sep 12 0.66	330.5i	2 561.87 Nov	519.76 Dec	21	(84)
(83)m= 169.34 Total gains – i (84)m= 555.52 7. Mean inter Temperature Utilisation fact Jan (86)m= 0.99 Mean interna	294.91 nternal ar 679.11 mal temper during he ctor for ga Feb 0.98 ltempera 21	420.66 Ind solar 792.2 Perature (Peating points for li Mar 0.95 Inture in l	549.98 (84)m = 901.1 (heating eriods in iving are 0.87 iving are 21	972.71 season the livea, h1,n May 0.71 ea T1 (1	+ (((s)	83)m 959.6 area f ee Ta Jun 0.52 ow ste	, watts 918.45 from Talable 9a) Jul 0.37 ps 3 to 7	853 cole 9 A 0.4 7 in T	.54 778.7 Th1 (°C) ug Sep 12 0.66 Table 9c) 1 21	330.5 664.7 Oct 0.92	6 204.01 2 561.87 Nov 0.99	519.76 Dec 1	21	(84)
(83)m= 169.34 Total gains – i (84)m= 555.52 7. Mean inter Temperature Utilisation fact Jan (86)m= 0.99 Mean interna (87)m= 21	294.91 nternal ar 679.11 mal temper during he ctor for ga Feb 0.98 ltempera 21	420.66 Ind solar 792.2 Perature (Peating points for li Mar 0.95 Inture in l	549.98 (84)m = 901.1 (heating eriods in iving are 0.87 iving are 21	972.71 season the livea, h1,n May 0.71 ea T1 (1	+ (§	83)m 959.6 area f ee Ta Jun 0.52 ow ste	, watts 918.45 from Talable 9a) Jul 0.37 ps 3 to 7	853 cole 9 A 0.4 7 in T	.54 778.7 Th1 (°C) ug Sep 12 0.66 Table 9c) 1 21 9, Th2 (°C)	330.5 664.7 Oct 0.92	2 561.87 Nov 0.99	519.76 Dec 1	21	(84)
(83)m= 169.34 Total gains – i (84)m= 555.52 7. Mean inter Temperature Utilisation fact Jan (86)m= 0.99 Mean interna (87)m= 21 Temperature (88)m= 19.99	294.91 nternal ar 679.11 cmal temper during he ctor for ga 1 tempera 21 during he 20	420.66 Ind solar 792.2 Perature (Peating points for limits for li	549.98 (84)m = 901.1 (heating eriods in iving are 21 eriods in 20.01	972.71 season the livea, h1,r May 0.71 ea T1 (1 21 rest of 20.01	+ (8 gm) ring m (so follo	area fragrens area from 59.6 area fragrens	yatts 918.45 from Talable 9a) Jul 0.37 ps 3 to 7 21 from Talable 9a)	853 ble 9 A 0.4 7 in T 2 able 9	.54 778.7 Th1 (°C) ug Sep 12 0.66 Table 9c) 1 21 9, Th2 (°C)	330.5i 664.7i Oct 0.92	2 561.87 Nov 0.99	519.76 Dec 1 21	21	(84) (85) (86) (87)
(83)m= 169.34 Total gains – i (84)m= 555.52 7. Mean inter Temperature Utilisation fact Jan (86)m= 0.99 Mean interna (87)m= 21 Temperature	294.91 nternal ar 679.11 cmal temper during he ctor for ga 1 tempera 21 during he 20	420.66 Ind solar 792.2 Perature (Peating points for limits for li	549.98 (84)m = 901.1 (heating eriods in iving are 21 eriods in 20.01	972.71 season the livea, h1,r May 0.71 ea T1 (1 21 rest of 20.01	+ (8 9 9 nn) ring m (see 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	area fragrens area from 59.6 area fragrens	yatts 918.45 from Talable 9a) Jul 0.37 ps 3 to 7 21 from Talable 9a)	853 ble 9 A 0.4 7 in T 2 able 9	Sep 12 0.66 Table 9c) 1 21 9, Th2 (°C) 03 20.02	330.5i 664.7i Oct 0.92	2 561.87 Nov 0.99	519.76 Dec 1 21	21	(84) (85) (86) (87)
(83)m= 169.34 Total gains – i (84)m= 555.52 7. Mean inter Temperature Utilisation fac [86)m= 0.99 Mean interna (87)m= 21 Temperature (88)m= 19.99 Utilisation fac (89)m= 0.99	294.91 nternal ar 679.11 cmal temper during he ctor for ga	420.66 Ind solar 792.2 Perature (Peating points for lime of l	549.98 (84)m = 901.1 (heating eriods in iving are 21 eriods in 20.01 est of do 0.83	972.71 972.71 972.71 1	+ (\(\)\ g \\ n) \\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	83)m 959.6 area f ee Ta Jun 0.52 ow ste 21 velling 20.02 ,m (se	y watts 918.45 from Talable 9a) Jul 0.37 ps 3 to 7 21 from Talable 9a) 1 from Talable 9a) 0.29	853 ble 9 A 0.4 7 in T 2 20. 9a) 0.3	Sep 0.66 Table 9c) 1 21 9, Th2 (°C) 03 20.02	330.5i 664.7i Oct 0.92 21 20.01	2 561.87 Nov 0.99 21 20.01	519.76 Dec 1 21 20	21	(84) (85) (86) (87) (88)
(83)m= 169.34 Total gains – i (84)m= 555.52 7. Mean inter Temperature Utilisation fact Jan (86)m= 0.99 Mean interna (87)m= 21 Temperature (88)m= 19.99 Utilisation fact (89)m= 0.99 Mean interna	294.91 Internal ar 679.11 Imal temper during heater for gar Feb 0.98 Itempera 21 during heater for gar 20 ctor for gar 1 during heater for gar 20 to for gar 1 tempera	420.66 Ind solar 792.2 Perature (Peating points for limits for limits for real limits for rea	549.98 (84)m = 901.1 (heating eriods in iving are 21 eriods in 20.01 est of do 0.83 the rest	972.71 972.71 972.71 1	+ (\(\frac{1}{2}\) f dw \(\frac{1}{2}\) \(\fra	83)m 959.6 area f ee Ta Jun 0.52 bw ste 21 velling 20.02 m (se 0.44 T2 (fe	ywatts 918.45 from Table 9a) Jul 0.37 ps 3 to 7 21 from Table 20.02 ee Table 0.29 ollow ste	853 ble 9 A 0.4 7 in T 2 able 9 0.3 9a) 0.3	Sep 12 0.66 Sable 9c) 1 21 Sq. Th2 (°C) 20.02 Sq. Th2 (°C) 3 20.02	330.5i 664.7i Oct 0.92 21 20.01	2 561.87 Nov 0.99 21 20.01	519.76 Dec 1 21 20	21]	(84) (85) (86) (87) (88)
(83)m= 169.34 Total gains – i (84)m= 555.52 7. Mean inter Temperature Utilisation fac [86)m= 0.99 Mean interna (87)m= 21 Temperature (88)m= 19.99 Utilisation fac (89)m= 0.99	294.91 nternal ar 679.11 cmal temper during he ctor for ga	420.66 Ind solar 792.2 Perature (Peating points for lime of l	549.98 (84)m = 901.1 (heating eriods in iving are 21 eriods in 20.01 est of do 0.83	e (73)m 972.71 season the livea, h1,n May 0.71 ea T1 (1 21 n rest of 20.01 welling, 0.65 of dwel	+ (\(\frac{1}{2}\) f dw \(\frac{1}{2}\) \(\fra	83)m 959.6 area f ee Ta Jun 0.52 ow ste 21 velling 20.02 ,m (se	y watts 918.45 from Talable 9a) Jul 0.37 ps 3 to 7 21 from Talable 9a) 1 from Talable 9a) 0.29	853 ble 9 A 0.4 7 in T 2 20. 9a) 0.3	3 0.58 to 7 in Table 03 20.02	330.5i 664.7i Oct 0.92 21 20.01 0.89 le 9c) 20.01	2 561.87 Nov 0.99 21 20.01	519.76 Dec 1 21 20 0.99		(84) (85) (86) (87) (88) (89)
(83)m= 169.34 Total gains – i (84)m= 555.52 7. Mean inter Temperature Utilisation fact (86)m= 0.99 Mean interna (87)m= 21 Temperature (88)m= 19.99 Utilisation fact (89)m= 0.99 Mean interna (90)m= 19.99	294.91 Internal ar 679.11 Imal temporal during he ctor for gas a company of the company of the ctor for gas a company of the c	deating points for line atting points for reating p	549.98 (84)m = 901.1 (heating eriods in iving are 21 eriods in 20.01 est of do 0.83 the rest 20.01	e (73)m 972.71 season the livea, h1,n May 0.71 ea T1 (for 20.01) welling, 0.65 of dwell 20.01	+ ((g g n)) ing m (si) (folloo) (fol	83)m 959.6 area f ee Ta Jun 0.52 ow ste 21 velling 20.02 ,m (se 0.44 T2 (fe	, watts 918.45 from Table 9a) Jul 0.37 ps 3 to 7 21 from Table 20.02 ee Table 0.29 ollow ste	853 Dole 9 A 0.4 7 in T 2 20. 9a) 0.3 eps 3	.54 778.7 .Th1 (°C) ug Sep .12 0.66 .Table 9c) 1 21	330.5i 664.7i Oct 0.92 21 20.01 0.89 le 9c) 20.01	2 561.87 Nov 0.99 21 20.01	519.76 Dec 1 21 20 0.99	21	(84) (85) (86) (87) (88) (89)
(83)m= 169.34 Total gains – i (84)m= 555.52 7. Mean inter Temperature Utilisation fact (86)m= 0.99 Mean internation (87)m= 21 Temperature (88)m= 19.99 Utilisation fact (89)m= 0.99 Mean internation fact (89)m= 19.99 Mean internation fact (90)m= 19.99	294.91 Internal ar 679.11 Image: during heater for gas 1 temperal 20 Internal temperal 21	420.66 Ind solar 792.2 Perature (Peating points for limits for limits for real limits for rea	549.98 (84)m = 901.1 (heating eriods in iving are 21 eriods ir 20.01 est of do 0.83 the rest 20.01 r the wh	e (73)m 972.71 season the livea, h1,n May 0.71 ea T1 (from 120.01) welling, 0.65 of dwell 20.01	+ (8 gm) ring m (so gm) f dw 2 gm ling 2 gm elling 2	83)m 959.6 area f ee Ta Jun 0.52 w ste 21 velling 20.02 m (se 0.44 T2 (fe 20.02	y watts 918.45 from Tal able 9a) Jul 0.37 ps 3 to 7 21 from Tal 20.02 ee Table 0.29 ollow ste 20.02	853 bole 9 A 0.4 7 in T 2 able 9 20. 9a) 0.3 eps 3 20.	3. 0.58 to 7 in Table 0.02 - fLA) × T2	330.5 664.7 Oct 0.92 21 20.01 0.89 le 9c) 20.01 fLA = Liv	2 561.87 Nov 0.99 21 20.01 ving area ÷ (519.76 Dec 1 21 20 0.99 20 4) =		(84) (85) (86) (87) (88) (89) (90) (91)
(83)m= 169.34 Total gains – i (84)m= 555.52 7. Mean inter Temperature Utilisation fact (86)m= 0.99 Mean interna (87)m= 21 Temperature (88)m= 19.99 Utilisation fact (89)m= 0.99 Mean interna (90)m= 19.99	294.91 nternal ar 679.11 mal temper during he ctor for ga	420.66 Ind solar 792.2 Perature (Peating points for lime of l	549.98 (84)m = 901.1 (heating eriods in iving are 21 eriods in 20.01 est of do 0.83 the rest 20.01 r the wh 20.42	= (73)m 972.71 season the livea, h1,n May 0.71 ea T1 (for 20.01) welling, 0.65 of dwel 20.01	+ (% g g n) ing m (si follo	83)m 959.6 area f ee Ta Jun 0.52 ow ste 21 velling 20.02 m (se 0.44 T2 (fe 20.02	, watts 918.45 from Table 9a) Jul 0.37 ps 3 to 7 21 from Table 20.02 ee Table 0.29 ollow ster 20.02 LA × T1 20.42	853 A 0.4 7 in T 2 20. 9a) 0.3 + (1 20.	3 0.58 to 7 in Table 03 20.02	330.5i 664.7i 0ct 0.92 21 20.01 0.89 20.01 fLA = Liv	2 561.87 Nov 0.99 21 20.01 20.01 ving area ÷ (519.76 Dec 1 21 20 0.99		(84) (85) (86) (87) (88) (89)

Signar 2041 2041 2041 2042 2042 2042 2042 2042 2042 2041 2041 (93)
Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a. Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
the utilisation factor for gains using Table 9a Mar
Utilisation factor for gains, hm: (94)ma 0.99 0.98 0.95 0.
(94) (
Useful gains, hmGm
(95)m=
Monthly average external temperature from Table 8 (96)m
(96)m= 4.3
Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m - (96)m] (97)m (308.25 1255.98 1123.3 917.53 692.78 457.29 300.24 315.33 498.67 780.2 1063.61 1302.02 (97)
97 ms 1308.25 1255.98 1123.3 917.53 692.78 457.29 300.24 315.33 498.67 780.2 1063.61 1302.02 (97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m
98 m 562.88 396.5 278.31 110.71 28.21 0 0 0 0 135.64 368.1 583.93 Total per year (kWh/year) = Sum(98)se 2464.29 (98) Space heating requirement in kWh/m²/year
Space heating requirement in kWh/m²/year Sum(98)sz 2464.29 (98)
Space heating requirement in kWh/m²/year 33.66 (99)
9a. Energy requirements — Individual heating systems including micro-CHP) Space heating: Fraction of space heat from secondary/supplementary system Fraction of space heat from main system(s) Fraction of space heat from main system(s) Fraction of space heat from main system 1 (204) = (202) × [1 - (203)] = 1 (204) Efficiency of main space heating system 1 Efficiency of secondary/supplementary heating system, % Discrept main space heating system 1 Efficiency of secondary/supplementary heating system, % Discrept main space heating system 1 Efficiency of secondary/supplementary heating system, % Discrept main space heating system 1 Efficiency of secondary/supplementary heating system, % Discrept main space heating system 1 Efficiency of secondary/supplementary heating system, % Discrept main space heating system 1 Efficiency of secondary/supplementary heating system, % Discrept main space heating system 1 Equation of total heating from main system 1 Equation of total heating system 1 Equation of total heati
Space heating: Fraction of space heat from secondary/supplementary system 0 (201)
Fraction of space heat from secondary/supplementary system
Fraction of space heat from secondary/supplementary system
Fraction of total heating from main system 1 (204) = (202) × [1 - (203)] = 1 (204) (204) = (202) × [1 - (203)] = 1 (204) (204) = (202) × [1 - (203)] = 1 (204) (204) = (202) × [1 - (203)] = 1 (204) = (202) × [1 - (203)] = 1 (204) = (202) × [1 - (203)] = 1 (204) = (202) × [1 - (203)] = 1 (204) = (202) × [1 - (203)] = 1 (204) = (202) × [1 - (203)] = 1 (204) = (202) × [1 - (203)] = 1 (204) = (202) × [1 - (203)] = 1 (204) = (202) × [1 - (203)] = 1 (204) = (202) × [1 - (203)] = 1 (204) = (202) × [1 - (203)] = 1 (204) = (202) × [1 - (203)] = (202) × [1 - (202)] = (202) × [1 - (202)] = (202) × [1 - (202)] = (202) × [1 - (202)] = (202) × [1 - (202)] = (202) × [1 - (202)] = (202) × [1 - (202)] = (202) × [1 - (202)] = (202) × [1 - (202)] = (202) × [1 - (202)] = (202) × [1 - (202)] = (202) × [1 - (202)] = (202) × [
Efficiency of main space heating system 1 Efficiency of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec KWh/year Space heating requirement (calculated above) 562.88 396.5 278.31 110.71 28.21 0 0 0 0 135.64 368.1 583.93 (211)m = {[(98)m x (204)]} x 100 ÷ (206) Total (kWh/year) = Sum(211),, 12 986.28 (211) Space heating fuel (secondary), kWh/month = {[(98)m x (201)]} x 100 ÷ (208) (215)m = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 Total (kWh/year) = Sum(215),, 12 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Efficiency of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Space heating requirement (calculated above) 562.88
S62.88 396.5 278.31 110.71 28.21 0 0 0 0 135.64 368.1 583.93
(211) m = {[[(98)m x (204)]] } x 100 ÷ (206)
225.28 158.69 111.39 44.31 11.29 0 0 0 54.29 147.33 233.71 Total (kWh/year) = Sum(211) _{15,1012} 986.28 (211) Space heating fuel (secondary), kWh/month = {[(98)m x (201)]} x 100 ÷ (208) (215)m=
Total (kWh/year) =Sum(211) _{16,1012} 986.28 (211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)]} x 100 \div (208) (215)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
= {[(98)m x (201)]} x 100 ÷ (208) (215)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
= {[(98)m x (201)]} x 100 ÷ (208) (215)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Total (kWh/year) =Sum(215) _{15,1012} 0 Water heating Output from water heater (calculated above) 183.22 161.32 169.01 150.95 147.51 131.22 125.47 138.45 138.44 156.55 166.24 178.62 Efficiency of water heater (217)m= 116.16 116.16 116.16 116.16 116.16 116.16 116.16 116.16 116.16 116.16 1217) Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m
Water heating Output from water heater (calculated above) 183.22 161.32 169.01 150.95 147.51 131.22 125.47 138.45 138.44 156.55 166.24 178.62 Efficiency of water heater (217)m= 116.16 116.
Output from water heater (calculated above) 183.22
183.22 161.32 169.01 150.95 147.51 131.22 125.47 138.45 138.44 156.55 166.24 178.62 Efficiency of water heater (217)m= 116.16
Efficiency of water heater (217)m= 116.16
(217)m= 116.16 116.16 116.16 116.16 116.16 116.16 116.16 116.16 116.16 116.16 116.16 116.16 116.16 (217) Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m
(219) m = (64) m x $100 \div (217)$ m
(219)m= 157.73 138.88 145.5 129.95 126.99 112.97 108.01 119.19 119.18 134.77 143.12 153.77
Total = $Sum(219a)_{112}$ = 1590.06 (219)
Annual totals kWh/year space heating fuel used, main system 1 kWh/year 986.28
Space heating fuel used, main system 1 986.28

Water heating fuel used			1590.06]
Electricity for pumps, fans and electric keep-hot				_
Total electricity for the above, kWh/year	sum of (230	0a)(230g) =	0	(231)
Electricity for lighting			322.24	(232)
Total delivered energy for all uses (211)(221) +	(231) + (232)(237b) =		2898.58	(338)
12a. CO2 emissions – Individual heating systems	s including micro-CHP			
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/yea	ır
Space heating (main system 1)	(211) x	0.519 =	511.88	(261)
Space heating (secondary)	(215) x	0.519 =	0	(263)
Water heating	(219) x	0.519 =	825.24	(264)
Space and water heating	(261) + (262) + (263) + (264) =		1337.12	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	0	(267)
Electricity for lighting	(232) x	0.519 =	167.24	(268)
Total CO2, kg/year	Sui	m of (265)(271) =	1504.36	(272)

 $(272) \div (4) =$

Dwelling CO2 Emission Rate

El rating (section 14)

(273)

(274)

20.55

SAP Input

Property Details: SF Flat

Address:

Located in: England Region: Thames valley

UPRN:

Date of assessment: 05 October 2023
Date of certificate: 05 October 2023

Assessment type: New dwelling design stage

Transaction type:

Tenure type:

Related party disclosure:

Thermal Mass Parameter:

New dwelling

Unknown

No related party

Indicative Value Medium

Water use <= 125 litres/person/day: True

PCDF Version: 512

Property description:

Dwelling type: Flat

Detachment:

Year Completed: 2023

Floor Location: Floor area:

Storey height:

Floor 0 59.71 m² 2.5 m

Living area: 20.52 m² (fraction 0.344)

Front of dwelling faces: South East

Opening types:

Name: Source: Type: Glazing: Argon: Frame:

se Manufacturer Solid

nw Manufacturer Windows low-E, En = 0.05, soft coat Yes

Name: Gap: Frame Factor: g-value: **U-value:** Area: No. of Openings: se mm 0.7 0.63 1.6 1.89 16mm or more 0.7 0.63 1.3 12.93 nw

Name: Type-Name: Location: Orient: Width: Height: se South East 0 0

nw Ext. North West 0 0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Element	<u>S</u>						
Ext.	29.43	12.93	16.5	0.24	0	False	N/A
Shel	25.2	1.89	23.31	0.11	0.43	False	N/A
Flat Roof	59.71	0	59.71	0.12	0		N/A
Internal Floment	6						

Internal Elements
Party Elements

Thermal bridges

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0696

Length	Psi-value		
6.71	0.05	E2	Other lintels (including other steel lintels)
21.94	0.04	E4	Jamb
7.5	0.058	E16	Corner (normal)

SAP Input

5	-0.069	E17	Corner (inverted internal area greater than external area)
7.5	0.068	E18	Party wall between dwellings
21.85	0.073	E7	Party floor between dwellings (in blocks of flats)
21.85	0.08	E14	Flat roof
11.69	0	P3	Intermediate floor between dwellings (in blocks of flats)
11.69	0.24	P4	Roof (insulation at ceiling level)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Natural ventilation (extract fans)

Number of chimneys: 0
Number of open flues: 0
Number of fans: 3
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with radiators or underfloor heating

Electric heat pumps Fuel: Electricity

Info Source: Boiler Database

Database: (rev 512, product index 101403, SEDBUK 221%):

Brand name: Vaillant Model: aroTHERM

Model qualifier: VWL 85/2 - Underfloor

(provides DHW all year) Systems with radiators

Central heating pump: 2013 or later

Design flow temperature: Design flow temperature >45°C

Unknown

Boiler interlock: Yes

Main heating Control:

Main heating Control: Time and temperature zone control by suitable arrangement of plumbing and electrical

services

Control code: 2207

Secondary heating system:

Secondary heating system: None

Water heating

Water heating: From main heating system

Water code: 901 Fuel :Electricity Hot water cylinder Cylinder volume: 90 litres

Cylinder insulation: Measured loss, 0.85kWh/day

Primary pipework insulation: True

Cylinderstat: True

Cylinder in heated space: True Flue Gas Heat Recovery System: Database (rev 512, product index)

Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown
Conservatory: No conservatory

Low energy lights: 100%

SAP Input

Low rise urban / suburban

Terrain type: EPC language: English Wind turbine: No None Photovoltaics: Assess Zero Carbon Home: No

		User D	etails:						
Assessor Name:	Pothony Pohinson	USEI L	Strom	o Num	hor		STD○	036516	
Software Name:	Bethany Robinson Stroma FSAP 2012		Softwa					n: 1.0.5.60	
		Property	Address						
Address :									
1. Overall dwelling dime	ensions:		(0)						
Ground floor			a(m²) 59.71	(1a) x		ight(m) 2.5	(2a) =	Volume(m³	(3a)
	a)+(1b)+(1c)+(1d)+(1e)+(1		59.71	(4)			(==)	140.21	
	a)	,	9.71	l)+(3c)+(3c	d)+(3e)+	(3n) =	440.07	7(5)
Dwelling volume				(3a)+(3b)+(30)+(30	1)+(36)+	.(311) =	149.27	(5)
2. Ventilation rate:	main seconda	ry	other		total			m³ per hou	r
Number of chimneys	heating heating 0 + 0	□ + □	0	7 = [0	x 4	40 =	0	(6a)
Number of open flues	0 + 0	╡╻╞	0	」	0	x	20 =	0	(6b)
Number of intermittent fa						x	10 =		(7a)
Number of passive vents				L	3		10 =	30	= ' '
·				L	0		40 =	0	(7b)
Number of flueless gas fi	iles				0	^		0	(7c)
							Air ch	anges per ho	our
Infiltration due to chimne	ys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	Γ	30		÷ (5) =	0.2	(8)
	peen carried out or is intended, procee	ed to (17),	otherwise (continue fi	rom (9) to	(16)			<u> </u>
Number of storeys in the Additional infiltration	he dwelling (ns)					[(0)	11v0 1 -	0	(9)
	.25 for steel or timber frame o	r 0 35 fo	r masoni	ry consti	ruction	[(9)	-1]x0.1 =	0	(10)
	resent, use the value corresponding t			•	action.			0	(/
deducting areas of openii		1 (000)	مطا مامم	ontor O			i		7(40)
If no draught lobby, en	floor, enter 0.2 (unsealed) or (ter 0.05, else enter 0	. i (Seale	eu), eise	enter 0				0	(12)
• ,	s and doors draught stripped							0	(14)
Window infiltration			0.25 - [0.2	2 x (14) ÷ 1	100] =			0	(15)
Infiltration rate			(8) + (10)	+ (11) + (12) + (13)	+ (15) =		0	(16)
Air permeability value,	q50, expressed in cubic metro	es per ho	our per s	quare m	etre of e	envelope	area	5	(17)
If based on air permeabil	lity value, then $(18) = [(17) \div 20] +$	(8), otherw	ise (18) = ((16)				0.45	(18)
	es if a pressurisation test has been do	ne or a de	gree air pe	rmeability	is being u	sed	,		_
Number of sides sheltere Shelter factor	ed		(20) = 1 -	[0 075 x (19)] =			2	(19)
Infiltration rate incorporat	ting shelter factor		(21) = (18		. •/]			0.85	(20)
Infiltration rate modified f	•		()	, (==,				0.38	(21)
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	peed from Table 7								
$(22)m = \begin{bmatrix} 5.1 & 5 \end{bmatrix}$	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (00-) (0)	2)m : 4							-	
Wind Factor $(22a)m = (22a)m = 1.27$ 1.25	2)m ÷ 4 1.23	0.95	0.92	1	1.08	1.12	1.18]	
1.20	1.30 0.33	1 0.00	1 0.02	<u> </u>	1	12	15	l	

0.49	0.48	0.47	ng for sh	0.41	0.36	0.36	0.35	0.38	0.41	0.43	0.45	1	
alculate effec		-	· ·	-			0.55	0.50	0.41	0.40	0.40	J	
If mechanica	ıl ventila	tion:										0	(2
If exhaust air he) = (23a)			0	(2
If balanced with	heat reco	very: effici	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =				0	(2
a) If balance	d mecha	anical ve	ntilation	with he	at recove	ery (MVI	HR) (24a	a)m = (22)	2b)m + (23b) × [1 – (23c)	; ÷ 100]	
4a)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(2
b) If balance							r ``	i `		- 	ı	1	
1b)m= 0	0	0	0	0	0	0	0	0	0	0	0	J	(2
c) If whole he				•	•				F (22h	.\			
if (22b)m lc)m= 0	0.5 x	(23b), t	nen (240	(230) = (230)	o); otner	wise (24	C) = (220)	0) m + 0.	5 × (230	0	0	1	(
,									U	0		J	(
d) If natural v if (22b)m									0.5]				
ld)m= 0.62	0.61	0.61	0.59	0.58	0.57	0.57	0.56	0.57	0.58	0.59	0.6]	(
Effective air	change	rate - er	 nter (24a	or (24k	o) or (24	c) or (24	d) in box	x (25)			•	•	
5)m= 0.62	0.61	0.61	0.59	0.58	0.57	0.57	0.56	0.57	0.58	0.59	0.6	1	(
Hoot loose	ond be	ot loop r	acromet	~ *!	•			•				•	
. Heat losses	_	·			Not Ar	00	Havoli	110	AXU		k volu		ΑΧk
EMENT	Gros area	-	Openin m		Net Ar A ,r		U-valı W/m2		(W/I	K)	k-value kJ/m²-		kJ/K
oors					1.89	x	1.6		3.024				(
indows					12.93	x1.	/[1/(1.3)+	0.04] =	15.98				(
alls Type1	29.4	3	12.93	3	16.5	x	0.24	i	3.96	<u> </u>		\neg	(
alls Type2	25.2	\equiv	1.89	=	23.31	x	0.11	≓ <u>-</u> i	2.45	=		f F	(
oof	59.7	〓	0	=	59.71	x	0.12	≓ <u>-</u> i	7.17	=		i i	
tal area of e					114.3	=	02						\` (
or windows and			effective wi	ndow U-va			ı formula 1	/[(1/U-valu	ıe)+0.04] a	ns given in	paragraph	h 3.2	(
nclude the area						· ·			, ,	J	, , ,		
bric heat los	s, W/K =	= S (A x	U)				(26)(30)) + (32) =				32.5	8
eat capacity (Cm = S(Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	537.3	39 (
ermal mass	parame	ter (TMF	o = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	Medium		250	(
r design assess				construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
n be used instea ermal bridge				icina Ar	nondiy l	(7.00	<u> </u>
etails of therma	•	,		Ο.	•	`						7.96	<u>, </u>
tal fabric hea			(30) -	2.30 A (O	,			(33) +	(36) =			40.5	4 (
ntilation hea	t loss ca	alculated	l monthly	/				(38)m	= 0.33 × (25)m x (5)			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
)m= 30.51	30.29	30.06	29.01	28.81	27.9	27.9	27.73	28.25	28.81	29.21	29.63		(
	oefficier	 nt \/\/K			•		•	(39)m	= (37) + (37)	38)m			
eat transfer o	OCHIU	IL. VV/!\											
eat transfer of 71.05	70.82	70.6	69.55	69.35	68.43	68.43	68.26	68.79	69.35	69.75	70.16	1	

Heat loss para	ameter (I	HLP), W	/m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 1.19	1.19	1.18	1.16	1.16	1.15	1.15	1.14	1.15	1.16	1.17	1.18		
				ı		ı	ı		Average =	: Sum(40) ₁	12 /12=	1.16	(40)
Number of day	ys in mo	nth (Tab	le 1a)					1					
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water hea	ting ene	rgy requi	irement:								kWh/ye	ear:	
Assumed occu if TFA > 13.9 if TFA £ 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (TFA -13		97		(42)
Annual average Reduce the annual not more that 125	al average	hot water	usage by	5% if the α	lwelling is	designed i	` ,		se target c		.07		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage i	n litres pe	r day for ea			ctor from	Table 1c x		! '	!	!			
(44)m= 89.18	85.93	82.69	79.45	76.2	72.96	72.96	76.2	79.45	82.69	85.93	89.18		
	•	•		!			!			ım(44) ₁₁₂ =		972.83	(44)
Energy content of	f hot water	used - cal	culated m	onthly = 4.	190 x Vd,r	n x nm x E	OTm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 132.24	115.66	119.35	104.05	99.84	86.16	79.84	91.61	92.71	108.04	117.94	128.07		_
If instantaneous v	vator hoati	ing at paint	of uso (no	hot water	r storago)	ontor O in	havas (16		Total = Su	ım(45) ₁₁₂ =	=	1275.53	(45)
		· ·	,	ı	, , , , , , , , , , , , , , , , , , ,		, ,	, , , ,		1			(40)
(46)m= 19.84 Water storage	17.35 loss:	17.9	15.61	14.98	12.92	11.98	13.74	13.91	16.21	17.69	19.21		(46)
Storage volum) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		90		(47)
If community h	neating a	and no ta	ınk in dw	elling, e	nter 110	litres in	(47)						
Otherwise if no	o stored	hot wate	er (this in	ncludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in ((47)			
Water storage													
a) If manufact				or is kno	wn (kWł	n/day):				0.	85		(48)
Temperature f										0.	54		(49)
Energy lost fro		•					(48) x (49)) =		0.	46		(50)
b) If manufactHot water store			-								0		(51)
If community h	•			_ (,	-7/					<u> </u>		(0.)
Volume factor	from Ta	ble 2a									0		(52)
Temperature f	actor fro	m Table	2b								0		(53)
Energy lost fro	m wate	r storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter (50) or	(54) in (55)								0.	46		(55)
Water storage	loss cal	culated f	for each	month			((56)m = ($(55) \times (41)$	m				
(56)m= 14.23	12.85	14.23	13.77	14.23	13.77	14.23	14.23	13.77	14.23	13.77	14.23		(56)
If cylinder contains	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where ((H11) is fro	m Append	ix H	
(57)m= 14.23	12.85	14.23	13.77	14.23	13.77	14.23	14.23	13.77	14.23	13.77	14.23		(57)
Primary circuit	loss (ar	nnual) fro	m Table	e 3							0		(58)
Primary circuit	,	•			59)m = ((58) ÷ 36	65 × (41)	m					
(modified by	/ factor f	rom Tab	le H5 if t	here is s	solar wat	ter heati	ng and a	cylinde	r thermo	stat)			
(59)m= 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 ca	lculated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	eat requ	uired for	water he	eating ca	alculated	for eacl	h month	(62)m	$1 = 0.85 \times 0$	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
		149.53	156.84	140.34	137.33	122.44	117.33	129.1		145.53	154.22	165.56		(62)
Solar DH	HW input of	calculated	using App	endix G or	· Appendix	H (negati	ve quantity	/) (entei	r '0' if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or V	vwhrs	applies	, see Ap	pendi	k G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	•	(63) (G2)
Output	from w	ater hea	ter											
(64)m=	169.74	149.53	156.84	140.34	137.33	122.44	117.33	129.1	1 128.99	145.53	154.22	165.56		
'						•		0	utput from wa	ater heate	r (annual)₁	12	1716.96	(64)
Heat g	ains fro	m water	heating,	kWh/mo	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m] + 0.8 x	د [(46)m	+ (57)m	+ (59)m]	
(65)m=	73.96	65.55	69.68	63.62	63.19	57.67	56.54	60.45	5 59.85	65.92	68.24	72.58		(65)
inclu	de (57)	m in cald	culation of	of (65)m	only if c	ylinder i	s in the	dwellir	ng or hot w	ater is fr	om com	munity h	leating	
5. Int	ernal ga	ains (see	Table 5	and 5a):									
Metabo	olic gain	ıs (Table	5). Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Au	g Sep	Oct	Nov	Dec		
(66)m=	118.41	118.41	118.41	118.41	118.41	118.41	118.41	118.4	1 118.41	118.41	118.41	118.41		(66)
Lightin	g gains	(calcula	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso se	e Table 5		•		•	
(67)m=	38.42	34.12	27.75	21.01	15.7	13.26	14.33	18.62	2 24.99	31.74	37.04	39.49		(67)
Appliar	nces ga	ins (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), al	lso see Ta	ble 5	•	•	•	
(68)m=	257.04	259.7	252.98	238.67	220.61	203.64	192.29	189.6	3 196.35	210.66	228.72	245.7		(68)
Cookin	g gains	(calcula	ted in A	pendix	L, equat	tion L15	or L15a	, also	see Table	5				
(69)m=	48.81	48.81	48.81	48.81	48.81	48.81	48.81	48.8	1 48.81	48.81	48.81	48.81		(69)
Pumps	and fai	ns gains	(Table 5	Ба)					•		!		•	
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0		(70)
Losses	e.g. ev	aporatio	n (nega	ive valu	es) (Tab	le 5)			•	•	•		•	
(71)m=	-78.94	-78.94	-78.94	-78.94	-78.94	-78.94	-78.94	-78.9	4 -78.94	-78.94	-78.94	-78.94		(71)
Water	heating	gains (T	able 5)						•				•	
(72)m=	99.41	97.54	93.65	88.37	84.93	80.1	75.99	81.26	83.13	88.6	94.78	97.55		(72)
Total i	nternal	gains =				(66)	m + (67)m	ı + (68)ı	m + (69)m + ((70)m + (7	1)m + (72)	m	ı	
(73)m=	483.15	479.65	462.67	436.33	409.53	385.28	370.9	377.7	9 392.75	419.27	448.82	471.02		(73)
6. Sol	ar gains	S:												
Solar g	ains are o	calculated	using sola	r flux from	Table 6a	and assoc	iated equa	tions to	convert to th	e applicat	ole orientat	ion.		
Orienta		Access F		Area		Flu			_ g	_	FF		Gains	
	٦	Table 6d		m²		Tal	ole 6a		Table 6b	Т	able 6c		(W)	
Northwe	est _{0.9x}	0.77	X	12.	93	x 1	1.28	x	0.63	X	0.7	=	44.59	(81)
Northwe	est _{0.9x}	0.77	X	12.	93	x 2	2.97	×	0.63	x	0.7	=	90.75	(81)
Northwe	est _{0.9x}	0.77	X	12.	93	X 4	1.38	x	0.63	x	0.7	=	163.51	(81)
Northwe	est _{0.9x}	0.77	х	12.	93	x 6	7.96	x	0.63	x	0.7	=	268.53	(81)

Northwe	est _{0.9x}	0.77	X	12.	93	x	9	1.35	x		0.63	x	0.7	=	360.96	(81)
Northwe	est _{0.9x}	0.77	X	12.	93	x	9	7.38	x		0.63	x	0.7		384.82	(81)
Northwe	est _{0.9x}	0.77	X	12.	93	x	9	91.1	x		0.63	x	0.7		359.99	(81)
Northwe	est _{0.9x}	0.77	X	12.	93	x	7	2.63	x		0.63	x	0.7		286.99	(81)
Northwe	est _{0.9x}	0.77	X	12.	93	x	5	0.42	x		0.63	x	0.7	=	199.24	(81)
Northwe	est _{0.9x}	0.77	X	12.	93	x	2	8.07	x		0.63	x	0.7	-	110.91	(81)
Northwe	est _{0.9x}	0.77	X	12.	93	x		14.2	x		0.63	×	0.7		56.1	(81)
Northwe	est _{0.9x}	0.77	X	12.	93	x	9	9.21	X		0.63	= x	0.7	╡ -	36.41	(81)
	_								,							
Solar g	ains in	watts, ca	alculate	d for eac	h month	1			(83)m	ı = Sı	um(74)m .	(82)m				
(83)m=	44.59	90.75	163.51	268.53	360.96	$\overline{}$	84.82	359.99	286		199.24	110.91	56.1	36.41		(83)
Total g	ains – i	nternal a	nd sola	r (84)m =	= (73)m	+ (8	33)m	, watts	!				-1		ı	
(84)m=	527.74	570.41	626.18	704.87	770.49	7	70.1	730.89	664	.78	591.99	530.18	504.92	507.43		(84)
7 Me	an inter	nal temp	erature	(heating	seasor)				•			•			
		during h		`		<i>′</i>	area f	from Tah	ole 9	Th	1 (°C)				21	(85)
-		tor for g				_)iC 0	,	. (0)				21	
	Jan	Feb	Mar	Apr	May	Ť	Jun	Jul	Δ	ug	Sep	Oct	Nov	Dec]	
(86)m=	0.99	0.98	0.96	0.9	0.75	+	0.55	0.41	0.4		0.73	0.93	0.98	0.99		(86)
` ′		<u> </u>		Į	Į				<u>!</u>			0.55	0.50	0.55		(00)
I		l temper			·	ollo		i -		-	e 9c)		_		1	
(87)m=	21	21	21	21	21		21	21	2	1	21	21	21	21		(87)
Temp	erature	during h	eating	periods i	rest of	dw	elling	from Ta	ble 9	9, Th	n2 (°C)				_	
(88)m=	19.93	19.93	19.93	19.95	19.95	1	9.96	19.96	19.	97	19.96	19.95	19.95	19.94		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,	m (se	e Table	9a)							
(89)m=	0.99	0.98	0.95	0.87	0.69	$\overline{}$	0.47	0.31	0.3	86	0.65	0.9	0.97	0.99]	(89)
Mean	intorna	l temper	atura in	the rest	of dwall	ina	T2 (f	ollow etc	ne 3	to 7	in Tahl	0.00)			J	
(90)m=		19.93	19.93	19.95	19.95	T	9.96	19.96	19.	\neg	19.96	19.95	19.95	19.94	1	(90)
(00)=	10.00	10.00	10.00	10.00	10.00	Τ.	0.00	10.00		<u> </u>			ing area ÷ (ļ	0.34	(91)
													3 (,	0.04	(01)
		l temper	<u>`</u>	1	r	$\overline{}$	-		r È	\neg					1	(2.2)
(92)m=	20.3	20.3	20.3	20.31	20.31		0.32	20.32	20.		20.32	20.31	20.31	20.3		(92)
,		nent to th		1		_			-			•	1 00 04		1	(02)
(93)m=	20.3	20.3	20.3	20.31	20.31	2	0.32	20.32	20.	32	20.32	20.31	20.31	20.3		(93)
		ting requ						44 . (.	- 01			(70)	.1	. I. (.	
		mean int factor fo		•		nea	at ste	ер 11 от	rabi	e yr	o, so tha	t II,M=	:(76)m an	d re-caid	culate	
	Jan	Feb	Mar	Apr	May	Γ	Jun	Jul	Α	ug	Sep	Oct	Nov	Dec]	
u Utilisa		tor for g		<u> </u>				.		<u></u>			1		J	
(94)m=	0.99	0.98	0.96	0.88	0.71		0.5	0.35	0.4	4	0.68	0.92	0.98	0.99]	(94)
Usefu	l gains,	hmGm ,	W = (9	4)m x (8	4)m								1	1	ı	
(95)m=	521.03	558.82	598.7	618.76	549.01	38	84.95	253.73	266	.05	400.59	485.23	493.05	502.02		(95)
Month	nly aver	age exte	rnal ten	perature	from T	abl	e 8			!						
(96)m=	4.3	4.9	6.5	8.9	11.7	$\overline{}$	14.6	16.6	16	.4	14.1	10.6	7.1	4.2		(96)
Heat I	oss rate	e for mea	an interr	nal temp	erature,	Lm	, W =	=[(39)m :	x [(9	3)m-	- (96)m]		•	•	
(97)m=	1136.57	1090.56	974.29	793.51	597.21	39	91.42	254.55	267	.67	427.61	673.49	921.23	1129.95		(97)
				-	•	•			-				•	•	•	

Space heating requireme	ent for	each m	onth, k\	Wh/mont	th = 0.02	24 x [(97))m – (95)m] x (4 ⁻	1)m			
(98)m= 457.96 357.33 27	9.44	125.82	35.86	0	0	0	0	140.07	308.29	467.18		
						Tota	l per year	(kWh/year) = Sum(9	8) _{15,912} =	2171.94	(98)
Space heating requireme	ent in k	kWh/m²	/year							[36.37	(99)
9a. Energy requirements -	– Indiv	ridual he	eating sy	ystems i	ncluding	micro-C	HP)					
Space heating:			./							Г		7(204)
Fraction of space heat from		•		mentary	-	(202) = 1 -	(201) -			ļ	0	(201)
Fraction of space heat fro		•	` ,			(202) = 13 (204) = (204)		(203)] =		Ĺ	1	(202)
Fraction of total heating f		-				(204) - (20	02) x [1 —	(203)] =		Į	1	(204)
Efficiency of main space		•		a ovetom	. 0/					Į	221.06	(206)
Efficiency of secondary/s	··	<u> </u>				Δ.	0	0.1	NI.		0	(208)
Jan Feb N Space heating requirement	Mar	Apr	May d above	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
· · · · · · · · · · · · · · · · · · ·	<u> </u>	125.82	35.86	0	0	0	0	140.07	308.29	467.18		
(211) m = {[(98)m x (204)]	} x 10	 00 ÷ (20	6)									(211)
· '	6.41	56.92	16.22	0	0	0	0	63.36	139.46	211.33		
<u> </u>						Tota	l (kWh/yea	ar) =Sum(2	211),15,1012	=	982.51	(211)
Space heating fuel (seco	• .	•	month									
$= \{[(98)m \times (201)]\} \times 100 - (205)m$			0	0		0	0	0	0			
(215)m= 0 0	0	0	0	0	0	0 Tota	0 I (kWh/vea	0 ar) =Sum(2	0 215),5,1012	0	0	(215)
Water heating							((((((((((((((((((((,	715,1012	L	0	(210)
Output from water heater	(calcul	lated at	oove)									
169.74 149.53 15	6.84	140.34	137.33	122.44	117.33	129.11	128.99	145.53	154.22	165.56		_
Efficiency of water heater											116.16	(216)
,		116.16	116.16	116.16	116.16	116.16	116.16	116.16	116.16	116.16		(217)
Fuel for water heating, kW (219) m = (64) m x $100 \div (64)$ m												
` ' 		120.81	118.23	105.41	101.01	111.14	111.05	125.29	132.76	142.53		
<u> </u>						Tota	I = Sum(2	19a) ₁₁₂ =			1478.1	(219)
Annual totals								k\	Wh/year	F	kWh/year	. –
Space heating fuel used, r	maın s	system	1							Į	982.51	╛
Water heating fuel used											1478.1	
Electricity for pumps, fans	and e	electric l	keep-ho	t								
Total electricity for the abo	ove, kV	Nh/yea	r			sum	of (230a).	(230g) =		[0	(231)
Electricity for lighting										Ī	271.4	(232)
Total delivered energy for	all use	es (211)(221)	+ (231)	+ (232).	(237b)	=			Ī	2732.01	(338)
10a. Fuel costs - individu	ıal hea	ating sy	stems:									_

Fuel kWh/year

Stroma FSAP 2012 Version: 1.0.5.60 (SAP 9.92) - http://www.stroma.com

Fuel Cost

£/year

Fuel Price

(Table 12)

Space heating - main system 1	(211) x	13.19 × 0.01 =	129.59 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 × 0.01 =	0 (242)
Water heating cost (other fuel)	(219)	13.19 × 0.01 =	194.96 (247)
Pumps, fans and electric keep-hot	(231)	13.19 × 0.01 =	0 (249)
(if off-peak tariff, list each of (230a) to (23			
Energy for lighting	(232)	13.19 × 0.01 =	35.8 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and	,		(055)
Total energy cost 11a. SAP rating - individual heating syst	(245)(247) + (250)(254) =		360.35 (255)
	CIIIS		
Energy cost deflator (Table 12)	[(255) × (256)] · [(4) + 45 0] -		0.42 (256)
Energy cost factor (ECF) SAP rating (Section 12)	$[(255) \times (256)] \div [(4) + 45.0] =$		1.45 (257) 79.84 (258)
12a. CO2 emissions – Individual heating	a systems including micro-CHP		79.84 (258)
12a. 002 cmissions maintaga noding			
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.519 =	509.92 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.519 =	767.13 (264)
Space and water heating	(261) + (262) + (263) + (264)	=	1277.06 (265)
Electricity for pumps, fans and electric ke	ep-hot (231) x	0.519 =	0 (267)
Electricity for lighting	(232) x	0.519	140.86 (268)
Total CO2, kg/year	s	um of (265)(271) =	1417.91 (272)
CO2 emissions per m ²	(2	272) ÷ (4) =	23.75 (273)
EI rating (section 14)			82 (274)
13a. Primary Energy			
	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1)	(211) x	3.07	3016.31 (261)
Space heating (secondary)	(215) x	3.07	0 (263)
Energy for water heating	(219) x	3.07	4537.76 (264)
Space and water heating	(261) + (262) + (263) + (264)	=	7554.07 (265)
Electricity for pumps, fans and electric ke	ep-hot (231) x	3.07	0 (267)
Electricity for lighting	(232) x	0 =	833.2 (268)
'Total Primary Energy	s	um of (265)(271) =	8387.27 (272)

Primary energy kWh/m²/year

 $(272) \div (4) =$

140.47

(273)

		llser I	Details:						
Assessor Name: Software Name:	Bethany Robinson Stroma FSAP 2012	<u> </u>	Strom Softwa					036516 on: 1.0.5.60	
		roperty	Address						
Address :									
1. Overall dwelling dime	nsions:	_							
Ground floor			a(m²)	(1a) x		ight(m)	(2a) =	Volume(m ³	(3a)
	o) ((1 b) ((1 o) ((1 d) ((1 o) ((1				4	2.5	(2a) –	149.27	(Ja)
•	a)+(1b)+(1c)+(1d)+(1e)+(1ı	')	59.71	(4)	\	I) (O)	(0.)		_
Dwelling volume				(3a)+(3b)+(3c)+(3c	d)+(3e)+	.(3n) =	149.27	(5)
2. Ventilation rate:	main seconda	·v	other		total			m³ per hou	r
N	heating heating	· 	Other	, ,	totai		40	iii per iiot	_
Number of chimneys	0 + 0	<u></u>	0] = [0		40 =	0	(6a)
Number of open flues	0 + 0	+	0] = <u>[</u>	0	x 2	20 =	0	(6b)
Number of intermittent fa	ns				3	X '	10 =	30	(7a)
Number of passive vents					0	X '	10 =	0	(7b)
Number of flueless gas fi	res				0	X 4	40 =	0	(7c)
							A * I		
				_				nanges per ho	_
•	ys, flues and fans = (6a)+(6b)+(7 een carried out or is intended, procee			continuo fr	30		÷ (5) =	0.2	(8)
Number of storeys in the		u 10 (17),	ourer wise t	onunae n	om (9) to	(10)		0	(9)
Additional infiltration	5 ()					[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0.	.25 for steel or timber frame or	0.35 fo	r masoni	y constr	ruction			0	(11)
if both types of wall are pr deducting areas of openir	resent, use the value corresponding to pas): if equal user 0.35	the grea	ter wall are	a (after					
,	loor, enter 0.2 (unsealed) or 0	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, ent	ter 0.05, else enter 0							0	(13)
<u> </u>	s and doors draught stripped							0	(14)
Window infiltration			0.25 - [0.2	. ,	-			0	(15)
Infiltration rate	250		(8) + (10)					0	(16)
•	q50, expressed in cubic metre ity value, then $(18) = [(17) \div 20] + (18)	-		•	etre or e	envelope	area	5	(17)
•	s if a pressurisation test has been do				is being u	sed		0.45	(10)
Number of sides sheltere	d							2	(19)
Shelter factor			(20) = 1 -		19)] =			0.85	(20)
Infiltration rate incorporat	•		(21) = (18) x (20) =				0.38	(21)
Infiltration rate modified for	- 		Ι	0	<u> </u>			1	
L 1	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp (22)m= 5.1 5	eed from Table / 4.9	3.8	3.7	4	4.3	4.5	4.7	1	
(22)m= 5.1 5	7.0 4.4 4.3 3.8	3.6	3.1	4	4.3	4.0	4.7		
Wind Factor $(22a)m = (22a)m $	2)m ÷ 4								
(22a)m= 1.27 1.25	1.23 1.1 1.08 0.95	0.95	0.92	1	1.08	1.12	1.18		

Adjusted infiltr	ation rat	e (allowi	ing for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
0.49	0.48	0.47	0.42	0.41	0.36	0.36	0.35	0.38	0.41	0.43	0.45]	
Calculate effe If mechanic		_	rate for t	he appli	cable ca	se		-	-	-			(23
If exhaust air h			endix N. (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) . othe	rwise (23b) = (23a)			0	(23
If balanced with									, (,			0	(23
a) If balance		•	•	· ·		`		,	2h\m + (23h) 🗴 [1 – (23c)		(2,
24a)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24
b) If balance	ed mech:	L anical ve	entilation	without	heat red	coverv (N	MV) (24b)m = (22	2b)m + (L 23b)		1	
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(24
c) If whole h	iouse ex n < 0.5 ×			•	•				.5 × (23b))		1	
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24
d) If natural if (22b)r	ventilation ventilation			•	•				0.5]	<u> </u>		1	
24d)m= 0.62	0.61	0.61	0.59	0.58	0.57	0.57	0.56	0.57	0.58	0.59	0.6]	(24
Effective air	change	rate - er	nter (24a) or (24k	o) or (24	c) or (24	d) in box	x (25)	•	•	•	-	
25)m= 0.62	0.61	0.61	0.59	0.58	0.57	0.57	0.56	0.57	0.58	0.59	0.6]	(25
3. Heat losse	e and he	at loss i	naramete	ar:			•					_	
LEMENT	Gros area	SS	Openin m	gs	Net Ar A ,r		U-valı W/m2		A X U (W/I	K)	k-value kJ/m²·	-	A X k kJ/K
Doors					1.89	X	1.6		3.024	,			(26
Vindows					12.93	x1	/[1/(1.3)+	0.04] =	15.98	=			(27
Valls Type1	29.4	13	12.9	3	16.5	X	0.24		3.96	= [\neg	(29
Valls Type2	25.2		1.89		23.31	×	0.11	<u> </u>	2.45	Ħ i		= =	(29
Roof	59.7	<u> </u>	0		59.71	_	0.12	=	7.17	=		=	(30
otal area of e					114.3	_							(3
for windows and * include the area	l roof wind	ows, use e			alue calcul		g formula 1	/[(1/U-valu	ie)+0.04] a	as given in	paragrapl	h 3.2	(-
abric heat los	ss, W/K :	= S (A x	U)				(26)(30)) + (32) =				32.5	8 (3:
leat capacity	Cm = S((A x k)						((28)	(30) + (32	2) + (32a).	(32e) =	537.3	39 (3
hermal mass	parame	ter (TMF	= Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250) (3
or design assess an be used inste				construct	ion are no	t known pi	recisely the	e indicative	e values of	TMP in Ta	able 1f		
hermal bridge	es : S (L	x Y) cal	culated (using Ap	pendix I	<						7.96	(30
details of therma otal fabric he		are not kn	own (36) =	= 0.05 x (3	1)			(33) +	(36) =			40.5	4 (3
entilation hea	at loss ca	alculated	d monthly	y				(38)m	= 0.33 × (25)m x (5))		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
38)m= 30.51	30.29	30.06	29.01	28.81	27.9	27.9	27.73	28.25	28.81	29.21	29.63		(3
	coefficio	ot \/\/K						(39)m	= (37) + (37)	38)m		_	
leat transfer o	,uemiciei	it, vv/ix						(00)111	- (01) 1 (00)			
leat transfer of 71.05	70.82	70.6	69.55	69.35	68.43	68.43	68.26	68.79	69.35	69.75	70.16]	

Heat loss para	meter (H	HLP), W/	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 1.19	1.19	1.18	1.16	1.16	1.15	1.15	1.14	1.15	1.16	1.17	1.18		
Number of day	re in mo	nth (Tah	le 1a)		•	•	•		Average =	Sum(40) ₁ .	12 /12=	1.16	(40)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water heat	ing ene	rgy requi	rement:								kWh/ye	ar:	
Assumed occu if TFA > 13.9 if TFA £ 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (¯	TFA -13.		97		(42)
Annual averag Reduce the annua not more that 125	ıl average	hot water	usage by	5% if the c	lwelling is	designed t			se target o		.07		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in	n litres per	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)						
(44)m= 89.18	85.93	82.69	79.45	76.2	72.96	72.96	76.2	79.45	82.69	85.93	89.18		— ,,,,
Energy content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x E	OTm / 3600			m(44) ₁₁₂ = ables 1b, 1	L	972.83	(44)
45)m= 132.24	115.66	119.35	104.05	99.84	86.16	79.84	91.61	92.71	108.04	117.94	128.07		
									Total = Su	m(45) ₁₁₂ =	=	1275.53	(45)
f instantaneous w									1004	17.00	40.04		(46)
46)m= 19.84 Water storage	17.35 loss:	17.9	15.61	14.98	12.92	11.98	13.74	13.91	16.21	17.69	19.21		(46)
Storage volum	e (litres)	includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		90		(47)
f community h	•			•			` '			`			
Otherwise if no Vater storage		not wate	er (this in	iciuaes i	nstantar	neous co	nod idmo	ers) ente	er o in (47)			
a) If manufact		eclared l	oss facto	or is kno	wn (kWł	n/day):				0.	85		(48
Temperature fa	actor fro	m Table	2b							0.	54		(49)
Energy lost fro		•					(48) x (49)) =		0.	46		(50)
b) If manufact Hot water stora			-								0		(51)
f community h	eating s	ee section		`		,					<u> </u>		` '
/olume factor	-		Ol-							—	0		(52)
Temperature fa							(47) v (54)	\ v (E 2) v (EQ)		0		(53)
Energy lost fro Enter (50) or (•	, KVVII/ye	ear			(47) X (51)) x (52) x (53) =	-	0 46		(54) (55)
Vater storage	, ,	,	or each	month			((56)m = (55) × (41)	m				•
56)m= 14.23	12.85	14.23	13.77	14.23	13.77	14.23	14.23	13.77	14.23	13.77	14.23		(56
cylinder contains	dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Appendi	хН	
57)m= 14.23	12.85	14.23	13.77	14.23	13.77	14.23	14.23	13.77	14.23	13.77	14.23		(57
Primary circuit	loss (ar	nnual) fro	m Table	3							0		(58)
Primary circuit					•	. ,	, ,						
(modified by					ı —			<u> </u>		<u> </u>	00.00		(50
59)m= 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 cal	lculated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	eat requ	uired for	water he	eating ca	alculated	for eacl	n month	(62)m	= 0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	169.74	149.53	156.84	140.34	137.33	122.44	117.33	129.11	128.99	145.53	154.22	165.56	<u> </u>	(62)
Solar Di	-IW input o	calculated	using App	endix G or	· Appendix	H (negati	ve quantity	/) (enter	'0' if no sola	r contribut	ion to wate	er heating)	I	
(add a	dditiona	l lines if	FGHRS	and/or V	WWHRS	applies	, see Ap	pendix	G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0		(63) (G2)
Output	from wa	ater hea	iter											
(64)m=	169.74	149.53	156.84	140.34	137.33	122.44	117.33	129.11	128.99	145.53	154.22	165.56		_
		-			-		-	Ou	tput from w	ater heate	r (annual) ₁	12	1716.96	(64)
Heat g	ains froi	m water	heating,	kWh/mo	onth 0.2	5 ´ [0.85	× (45)m	+ (61)	m] + 0.8 x	k [(46)m	+ (57)m	+ (59)m	1	
(65)m=	73.96	65.55	69.68	63.62	63.19	57.67	56.54	60.45	59.85	65.92	68.24	72.58		(65)
inclu	ide (57)ı	m in cal	culation of	of (65)m	only if c	ylinder i	s in the o	dwelling	g or hot w	ater is fr	om com	munity h	eating	
5. Int	ernal ga	ains (see	e Table 5	and 5a):									
Metabo	olic gain	s (Table	e 5), Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	98.67	98.67	98.67	98.67	98.67	98.67	98.67	98.67	98.67	98.67	98.67	98.67		(66)
Lightin	g gains	(calcula	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5	•		•	•	
(67)m=	15.37	13.65	11.1	8.4	6.28	5.3	5.73	7.45	10	12.69	14.82	15.79	1	(67)
Applia	nces ga	ins (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), als	so see Ta	ble 5			ı	
(68)m=	172.21	174	169.5	159.91	147.81	136.44	128.84	127.05	131.55	141.14	153.24	164.62	1	(68)
Cookir	ng gains	(calcula	ated in A	pendix	L, equa	tion L15	or L15a)	, also s	see Table	5	•	•	'	
(69)m=	32.87	32.87	32.87	32.87	32.87	32.87	32.87	32.87	32.87	32.87	32.87	32.87		(69)
Pumps	and far	ns gains	(Table 5	Ба)		!			•	!			I	
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	[(70)
Losses	e.g. ev	aporatio	n (nega	ive valu	es) (Tab	le 5)			•	•	•		1	
(71)m=	-78.94	-78.94	-78.94	-78.94	-78.94	-78.94	-78.94	-78.94	-78.94	-78.94	-78.94	-78.94	[(71)
Water	heating	gains (T	rable 5)						•			<u>.</u>	ı	
(72)m=	99.41	97.54	93.65	88.37	84.93	80.1	75.99	81.26	83.13	88.6	94.78	97.55		(72)
Total i	nternal	gains =				(66)	m + (67)m	+ (68)m	ı + (69)m +	(70)m + (7	1)m + (72)	m	ı	
(73)m=	339.6	337.79	326.85	309.28	291.63	274.44	263.16	268.36	277.28	295.03	315.44	330.56		(73)
6. So	lar gains	S:												
Solar g	ains are o	alculated	using sola	r flux from	Table 6a	and assoc	ated equa	tions to	convert to th	ne applicat	ole orientat	ion.		
Orienta		Access F		Area		Flu			_ g	_	FF		Gains	
	1	Table 6d		m²		Tal	ole 6a		Table 6b	Т	able 6c		(W)	
Northw	est _{0.9x}	0.77	X	12.	93	x 1	1.28	X	0.63	x	0.7	=	44.59	(81)
Northw	est _{0.9x}	0.77	X	12.	93	x 2	2.97	x	0.63	x	0.7	=	90.75	(81)
Northw	est _{0.9x}	0.77	X	12.	93	X 4	1.38	x	0.63	x	0.7	=	163.51	(81)
Northw	est _{0.9x}	0.77	X	12.	93	x 6	7.96	Х	0.63	x	0.7	=	268.53	(81)

Northwest _{0.9x}	0.77	X	12.	93	x	9	1.35	X		0.63	x	0.7	:	= [360.96	(81)
Northwest _{0.9x}	0.77	X	12.	93	x	9	7.38	x		0.63	x	0.7		= [384.82	(81)
Northwest _{0.9x}	0.77	X	12.	93	x	9	91.1	x		0.63	x	0.7	-	= [359.99	(81)
Northwest 0.9x	0.77	x	12.	93	х	7:	2.63	x		0.63	x	0.7		- [286.99	(81)
Northwest 0.9x	0.77	x	12.	93	x	50	0.42	x		0.63	x	0.7	-	= [199.24	(81)
Northwest _{0.9x}	0.77	x	12.	93	х	2	8.07	x		0.63	×	0.7		- [110.91	(81)
Northwest 0.9x	0.77	x	12.	93	х	1	4.2	x		0.63	×	0.7		- [56.1	(81)
Northwest _{0.9x}	0.77	x	12.	93	x	9	9.21	X		0.63	_ x	0.7		<u> </u>	36.41	(81)
					ı			ı						١		_
Solar gains in v	vatts. ca	lculated	for eac	n month				(83)m	ı = Sı	um(74)m .	(82)m					
(83)m= 44.59	90.75	163.51	268.53	360.96	$\overline{}$	34.82	359.99	286		199.24	110.91	56.1	36.41	1		(83)
Total gains – in	iternal a	nd solar	(84)m =	(73)m	+ (8	33)m ,	watts		1		<u> </u>	1	<u>I</u>			
(84)m= 384.18	428.55	490.37	577.82	652.59	65	59.26	623.16	555	.35	476.52	405.94	371.54	366.9	7		(84)
7. Mean interr	al tomp	oroturo	(hooting	coacon												
Temperature						aroa f	rom Tak	مام ۵	Th	1 (°C)				ſ	21	(85)
•	_	•			_			л с э,	, , , , , ,	1 (0)				l	21	(00)
Utilisation fact	Feb				Ť		Jul	Ι	ا ما	Sep	Oct	T Nov	Do	\Box		
(86)m= Jan	0.99	Mar 0.99	Apr 0.95	May 0.83	+	Jun 0.63	0.48	0.5	ug	0.83	Oct 0.97	0.99	De			(86)
(86)m= 1	0.99	0.99	0.95	0.03).03	0.40	0.5	55	0.03	0.97	0.99	<u> </u>			(00)
Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)																
(87)m= 21	21	21	21	21		21	21	2	1	21	21	21	21			(87)
Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)																
(88)m= 19.93	19.93	19.93	19.95	19.95	1	9.96	19.96	19.	97	19.96	19.95	19.95	19.94	4		(88)
Utilisation fact	or for a	ains for i	est of d	wellina.	h2.	m (se	e Table	9a)	•							
(89)m= 1	0.99	0.98	0.93	0.77	_).54	0.37	0.4	13	0.76	0.96	0.99	1			(89)
	40,000,000		160 4004	مد طبیرماا	 ::		llow oto		<u> </u>	7 :n Tabl	- 0-)		Į.			
Mean internal												19.95	10.04			(90)
(90)m= 19.93	19.93	19.93	19.90	19.95	'	9.90	19.90	19.	91			ing area ÷ (┧	0.04	(91)
											LA - LIV	ing area + (- ,) –	Į	0.34	(91)
Mean internal	tempera	ature (fo	r the wh	ole dwe	lling	g) = fL	_A × T1	+ (1	– fL	A) × T2		_				
(92)m= 20.3	20.3	20.3	20.31	20.31	2	0.32	20.32	20.	32	20.32	20.31	20.31	20.3			(92)
Apply adjustm	1				_						·	1	1	_		
(93)m= 20.3	20.3	20.3	20.31	20.31	2	0.32	20.32	20.	32	20.32	20.31	20.31	20.3			(93)
8. Space heat	·															
Set Ti to the net the utilisation					ned	at ste	ep 11 of	Tabl	e 9b	o, so tha	t Ti,m=	(76)m an	id re-ca	alc	ulate	
Jan	Feb	Mar	Apr		Г	Jun	Jul	Ι		Sep	Oct	Nov	De	\Box		
Utilisation fact				May		Juli	Jui	A	ug	Sep	Oct	INOV	De			
(94)m= 1	0.99	0.98	0.93	0.79	1	0.58	0.41	0.4	18	0.79	0.97	0.99	1			(94)
Useful gains,	I				L `	1	0	0		00	0.0.	1 0.00	<u> </u>			(-)
(95)m= 382.92	425.87	481.88	539.67	518.14	37	79.41	252.89	264	.15	374.39	392.37	369.08	366.0	1		(95)
Monthly avera						!						1				
(96)m= 4.3	4.9	6.5	8.9	11.7	_	4.6	16.6	16.	.4	14.1	10.6	7.1	4.2			(96)
Heat loss rate			al tempe													
	1090.56	974.29	793.51	597.21	_	91.42	254.55	267	_	427.61	673.49	921.23	1129.9	95		(97)
									!			1	<u> </u>			

Space heating requirement for each month, kWh/month = $0.024 \times [(97)m - (95)m] \times (41)m$		
(98)m= 560.71 446.67 366.35 182.77 58.83 0 0 0 0 209.16 397.55 568.37		_
Total per year (kWh/year) = Sum(98) _{15,912} =	2790.4	(98)
Space heating requirement in kWh/m²/year	46.73	(99)
9a. Energy requirements – Individual heating systems including micro-CHP)		
Space heating:		1,
Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 - (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 - (203)] =	1	(204)
Efficiency of main space heating system 1	221.06	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	kWh/yea	r
Space heating requirement (calculated above) 560.71 446.67 366.35 182.77 58.83 0 0 0 0 209.16 397.55 568.37		
$(211)m = \{[(98)m \times (204)] \} \times 100 \div (206)$		(211)
253.65 202.06 165.73 82.68 26.61 0 0 0 94.61 179.84 257.11		(211)
Total (kWh/year) =Sum(211) _{15,1012} =	1262.28	(211)
Space heating fuel (secondary), kWh/month		J
$= \{[(98)m \times (201)]\} \times 100 \div (208)$		
(215)m= 0 0 0 0 0 0 0 0 0 0 0 0 0		1,,,,
Total (kWh/year) =Sum(215) _{15,1012} =	0	(215)
Water heating Output from water heater (calculated above)		
169.74 149.53 156.84 140.34 137.33 122.44 117.33 129.11 128.99 145.53 154.22 165.56		
Efficiency of water heater	116.16	(216)
(217)m= 116.16 116.16 116.16 116.16 116.16 116.16 116.16 116.16 116.16 116.16 116.16 116.16 116.16		(217)
Fuel for water heating, kWh/month		
$ (219)m = (64)m \times 100 \div (217)m $ $ (219)m = 146.12 128.72 135.02 120.81 118.23 105.41 101.01 111.14 111.05 125.29 132.76 142.53 $		
Total = Sum(219a) ₁₁₂ =	1478.1	(219)
Annual totals kWh/year	kWh/year	, -
Space heating fuel used, main system 1	1262.28]
Water heating fuel used	1478.1]
Electricity for pumps, fans and electric keep-hot		
_	0	(231)
Electricity for pumps, fans and electric keep-hot	0 271.4	(231)
Electricity for pumps, fans and electric keep-hot Total electricity for the above, kWh/year sum of (230a)(230g) =]

3

Energy kWh/year

Emission factor kg CO2/kWh

Emissions kg CO2/year

Space heating (main system 1)	(211) x	0.519	=	655.12	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	767.13	(264)
Space and water heating	(261) + (262) + (263) + (264)	=		1422.26	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	0	(267)
Electricity for lighting	(232) x	0.519	=	140.86	(268)
Total CO2, kg/year	S	sum of (265)(271) =		1563.11	(272)
Dwelling CO2 Emission Rate	((272) ÷ (4) =		26.18	(273)
El rating (section 14)				80	(274)