13 Netherhall Gardens, London, NW3

Sustainability Report for Phase 2 (Extension)



August 2021

MWL (Mendick Waring Ltd) Lymehouse Studios, 30-31 Lyme Street, London, NW1 0EE T: 020 8446 9696 www.mwl-group.com

Issue Details

Project	13 Netherhall Gardens, London, NW3
MWL Reference	J2629
Report Scope	Sustainability Report for Phase 2
Revision	1.1 – Final Report for Submission
Date	11/08/2021
Author	Ioannis Protonotarios
Checked By	Fergus Traynor

Rev	Date	Description	Ву	Approved
1.1 - Final	11/08/2021	Sustainability Report for Phase 2	IP	FT

Directors Fergus Traynor IEng ACIBSE Suresh Patel BEng (Hons) AMIMechE Jon Harris HND Dheran Bhudia BA (Hons)

Registered Office: Edelman House, 1238 High Road, N20 OLH. Registered in England No. 4700822

MWL Lymehouse Studios, 30-31 Lyme Street, London, NW1 0EE

Telephone: 020 8446 9696 E-mail: enquiries@mwl-group.com Website: www.mwl-group.com





Contents

1.0	Executive Summary	3
2.0	Site Location and Development Proposal	4
3.0	Policy Context	4
4.0	Energy Efficient Design	7
5.0	Water Usage	7
6.0	Design Specifications	8
7.0	SAP Results Analysis	9
8.0	Conclusion	. 10
Appe	ndix A – SAP Reports	. 11
Appe	ndix B – Water Calculation	. 12

Disclaimer





MWL disclaims any responsibility to the Client and others in respect of any matters outside the scope of this report. This report has been prepared with reasonable skill, care and diligence within the terms of the Contract with the Client and taking account of the manpower, resources, investigations and testing devoted to it by agreement with the Client. This report is confidential to the Client and MWL accepts no responsibility of whatsoever nature to third parties

1.0 Executive Summary

This report describes the energy & sustainability measures for the new-build extension of the existing building in 13 Netherhall Gardens, in London.

The extension consists of the Phase 2 of the above scheme and contains 4 new flats, 2 on the lower ground floor and 2 on the basement floor.

This document seeks to address the measures of Sustainability and demonstrate the design intention in relation to policies at National, Regional and Local level as appropriate.

SAP calculations have been carried out for the scheme and viability of the available options have been explored. The proposed specification complies with the Part L1B of Building Regulations and the local & national policies.

Requirements, Energy Efficient Features and Approach

In accordance with Building Regulations Part L1B, the extension units are not required to achieve a Dwelling CO_2 Emission Rate (DER) below the notional Target CO_2 Emission Rate (TER), however it is mandatory any extensions to the existing building being made to comply with minimum energy efficiency requirements in relation to the selected fabric & systems specification.

The SAP 2012 methodology has been used to calculate the energy consumption and resultant CO_2 emissions for the proposed residential units.

As an extension to the existing property, a 'fabric first' approach was initially considered by using upgraded thermal elements compared to the existing units, incorporating passive design measures such as low u-values, low air leakage and low thermal bridging.

Efficient energy use and distribution is assured by upgrading the existing outdated heating and hot water systems with highly efficient natural gas combi boilers for heating and hot water, using appropriate efficient heating controls. Further, 100% low energy lighting will replace the existing lights.

Summary of the Results

By incorporating a combination of feasible passive measures along with the use of highly efficient natural gas combi boilers and 100% low energy lights, the CO_2 emissions of the residential units, of the extension, have been reduced by 73.90% compared to the ones of the base case existing building. The results for are presented in the table & graph below:

Phase 2 Produced CO2 Emissions									
Development	Regulated CO2 Emissions / Annum (tonnes)	% Improvements by Energy Hierarchy	% Cumulative Improvements						
Base Case Existing	30.51	-	-						
Proposed	7.96	73.90%	73.90%						
Overall CO2 Emissions Reduction: 73.90%									



In addition, a water calculation has been completed and has been included in Appendix B, which shows that the internal water consumption for the residential units is less than 105 litres/person/day, complying with the local policies.





2.0 Site Location and Development Proposal

The existing development is located at 13 Netherhall Gardens, in London. It is a fully residential building, consisting of ground floor, first floor, second floor and third floor.

The proposed Phase 2 design includes a new-build extension to the existing development, which consists of 2 extra floors, a lower ground floor containing 2 new flats and a basement floor containing another 2 new flats (plots 8-11).

The site is located in the London borough of Camden, in North London. The surrounding area is a mix of open spaces and low-rise residential developments. There are many nearby transport links close to the development, including a short walk to the closest bus stop and Finchley Road tube station.



Figure 1: Site location, showing the 13 Netherhall Gardens development

3.0 Policy Context

In this section of the report, National, Regional and Local planning policies and requirements are presented. The energy and sustainability strategies to meet the policies have also briefly been introduced. The details of how the scheme incorporates these policies have been presented in the body of this report.

The following policies have been considered:

National Planning Policy Framework (February 2019)

Policy 14. Meeting the challenge of climate change, flooding and coastal change:

149. Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure.

152. New development should be planned for in ways that:

a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and

b) can help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards.

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

a) comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and

b) take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.





New London Plan (March 2021)

After a rigorous process of consultation and Examination in Public, the New London Plan has been finally published in March 2021.

Policy SI 2: Minimising greenhouse gas emission

Development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:

- 1. Be lean: use less energy.
- 2. Be clean: supply energy efficiently and cleanly, exploit local energy resource.
- 3. Be green: maximise use of renewable energy.

Policy SI 4: Managing heat risk

Development proposals should minimise adverse impacts on the urban heat island through design, layout, orientation, materials and the incorporation of green infrastructure.

Policy SI 5: Water infrastructure

Development proposals should, through the use of Planning Conditions, minimise the use of mains water in line with the Optional Requirement of the Building Regulations (residential development), achieving mains water consumption of 105 litres or less **per head per day** (excluding allowance of up to five litres for external water consumption) and incorporate measures such as smart metering, water saving and recycling measures, including retrofitting, to help to achieve lower water consumption rates and to maximise future-proofing.

Camden Borough Council Requirements (Camden Local Plan 2017 and Camden **CPG Documents 2021)**

With specific regards to the energy & sustainability requirements, the following policies of Camden Borough Council apply in this development:

• For Minor developments the performance against carbon reduction targets should be included in a Sustainability Statement and calculated through the Part L 2013 of the Building Regulations methodology Standard Assessment Procedure (SAP) 2012. The

reduction carbon target for Minor Refurbishment developments is to achieve the greatest possible reduction - meeting Part L1B for retained thermal elements.

- The Council will require all development to minimise the effects of climate change and encourage all developments to meet the highest feasible environmental standards that are financially viable during construction and occupation (including support and encourage sensitive energy efficiency improvements to existing buildings).
- All buildings, whether being updated or refurbished, are expected to reduce their carbon emissions by making improvements to the existing building. Work involving a change of use or an extension to an existing property is included.
- All new residential development will be required to demonstrate that the development is capable of achieving a maximum internal water use of 105 litres per person/day.
- All development in Camden is expected to reduce carbon dioxide emissions by following the energy hierarchy of London Plan.
- Natural 'passive' measures should be prioritised over active measures to reduce • energy.
- All developments (including refurbishments and minor developments) should incorporate green/blue roofs, brown roof and/or green walls where appropriate.
- Residential refurbishments, conversions or extensions should be assessed under Part L1B of Building Regulations.
- The Council will require all developments, including alterations and extensions to existing buildings, to be of the highest standard of design.
- All buildings, whether being updated or refurbished, are expected to reduce their carbon emissions by making improvements to the existing building. Work involving a change of use or an extension to an existing property is included.









Note: The proposed Phase 2 development consists of less than 5 units and less than 500 m² GIA, and therefore is considered as a minor development, which means that won't need to follow the local & national policies which are proposed for the larger developments (major developments).

Approved Document Part L1B 2013 of Building Regulations

Approved document Part L1B sets the standard for energy performance for existing residential buildings, including conversions and new-build extensions. The document gives guidance on compliance with the energy efficiency requirements as follow:

- Guidance for new thermal elements in the case of existing buildings including extensions. There are standard fabric parameters which should be considered.
- Guidance for the proposed building services in the case of existing buildings including extensions. There are standard requirements in terms of performance and controls, which should be considered.
- Consequential improvements also apply to major developments with an extension. Major existing developments considered the developments with a total useful floor area over 1000 m², therefore this doesn't apply for this development as the existing building of 13 Netherhall Gardens (without including the new-build extension) has a total useful floor area of less than 1000 m².



Figure 3: Approved Document Part L of Building Regulations





4.0 Energy Efficient Design

Carbon reduction and energy performance have been maximised through measures developed in line with the energy hierarchy. This includes:

Passive Design: As an extension to an existing listed property, a 'fabric first' approach was followed. Low U-values, air permeability and thermal will reduce the heat loss through the building envelope.

Energy Efficient Fabric: Opaque elements will target excellent U-values, whilst envelope air permeability will be reduced to a target rate of $\leq 5 \text{ m}^3/\text{hm}^2$ at 50 Pa through an airtight layer on the warm side of the insulation, and efficient windows are currently proposed for all the dwelling's facades.

Energy Efficient Systems: Efficient energy use and distribution is assured by upgrading the existing outdated heating and hot water systems with highly efficient natural gas combi boilers for heating and hot water, using appropriate efficient heating controls. Further, 100% low energy lighting will replace the existing lights.

Methodology: As mentioned, the strategy is based on the energy hierarchy of the London Plan. <u>However, for this development only a Be Lean strategy will be required in order to comply with the planning policies, as it is an extension and not a major new-build <u>development.</u></u>

Government Approved Software **NHER Plan Assessor 6.3.9** has been used to calculate energy consumption and resultant CO2 emissions.

From this, the Target Emissions Rate (TER) and the potential improvement through energy efficiency, the Dwellings Emissions Rate (DER), are established for a Base Case - Existing building model for Phase 2 and for the Proposed Phase 2 development (which includes the 4 units of the extension).



The base case model is compared to the proposed Phase 2 model to demonstrate the effectiveness of all these proposed measures in relation to sustainability, energy efficiency and CO2 emissions.

The latest drawings have been used for the SAP calculations of the proposed Phase 2 development, as below:

- AL.05.07.1.7 1. B1-Basement_reduced south wing
- AL.05.07.1.6 2. L1-Lower Ground Floor
- AL.05.07.1.5 3. GF-Ground Floor
- AL.08.01.1-4 Sections

5.0 Water Usage

Based on the Camden Local Policies (as analysed in Chapter 3) the water consumption (internal) for the residential units must be equal or less than 105 litres/person/day.

The sanitary ware specification which yet to be clearly defined, however could achieve the desired savings with the following:

- 6 / 3 dual-flush WCs
- Taps on wash-hand basins with maximum flow rate of 2 litres per minute (aerated taps)
- Showers with maximum flow rate of 9 litres per minute (flow restrictors)
- Taps in the kitchen 10 litres per minute (aerated taps)
- Baths over flow prevention installed to activate at 150 litres
- 'A' rated washing machines, where provided (less than 8.17 litres per kg)
- 'A' rated dishwashers, where provided (less than 1.25 litres water usage per place setting)

By implementing measures such as those recommended above will reduce the internal potable water consumption to less than 105 litres per person per day, as required.

The preliminary water calculation for the residential units has been included in Appendix B.



e of 2 litres per minute (aerated taps) inute (flow restrictors) aps) 150 litres than 8.17 litres per kg) an 1.25 litres water usage per place



6.0 Design Specifications

MWL has carried out the SAP calculations for the proposed dwellings, of Phase 2 scheme, with the below listed fabric and system specifications.

Passive Design

New-Build Extension (4 Residential Units)

Thermal Element	Standards for New Thermal Elements by Part L1B 2013	Proposed Fabric Parameters for Phase 2
Heat Loss Walls	0.28 W/m ² K	0.18 W/m²K
Heat Loss Roofs	0.18 W/m ² K	0.15 W/m ² K
Heat Loss Floors	0.22 W/m ² K	0.18 W/m ² K
External Windows	1.60 W/m ² K	1.40 W/m ² K
External Glazed Doors	1.80 W/m ² K	1.40 W/m ² K
Entrance Internal Doors	1.80 W/m ² K	1.40 W/m ² K
Air permeability	Reasonable provision to reduce unwanted air leakage.	5.00 m³/m².h @ 50pa
Ψ values (Thermal Bridging)	The building fabric should be constructed so that there are no reasonably avoidable thermal bridges.	Accredited Construction Details (ACD) used in order to avoid thermal bridges.

Active Design

New-Build Extension (4 Residential Units)

Services	Proposals for Phase 2
Space Heating / Hot Water	Natural Gas Combi B
	Boiler Model – Vaillar
	Boiler Efficiency – 88
Mechanical Cooling	None
Renewables	None
Heating Controls	Programmer, Room T
Ventilation	Natural Ventilation w
Lighting	100% have luminous

The above specifications (both for fabric and systems) are sufficient for complying with the requirements of Part L1B 2013 of Building Regulations, as required by the planning policies (presented in chapter 3).

As mentioned in the previous chapter, the proposed Phase 2 development will be compared with a base case existing model (based on Phase 2 design), by undertaking SAP calculations, in order to quantify the impact of the proposed improvements (which illustrated in the tables above).

The selected fabric parameters and systems for the base case existing model are based on the rdSAP (reduced data SAP for existing dwellings) methodology, which includes specific values based on the age of a building (the existing Netherhall Gardens building was built in late 19th century) and the actual materials & systems used in the existing property (based on a site survey).

The outcome of this comparison is presented in the next chapter.



2
Boiler
ant
8.8%
Thermostat, TRVs
with Intermittent Extract Fans
Is efficacy ≥ 45 lm/W



7.0 SAP Results Analysis

As mentioned in the previous chapters, a fabric first approach was initially considered, by improving the U-Values and the other fabric parameters, based on Part L1B guidance. Then the heating systems and the lighting were upgraded compared to the existing building, in order to comply with the Part L standards but also to reduce further the produced CO2 emissions.

This chapter will present the result of the SAP calculations, which have been completed for the proposed residential units, in comparison with a base case existing model (as analysed in the previous chapter).

The result is illustrated in the following figure, which compares the area-weighted average Dwelling Emission Rate (DER) of the base case existing units with the area-weighted average Dwelling Emission Rate (DER) of the improved proposed units of Phase 2 Netherhall Gardens Development.

A reduction of 73.90% in CO₂ emissions has been achieved with the implementation of the proposed improvements in fabric and systems specification.



Figure 4: CO2 reduction of the proposed development over the base case existing model

The total regulated carbon dioxide (CO₂) emissions of the residential units by incorporating all the improvements have been calculated to 7.96 CO₂ tonnes per annum, compared to 30.51 CO_2 tonnes per annum of the base case existing carbon emissions, as illustrated in the table below.

Phase 2 Produced CO2 Emissions									
Development	Regulated CO2 Emissions / Annum (tonnes)	% Improvements by Energy Hierarchy	% Cumulative Improvements						
Base Case Existing	30.51	-	-						
Proposed	7.96	73.90%	73.90%						
Overall CO2 Emissions Reduction: 73.90%									

Table 1: Produced CO2 emissions in tonnes/annum for proposed Phase 2 development





8.0 Conclusion

The Sustainability report seeks to address the measures of Sustainability (where applicable) and demonstrate the design intention in relation to policies at National, Regional and Local level as appropriate.

As analysed in the previous chapters of this report, Phase 2 residential units comply with the Part L1B of Building Regulations standards and with all the local & national planning policies.

The SAP methodology has been used to calculate the energy consumption and resultant CO2 emissions for the proposed Phase 2 residential units, which consist of a new-build extension to the existing building located in 13 Netherhall Gardens, in London.

By incorporating a combination of all the feasible passive measures (fabric improvements) along with the use of low energy lights and highly efficient natural gas combi boilers for heating and hot water, the CO2 emissions of the proposed Phase 2 development have been reduced by 73.90%, in comparison with the CO2 emissions of a base case existing model (which is based on Phase 2 design and rdSAP parameters). The above result consists a huge improvement in produced carbon emissions.

In addition, a water calculation has been completed, which shows that the internal water consumption of the proposed residential units is less than 105 litres per person per day, as required by the planning policies.

The SAP reports for the proposed 4 residential units of Netherhall Gardens Phase 2 development, are presented in Appendix A.





Appendix A – SAP Reports





SAP Worksheet Design - Draft



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

Assessor name	Mr Ioan	inis Protono	tarios					Assessor nun	nber	23		
Client								Last modified	ł	11/08	/2021	
Address	Flat 8, 1	.3 Netherhal	l Gardens,	London, N	W3							
1. Overall dwelling di	mensions											
				А	irea (m²)		ľ	Average storey height (m)	,	Vo	lume (m³)	
Lowest occupied					53.23	(1a) x	Г	3.08	(2a) =		163.95	(3a)
Total floor area	(1a	a) + (1b) + (1	c) + (1d)(1n) =	53.23	(4)						
Dwelling volume								(3a) + (3b) + (3	c) + (3d)(3	3n) =	163.95	(5)
2 Ventilation rate							<u> </u>					
2. Ventilation rate											³ nor hour	
									Т.	m	per nour	٦
Number of chimneys								0	x 40 =		0	_ (6a)
Number of open flues							Ļ	0	_ x 20 =		0	_ (6b)
Number of intermitten	t fans							2	_ x 10 =		20	_ (7a)
Number of passive ven	ts						L	0	_ x 10 =		0	_ (7b) ¬
Number of flueless gas	fires						L	0	x 40 =	• L	0	_ (7c)
										Air e	hanges pe hour	r
Infiltration due to chim	nevs, flues, fai	ns. PSVs		(6a)	+ (6b) + (7	a) + (7b) + (7c) = [20] ÷ (5) =	-	0.12	(8)
If a pressurisation test	has been carrie	ed out or is i	ntended, p	roceed to (.	17), otherw	vise continu	e from	(9) to (16)] (-)
Air permeability value.	a50. expresse	d in cubic m	etres per h	our per sau	uare metre	of envelope	e area	, , ,			5.00	(17)
If based on air permeat	pility value. the	en (18) = [(1]	7) ÷ 20] + (8). otherwi	se (18) = (1	6)					0.37	(18)
Number of sides on wh	ich the dwellir	ng is sheltere	ed .			-,					2	(19)
Shelter factor		0						1 -	- [0.075 x (1	9)] =	0.85	(20)
Infiltration rate incorpo	orating shelter	factor							(18) x (2	20) =	0.32	(21)
Infiltration rate modifie	d for monthly	wind speed	:						. , .	·		_ · ·
Jai	n Feb	Mar	Apr	May	Jun	Jul	Au	g Sep	Oct	Nov	Dec	
Monthly average wind	speed from Ta	ble U2										
5.1	0 5.00	4.90	4.40	4.30	3.80	3.80	3.7	0 4.00	4.30	4.50	4.70	(22)
Wind factor (22)m \div 4												
1.2	8 1.25	1.23	1.10	1.08	0.95	0.95	0.9	3 1.00	1.08	1.13	1.18	(22a)
Adjusted infiltration rat	e (allowing fo	r shelter and	wind fact	or) (21) x (2	22a)m							
0.4	0 0.40	0.39	0.35	0.34	0.30	0.30	0.2	9 0.32	0.34	0.36	0.37	(22b)
Calculate effective air c	hange rate for	the applica	ble case:									
If mechanical ventil	ation: air chan	ge rate thro	ugh system	1							N/A	(23a)
If balanced with hea	it recovery: eff	ficiency in %	allowing for	or in-use fa	ctor from T	able 4h					N/A	(23c)
d) natural ventilatio	n or whole ho	use positive	input vent	ilation fron	n loft							
0.5	8 0.58	0.58	0.56	0.56	0.55	0.55	0.5	4 0.55	0.56	0.56	0.57	(24d)
Effective air change rat	e - enter (24a)	or (24b) or	(24c) or (24	4d) in (25)								
0.5	8 0.58	0.58	0.56	0.56	0.55	0.55	0.5	4 0.55	0.56	0.56	0.57	(25)



3. Heat losses a	ind heat lo	ss paramet	er										
Element			a	Gross area, m ²	Openings m ²	Net A,	area m²	U-value W/m²K	A x U V	V/К к-v kJ	value, /m².K	Ахк, kJ/K	
Door						1.	96 x	1.40	= 2.74	Ļ			(26)
Window						13	.06 x	1.33	= 17.3	1			(27)
Ground floor						4.	20 x	0.18	= 0.76	;			(28a)
External wall						67	.60 x	0.18	= 12.1	7			(29a)
Party wall						25	.30 x	0.00	= 0.00)			(32)
Total area of ext	ernal elem	ents ∑A, m²	:			86	.82						(31)
Fabric heat loss,	W/K = ∑(A	× U)							(2	6)(30) + (32) =	32.98	(33)
Heat capacity Cn	n = ∑(А x к))						(28)	.(30) + (32)	+ (32a)(3	2e) =	N/A	 (34)
Thermal mass pa	arameter (1	「MP) in kJ/n	n²K									250.00	(35)
Thermal bridges	: Σ(L x Ψ) c	alculated us	sing Appen	idix K								9.38	 (36)
Total fabric heat	loss									(33) + (36) =	42.36	(37)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	_ ` `
Ventilation heat	loss calcula	ated month	ly 0.33 x (25)m x (5)									
	31.45	31.28	31.11	30.32	30.18	29.49	29.49	29.37	29.76	30.18	30.47	30.79	(38)
Heat transfer co	efficient, W	//K (37)m +	- (38)m	1	1 1								_ ` `
	73.81	73.64	73.47	72.68	72.54	71.85	71.85	71.73	72.12	72.54	72.84	73.15	7
									Average =	 Σ(39)112	/12 =	72.68	 (39)
Heat loss param	eter (HLP),	W/m²K (39	9)m ÷ (4)							2()	,		
•	1.39	1.38	1.38	1.37	1.36	1.35	1.35	1.35	1.35	1.36	1.37	1.37	٦
					1			1	Average =	$\Sigma(40)112$	/12 =	1.37	 (40)
Number of days	in month (Table 1a)								2 7 - 7	, L	-	
· · · · · · , ·	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)
	01.00	20.00	01.00	00.00	01.00	00.00	01.00			01.00		01.00	()
4. Water heatir	ng energy r	equiremen	t										
Assumed occupa	incy, N											1.79	(42)
Annual average	hot water ι	usage in litro	es per day	Vd,average	e = (25 x N) +	36						76.60	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage	in litres pe	er day for ea	ach month	Vd,m = fac	ctor from Tab	ole 1c x (43)						
	84.26	81.20	78.13	75.07	72.01	68.94	68.94	72.01	75.07	78.13	81.20	84.26	
										∑(44)1	12 =	919.22	(44)
Energy content of	of hot wate	er used = 4.1	L8 x Vd,m >	k nm x Tm/	'3600 kWh/m	nonth (see	Tables 1b	, 1c 1d)					
	124.96	109.29	112.78	98.32	94.34	81.41	75.44	86.57	87.60	102.09	111.44	121.02	
										∑(45)1	12 =	1205.24	(45)
Distribution loss	0.15 x (45)m											
	18.74	16.39	16.92	14.75	14.15	12.21	11.32	12.98	13.14	15.31	16.72	18.15	(46)
Water storage lo	oss calculat	ed for each	month (5	5) x (41)m									
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(56)
If the vessel cont	tains dedic	ated solar s	torage or o	dedicated \	WWHRS (56)r	m x [(47) -	Vs] ÷ (47)	<i>,</i> else (56)					
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(57)
Primary circuit lo	oss for each	n month fro	m Table 3										
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)
Combi loss for ea	ach month	from Table	3a, 3b or 3	Bc									
	42.94	37.37	39.82	37.02	36.69	34.00	35.13	36.69	37.02	39.82	40.04	42.94	(61)
Total heat requir	red for wat	er heating o	calculated	for each m	onth 0.85 x ((45)m + (4	6)m + (57))m + (59)m ·	+ (61)m				
	167.90	146.66	152.59	135.34	131.03	115.41	110.57	123.26	124.62	141.91	151.48	163.95	(62)

		using rippe		when any u									
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
Output from wa	ter heater f	or each mo	nth (kWh/r	month) (62	2)m + (63)m	l							
	167.90	146.66	152.59	135.34	131.03	115.41	110.57	123.26	124.62	141.91	151.48	163.95	
										∑(64)1	12 = 1	664.73	(64)
Heat gains from	water heat	ing (kWh/m	nonth) 0.25	5 × [0.85 × ((45)m + (61)m] + 0.8 ×	[(46)m + (57)m + (59)	m]				_
	52.28	45.68	47.45	41.95	40.54	35.57	33.87	37.96	38.38	43.90	47.06	50.97	(65)
5. Internal gains													
or internal gan	lan	Feb	Mar	Apr	May	lun	Iul	Διισ	Sen	Oct	Nov	Dec	
Metabolic gains	(Table 5)	100		ΛPi	inay	Juli	Jui	Aug	Sep	011	100	Dee	
Metabolic gains		107 12	107 12	107 12	107 12	107 12	107 12	107.12	107 12	107 12	107.12	107 12	(66)
Lighting gains (c	alculated in	Appendix I	equation	107.12		107.12	107.12	107.12	107.12	107.12	107.12	107.12] (00)
	24.69	20.90	25.05	19 07	1/ 10	11 07	12.02	16.91	2256	28 65	22.14	25.65	(67)
Appliance gains	(calculated	in Annendi		10.97	14.10	11.97	12.95	10.81	22.50	28.05	55.44	35.05] (07)
Appliance gains							472.70	171.25	477.40	100.25	205 57	222.04	
Cooking going (o	232.26	234.67	228.60	215.67	199.34	184.00	173.76	1/1.35	177.42	190.35	206.67	222.01	(68)
COOKING gains (C	alculated in		L, equation	L15 or L15	a), also see		17.50	17.50		17 5 0	17.50		
	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	(69)
Pump and fan ga	ains (Table 5	ba)											٦
	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00] (70)
Losses e.g. evap	oration (Tab	ole 5)									I	1	7
	-71.41	-71.41	-71.41	-71.41	-71.41	-71.41	-71.41	-71.41	-71.41	-71.41	-71.41	-71.41	(71)
Water heating g	ains (Table	5)											_
	70.27	67.98	63.78	58.26	54.49	49.40	45.52	51.02	53.31	59.00	65.37	68.51	(72)
Total internal ga	ins (66)m +	· (67)m + (6	8)m + (69)ı	m + (70)m ·	+ (71)m + (7	72)m							
	423.42	419.66	403.63	379.10	354.22	331.58	318.41	325.38	339.50	364.21	391.68	412.37	(73)
6. Solar gains	423.42	419.66	403.63	379.10	354.22	331.58	318.41	325.38	339.50	364.21	391.68	412.37	(73)
6. Solar gains	423.42	419.66	403.63	379.10	354.22	331.58	318.41	325.38	339.50 g	364.21	391.68	412.37	(73)
6. Solar gains	423.42	419.66	403.63 Access f Table	379.10 actor 6d	354.22 Area m ²	331.58 Sol	318.41 ar flux //m²	325.38 spec	339.50 g ific data	364.21 FF specific d	391.68	412.37 Gains W] (73)
6. Solar gains	423.42	419.66	403.63 Access f Table	379.10 actor 6d	354.22 Area m ²	331.58 Sol	318.41 ar flux //m²	325.38 spect or T	339.50 g ific data able 6b	364.21 FF specific d or Table	391.68 lata 6c	412.37 Gains W] (73)
6. Solar gains West	423.42	419.66	403.63 Access f Table	379.10 actor 6d 7x	354.22 Area m ² 7.64	331.58 Sol. W	318.41 ar flux //m ² 9.64 x	325.38 speci or T 0.9 x ()	g fific data able 6b	FF specific d or Table	391.68	412.37 Gains W 52.41] (73)] (80)
6. Solar gains West SouthWest	423.42	419.66	403.63 Access f Table 0.77	379.10 actor 6d 7 x [7 x [354.22 Area m ² 7.64 2.54	331.58 Sol. M X 1 X 3	318.41 ar flux //m ² 9.64 x 6.79 x	325.38 speci or T 0.9 x (0 0.9 x (0	g ific data able 6b 0.63 x x 0.63 x	364.21 FF specific d or Table 0.80 0.80	391.68	412.37 Gains W 52.41 32.64] (73)] (80)] (79)
6. Solar gains West SouthWest South	423.42	419.66	403.63 Access f Table	379.10 actor 6d 7 x [7 x [7 x [354.22 Area m ² 7.64 2.54 1.74	331.58 Sol. W X 1 X 3 X 3 X 4	318.41 ar flux //m ² 9.64 x 6.79 x 6.75 x	325.38 speci or T 0.9 x (0 0.9 x (0 0.9 x (0	g fic data able 6b 0.63 x 0.63 x 0.63 x	364.21 FF specific d or Table 0.80 0.80	391.68	412.37 Gains W 52.41 32.64 28.41] (73)] (80)] (79)] (78)
6. Solar gains West SouthWest South NorthWest	423.42	419.66	403.63 Access f Table 0.77 0.77 0.77	379.10 actor 6d 7 x [7 x [7 x [7 x [7 x]	354.22 Area m ² 7.64 2.54 1.74 1.14	331.58 Sol. M X 1 X 3 X 4 X 4 X 1	318.41 ar flux //m ² 9.64 x 6.79 x 6.75 x 1.28 x	325.38 speci or T 0.9 x (0 0.9 x (0 0.9 x (0 0.9 x (0 0.9 x (0	g ific data able 6b 0.63 x 0.63 x 0.63 x 0.63 x	364.21 FF specific d or Table 0.80 0.80 0.80 0.80	391.68	412.37 Gains W 52.41 32.64 28.41 4.49] (73)] (80)] (79)] (78)] (81)
6. Solar gains West SouthWest South NorthWest Solar gains in wa	423.42 423.42	419.66	403.63 Access f Table 0.77 0.77 0.77	379.10 actor 6d 7 x [7 x [7 x [7 x]	354.22 Area m ² 7.64 2.54 1.74 1.14	331.58 Sol X X X X X X X X X X X	318.41 ar flux //m ² 9.64 x 6.79 x 6.75 x 1.28 x	325.38 speci or T 0.9 x (0 0.9 x (0 0.9 x (0 0.9 x (0	g fic data able 6b 0.63 x 0.63 x 0.63 x 0.63 x	364.21 FF specific d or Table 0.80 0.80 0.80 0.80	391.68	412.37 Gains W 52.41 32.64 28.41 4.49] (73)] (80)] (79)] (78)] (81)
6. Solar gains West SouthWest South NorthWest Solar gains in wa	423.42 423.42 atts Σ(74)m	419.66 (82)m 213.80	403.63 Access f Table 0.77 0.77 0.77 0.77 0.77	379.10 actor 6d 7 x [7 x [7 x [7 x [7 x]	354.22 Area m ² 7.64 2.54 1.74 1.14	331.58 Sol. M X 1 X 3 X 4 X 4 X 1 S19.70	318.41 ar flux //m ² 9.64 x 6.79 x 6.75 x 1.28 x 497.08	325.38 speci or T 0.9 x (0 0.9 x (0 0 0.9 x (0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	g ific data able 6b 0.63 x 0.63 x 0.63 x 0.63 x 0.63 x	364.21 FF specific d or Table 0.80 0.80 0.80 0.80	391.68	412.37 Gains W 52.41 32.64 28.41 4.49 99.25] (73)] (80)] (79)] (78)] (81)] (83)
6. Solar gains West SouthWest South NorthWest Solar gains in wa	423.42 atts Σ(74)m 117.96 ernal and so	419.66 (82)m 213.80 lar (73)m +	403.63 Access f Table 0.77 0.77 0.77 320.67 (83)m	379.10 actor 6d 7 x [7 x [7 x [7 x [7 x [7 x [7 x [354.22 Area m ² 7.64 2.54 1.74 1.14 513.54	331.58 Sol. X X 1 X 3 X 4 X 1 519.70	318.41 ar flux //m ² 9.64 x 6.79 x 6.75 x 1.28 x 497.08	325.38 speci or T 0.9 x (0 0.9 x (0 0 0.9 x (0 0 0 0 0 0 0 0 0 0 0 0 0 0	339.50 g ific data able 6b 0.63 x	364.21 FF specific d or Table 0.80 0.80 0.80 244.47	391.68	412.37 Gains W 52.41 32.64 28.41 4.49 99.25] (73)] (80)] (79)] (78)] (81)] (83)
6. Solar gains West SouthWest South NorthWest Solar gains in wa Total gains - inte	423.42 423.42 atts ∑(74)m 117.96 ernal and so 541.37	419.66 (82)m 213.80 lar (73)m +	403.63 Access f Table 0.77 0.77 0.77 0.77 320.67 (83)m 724 30	379.10 actor 6d 7 x 7 7 x 7 7 x 7 7 x 7 434.56	354.22 Area m ² 7.64 2.54 1.74 1.14 513.54	331.58 Sol. M X 1 X 3 X 4 X 1 519.70	318.41 ar flux //m ² 9.64 x 6.79 x 6.75 x 1.28 x 497.08	325.38 speci or T 0.9 x (0 0.9 x (0 0 0.9 x (0 0 0 0.9 x (0 0 0 0.9 x (0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	g ific data able 6b 0.63 x	364.21 FF specific d or Table 0.80 0.80 0.80 0.80 244.47 608.68	391.68	412.37 Gains W 52.41 32.64 28.41 4.49 99.25] (73)] (80)] (79)] (78)] (81)] (83)] (83)
6. Solar gains West SouthWest South NorthWest Solar gains in wa Total gains - inte	423.42 423.42 atts ∑(74)m 117.96 ernal and so 541.37	419.66 (82)m 213.80 lar (73)m + 633.46	403.63 Access f Table 0.77 0.77 0.77 320.67 (83)m 724.30	379.10 actor 6d 7 x [7 x [7 x [7 x [434.56 813.65	354.22 Area m ² 7.64 2.54 1.74 1.14 513.54 867.76	331.58 Sol X 1 X 3 X 4 X 1 519.70 851.28	318.41 ar flux //m ² 9.64 x 6.79 x 6.75 x 1.28 x 497.08 815.49	325.38 speci or T 0.9 x (0 0.9 x (0 0.9 x (0 0.9 x (0 437.91 763.29	g ific data able 6b 0.63 x 0.63 x 0.63 x 0.63 x 360.74 360.74	364.21 FF specific d or Table 0.80 0.80 0.80 244.47 608.68	391.68	412.37 Gains W 52.41 32.64 28.41 4.49 99.25 511.63] (73)] (80)] (79)] (78)] (81)] (83)] (84)
6. Solar gains West SouthWest South NorthWest Solar gains in wa Total gains - inte 7. Mean intern	423.42 423.42 417.96 4117.96 411.37 41.37 41 tempera	419.66 (82)m 213.80 lar (73)m + 633.46 ture (heatin	403.63 Access f Table 0.77 0.77 0.77 320.67 (83)m 724.30	379.10 actor 6d 7 X [7 X [7 X [7 X [7 X] 434.56 813.65	354.22 Area m ² 7.64 2.54 1.74 1.14 513.54 867.76	331.58 Sol. X 1 X 3 X 4 X 4 X 1 519.70 851.28	318.41 ar flux //m ² 9.64 x 6.79 x 6.75 x 1.28 x 497.08 815.49	325.38 speci or Ti 0.9 x (0) 0.9 x (0) 0.9 x (0) 0.9 x (0) 437.91 763.29	g ific data able 6b 0.63 x 0.63 x	364.21 FF specific d or Table 0.80 0.80 0.80 0.80 244.47 608.68	391.68	412.37 Gains W 52.41 32.64 28.41 4.49 99.25 511.63] (73)] (80)] (79)] (78)] (81)] (83)] (83)
 6. Solar gains West SouthWest South NorthWest Solar gains in wa Total gains - intern 7. Mean intern Temperature du 	423.42 423.42 423.42 117.96 ernal and so 541.37 ral temperations tring heating	419.66 (82)m 213.80 lar (73)m + 633.46 ture (heating g periods in	403.63 Access f Table 0.77 0.77 0.77 0.77 320.67 (83)m 724.30 the living a	379.10 actor 6d 7 x 7 7 x 7 7 x 7 7 x 7 7 x 7 434.56 813.65 area from T	354.22 Area m ² 7.64 2.54 1.74 1.14 513.54 867.76	331.58 Sol X X X X X X 4 X 1 519.70 851.28 (°C)	318.41 ar flux //m ² 9.64 x 6.79 x 6.75 x 1.28 x 497.08 815.49	325.38 speci or T 0.9 x (0 0.9 x (0 0 0.9 x (0 0 0.9 x (0 0 0.9 x (0 0 0 0.9 x (0 0 0 0 0.9 x (0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	g ific data able 6b 0.63 x 700.23 x	364.21 FF specific d or Table 0.80 0.80 0.80 244.47 608.68	391.68	412.37 Gains W 52.41 32.64 28.41 4.49 99.25 511.63 511.63 21.00] (73)] (80)] (79)] (78)] (81)] (83)] (83)] (84)
 6. Solar gains West SouthWest South NorthWest Solar gains in wa Total gains - intern 7. Mean intern Temperature due 	423.42 423.42 117.96 117.96 541.37 541.37 117.96 541.37 117.96 117.	419.66 (82)m 213.80 lar (73)m + 633.46 ture (heating periods in Feb	403.63 Access f Table 0.77 0.77 0.77 0.77 320.67 (83)m 724.30 ng season) the living a Mar	379.10 actor 6d 7 X 7 7 X 7 7 X 7 7 X 7 7 X 7 434.56 813.65 813.65 area from T Apr	354.22 Area m ² 7.64 2.54 1.74 1.14 513.54 867.76 867.76	331.58 Sol. M X 1 X 3 X 4 X 4 S19.70 851.28 (°C) Jun	318.41 ar flux //m ² 9.64 x 6.79 x 6.75 x 1.28 x 497.08 815.49	325.38 speci or Ti 0.9 x (0) 0.9 x (0) 0.9 x (0) 0.9 x (0) 437.91 763.29 Aug	g ific data able 6b 0.63 x 360.74 x 700.23 x	364.21 FF specific d or Table 0.80 0.80 0.80 0.80 244.47 608.68	391.68	412.37 Gains W 52.41 32.64 28.41 4.49 99.25 511.63 511.63 21.00 Dec] (73)] (80)] (79)] (78)] (81)] (83)] (83)] (84)
 6. Solar gains West SouthWest South NorthWest Solar gains in wat Total gains - intern 7. Mean intern Temperature du Utilisation facto 	423.42 423.42 423.42 423.42 117.96 ernal and so 541.37 hal temperation Jan r for gains for	419.66 419.66 213.80 213.80 lar (73)m + 633.46 ture (heating g periods in Feb or living are	403.63 Access f Table 0.77 0.77 0.77 0.77 320.67 (83)m 724.30 ng season) the living a Mar an 1,m (sea	379.10 actor 6d 7 x 7 7 x 7 8 13.65 8 13.65 8 13.65 8 13 8 10 10 10 10 10 10 10 10 10 10 10 10 10	354.22 Area m ² 7.64 2.54 1.74 1.14 513.54 867.76 867.76	331.58 Sol X X X X X X X X 1 S19.70 851.28 (°C) Jun	318.41 ar flux //m ² 9.64 x 6.79 x 6.75 x 1.28 x 497.08 815.49 Jul	325.38 specior T 0.9 x (0 0.9 x (0 0.9 x (0 0.9 x (0 0.9 x (0 437.91 763.29 Aug	8 ific data able 6b 0.63 x 0.63 x 0.63 x 0.63 x 0.63 x 0.63 x 360.74 360.74	364.21 FF specific d or Table 0.80 0.80 0.80 244.47 608.68	391.68	412.37 Gains W 52.41 32.64 28.41 4.49 99.25 511.63 511.63 21.00 Dec] (73)] (80)] (79)] (78)] (81)] (83)] (83)] (84)
 6. Solar gains West SouthWest South NorthWest Solar gains in wat Total gains - international gains - internationa	423.42 423.42 423.42 423.42 423.42 (74)m 117.96 ernal and so 541.37 ral temperations for gains for 0.98	419.66 419.66 (82)m 213.80 lar (73)m + 633.46 ture (heating periods in Feb per living area 0.97	403.63 Access f Table 0.77 0.77 0.77 0.77 320.67 (83)m 724.30 ng season) the living a Mar ta n1,m (sec 0.93	379.10 actor 6d 7 X [7 X	354.22 Area m ² 7.64 2.54 1.74 1.14 513.54 867.76 able 9, Th1 May 0.70	331.58 Sol. M X 1 X 3 X 4 X 4 X 1 519.70 851.28 (°C) Jun 0.52	318.41 ar flux //m ² 9.64 x 6.79 x 6.75 x 1.28 x 497.08 815.49 Jul 0.38	325.38 speci or Ti 0.9 x (0) 0.9 x (0) 0.9 x (0) 0.9 x (0) 437.91 763.29 Aug 0.43	339.50 g ific data able 6b 0.63 x 360.74 x 5ep 0.66	364.21 FF specific d or Table 0.80 0.80 0.80 0.80 244.47 608.68 Oct 0.89	391.68	412.37 Gains W 52.41 32.64 28.41 4.49 99.25 511.63 511.63 21.00 Dec 0.99] (73)] (80)] (79)] (78)] (81)] (83)] (83)] (84)] (85)
 6. Solar gains West SouthWest South NorthWest Solar gains in wat Total gains - intern 7. Mean intern Temperature du Utilisation facto Mean internal tag 	423.42 423.42 423.42 423.42 423.42 117.96 ernal and so 541.37 al temperation Jan r for gains for 0.98 emp of living	419.66 419.66	403.63 Access f Table 0.77 0.77 0.77 0.77 0.77 320.67 (83)m 724.30 mg season) the living a Mar ea n1,m (see 0.93 teps 3 to 7	379.10 actor 6d 7 x 7 7 x 7 813.65 815 815 815 815 815 815 815 81	354.22 Area m ² 7.64 2.54 1.74 1.14 513.54 867.76 867.76 able 9, Th1 May 0.70	331.58 Sol X 1 X 3 X 4 X 1 519.70 851.28 (°C) Jun 0.52	318.41 ar flux //m ² 9.64 x 6.79 x 6.75 x 1.28 x 497.08 815.49 Jul 0.38	325.38 speci or T 0.9 x (0 0.9 x (0 0.9 x (0 0.9 x (0 437.91 763.29 Aug 0.43	8 ific data able 6b 0.63 x 0.63 x 0.63 x 0.63 x 0.63 x 360.74 360.74 700.23	364.21 FF specific d or Table 0.80 0.80 0.80 244.47 608.68 Oct 0.89	391.68 lata 6c = [] = [] = [] = [] 143.78 535.46 S35.46	412.37 Gains W 52.41 32.64 28.41 4.49 99.25 511.63 511.63 21.00 Dec 0.99] (73)] (80)] (79)] (78)] (81)] (83)] (83)] (84)] (85)] (86)
 6. Solar gains West SouthWest South NorthWest Solar gains in wat Total gains - international solution factoon Mean international term 	423.42 423.42 423.42 423.42 423.42 423.42 17.96 ernal and so 541.37 17.96 ernal and so 541.37 al temperation for gains for 0.98 emp of living 19.82	419.66 419.66 (82)m 213.80 lar (73)m + 633.46 ture (heating periods in Feb per living area 0.97 g area T1 (s 20.03	403.63 Access f Table 0.77 0.77 0.77 0.77 320.67 (83)m 724.30 (83)m 724.30 ng season) the living a Mar ea n1,m (see 0.93 teps 3 to 7 20.34	379.10 actor 6d 7 X [7 X	354.22 Area m ² 7.64 2.54 1.74 1.14 513.54 867.76 able 9, Th1 May 0.70	331.58 Sol. M X 1 X 3 X 4 X 4 S19.70 851.28 (°C) Jun 0.52 20.98	318.41 ar flux //m ² 9.64 x 6.79 x 6.75 x 1.28 x 497.08 815.49 Jul 0.38 21.00	325.38 speci or Ti 0.9 x (0) 0.9 x (0) 0.9 x (0) 0.9 x (0) 437.91 763.29 Aug 0.43 20.99	339.50 g ific data able 6b 0.63 x 360.74 x 5ep 0.66 0.66 20.94	364.21 FF specific d or Table 0.80 0.80 0.80 0.80 244.47 608.68 Oct 0.89 20.64	391.68 lata 6c = [] = [] = [] = [] = [] 143.78 535.46 [Nov 0.97 20.16	412.37 Gains W 52.41 32.64 28.41 4.49 99.25 511.63 511.63 21.00 Dec 0.99] (73)] (80)] (79)] (78)] (81)] (83)] (83)] (84)] (85)] (85)] (86)] (86)

19.79

19.78 (88)

19.80

19.80

19.77

19.78

19.78

19.79

19.79

19.80

19.80

19.79

Utilisation factor	for gains fo	or rest of d	welling n2,	m									
[0.98	0.96	0.91	0.80	0.63	0.43	0.28	0.32	0.56	0.85	0.96	0.98	(89)
Mean internal ter	nperature	in the rest	of dwelling	g T2 (follow	steps 3 to	7 in Table 9	e)						
	18.74	18.95	19.24	19.56	19.73	19.79	19.80	19.80	19.77	19.54	19.09	18.70	(90)
Living area fractio	n								Li	ving area ÷	(4) =	0.60	(91)
Mean internal ter	nperature	for the wh	ole dwellin	g fLA x T1 +	+(1 - fLA) x	Т2							
[19.39	19.60	19.90	20.23	20.42	20.50	20.52	20.52	20.47	20.20	19.74	19.35	(92)
Apply adjustment	to the me	an interna	l temperat	ure from Ta	able 4e whe	ere appropr	iate						
	19.39	19.60	19.90	20.23	20.42	20.50	20.52	20.52	20.47	20.20	19.74	19.35	(93)
0. Current hand the	· · · · · ·												
8. Space neating	requiremo	ent Fab	Max	A	N 4	I	1.4	A	Com	0.4	Neu	Dee	
	Jan	Feb	war	Apr	iviay	Jun	Jui	Aug	Sep	Uct	NOV	Dec	
	for gains, η		0.01	0.00	0.07	0.40		0.20	0.62	0.07	0.00	0.00	
	0.98	0.96	0.91	0.82	0.67	0.49	0.34	0.38	0.62	0.87	0.96	0.98] (94)
Userul gains, ηme	5m, vv (94))m x (84)m			500.50	444.22	270.04	202.67	422.40	500 55	542.42	502.00	
	528.94	606.32	661.98	666.62	580.58	414.28	279.94	292.67	432.10	526.55	513.42	502.06] (95)
Nonthiy average	external te	emperature			14 70	14.60	10.00	16.40	1110	10.00	7.40	1.00	
	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20] (96)
Heat loss rate for			erature, Lm	, w [(39)m	1 x [(93)m -	(96)mj	201.61	205.27	450.45	COC 10	020.27	1107.04	
Space beating rea	1113.53	1082.53	984.71	823.38	[032.83]	424.24	281.61	295.37	459.45	696.40	920.37	1107.94] (97)
Space nearing req	urement,	220.04	111 0.024 x	[(97)m - (9	5)mj x (41)		0.00	0.00	0.00	126.26	202.00	450.70	7
L	434.94	320.01	240.12	112.87	38.88	0.00	0.00	0.00	0.00		293.00		
Change booting roo	uiromont l	1) M/b /m2/1	0.0 <i>r</i>						2(9	8)15, 10 (08)	12 = 2	2016.95] (98)] (00)
Space nearing req	Juliement	« vv ii / iii / y	ear							(96)	÷ (4)	57.69] (99)
9a. Energy requi	rements - i	individual	heating sy	stems inclu	iding micro	-СНР							
Space heating													
Fraction of space	heat from	secondary	/suppleme	ntary syste	m (table 11	L)						0.00	(201)
Fraction of space	heat from	main syste	em(s)							1 - (20	01) =	1.00	(202)
Fraction of space	heat from	main syste	em 2									0.00	(202)
Fraction of total s	pace heat	from main	system 1						(20	02) x [1- (20	3)] =	1.00	(204)
Fraction of total s	pace heat	from main	system 2							(202) x (20	03) =	0.00	(205)
Efficiency of main	system 1 ((%)										89.70	(206)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating fue	el (main sys	tem 1), kV	Vh/month										
	484.88	356.76	267.69	125.83	43.34	0.00	0.00	0.00	0.00	140.87	326.65	502.54]
									∑(21	1)15, 10	12 = 2	2248.55	(211)
Water heating													
Efficiency of wate	r heater												
	86.64	86.26	85.49	83.90	81.71	79.60	79.60	79.60	79.60	84.06	85.98	86.76	(217)
Water heating fue	el, kWh/mo	onth											
	193.79	170.02	178.50	161.32	160.38	144.99	138.91	154.85	156.56	168.82	176.18	188.97]
										5(2192)1	12 -	1002.20	(219)
Annual totals										2(2150)1	12	1993.28] (/
Space heating fue										2(2150)1	.12	1993.28] (,
	el - main sys	stem 1								2(2150)1		2248.55] (,
Water heating fue	el - main sys	stem 1								2(2150)1		2248.55 1993.28]
Water heating fue Electricity for pun	el - main sys el nps, fans ar	stem 1 nd electric	keep-hot (Table 4f)				_				2248.55 1993.28]
Water heating fue Electricity for pun central heating	el - main sys el nps, fans ar g pump or f	stem 1 nd electric water pun	keep-hot (np within w	Table 4f) arm air hea	ating unit				30.00]		2248.55 1993.28]] (230c)

boiler flue fan			45.00			(230e)
Total electricity for the above, kWh/year					75.00	(231)
Electricity for lighting (Appendix L)					245.00	(232)
Total delivered energy for all uses		((211)(221) + (231) + (2	32)(237b) =	4561.83	(238)
10a. Fuel costs - individual heating systems including micro-CH	IP					
	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	2248.55	x	3.48	x 0.01 =	78.25	(240)
Water heating	1993.28	х	3.48	x 0.01 =	69.37	(247)
Pumps and fans	75.00	х	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	245.00	х	13.19	x 0.01 =	32.32	(250)
Additional standing charges					120.00	(251)
Total energy cost			(240)(242) + (245)(254) =	309.82	(255)
11a. SAP rating - individual heating systems including micro-CH	HP					
Energy cost deflator (Table 12)					0.42	(256)
Energy cost factor (ECF)					1.32	(257)
SAP value					81.52]
SAP rating (section 13)					82	(258)
SAP band					В]
12a. CO ₂ emissions - individual heating systems including micro	o-CHP					
	Energy		Emission factor		Emissions	

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	2248.55	x	0.216] = [485.69	(261)
Water heating	1993.28	x	0.216] = [430.55	(264)
Space and water heating			(261) + (262) +	- (263) + (264) =	916.24	(265)
Pumps and fans	75.00	x	0.519] = [38.93	(267)
Electricity for lighting	245.00	x	0.519] = [127.16	(268)
Total CO2, kg/year				(265)(271) =	1082.32	(272)
Dwelling CO ₂ emission rate				(272) ÷ (4) =	20.33	(273)
El value					85.24]
El rating (section 14)					85	(274)
El band					В]

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

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	2248.55	x	1.22	=	2743.24	(261)
Water heating	1993.28	x	1.22	=	2431.80	(264)
Space and water heating			(261) + (262) +	(263) + (264) =	5175.03	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	245.00	x	3.07	=	752.16	(268)
Primary energy kWh/year					6157.44	(272)
Dwelling primary energy rate kWh/m2/year					115.68	(273)

SAP Worksheet Design - Draft



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

Assessor name		Mr Ioanr	nis Protono	tarios					Assessor nun	nber	23		
Client									Last modified	ł	11/08	/2021	
Address		Flat 9, 13	3 Netherhal	l Gardens,	London, N	W3							
1. Overall dwell	ing dimen	sions											
					A	Area (m²)			Average storey height (m)	,	Vo	lume (m³)	
Lowest occupied						116.18	(1a) x		3.08] (2a) =		357.83	(3a)
Total floor area		(1a)	+ (1b) + (1	c) + (1d)(1n) =	116.18	(4)						
Dwelling volume									(3a) + (3b) + (3	sc) + (3d)(3	8n) =	357.83	(5)
2. Ventilation ra	ite												
											m	³ ner hour	
Number of chimp	0.16							Г	0] v 40 -		0	(62)
Number of chinin	flues								0	X40 =		0	
Number of open	nues	_						L	0	_ x 20 =		20] (Ja)
Number of Intern	nittent fan	S							3] X 10 =		30] (7a)
Number of passiv	e vents							L	0] X 10 =		0	
Number of flueles	ss gas tires	5						L	0	_ x 40 =	•	0	_ (/c)
											Air	hour	r
Infiltration due to	chimneys	s, flues, fan	s, PSVs		(6a) + (6b) + (7	'a) + (7b) +	(7c) = [30	÷ (5) =		0.08	(8)
If a pressurisatior	n test has k	been carried	d out or is i	ntended, pi	roceed to (17), otherw	vise continu	ie from	(9) to (16)				_
Air permeability v	/alue, q50,	expressed	in cubic m	etres per h	our per sq	uare metre	of envelop	e area				5.00	(17)
If based on air pe	rmeability	value, the	n (18) = [(1	7) ÷ 20] + (8	3), otherwi	ise (18) = (1	.6)					0.33	(18)
Number of sides	on which t	he dwelling	g is sheltere	ed								1	(19)
Shelter factor									1	- [0.075 x (1	9)] =	0.93	(20)
Infiltration rate in	ncorporatir	ng shelter f	actor							(18) x (2	20) =	0.31	(21)
Infiltration rate m	nodified fo	r monthly v	wind speed	:									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Au	g Sep	Oct	Nov	Dec	
Monthly average	wind spee	d from Tab	ole U2										
[5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.7	0 4.00	4.30	4.50	4.70	(22)
Wind factor (22)r	n ÷ 4												
[1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.9	3 1.00	1.08	1.13	1.18	(22a)
Adjusted infiltrati	ion rate (al	llowing for	shelter and	d wind facto	or) (21) x (2	22a)m							
[0.39	0.39	0.38	0.34	0.33	0.29	0.29	0.2	9 0.31	0.33	0.35	0.36	(22b)
Calculate effectiv	e air chang	ge rate for	the applica	ble case:									
If mechanical	ventilation	n: air chang	e rate thro	ugh system	I							N/A	(23a)
If balanced wi	th heat red	covery: effi	ciency in %	allowing fo	or in-use fa	actor from T	Table 4h					N/A	(23c)
d) natural ven	tilation or	whole hou	se positive	input vent	ilation fror	n loft							_
[0.58	0.57	0.57	0.56	0.56	0.54	0.54	0.5	0.55	0.56	0.56	0.57	(24d)
Effective air chan	ge rate - e	nter (24a) (or (24b) or	(24c) or (24	1d) in (25)								_
	0.58	0.57	0.57	0.56	0.56	0.54	0.54	0.5	0.55	0.56	0.56	0.57	(25)



3. Heat losses a	and heat lo	ss paramet	er										
Element			а	Gross rea, m²	Openings m ²	Net A,	area m²	U-value W/m²K	A x U W	/К к-v kJ,	value, /m².K	Ахк, kJ/K	
Door						1.	.96 x	1.40	= 2.74				(26)
Window						22	.63 x	1.33	= 30.00				(27)
Ground floor						71	51 x	0.18	= 12.87				(28a)
External wall						130	6.01 x	0.18	= 24.48				(29a)
Party wall						24	.98 x	0.00	= 0.00				(32)
Roof						19).57 x	0.15	= 2.94				(30)
Total area of ext	ernal eleme	ents ∑A, m²	!			25:	1.68						(31)
Fabric heat loss,	W/K = ∑(A	× U)							(26	5)(30) + (3	32) =	73.03	(33)
Heat capacity Cr	n = ∑(А x к)							(28)	.(30) + (32) +	- (32a)(32	2e) =	N/A	(34)
Thermal mass pa	arameter (T	MP) in kJ/n	n²K									250.00	(35)
Thermal bridges	: Σ(L x Ψ) ca	alculated us	sing Append	dix K								18.18	(36)
Total fabric heat	loss		0 11							(33) + (3	36) =	91.21	(37)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat	loss calcula	ted month	ly 0.33 x (2	25)m x (5)				, c					
	68.20	67.84	67.49	65.86	65.55	64.12	64.12	63.86	64.67	65.55	66.17	66.82	(38)
Heat transfer co	efficient, W	//K (37)m +	+ (38)m					1	1				_ (,
	159.41	159.05	158.70	157.07	156.76	155.34	155.34	155.07	155.89	156.76	157.38	158.03	7
								1	Average = Σ	(39)112/	/12 =	157.07	 (39)
Heat loss param	eter (HLP).	W/m²K (39	9)m ÷ (4)						2000				_ ()
·····	1 37	1 37	1 37	1 35	1 35	1 34	1 34	1 33	1 34	1 35	1 35	1 36	7
	1.07		2.07	2.00	1 2.00			1.00	Average = Σ	(40)1 12/	/12 =	1 35	
Number of days	in month (1	Table 1a)								(,,		2.00	
	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)
							1						
4. Water heati	ng energy r	equiremen	t										
Assumed occupa	ancy, N											2.85	(42)
Annual average	hot water u	isage in litro	es per day v	Vd,average	= (25 x N) +	36						101.82	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage	e in litres pe	r day for ea	ach month '	Vd,m = fact	tor from Tab	le 1c x (43	3)						
	112.00	107.93	103.86	99.79	95.71	91.64	91.64	95.71	99.79	103.86	107.93	112.00	
										∑(44)1	.12 =	1221.87	(44)
Energy content	of hot wate	r used = 4.1	L8 x Vd,m x	nm x Tm/3	3600 kWh/m	onth (see	Tables 1b	, 1c 1d)					
	166.10	145.27	149.91	130.69	125.40	108.21	100.28	115.07	116.44	135.70	148.13	160.86	
										∑(45)1	.12 =	1602.06	(45)
Distribution loss	0.15 x (45))m											
	24.91	21.79	22.49	19.60	18.81	16.23	15.04	17.26	17.47	20.36	22.22	24.13	(46)
Water storage lo	oss calculate	ed for each	month (55	5) x (41)m									
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(56)
If the vessel con	tains dedica	ated solar s	torage or d	ledicated W	/WHRS (56)r	m x [(47) -	Vs] ÷ (47)	, else (56)			•		
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(57)
Primary circuit lo	oss for each	month fro	m Table 3										
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)
Combi loss for e	ach month	from Table	3a, 3b or 3	ic	• • •								_ * *
	50.96	46.03	50.96	49.21	48.77	45.19	46.70	48.77	49.21	50.96	49.32	50.96	(61)
Total heat requi	red for wat	er heating o	calculated f	or each mo		(45)m + (4	6)m + (57)m + (59)m ·	+ (61)m			1	_ · ·

									-				_
	217.06	191.30	200.87	179.90	174.18	153.41	146.97	163.84	165.65	186.66	197.44	211.82	(62)
Solar DHW input	calculated	using Appe	endix G or A	Appendix H									
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
Output from wa	ter heater f	or each mo	nth (kWh/	month) (62	_ 2)m + (63)m	ו ו	1	-		1		1	
	217.06	191 30	200.87	179.90	17/ 18	153 /1	1/6 97	163.84	165.65	186.66	197 //	211.82	1
	217.00	151.50	200.07	175.50	174.10	155.41	140.57	105.04	105.05	5(64)1	12 -	190.10	
		. // //		- 10.05			[(46)			2(04)1	.12 =	2189.10	(64)
Heat gains from	water heat	ing (kWh/m	ionth) 0.2	5 × [0.85 ×	(45)m + (61	.)m] + 0.8 ×	< [(46)m +	(57)m + (59))mj		1	1	-
	67.97	59.81	62.58	55.76	53.89	47.28	45.02	50.45	51.02	57.86	61.58	66.23	(65)
5 Internal gain	s												
5. Internal Sain	lan	Fah	Max	A 19.11	Max	lua	I.J.	A	Con	Oct	Nev	Dec	
	Jan	Feb	iviar	Apr	iviay	Jun	Jui	Aug	Sep	Uct	NOV	Dec	
Metabolic gains	(Table 5)			1			1			1		1	-
	170.84	170.84	170.84	170.84	170.84	170.84	170.84	170.84	170.84	170.84	170.84	170.84	(66)
Lighting gains (ca	alculated in	Appendix l	., equation	L9 or L9a),	also see Ta	ble 5							
	62.44	55.46	45.10	34.15	25.52	21.55	23.28	30.27	40.62	51.58	60.20	64.18	(67)
Appliance gains	(calculated	in Appendi	x L, equatio	on L13 or L	13a), also se	ee Table 5							
	418.14	422.48	411.54	388.27	358.88	331.27	312.82	308.48	319.41	342.69	372.07	399.69	(68)
Cooking gains (c	alculated in	Appendix I	L, equation	L15 or L15	a), also see	Table 5						1	
	54 93	54.93	54.93	54 93	54.93	54 93	54 93	54.93	54.93	54.93	54.93	54 93	(69)
Pump and fap ga	ins (Table)	5a)	54.55	54.55	54.55	54.55	54.55	1 34.55	54.55	54.55	54.55	54.55] (03)
			2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	
	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00] (70)
Losses e.g. evap	oration (Tal	ble 5)						_		1		1	-
	-113.89	-113.89	-113.89	-113.89	-113.89	-113.89	-113.89	-113.89	-113.89	-113.89	-113.89	-113.89	(71)
Water heating g	ains (Table	5)											
	91.35	89.00	84.12	77.44	72.43	65.67	60.51	67.81	70.86	77.77	85.53	89.01	(72)
Total internal ga	ins (66)m -	+ (67)m + (6	8)m + (69)	m + (70)m	+ (71)m + (7	72)m							
	686.81	681.82	655.64	614.73	571.72	533.36	511.48	521.43	545.77	586.92	632.68	667.76	(73)
								•	•	•	•		-
6. Solar gains													
			Access f	factor	Area	Sol	ar flux		g	FF		Gains	
			Table	6d	m²	V	V/m²	spec	ific data	specific o	data	W	
								or I					-
East			0.7	7 X	1.82	x 1	.9.64	< 0.9 x	0.63	0.80	=	12.48	(76)
West			0.7	7 X [8.25	x 1	.9.64	« 0.9 x	0.63	0.80	=	56.59	(80)
North			0.7	7 x	10.56	x 1	.0.63	(0.9 x	0.63 >	0.80	=	39.22	(74)

NorthEast			
Solar gains in wa	tts ∑(74)m	(82)m	
	116.18	226.12	Ι

Total gains - internal and solar (73)m + (83)m

802.99	907.94	1034.45	1191.34	1308.87	1303.58	1238.21	1123.68	992.94	856.08

7. Mean intern	al tempera	ture (heati	ng season)										
Temperature du	ring heating	g periods ir	the living	area from T	able 9, Th1	L(°C)						21.00	(85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor	for gains f	or living are	ea n1,m (se	e Table 9a)									
	1.00	0.99	0.98	0.95	0.86	0.69	0.53	0.60	0.85	0.97	0.99	1.00	(86)
Mean internal te	mp of livin	g area T1 (s	steps 3 to 7	in Table 9c	:)								
	19.55	19.71	20.00	20.40	20.74	20.93	20.98	20.97	20.82	20.38	19.90	19.53	(87)
Temperature du	ring heating	a noriods ir	the rest of	f dwelling f	om Table (a Th2(°C)							

770.22

11.28

726.72

x 0.9 x

602.24

0.63

447.17

х

0.80

269.17

=

144.43

777.11

7.88

95.94

763.69 (84)

(75)

(83)

х

Temperature during heating periods in the rest of dwelling from Table 9, Th2("C)

0.77

378.81

х

576.61

2.00

737.15

	19.78	19.79	19.79	19.80	19.80	19.81	19.81	19.81	19.81	19.80	19.80	19.79	(88)
Utilisation facto	r for gains f	or rest of dv	velling n2.	m] ()
	1.00	0.99	0.98	0.93	0.80	0 59	0.40	0.46	0.77	0.96	0.99	1.00	(89)
Mean internal to	emperature	in the rest o	of dwelling	T2 (follow	stens 3 to	7 in Table 9))	0.40	0.77	0.50	0.55	1.00] (03)
		19.65	19.04	10.22	10.62	10.79	10.91	10.91	10 71	10.22	10.01	19.47	
Living area fract	10.45	18.05	10.94	19.55	19.05	19.78	19.01	19.01	19.71	19.52	(4) =	0.20	(90)
Living area fract	lon	fanthaudha	ما المنابع	~ fl A T1 .	(1 £1 A)				LI	ving area -	(4) =	0.29] (91)
wean internal to	emperature	for the who		g TLA X TI 4	F(I - TLA) X I	2				10.00	10.15	10.70	1 (00)
A	18.80	18.96	19.25	19.64	19.96	20.12	20.15	20.15	20.03	19.63	19.15	18.78	(92)
Apply adjustme	nt to the me	ean internal	temperati	ure from Ta	ible 4e whe	re appropr	iate					1	1
	18.80	18.96	19.25	19.64	19.96	20.12	20.15	20.15	20.03	19.63	19.15	18.78	(93)
8. Space heating	ng requirem	ient											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	or for gains.	nm		ľ									
			0.97	0.93	0.81	0.62	0.44	0.50	0.79	0.95	0 99	0.99	(94)
Liseful gains nr	- 0.55 nGm W (94	1)m v (84)m	0.57	0.55	0.01	0.02	0.44	0.50	0.75	0.55	0.55	0.55] (34)
			1007.00	1102.05	1061.80	906 74	E42.21	F.C.F. 0.1	790.02	917.06	769 12	750.72	
Monthly average	/97.83	897.40	1007.09	0.111	1001.80	800.74	543.31	202.91	780.93	817.00	708.13	/59./3] (95)
wonthly averag	e external to	emperature											1 (2 2)
	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20] (96)
Heat loss rate fo	or mean inte	ernal tempei	rature, Lm	, W [(39)m	ı x [(93)m -	(96)m]							1
	2311.36	2235.86	2023.05	1687.20	1294.16	856.99	551.71	581.05	925.02	1415.07	1896.41	2303.64	(97)
Space heating re	equirement,	, kWh/mont	h 0.024 x	[(97)m - (9	5)m] x (41)ı	n							,
	1126.06	899.40	755.87	420.73	172.88	0.00	0.00	0.00	0.00	444.92	812.36	1148.66	
									Σ(98	3)15, 10	12 =	5780.88	(98)
Space heating re	equirement	kWh/m²/ye	ar							(98)	÷ (4)	49.76	(99)
92 Eporgy rog													
	uirements -	individual h	heating sv	stems inclu	iding micro	-CHP							
Space boating	uirements -	individual h	neating sys	stems inclu	iding micro	-СНР							
Space heating	uirements -	individual h	neating sys	stems inclu	iding micro	-СНР						0.00	(201)
Space heating Fraction of space	e heat from	individual f	suppleme	stems inclu ntary syste	nding micro m (table 11	-СНР)				1 (20	21) -	0.00] (201)] (202)
Space heating Fraction of space Fraction of space	e heat from heat from	individual f secondary/ main syster	supplements supplement m(s)	stems inclu ntary syste	nding micro m (table 11	-CHP)	5			1 - (20)1) =	0.00] (201)] (202)] (202)
Space heating Fraction of spac Fraction of spac Fraction of spac	e heat from heat from heat from	secondary/ main syster main syster	neating sys supplement m(s) m 2	stems inclu ntary syste	nding micro m (table 11	-CHP)				1 - (20	01) =	0.00 1.00 0.00] (201)] (202)] (202)
Space heating Fraction of space Fraction of space Fraction of space Fraction of total	e heat from the heat from the heat from the heat from I space heat	secondary/ main syster main syster from main s	supplement (s) m 2 system 1	stems inclu	nding micro m (table 11	-CHP)			(20	1 - (20)2) x [1- (20)1) = 3)] =	0.00 1.00 0.00 1.00] (201)] (202)] (202)] (204)
Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total	e heat from e heat from e heat from l space heat l space heat	secondary/ main syster main syster from main s	supplement (s) m 2 system 1 system 2	stems inclu	nding micro m (table 11	-CHP)			(20	1 - (20)2) x [1- (20 (202) x (20	01) = 3)] = 03) =	0.00 1.00 0.00 1.00 0.00] (201)] (202)] (202)] (202)] (204)] (205)
Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Fraction of total Efficiency of ma	te heat from te heat from te heat from I space heat I space heat in system 1	secondary/ main syster main syster from main s from main s (%)	supplement (s) m 2 system 1 system 2	stems inclu	nding micro	-CHP)			(20	1 - (20)2) x [1- (20 (202) x (20	01) = 3)] = 03) =	0.00 1.00 0.00 1.00 0.00 89.70] (201)] (202)] (202)] (204)] (205)] (206)
Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma	e heat from e heat from e heat from I space heat I space heat in system 1 Jan	secondary/ main syster main syster from main s from main s (%) Feb	supplement m(s) m 2 system 1 system 2 Mar	stems inclu ntary syste Apr	nding micro m (table 11 May	-CHP) Jun	Jul	Aug	(20 Sep	1 - (20)2) x [1- (20 (202) x (20 Oct	01) = 3)] = 03) = Nov	0.00 1.00 1.00 1.00 0.00 89.70 Dec] (201)] (202)] (202)] (204)] (205)] (206)
Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu	e heat from e heat from e heat from I space heat I space heat in system 1 Jan uel (main sy	secondary/ main syster main syster from main s from main s (%) Feb stem 1), kW	supplement m(s) m 2 system 1 system 2 Mar h/month	stems inclu ntary syste Apr	nding micro m (table 11 May	-CHP) Jun	Jul	Aug	(20 Sep	1 - (20)2) x [1- (20 (202) x (20 Oct	01) = 3)] = 03) = Nov	0.00 1.00 0.00 1.00 0.00 89.70 Dec] (201)] (202)] (202)] (204)] (205)] (206)
Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu	e heat from the heat from the heat from I space heat I space heat I space heat U space heat Jan Uel (main sy	individual f secondary/ main syster main syster from main s from main s (%) Feb stem 1), kW 1002.67	supplement (s) m 2 system 1 system 2 Mar h/month 842.67	Apr 469.04	May 192.73	-CHP) Jun 0.00	Jul 0.00	Aug	(20 Sep 0.00	1 - (20)2) x [1- (20 (202) x (20 Oct 496.00	01) = 3)] = 03) = Nov	0.00 1.00 1.00 0.00 89.70 Dec 1280.56] (201)] (202)] (202)] (204)] (205)] (206)
Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu	e heat from the heat from the heat from I space heat I space heat I space heat Jan Uel (main sy 1255.36	secondary/ main syster main syster from main s from main s (%) Feb stem 1), kW 1002.67	supplement (s) m 2 system 1 system 2 Mar h/month 842.67	Apr 469.04	May 192.73	-CHP) Jun 0.00	Jul 0.00	Aug	(20 Sep 0.00 Σ(21:	1 - (20)2) x [1- (20 (202) x (20 Oct 496.00 1)15, 10	01) = 3)] = 03) = Nov 905.64 12 =	0.00 1.00 0.00 1.00 0.00 89.70 Dec 1280.56 5444.68] (201)] (202)] (202)] (204)] (205)] (206)] (206)] (211)
Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating for Water heating	e heat from the heat from the heat from I space heat I space heat I space heat Jan Uel (main sy 1255.36	individual f secondary/ main syster main syster from main s from main s (%) Feb stem 1), kW 1002.67	supplement (s) m 2 system 1 system 2 Mar h/month 842.67	Apr 469.04	May	-CHP) Jun 0.00	Jul 0.00	Aug	(20 Sep 0.00 Σ(21:	1 - (20)2) x [1- (20 (202) x (20 Oct 496.00 1)15, 10	01) = 3)] = 03) = Nov 905.64 12 =	0.00 1.00 1.00 0.00 89.70 Dec 1280.56 5444.68] (201)] (202)] (202)] (204)] (205)] (206)]] (211)
Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating Efficiency of wa	ter heater we heat from we heat from the heat from theat from the heat from the heat from the heat from	individual f secondary/ main syster main syster from main s from main s (%) Feb stem 1), kW 1002.67	supplement (s) m 2 system 1 system 2 Mar h/month 842.67	Apr 469.04	May 192.73	-CHP) Jun 0.00	Jul 0.00	Aug	(20 Sep 0.00 Σ(21:	1 - (20)2) x [1- (20 (202) x (20 Oct 496.00 1)15, 10	01) = 3)] = 03) = Nov 905.64 12 =	0.00 1.00 0.00 1.00 0.00 89.70 Dec 1280.56 5444.68] (201)] (202)] (202)] (204)] (205)] (206)] (206)
Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating for Water heating Efficiency of war	ter heater (87.90	individual f secondary/ main syster main syster from main s from main s (%) Feb stem 1), kW 1002.67	supplement (s) m 2 system 1 system 2 Mar h/month 842.67	Apr 469.04 86.42	May 192.73	-CHP) Jun 0.00 79.60	Jul 0.00 79.60	Aug 0.00 79.60	(20 Sep 0.00 Σ(21: 79.60	1 - (20)2) x [1- (20 (202) x (20 Oct 1)15, 10 86.46	01) = 3)] = 03) = Nov 905.64 12 = 87.53	0.00 1.00 1.00 0.00 89.70 Dec 1280.56 5444.68 87.96] (201)] (202)] (202)] (204)] (205)] (206)] (211)] (211)
Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating Water heating f	uirements - e heat from e heat from se heat from I space heat I space heat in system 1 Jan uel (main sy 1255.36 ter heater 87.90 uel, kWh/m	individual f secondary/ main syster main syster from main s from main s (%) Feb stem 1), kW 1002.67 87.75 onth	supplement (s) m 2 system 1 system 2 Mar h/month 842.67 87.37	Apr 469.04 86.42	May 192.73 84.33	-CHP) Jun 0.00 79.60	Jul 0.00 79.60	Aug 0.00 79.60	(20 Sep 0.00 Σ(21: 79.60	1 - (20)2) x [1- (20 (202) x (20 Oct 1)15, 10 86.46	01) = 3)] = 03) = Nov 905.64 12 = 87.53	0.00 1.00 0.00 1.00 0.00 89.70 Dec 1280.56 5444.68 87.96] (201)] (202)] (202)] (204)] (205)] (206)] (206)] (211)
Space heating Fraction of space Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating for Water heating Efficiency of war Water heating for	uirements - e heat from e heat from l space heat l space l space heat l space hea	individual f secondary/ main syster from main s from main s (%) Feb stem 1), kW 1002.67 87.75 onth 218.01	supplement (s) m 2 system 1 system 2 Mar h/month 842.67 87.37 229.90	Apr 469.04 86.42 208.18	May 192.73 84.33	-CHP) Jun 0.00 79.60 192.72	Jul 0.00 79.60 184.64	Aug 0.00 79.60	(20 Sep 0.00 Σ(21: 79.60	1 - (20)2) x [1- (20 (202) x (20 Oct 1)15, 10 86.46 215.90	01) = 3)] = 3)] = 03) = Nov 905.64 12 = 87.53 225.58	0.00 1.00 0.00 89.70 Dec 1280.56 5444.68 87.96 87.96] (201)] (202)] (202)] (204)] (205)] (206)] (206)] (211)] (217)]
Space heating Fraction of space Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating Water heating f	e heat from the heat from the heat from the heat from the heat from the heat from the heat from the heat from the heat from the heat from the	individual f secondary/ main syster main syster from main s from main s (%) Feb stem 1), kW 1002.67 87.75 onth 218.01	supplement (s) m 2 system 1 system 2 Mar h/month 842.67 87.37 229.90	Apr 469.04 86.42 208.18	May 192.73 84.33 206.54	-CHP) Jun 0.00 79.60 192.72	Jul 0.00 79.60 184.64	Aug 0.00 79.60 205.83	(20 Sep 0.00 Σ(21: 79.60 208.10	1 - (20)2) x [1- (20 (202) x (20 Oct 496.00 1)15, 10 86.46 215.90 Σ(219a)1	01) = 3)] = 03) = Nov 905.64 12 = 87.53 225.58 12 =	0.00 1.00 0.00 1.00 0.00 89.70 Dec 1280.56 5444.68 87.96 87.96 240.81 2583.16] (201)] (202)] (202)] (204)] (205)] (205)] (206)] (211)] (211)] (217)] (217)
Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating Water heating f Annual totals	uirements - e heat from e heat from I space heat I space	individual f secondary/ main syster from main s from main s (%) Feb stem 1), kW 1002.67 87.75 onth 218.01	supplement (s) m 2 system 1 system 2 Mar h/month 842.67 87.37 229.90	Apr 469.04 86.42 208.18	May 192.73 84.33 206.54	-CHP) Jun 0.00 79.60 192.72	Jul 0.00 79.60 184.64	Aug 0.00 79.60 205.83	(20 Sep 0.00 Σ(21: 79.60 208.10	$1 - (20) \times [1 - (20) \times [1 - (20) \times $	01) = 3)] = 3)] = 3) = Nov 905.64 12 = 87.53 225.58 12 = 225.58	0.00 1.00 0.00 89.70 Dec 1280.56 5444.68 87.96 87.96 240.81 2583.16] (201)] (202)] (202)] (204)] (205)] (206)] (206)] (211)] (217)] (217)] (219)
Space heating Fraction of space Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating Efficiency of war Water heating fu	uirements - ee heat from ee heat from is pace heat is pace heat is system 1 Jan uel (main sy 1255.36 ter heater 87.90 uel, kWh/m 246.94	individual f secondary/ main syster from main s from main s (%) Feb stem 1), kW 1002.67 87.75 onth 218.01	supplement (s) m 2 system 1 system 2 Mar h/month 842.67 87.37 229.90	Apr 469.04 86.42 208.18	May 192.73 84.33 206.54	-CHP) Jun 0.00 79.60 192.72	Jul 0.00 79.60 184.64	Aug 0.00 79.60 205.83	(20 Sep 0.00 Σ(21: 79.60 208.10	1 - (20)2) x [1- (20 (202) x (20 Oct 496.00 1)15, 10 86.46 215.90 Σ (219a)1	01) = 3)] = 03) = Nov 905.64 12 = 87.53 225.58 12 =	0.00 1.00 0.00 1.00 0.00 89.70 Dec 1280.56 5444.68 87.96 240.81 2583.16 5444.68] (201)] (202)] (202)] (204)] (205)] (205)] (206)] (211)] (211)] (217)] (219)
Space heating Fraction of space Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating fu Annual totals Space heating fu Water heating fu	uirements - e heat from e heat from l space heat l space l space heat l space hea	individual f secondary/ main syster from main s from main s (%) Feb stem 1), kW 1002.67 87.75 onth 218.01	supplement (s) m 2 system 1 system 2 Mar h/month 842.67 87.37 229.90	Apr 469.04 86.42 208.18	May 192.73 84.33 206.54	-CHP) Jun 0.00 79.60 192.72	Jul 0.00 79.60 184.64	Aug 0.00 79.60 205.83	(20 Sep 0.00 Σ(21: 79.60 208.10	$1 - (20) \times [1 - (20) \times [1 - (20) \times $	01) = 3)] = 3)] = 03) = Nov 905.64 12 = 87.53 225.58 12 = 12 =	0.00 1.00 0.00 1.00 89.70 Dec 1280.56 5444.68 87.96 2283.16 5444.68] (201)] (202)] (202)] (204)] (205)] (206)] (211)] (211)] (217)] (219)]
Space heating Fraction of space Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating f Annual totals Space heating fu Water heating fu	uirements - e heat from e heat from e heat from I space heat I space h	individual f secondary/ main syster from main s from main s (%) Feb stem 1), kW 1002.67 87.75 onth 218.01	supplement (s) m 2 system 1 system 2 Mar h/month 842.67 87.37 229.90	Apr 469.04 86.42 208.18	May May 192.73 84.33 206.54	-CHP) Jun 0.00 79.60 192.72	Jul 0.00 79.60 184.64	Aug 0.00 79.60 205.83	(20 Sep 0.00 Σ(21: 79.60 208.10	1 - (20)2) x [1- (20 (202) x (20 Oct 496.00 1)15, 10 86.46 215.90 Σ (219a)1	01) = 3)] = 03) = Nov 905.64 12 = 87.53 225.58 12 = 12 =	0.00 1.00 0.00 1.00 0.00 89.70 Dec 1280.56 5444.68 87.96 240.81 2583.16 5444.68] (201)] (202)] (202)] (204)] (205)] (205)] (206)] (211)] (211)] (217)] (219)]

central heating pump or water pump within warm air heating	g unit		30.00			(230c)
boiler flue fan			45.00			(230e)
Total electricity for the above, kWh/year					75.00	(231)
Electricity for lighting (Appendix L)					441.10	(232)
Total delivered energy for all uses		(211)	(221) + (231) + (2	232)(237b) =	9543.94	(238)
10. Evelopeta individual bactica suctous includios using 0						
10a. Fuel costs - Individual heating systems including micro-CF	1P 					
	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	6444.68	х	3.48	x 0.01 =	224.27	(240)
Water heating	2583.16	х	3.48	x 0.01 =	89.89	(247)
Pumps and fans	75.00	х	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	441.10	x	13.19	x 0.01 =	58.18	(250)
Additional standing charges					120.00	(251)
Total energy cost			(240)(242) +	(245)(254) =	502.24	(255)
11a. SAP rating - individual heating systems including micro-Cl	HP					
Energy cost deflator (Table 12)					0.42	(256)
Energy cost factor (ECF)					1.31	(257)
SAP value					81.74]
SAP rating (section 13)					82	(258)
SAP band					В]
						-
12a. CO ₂ emissions - individual heating systems including micr	o-CHP					

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO₂/year	
Space heating - main system 1	6444.68	x	0.216	= [1392.05	(261)
Water heating	2583.16	x	0.216	= [557.96	(264)
Space and water heating			(261) + (262) +	(263) + (264) = [1950.01	(265)
Pumps and fans	75.00	x	0.519	= [38.93	(267)
Electricity for lighting	441.10	x	0.519	= [228.93	(268)
Total CO2, kg/year				(265)(271) = [2217.87	(272)
Dwelling CO ₂ emission rate				(272) ÷ (4) = [19.09	(273)
El value				[81.56]
El rating (section 14)				[82	(274)
El band				[В]

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

	Energy kWh/year		Primary factor		Primary Energy kWh/year	,
Space heating - main system 1	6444.68	x	1.22	=	7862.51	(261)
Water heating	2583.16	х	1.22	=	3151.45	(264)
Space and water heating			(261) + (262) +	- (263) + (264) =	11013.97	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	441.10	x	3.07	=	1354.16	(268)
Primary energy kWh/year					12598.38	(272)
Dwelling primary energy rate kWh/m2/year					108.44	(273)

SAP Worksheet Design - Draft



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

Assessor name	Mr Ioan	nis Protonol	tarios					Assessor nun	nber	23		
Client								Last modified	ł	11/08	/2021	
Address	Flat 10,	13 Netherha	all Gardens	, London	, NW3							
1. Overall dwelling dim	ensions											
					Area (m²)			Average storey height (m)	,	Vo	lume (m³)	
Lowest occupied					113.54	<mark>(1a)</mark> x	Ε	2.78	(2a) =		315.64	(3a)
Total floor area	(1a) + (1b) + (1e	c) + (1d)(1n) =	113.54	(4)						
Dwelling volume								(3a) + (3b) + (3	c) + (3d)(3	n) =	315.64	(5)
2. Ventilation rate												
										m	' per hour	
Number of chimneys							Г	0	x 40 =		0	(6a)
Number of open flues							Ì	0	 x 20 =		0	(6b)
Number of intermittent	fans						Ī	4	 x 10 =		40	(7a)
Number of passive vents							[0	x 10 =		0	(7b)
Number of flueless gas f	res							0	x 40 =		0	(7c)
										Air o	hanges pei hour	r
Infiltration due to chimn	eys, flues, far	s, PSVs		(6	a) + (6b) + (7	7a) + (7b) +	(7c) = [40	÷ (5) =		0.13	(8)
If a pressurisation test he	as been carrie	d out or is ii	ntended, p	roceed to	(17), otherv	vise continu	ie from	(9) to (16)				
Air permeability value, q	50, expressed	l in cubic me	etres per h	our per s	quare metre	of envelop	e area				5.00	(17)
If based on air permeabi	lity value, the	n (18) = [(17	7) ÷ 20] + (8	8), otherv	vise (18) = (1	L6)					0.38	(18)
Number of sides on whic	h the dwellin	g is sheltere	ed								2	(19)
Shelter factor								1 ·	- [0.075 x (19	9)] =	0.85	(20)
Infiltration rate incorpor	ating shelter	factor							(18) x (2	0) =	0.32	(21)
Infiltration rate modified	for monthly	wind speed	:									
Jan	Feb	Mar	Apr	May	Jun	Jul	Au	g Sep	Oct	Nov	Dec	
Monthly average wind s	beed from Tal	ble U2				_						-
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.7	0 4.00	4.30	4.50	4.70	(22)
Wind factor (22)m ÷ 4							-1					٦
1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.9	3 1.00	1.08	1.13	1.18	(22a)
Adjusted infiltration rate	(allowing for	shelter and	wind facto	or) (21) x	(22a)m	0.00		0 0 00		0.00		
Calculate offective air ch	0.40	0.39	0.35	0.34	0.30	0.30	0.3	0 0.32	0.34	0.36	0.38	(22b)
If machanical vantilat	ionu oir chong	the application	ugh custom									(222)
If halanced with heat		iciency in %	allowing f	n nr in-uso	factor from ⁻	Table 1b					N/A	(23c)
d) natural ventilation	or whole hou	ise positive	input vent	ilation fro	om loft						11/7	_ (230)
0.58	0.58	0.58	0.56	0.56	0.55	0.55	05	4 0.55	0.56	0.56	0.57	(24d)
Effective air change rate	- enter (24a)	or (24b) or ((24c) or (24	4d) in (25)	0.55	1 0.5	. 0.55	0.00	5.50		_ (∠-ru)
0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.5	4 0.55	0.56	0.56	0.57	(25)
0.00												_ 、 _ /



3. Heat losses a	and heat lo	ss paramet	er	_								-	
Element			а	Gross rea, m ²	Openings m ²	Net A,	area m²	U-value W/m²K	AxUW	//К к-\ kJ,	/alue, /m².K	Ахк, kJ/K	
Door						1.	.96 x	1.40	= 2.74				(26)
Window						23	.92 x	1.33	= 31.71				(27)
Basement floor						113	3.54 x	0.18	= 20.44	Ļ			(28)
External wall						119	9.35 x	0.18	= 21.48	3			(29a)
Party wall						10	.13 x	0.00	= 0.00				(32)
Roof						62	.70 x	0.15	= 9.41				(30)
Total area of ext	ernal eleme	ents ∑A, m²	!			323	1.47						(31)
Fabric heat loss,	W/K = ∑(A	× U)							(2	5)(30) + (3	32) =	85.78	(33)
Heat capacity Cr	n = ∑(А x к)							(28)	(30) + (32)	+ (32a)(3	2e) =	N/A	(34)
Thermal mass pa	arameter (T	MP) in kJ/r	n²K									250.00	(35)
Thermal bridges	: Σ(L x Ψ) ca	alculated us	sing Appen	dix K								12.46	(36)
Total fabric heat	loss									(33) + (3	36) =	98.24	(37)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat	loss calcula	ited month	ly 0.33 x (2	25)m x (5)									
	60.76	60.43	60.09	58.54	58.25	56.90	56.90	56.65	57.42	58.25	58.84	59.45	(38)
Heat transfer co	efficient, W	//K (37)m +	+ (38)m										
	159.00	158.66	158.33	156.78	156.49	155.14	155.14	154.89	155.66	156.49	157.08	157.69	
									Average = 2	<u>(</u> 39)112	/12 =	156.78	(39)
Heat loss param	eter (HLP),	W/m²K (39	9)m ÷ (4)										
	1.40	1.40	1.39	1.38	1.38	1.37	1.37	1.36	1.37	1.38	1.38	1.39	
									Average = 2	<u>(</u> 40)112	/12 =	1.38	(40)
Number of days	in month (1	Fable 1a)											
	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)
4. Water heatin	ng energy r	equiremen	t										
Assumed occupa	ancy. N											2.83	(42)
Annual average	hot water u	isage in litre	es per dav '	Vd.average	= (25 x N) +	36						101.52	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage	in litres pe	r dav for ea	ach month '	Vd.m = fact	, tor from Tab	le 1c x (43	3)	U	•				
Ū	111.67	, 107.61	103.55	99.49	95.43	91.37	91.37	95.43	99.49	103.55	107.61	111.67	7
								1		Σ(44)1	.12 =	1218.23	(44)
Energy content of	of hot wate	r used = 4.1	L8 x Vd,m x	nm x Tm/3	3600 kWh/m	onth (see	Tables 1b	, 1c 1d)		2()=			_ (,
	165.60	144.84	149.46	130.30	125.03	107.89	99.98	114.72	116.10	135.30	147.69	160.38	
										∑(45)1	.12 = 🔤	1597.29	(45)
Distribution loss	0.15 x (45))m											
	24.84	21.73	22.42	19.55	18.75	16.18	15.00	17.21	17.41	20.29	22.15	24.06	(46)
Water storage lo	oss calculate	ed for each	month (55	5) x (41)m									
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(56)
If the vessel cont	tains dedica	ated solar s	torage or d	ledicated W	/WHRS (56)r	m x [(47) -	Vs] ÷ (47),	else (56)					
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(57)
Primary circuit lo	oss for each	month fro	m Table 3										
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)
Combi loss for ea	ach month	from Table	3a, 3b or 3	c									-
	50.96	46.03	50.96	49.06	48.63	45.06	46.56	48.63	49.06	50.96	49.32	50.96	(61)
Total heat requi	red for wate	er heating o	calculated f	or each mo	onth 0.85 x ((45)m + (4	6)m + (57)	m + (59)m +	- (61)m				

			Access f Table	actor 6d	Area m²	Sol W	ar flux //m²	speci or Ta	g fic data able 6b	FF specific d or Table	lata 6c	Gains W	
6. Solar gains													
	00.00	075.10	049.22	008.72	500.21	526.27	500.03	210.22	540.58	201.31	020.57	001.22] (73)
i otai internai ga		675 10	640 22	608 72	566 21	528.27	506.62	516 52	540 59	581 21	626 57	661 22	(72)
Total internal ca	ins (66)m	67.79	8 m + (60)	1/1.21	12.22	72)m	00.33	07.01	70.65	11.59	03.33	00.0U] (72)
water nearing g		00 70	82.02	77 21	72.22	65.47	60.22	67.61	70.65	77.50	05.33	00 00	(72)
Water heating g	ains (Tahle	5)	-113.30	-113.30	-115.56	-113.36	-113.30	-115.56	-115.56	-115.50	-113.30	-113.30] (/ 1)
2033C3 C.g. Evap	_112 20	_112 20	-112 20	-113 30	_112 20	-113 30	-112 20	-112 20	-113 39	_112 20	_112 20	-112 20	7 (71)
	oration (Tak) 5.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00] (70)
	3 00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3 00	3.00	3.00	3 00	(70)
Pump and fan ga	ains (Table 1	5a)	54.04	54.04	57.04	54.04	54.04	54.04	57.04	54.04	54.04	57.04	
Sooning Baning (c	5/ 9/	5/ 9/	5/ 2/	5/ 9/	5/ 2/	5/ 8/	54.84	54.84	5/ 8/	5/ 8/	54.84	5/1 9/1	(60)
Cooking gains (c	alculated in	Annendix		115 or 115		Table 5	500.75	304.31	515.50	550.20	307.20	554.54] (00)
	412.76	417.04	406.25	383 27	354.26	327.00	308 79	304 51	315 30	338.28	367.28	394 54	(68)
Appliance gains	(calculated	in Appendi	x L. equatio	on L13 or L2	L3a). also se	e Table 5		10.00		00.01] (0,)
-0	61.64	54.74	44.52	33.71	25.20	21.27	22.98	29.88	40.10	50.91	59.42	63.35	(67)
Lighting gains (ca	alculated in	Appendix I	L, equation	L9 or L9a),	also see Ta	ble 5] ()
-	170.07	170.07	170.07	170.07	170.07	170.07	170.07	170.07	170.07	170.07	170.07	170.07	(66)
Metabolic gains	(Table 5)			•				Ū					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
5. Internal gain	s												
	67.80	59.67	62.44	55.59	53.73	47.14	44.88	50.30	50.87	57.73	61.43	66.07	(65)
Heat gains from	water heat	ing (kWh/m	nonth) 0.25	5 × [0.85 ×	(45)m + (61	.)m] + 0.8 ×	[(46)m + (5	57)m + (59)	m]				-
									_	∑(64)1	.12 =2	183.47	(64)
	216.56	190.87	200.42	179.37	173.66	152.95	146.54	163.35	165.16	186.26	197.00	211.34	
Output from wa	ter heater f	or each mo	nth (kWh/ı	month) (62	2)m + (63)m	1							-
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
Solar DHW input	t calculated	using Appe	endix G or A	Appendix H							1		-
	216.56	190.87	200.42	179.37	173.66	152.95	146.54	163.35	165.16	186.26	197.00	211.34	(62)
	-						1						٦

0.77

0.77

0.77

0.77

417.31

Mar

0.98

20.01

Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

North

West

SouthWest

NorthWest

Solar gains in watts ∑(74)m...(82)m

138.38

Total gains - internal and solar (73)m + (83)m 818.44

7. Mean internal temperature (heating season)

Jan

1.00

19.54

259.87

934.98

Feb

0.99

19.71

Utilisation factor for gains for living area n1,m (see Table 9a)

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

Temperature during heating periods in the living area from Table 9, Th1(°C)

11.15

6.67

3.05

3.05

778.53

May

0.84

20.75

х

х

х

х

1066.53 1225.28 1344.73 1339.08 1272.61 1156.39

810.80

Jun

0.68

20.93

10.63

19.64

36.79

11.28

765.98

Jul

0.52

20.98

х

х

х

х

616.56

Apr

0.94

20.41

x 0.9 x

x 0.9 x

x 0.9 x

x 0.9 x

639.86

Aug

0.59

20.97

0.63

0.63

0.63

0.63

485.74

1026.32

Sep

0.83

20.82

х

х

х

х

0.80

0.80

0.80

0.80

304.10

885.41

Oct

0.97

20.39

41.41

45.75

39.20

12.02

115.51

21.00

Dec

1.00

19.51

776.73 (84)

=

=

=

=

170.21

796.77

Nov

0.99

19.89

(74)

(80)

(79)

(81)

(83)

(85)

(86)

(87)

	10.76	10.77	10 77	10.79	10.79	10 70	10.70	10.70	10 70	10.79	10.79	10.77	(00)
Litilization facto	19.70	19.77	19.77	 	19.78	19.79	19.79	19.79	19.79	19.78	19.78	19.77] (00)
					0.70	0.57	0.00	0.45	0.75	0.05	0.00	1.00	
	0.99	0.99	0.97	0.92	0.79		0.38	0.45	0.75	0.95	0.99	1.00] (89)
Mean internal to	emperature	in the rest	of dwelling	g 12 (follow	steps 3 to	/ in Table S	JC)					-	1
	18.46	18.63	18.93	19.32	19.62	19.76	19.79	19.78	19.69	19.31	18.82	18.44] (90) T
Living area fract	ion								Li	ving area ÷	(4) =	0.46] (91)
Mean internal to	emperature	for the wh	ole dwellin	g fLA x T1 +	-(1 - fLA) x T	72				1		1	-
	18.96	19.13	19.42	19.82	20.13	20.30	20.33	20.33	20.21	19.80	19.31	18.93	(92)
Apply adjustme	nt to the me	an internal	temperatu	ure from Ta	ble 4e whe	re appropr	iate						-
	18.96	19.13	19.42	19.82	20.13	20.30	20.33	20.33	20.21	19.80	19.31	18.93	(93)
8. Space heating	ng requirem	ent											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains, ı	յՠ		-	-								
	0.99	0.99	0.97	0.92	0.81	0.62	0.45	0.51	0.78	0.95	0.99	0.99	(94)
Useful gains. nm	1Gm. W (94)m x (84)m											
0 / 1	812.55	922.63	1034.94	1127.76	1083.49	829.48	569.20	590.74	802.50	841.22	786.46	772.23	(95)
Monthly averag	e external to	emperature	e from Tabl	e U1] (,
. ,	4 30	4 90	6 50	8 90	11 70	14 60	16 60	16 40	14 10	10.60	7 10	4 20	(96)
Heat loss rate fo	or mean inte	ernal tempe	prature Im	W [(39)m	x [(93)m -	(96)ml	10.00	10.40	14.10	10.00	7.10	4.20] (50)
	2330 59	2257 15	2046.07	1711.86	1319.87	883.80	579.34	608.45	951 / 0	1440.03	1918 //	2322.08] (97)
Snace heating re		kWh/mon	th 0.024 x	[(97)m - (9	5 m x (41)r	n 000.00	575.54	000.45	551.40	1440.03	1910.44	2522.50] (37)
Space neuting r	1120 42	206.20	752 29	420 55	175 07	0.00	0.00	0.00	0.00	445.52	915.02	1152 75	1
	1125.42	890.80	752.20	420.55	175.87	0.00	0.00	0.00	5/0	8)1 5 10	12 -	5789.22]] (98)
									Z	5)15, 10	.12	5765.22	(30)
Space heating r	auiromont	$kMh/m^2/w$	har							(00)	÷ (4)	50.00	(00)
Space heating re	equirement	kWh/m²/ye	ear							(98)	÷ (4)	50.99	(99)
Space heating re 9a. Energy req	equirement uirements -	kWh/m²/ye	ear heating sys	stems inclu	iding micro	-СНР				(98)	÷ (4)	50.99	(99)
Space heating re 9a. Energy req Space heating	equirement uirements -	kWh/m²/ye	ear heating sys	stems inclu	ding micro	-СНР)	(98)	÷ (4)	50.99] (99)
Space heating re 9a. Energy req Space heating Fraction of space	equirement uirements - e heat from	kWh/m²/ye individual secondary,	ear heating sys /supplemen	stems inclu ntary system	nding micro m (table 11	-CHP))	(98)	÷ (4)	50.99] (99)] (201)
Space heating ro 9a. Energy req Space heating Fraction of spac Fraction of spac	equirement uirements - e heat from e heat from	kWh/m²/ye individual secondary, main syste	ear heating sys /supplements: m(s)	stems inclu ntary system	iding micro m (table 11	-CHP)				(98)	÷ (4)	50.99 0.00 1.00] (99)] (201)] (202)
Space heating re 9a. Energy req Space heating Fraction of spac Fraction of spac Fraction of spac	equirement uirements - e heat from e heat from e heat from	kWh/m ² /ye individual secondary, main syste main syste	ear heating sys /supplemen m(s) m 2	stems inclu ntary system	iding micro m (table 11	-CHP)				(98) 1 - (20	÷ (4)	50.99 0.00 1.00 0.00] (99)] (201)] (202)] (202)
Space heating ro 9a. Energy req Space heating Fraction of spac Fraction of spac Fraction of spac Fraction of spac	equirement uirements - e heat from e heat from e heat from space heat	kWh/m²/ye individual secondary, main syste main syste from main	ear heating sys /supplemen m(s) m 2 system 1	stems inclu ntary system	ding micro	-CHP)			(20	(98) 1 - (20 02) × [1- (20	÷ (4) D1) = 3)] =	50.99 0.00 1.00 0.00 1.00] (99)] (201)] (202)] (202)] (204)
Space heating re 9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total	equirement uirements - e heat from e heat from e heat from space heat space heat	kWh/m ² /ye individual secondary, main syste main syste from main from main	ear heating sys /supplemen .m(s) .m 2 system 1 system 2	stems inclu ntary system	nding micro	-CHP)			(20	(98) 1 - (20)2) × [1- (20 (202) × (20	÷ (4) D1) = 3)] = D3) =	50.99 0.00 1.00 0.00 1.00 0.00] (99)] (201)] (202)] (202)] (202)] (204)] (205)
Space heating re 9a. Energy req Space heating Fraction of spac Fraction of spac Fraction of spac Fraction of total Fraction of total Efficiency of ma	equirement uirements - e heat from e heat from e heat from space heat space heat in system 1	kWh/m²/ye individual secondary, main syste main syste from main from main (%)	ear heating sys /supplemen m(s) m 2 system 1 system 2	stems inclu	ding micro	-CHP)			(20	(98) 1 - (2()2) x [1- (20 (202) x (2(÷ (4) D1) = 3)] = D3) =	50.99 0.00 1.00 0.00 1.00 0.00 89.70] (99)] (201)] (202)] (202)] (202)] (204)] (205)] (206)
Space heating re 9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma	equirement uirements - e heat from e heat from space heat space heat in system 1 Jan	kWh/m²/ye individual secondary, main syste main syste from main from main (%) Feb	ear heating sys /supplemen m(s) m 2 system 1 system 2 Mar	stems inclu ntary syster	nding micro m (table 11 May	-CHP) Jun	Jul	Aug	(20 Sep	(98) 1 - (20)2) × [1- (20 (202) × (20 Oct	÷ (4)	50.99 0.00 1.00 0.00 1.00 0.00 89.70 Dec] (99)] (201)] (202)] (202)] (204)] (205)] (206)
Space heating re 9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu	equirement uirements - e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sys	kWh/m²/ye individual secondary, main syste main syste from main from main (%) Feb stem 1), kW	ear heating sys (supplemen m(s) m 2 system 1 system 2 Mar Vh/month	stems inclu ntary system Apr	ding micro m (table 11 May	-CHP) Jun	Jul	Aug	(20 Sep	(98) 1 - (20)2) x [1- (20 (202) x (20 Oct	÷ (4)	50.99 0.00 1.00 0.00 1.00 89.70 Dec] (99)] (201)] (202)] (202)] (202)] (204)] (205)] (206)
Space heating re 9a. Energy req Space heating Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu	equirement uirements - e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sys	kWh/m²/ye individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 999.78	ear heating sys /supplemen em(s) em 2 system 1 system 1 system 2 Mar /h/month 838.66	stems inclu ntary syster Apr 468.84	ding micro m (table 11 May 196.06	-CHP) Jun 0.00	Jul 0.00	Aug 0.00	(20 Sep 0.00	(98) 1 - (20)2) x [1- (20 (202) x (20 Oct 496.67	÷ (4)	50.99 0.00 1.00 0.00 1.00 0.00 89.70 Dec 1286.24] (99)] (201)] (202)] (202)] (204)] (205)] (206)
Space heating re 9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu	equirement uirements - e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sy: 1259.11	kWh/m²/ye individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 999.78	ear heating sys /supplemen m(s) m 2 system 1 system 2 Mar /h/month 838.66	stems inclu ntary system Apr 468.84	ding micro m (table 11 May 196.06	-CHP) Jun 0.00	Jul 0.00	Aug 0.00	(20 Sep 0.00 Σ(21)	(98) 1 - (20)2) x [1- (20 (202) x (20 Oct 496.67 1)15, 10	÷ (4) D1) = 3)] = D3) = Nov 908.61 12 =	50.99 0.00 1.00 0.00 1.00 0.00 89.70 Dec 1286.24 5453.98] (99)] (201)] (202)] (202)] (204)] (205)] (206)]] (211)
Space heating re 9a. Energy req Space heating Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating	equirement uirements - e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sys 1259.11	kWh/m²/ye individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 999.78	ear heating sys /supplemen em(s) em 2 system 1 system 1 system 2 Mar /h/month 838.66	stems inclu ntary system Apr 468.84	nding micro m (table 11 May 196.06	-CHP) Jun 0.00	Jul 0.00	Aug 0.00	(20 Sep 0.00 Σ(21:	(98) 1 - (20)2) x [1- (20 (202) x (20 Oct 496.67 1)15, 10	÷ (4) (1) = (3)] = (3) = (4) = (5) = (5) = (4) = (5) = (5	50.99 0.00 1.00 0.00 1.00 0.00 89.70 Dec 1286.24 1286.24] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (206)] (211)
Space heating re 9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating Efficiency of wa	equirement uirements - e heat from e heat from e heat from space heat in system 1 Jan uel (main sy: 1259.11 ter heater	kWh/m²/ye individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 999.78	ear heating sys /supplemen m(s) m 2 system 1 system 2 Mar /h/month 838.66	stems inclu ntary system Apr 468.84	ding micro m (table 11 May 196.06	-CHP) Jun 0.00	Jul 00.0	Aug	(20 Sep 0.00 Σ(21	(98) 1 - (20)2) x [1- (20 (202) x (20 (202) x (20 Oct 496.67 1)15, 10	÷ (4) D1) = 3)] = D3) = Nov 908.61 12 =	50.99 0.00 1.00 0.00 1.00 0.00 89.70 Dec 1286.24 5453.98] (99)] (201)] (202)] (202)] (204)] (205)] (206)]] (211)
Space heating re 9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating Efficiency of war	equirement uirements - e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sys 1259.11 ter heater	kWh/m²/ye individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 999.78	ear heating sys /supplemen em(s) em 2 system 1 system 2 Mar /h/month 838.66	Apr 468.84	May 196.06	-CHP) Jun 0.00	Jul 0.00	Aug 0.00	(20 Sep 0.00 Σ(21: 79.60	(98) 1 - (20)2) x [1- (20 (202) x (20 Oct 496.67 1)15, 10	÷ (4)	50.99 0.00 1.00 0.00 1.00 0.00 89.70 Dec 1286.24 1286.24 5453.98] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (206)] (211)
Space heating re 9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating Efficiency of war Water heating fu	equirement uirements - e heat from e heat from e heat from space heat in system 1 Jan uel (main sy: 1259.11 ter heater 87.91 uel, kWh/m	kWh/m²/ye individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 999.78 87.75 onth	ear heating sys /supplemen m(s) m 2 system 1 system 2 Mar /h/month 838.66 87.37	Apr 468.84 86.42	May 196.06 84.38	-CHP) Jun 0.00 79.60	Jul 0.00 79.60	Aug 0.00 79.60	(20 Sep 0.00 Σ(21) 79.60	(98) 1 - (20)2) × [1- (20 (202) × (20 Oct 496.67 1)15, 10 86.47	÷ (4) D1) = 3)] = D3) = Nov 908.61 12 = 87.54	50.99 0.00 1.00 0.00 1.00 0.00 89.70 Dec 1286.24 5453.98 87.97] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (211)] (211)
Space heating re 9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating Efficiency of war Water heating fu	equirement uirements - e heat from e heat from e heat from l space heat in system 1 Jan uel (main system 1 1259.11 ter heater 87.91 uel, kWh/m 246.36	kWh/m²/ye individual secondary, main syste from main from main (%) Feb stem 1), kW 999.78 87.75 onth 217.52	ear heating sys /supplemen em(s) em 2 system 1 system 2 Mar /h/month 838.66 87.37	Apr 468.84 86.42	May 196.06 84.38	-CHP) Jun 0.00 79.60	Jul 0.00 79.60	Aug 0.00 79.60	(20 Sep 0.00 Σ(21: 79.60	(98) 1 - (20)2) × [1- (20 (202) × (20 Oct 496.67 1)15, 10 86.47 215.41	÷ (4) (1) = (3)] = (3) = (4) = (4) = (5) = (4) = (5) = (5	50.99 0.00 1.00 0.00 1.00 0.00 89.70 Dec 1286.24 5453.98 87.97 87.97] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (206)] (211)] (217)
Space heating re 9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating Efficiency of war Water heating fu	equirement uirements - e heat from e heat from e heat from space heat space heat space heat in system 1 Jan uel (main system 1259.11 ter heater 87.91 uel, kWh/m 246.36	kWh/m²/ye individual secondary, main syste from main from main (%) Feb stem 1), kW 999.78 87.75 onth 217.52	ear heating sys /supplemen m(s) m 2 system 1 system 2 Mar /h/month 838.66 87.37 229.40	Apr 468.84 86.42 207.55	ding micro m (table 11 May 196.06 84.38 205.80	-CHP) Jun 0.00 79.60 192.15	Jul 0.00 79.60 184.09	Aug 0.00 79.60 205.22	(20 Sep 0.00 Σ(21: 79.60 207.48	(98) 1 - (20)2) × [1- (20 (202) × (20 Oct 496.67 1)15, 10 86.47 215.41 5(2192)1	÷ (4) D1) = 3)] = 3)] = 03) = Nov 908.61 12 = 87.54 225.05 12 =	50.99 0.00 1.00 0.00 1.00 0.00 89.70 Dec 1286.24 5453.98 87.97 87.97 240.23 2576.27] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (211)] (211)] (217)]
Space heating re 9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating Efficiency of war Water heating fu	equirement uirements - e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main system 1 1259.11 ter heater 87.91 uel, kWh/m 246.36	kWh/m²/ye individual secondary, main syste from main from main (%) Feb stem 1), kW 999.78 87.75 onth 217.52	ear heating sys /supplemen em(s) em 2 system 1 system 2 Mar /h/month 838.66 87.37 229.40	Apr 468.84 86.42 207.55	ding micro m (table 11 May 196.06 84.38 205.80	-CHP) Jun 0.00 79.60 192.15	Jul 0.00 79.60 184.09	Aug 0.00 79.60 205.22	(20 Sep 0.00 Σ(21: 79.60 207.48	(98) 1 - (20)2) × [1- (20 (202) × (20 Oct 496.67 1)15, 10 86.47 215.41 Σ(219a)1	÷ (4)	50.99 0.00 1.00 0.00 89.70 Dec 1286.24 5453.98 87.97 87.97 240.23 2576.27] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (206)] (211)] (211)] (217)] (219)
Space heating re 9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Efficiency of ma Space heating fu Water heating Efficiency of war Water heating for Annual totals Space heating for	equirement uirements - e heat from e heat from e heat from space heat in system 1 Jan uel (main system 1 1259.11 ter heater 87.91 uel, kWh/m 246.36	kWh/m²/ye individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 999.78 87.75 onth 217.52	ear heating sys /supplemen m(s) m 2 system 1 system 2 <i>Mar</i> /h/month 838.66 87.37 229.40	Apr 468.84 86.42 207.55	ding micro m (table 11 May 196.06 84.38 205.80	-CHP) Jun 0.00 79.60 192.15	Jul 0.00 79.60 184.09	Aug 0.00 79.60 205.22	(20 Sep 0.00 Σ(21) 79.60 207.48	(98) 1 - (20)2) × [1- (20 (202) × (20 Oct 496.67 1)15, 10 86.47 215.41 Σ(219a)1	÷ (4) D1) = 3)] = D3) = Nov 908.61 12 = 87.54 225.05 12 =	50.99 0.00 1.00 0.00 1.00 0.00 89.70 Dec 1286.24 5453.98 87.97 240.23 2576.27 5453.98] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (211)] (211)] (217)] (219)
Space heating re 9a. Energy req Space heating Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating Efficiency of war Water heating fu Annual totals Space heating fu	equirement uirements - e heat from e heat from e heat from l space heat in system 1 Jan uel (main system 1 1259.11 ter heater 87.91 uel, kWh/m 246.36 uel - main system	kWh/m²/ye individual secondary, main syste from main from main (%) Feb stem 1), kW 999.78 87.75 onth 217.52	ear heating sys /supplemen em(s) em 2 system 1 system 2 Mar /h/month 838.66 87.37 229.40	Apr 468.84 86.42 207.55	ding micro m (table 11 May 196.06 84.38 205.80	-CHP) Jun 0.00 79.60 192.15	Jul 0.00 79.60 184.09	Aug 0.00 79.60 205.22	(20 Sep 0.00 Σ(21: 79.60 207.48	(98) 1 - (20)2) × [1- (20 (202) × (20 Oct 496.67 1)15, 10 86.47 215.41 Σ(219a)1	÷ (4)	50.99 0.00 1.00 0.00 1.00 0.00 89.70 Dec 1286.24 5453.98 87.97 240.23 2576.27 5453.98] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (206)] (211)] (211)] (217)] (219)]
Space heating re 9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Efficiency of ma Space heating fu Water heating functional Water heating function Space h	equirement uirements - e heat from e heat from e heat from l space heat in system 1 Jan uel (main sy: 1259.11 ter heater 87.91 uel, kWh/m 246.36 uel - main sy uel uel	kWh/m²/ye individual secondary, main syste from main from main (%) Feb stem 1), kW 999.78 87.75 onth 217.52	ear heating sys /supplemen m(s) m 2 system 1 system 2 Mar /h/month 838.66 87.37 229.40	Apr 468.84 86.42 207.55	ding micro m (table 11 May 196.06 84.38 205.80	-CHP) Jun 0.00 79.60 192.15	Jul 0.00 79.60 184.09	Aug 0.00 79.60 205.22	(20 Sep 0.00 Σ(21) 79.60 207.48	(98) 1 - (20)2) × [1- (20 (202) × (20 Oct 496.67 1)15, 10 86.47 215.41 Σ(219a)1	÷ (4) D1) = 3)] = D3) = Nov 908.61 12 = 87.54 225.05 12 = 12 = (0) 225.05 12 = 12 = (0) 225.05 12 = (1) 225.05 12 = (1) 225.05 12 = (1) 225.05 12 = (1) 225.05 12 = (1) 225.05 12 = (1) 225.05 (1) (1) (1) (1) (1) (1) (1) (1)	50.99 0.00 1.00 0.00 1.00 0.00 89.70 Dec 1286.24 5453.98 87.97 240.23 2576.27 5453.98] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (211)] (211)] (217)] (219)]

						()
central heating pump or water pump within warm air heating u	unit		30.00			(230c)
boiler flue fan			45.00			(230e)
Total electricity for the above, kWh/year					75.00	(231)
Electricity for lighting (Appendix L)					435.40	(232)
Total delivered energy for all uses		(211))(221) + (231) + (2	232)(237b) =	9540.65	(238)
10. Fuel sector individual bactive suctors including micro CUD						
10a. Fuel costs - Individual neating systems including micro-CHP	· · · · ·					
	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	6453.98	x	3.48	x 0.01 =	224.60	(240)
Water heating	2576.27	x	3.48	x 0.01 =	89.65	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	435.40	x	13.19	x 0.01 =	57.43	(250)
Additional standing charges					120.00	(251)
Total energy cost			(240)(242) +	(245)(254) =	501.57	(255)
11a. SAP rating - individual heating systems including micro-CHF	р					
Energy cost deflator (Table 12)					0.42	(256)
Energy cost factor (ECF)					1.33	(257)
SAP value					81.46]
SAP rating (section 13)					81	(258)
SAP band					В]
12a. CO ₂ emissions - individual heating systems including micro-	-CHP					

	Energy kWh/year		Emission factor kg CO₂/kWh		Emissions kg CO₂/year	
Space heating - main system 1	6453.98	x	0.216	= [1394.06	(261)
Water heating	2576.27	x	0.216	= [556.47	(264)
Space and water heating			(261) + (262) +	(263) + (264) = [1950.53	(265)
Pumps and fans	75.00	x	0.519	= [38.93	(267)
Electricity for lighting	435.40	x	0.519	= [225.97	(268)
Total CO ₂ , kg/year				(265)(271) = [2215.43	(272)
Dwelling CO ₂ emission rate				(272) ÷ (4) = [19.51	(273)
El value				[81.27	
El rating (section 14)				[81	(274)
El band				[В	

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

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	6453.98	x	1.22	=	7873.86	(261)
Water heating	2576.27	x	1.22	=	3143.04	(264)
Space and water heating			(261) + (262) +	(263) + (264) =	11016.90	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	435.40	x	3.07	=	1336.69	(268)
Primary energy kWh/year					12583.84	(272)
Dwelling primary energy rate kWh/m2/year					110.83	(273)

SAP Worksheet Design - Draft



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

Assessor name	Mr Ioan	inis Protono	tarios					Assessor nun	nber	23		
Client								Last modified	t	11/08	/2021	
Address	Flat 11,	13 Netherha	all Gardens	, London, I	NW3							
				, ,								
1. Overall dwelling di	mensions											
				A	irea (m²)		F	Verage storey height (m)	1	Vo	lume (m³)	
Lowest occupied					91.86	(1a) x	Г	2.78	(2a) =		255.37	(3a)
Total floor area	(1a	a) + (1b) + (1	c) + (1d)(1n) =	91.86	(4)						
Dwelling volume								(3a) + (3b) + (3	3c) + (3d)(3	3n) =	255.37	(5)
2 Ventilation rate												
2. Ventilation rate											3	
									7	m 	per nour	٦
Number of chimneys							L	0	x 40 =		0	_ (6a)
Number of open flues							Ļ	0	x 20 =		0	_ (6b)
Number of intermitten	t fans						_	4	x 10 =		40	_ (7a)
Number of passive ven	ts							0	x 10 =	·	0	(7b)
Number of flueless gas	fires						L	0	x 40 =	-	0	(7c)
										Air o	hanges pe hour	r
Infiltration due to chim	neys, flues, fai	ns, PSVs		(6a)	+ (6b) + (7	a) + (7b) + (7c) = [40	÷ (5) =	-	0.16	(8)
If a pressurisation test	has been carrie	ed out or is i	ntended, p	roceed to (17), otherw	vise continu	e from (′9) to (16)				
Air permeability value,	q50, expresse	d in cubic m	etres per h	our per squ	uare metre	of envelope	e area				5.00	(17)
If based on air permeal	bility value, the	en (18) = [(1]	7) ÷ 20] + (8	8), otherwi	se (18) = (1	6)					0.41	(18)
Number of sides on wh	ich the dwellir	ng is sheltere	ed								1	(19)
Shelter factor		0						1 -	- [0.075 x (1	9)] =	0.93	(20)
Infiltration rate incorpo	orating shelter	factor							(18) x (2	20) =	0.38	(21)
Infiltration rate modifie	ed for monthly	wind speed	:									
Jai	n Feb	Mar	Apr	May	Jun	Jul	Au	g Sep	Oct	Nov	Dec	
Monthly average wind	speed from Ta	ble U2										
5.1	0 5.00	4.90	4.40	4.30	3.80	3.80	3.70	0 4.00	4.30	4.50	4.70	(22)
Wind factor (22)m ÷ 4					•							_
1.2	8 1.25	1.23	1.10	1.08	0.95	0.95	0.93	3 1.00	1.08	1.13	1.18	(22a)
Adjusted infiltration rat	e (allowing fo	r shelter and	l wind fact	or) (21) x (2	22a)m							
0.4	8 0.47	0.46	0.41	0.40	0.36	0.36	0.3	5 0.38	0.40	0.42	0.44	(22b)
Calculate effective air c	hange rate for	the applica	ble case:									
If mechanical ventil	ation: air chan	ge rate thro	ugh system	1							N/A	(23a)
If balanced with hea	at recovery: eff	ficiency in %	allowing for	or in-use fa	ctor from T	able 4h					N/A	(23c)
d) natural ventilatio	n or whole ho	use positive	input vent	ilation fron	n loft							
0.6	1 0.61	0.61	0.59	0.58	0.56	0.56	0.56	6 0.57	0.58	0.59	0.60	(24d)
Effective air change rat	e - enter (24a)	or (24b) or	(24c) or (24	4d) in (25)								
0.6	1 0.61	0.61	0.59	0.58	0.56	0.56	0.56	6 0.57	0.58	0.59	0.60	(25)



3. Heat losses a	and heat lo	ss paramet	er										
Element			а	Gross rea, m²	Openings m ²	s Net A,	area m²	U-value W/m²K	A x U W	/К к-\ kJ,	/alue, /m².K	Ахк, kJ/K	
Door						1.	.96 x	1.40	= 2.74				(26)
Window						25	.52 x	1.33	= 33.83				(27)
Basement floor						91	86 x	0.18	= 16.53				(28)
External wall						104	4.54 x	0.18	= 18.82				(29a)
Party wall						10).13 x	0.00	= 0.00				(32)
Roof						34	.49 x	0.15	= 5.17				(30)
Total area of ext	ternal eleme	ents ∑A, m²	2			25	8.37						(31)
Fabric heat loss,	W/K = ∑(A	× U)							(26	5)(30) + (3	32) =	77.10	(33)
Heat capacity Cr	m = ∑(А x к)							(28)	.(30) + (32) +	+ (32a)(3	2e) =	N/A	(34)
Thermal mass pa	arameter (T	MP) in kJ/r	n²K									250.00	(35)
Thermal bridges	:: ∑(L x Ψ) ca	alculated us	sing Appen	dix K								11.39	(36)
Total fabric heat	t loss									(33) + (3	36) =	88.49	(37)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat	loss calcula	ted month	ly 0.33 x (2	25)m x (5)									
	51.83	51.45	51.08	49.35	49.03	47.52	47.52	47.24	48.10	49.03	49.68	50.37	(38)
Heat transfer co	efficient, W	//K (37)m +	+ (38)m										
	140.32	139.94	139.57	137.84	137.52	136.01	136.01	135.73	136.59	137.52	138.17	138.86	
									Average = ∑	(39)112/	/12 =	137.84	(39)
Heat loss param	eter (HLP),	W/m²K (39	9)m ÷ (4)										_
	1.53	1.52	1.52	1.50	1.50	1.48	1.48	1.48	1.49	1.50	1.50	1.51	
									Average = ∑	(40)112/	/12 =	1.50	(40)
Number of days	in month (1	Fable 1a)			,							1	_
	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	_ (40)
4. Water heati	ng energy r	equiremen	t										
Assumed occupa	ancy, N											2.65	(42)
Annual average	hot water u	isage in litr	es per day '	Vd,average	= (25 x N) +	36						97.15	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage	e in litres pe	r day for ea	ach month '	Vd,m = fact	tor from Tab	ole 1c x (43	3)	_				_	_
	106.86	102.97	99.09	95.20	91.32	87.43	87.43	91.32	95.20	99.09	102.97	106.86	
Energy content	of hot wate	r used = 4.3	18 x Vd.m x	nm x Tm/3	3600 kWh/m	onth (see	Tables 1b). 1c 1d)		∑(44)1	.12 =	1165.74	_ (44)
	158.47	138.60	143.02	124.69	119.64	103.24	95.67	109.78	111.09	129.47	141.33	153.47	7
		100.00	1.0.01	12		10012 .		1 200110		Σ(45)1	.12 =	1528.48	 (45)
Distribution loss	0.15 x (45)	m								2(,=			
	23.77	20.79	21.45	18.70	17.95	15.49	14.35	16.47	16.66	19.42	21.20	23.02	(46)
Water storage lo	oss calculate	ed for each	month (55	5) x (41)m									
-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(56)
If the vessel con	tains dedica	ted solar s	torage or d	ledicated W	/ /WHRS (56)i	m x [(47) -	Vs] ÷ (47)	, else (56)	1		1	1	_ · ·
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(57)
Primary circuit le	oss for each	month fro	m Table 3								•		_ · ·
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)
Combi loss for e	ach month	from Table	3a, 3b or 3	c									
	50.96	46.03	50.49	46.95	46.53	43.12	44.55	46.53	46.95	50.49	49.32	50.96	(61)
Total heat requi	red for wat	er heating o	calculated f	or each mo	onth 0.85 x	(45)m + (4	6)m + (57)m + (59)m -	+ (61)m				-

	209.43	184.63	193.52	171.64	166.18	146.36	140.22	156.32	158.04	179.96	190.64	204.43	(62)
Solar DHW inpu	t calculated	l using Appe	endix G or A	Appendix H									
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
Output from wa	ter heater f	for each mo	nth (kWh/ı	month) (62	2)m + (63)m	1							
	209.43	184.63	193.52	171.64	166.18	146.36	140.22	156.32	158.04	179.96	190.64	204.43]
		I								Σ(64)1	12 = 2	101.36	(64)
Heat gains from	water heat	ing (kM/h/m	(0.11)	5 ~ [0 85 ~ /	$(15)m \pm (61)$)m] ± 0.8 ×	[(46)m + (9)]	(50) ±	ml	2(01)1		101.50	
ficut guills from			60.19			۸۲ 11		49.14	10,00	FF 67	50.22	62.77	
	05.43	57.59	60.18	53.20	51.41	45.11	42.95	48.14	48.08	55.07	59.32	03.77	(כס)
5. Internal gair	าร												
	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains	(Table 5)			ľ				. 0					
Wetabolie guilis		150.00	150.02	150.02	150.02	150.02	150.02	150.02	150.02	150.02	150.02	150.02	
	159.02	159.02	159.02	159.02	159.02	159.02	159.02	159.02	159.02	159.02	159.02	159.02	(66)
Lighting gains (c	alculated in	i Appendix I	, equation	L9 or L9a),	also see Ta	ible 5						1	1
	54.04	48.00	39.03	29.55	22.09	18.65	20.15	26.19	35.16	44.64	52.10	55.54	(67)
Appliance gains	(calculated	in Appendi	x L, equatio	on L13 or L1	l3a), also se	ee Table 5							
	361.88	365.63	356.17	336.02	310.60	286.69	270.73	266.97	276.44	296.58	322.01	345.91	(68)
Cooking gains (c	alculated ir	n Appendix	L, equation	L15 or L15	a), also see	Table 5							
	53.55	53.55	53.55	53.55	53.55	53.55	53.55	53.55	53.55	53.55	53.55	53.55	(69)
Pump and fan g	ains (Table	5a)											
	3.00	, 3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
	oration (Ta	ble 5)	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00] (, 0)
LUSSES E.g. Evap			100.01	100.01	100.01	100.01	100.04	100.01	100.01				1 (= 4)
	-106.01	-106.01	-106.01	-106.01	-106.01	-106.01	-106.01	-106.01	-106.01	-106.01	-106.01	-106.01	(/1)
Water heating g	ains (Table	5)											
	87.94	85.70	80.88	73.88	69.11	62.65	57.73	64.70	67.61	74.83	82.39	85.71	(72)
Total internal ga	87.94 ains (66)m -	85.70 + (67)m + (6	80.88 i8)m + (69)i	73.88 m + (70)m -	69.11 + (71)m + (7	62.65 72)m	57.73	64.70	67.61	74.83	82.39	85.71	(72)
Total internal ga	87.94 ains (66)m - 613.42	85.70 + (67)m + (6 608.89	80.88 8)m + (69) 585.65	73.88 m + (70)m - 549.02	69.11 + (71)m + (7 511.35	62.65 72)m 477.55	57.73 458.16	64.70 467.42	67.61 488.76	74.83	82.39 566.06	85.71	(72)
Total internal ga	87.94 ains (66)m - 613.42	85.70 + (67)m + (6 608.89	80.88 8)m + (69) 585.65	73.88 m + (70)m - 549.02	69.11 + (71)m + (7 511.35	62.65 72)m 477.55	57.73 458.16	64.70 467.42	67.61 488.76	74.83 525.61	82.39 566.06	85.71 596.72	(72) (73)
Total internal ga	87.94 ains (66)m - 613.42	85.70 + (67)m + (6 608.89	80.88 8)m + (69) 585.65	73.88 m + (70)m + 549.02	69.11 + (71)m + (7 511.35	62.65 72)m 477.55	57.73 458.16	64.70 467.42	67.61 488.76	74.83	82.39 566.06	85.71	(72) (73)
Total internal ga 6. Solar gains	87.94 ains (66)m - 613.42	85.70 + (67)m + (6 608.89	80.88 8)m + (69) 585.65 Access f	73.88 m + (70)m + 549.02	69.11 + (71)m + (7 511.35 Area	62.65 72)m 477.55 Sola	57.73 458.16 ar flux	64.70 467.42	67.61 488.76 g	74.83 525.61 FF	82.39 566.06	85.71 596.72 Gains	(72)
Total internal ga	87.94 ains (66)m - 613.42	85.70 + (67)m + (6 608.89	80.88 8)m + (69)r 585.65 Access f Table	73.88 m + (70)m - 549.02 actor 6d	69.11 + (71)m + (7 511.35 Area m ²	62.65 72)m 477.55 Sola W	57.73 458.16 ar flux //m ²	64.70 467.42 spect	67.61 488.76 g ific data able 6b	74.83 525.61 FF specific c	82.39 566.06	85.71 596.72 Gains W	(72) (73)
Total internal ga	87.94 ains (66)m - 613.42	85.70 + (67)m + (6 608.89	80.88 8)m + (69)r 585.65 Access f Table	73.88 m + (70)m + 549.02 actor 6d	69.11 + (71)m + (7 511.35 Area m ²	62.65 72)m 477.55 Sola W	57.73 458.16 ar flux //m ²	64.70 467.42 speci or T	67.61 488.76 g ific data able 6b	74.83 525.61 FF specific c or Table	82.39 566.06	85.71 596.72 Gains W	(72)
Total internal ga	87.94 ains (66)m - 613.42	85.70 + (67)m + (6 608.89	80.88 (8)m + (69)n 585.65 Access f Table 0.7	73.88 m + (70)m + 549.02 actor 6d 7 x	69.11 + (71)m + (7 511.35 Area m ² 14.21	62.65 72)m 477.55 Sola W	57.73 458.16 ar flux //m ² 6.75 x	64.70 467.42 speci or T	67.61 488.76 fific data able 6b	74.83 525.61 FF specific c or Table 0.80	82.39 566.06 data 6c	85.71 596.72 Gains W 232.04	(72) (73)
Total internal ga 6. Solar gains South West	87.94 ains (66)m - 613.42	85.70 + (67)m + (6 608.89	80.88 8)m + (69)n 585.65 Access f Table 0.7 0.7	73.88 m + (70)m + 549.02 actor 6d 7 x [7 x [69.11 + (71)m + (7 511.35 Area m ² 14.21 11.31	62.65 72)m 477.55 Sola V X 44 X 19	57.73 458.16 ar flux //m ² 6.75 x 9.64 x	64.70 467.42 speci or Tr 0.9 x (0 0.9 x (0	67.61 488.76 ific data able 6b 0.63 x x	74.83 525.61 FF specific c or Table 0.80 0.80	82.39 566.06 data e 6c = [= [85.71 596.72 Gains W 232.04 77.58	(72) (73) (78) (80)
Total internal ga 6. Solar gains South West Solar gains in wa	87.94 hins (66)m - 613.42	85.70 + (67)m + (6 608.89	80.88 (8)m + (69) 585.65 Access f Table 0.7 0.7	73.88 m + (70)m + 549.02 actor 6d 7 x [7 x [69.11 + (71)m + (7 511.35 Area m ² 14.21 11.31	62.65 72)m 477.55 Sola X X 4 X 1 X 1	57.73 458.16 ar flux //m ² 6.75 x 9.64 x	64.70 467.42 speci or T 0.9 x (0.9 x (67.61 488.76 ific data able 6b 0.63 x 0.63 x	74.83 525.61 FF specific c or Table 0.80 0.80	82.39 566.06 data 6c = [85.71 596.72 Gains W 232.04 77.58	(72) (73) (78) (80)
Total internal ga 6. Solar gains South West Solar gains in wa	87.94 ains (66)m - 613.42 613.42 613.42 613.42 613.42 613.42 613.42 613.42	85.70 + (67)m + (6 608.89 1(82)m 531.79	80.88 8)m + (69)n 585.65 Access f Table 0.7 0.7 734.02	73.88 m + (70)m + 549.02 actor 6d 7 x 7 x 911.64	69.11 + (71)m + (7 511.35 Area m ² 14.21 11.31 1016.87	62.65 72)m 477.55 Sola X X 4 X 1 1005.99	57.73 458.16 ar flux //m ² 6.75 x 9.64 x 971.47	64.70 467.42 speci or Tr 0.9 x (0 0.9 x (0 894.60	67.61 488.76 ific data able 6b 0.63 x 0.63 x 796.37	74.83 525.61 FF specific c or Table 0.80 0.80 589.97	82.39 566.06 data 6c =	85.71 596.72 Gains W 232.04 77.58 264.30	(72) (73) (78) (80) (83)
Total internal ga 6. Solar gains South West Solar gains in wa Total gains - inter	87.94 ins (66)m - 613.42 atts Σ(74)m 309.62 ernal and sc	85.70 + (67)m + (6 608.89 (82)m 531.79 olar (73)m +	80.88 (8)m + (69)n 585.65 Access f Table 0.7 (0.7 734.02 (83)m	73.88 m + (70)m + 549.02 actor 6d 7 x [7 x [911.64	69.11 + (71)m + (7 511.35 Area m ² 14.21 11.31 1016.87	62.65 72)m 477.55 Sola W 2 x 4 x 1 1 1005.99	57.73 458.16 ar flux //m ² 6.75 x 9.64 x 971.47	64.70 467.42 spect or T 0.9 x (0 0.9 x (0 894.60	67.61 488.76 fific data able 6b 0.63 x 0.63 x 796.37	74.83 525.61 FF specific c or Table 0.80 0.80 589.97	82.39 566.06	85.71 596.72 Gains W 232.04 77.58 264.30	(72) (73) (78) (80) (83)
Total internal ga 6. Solar gains South West Solar gains in wa Total gains - inte	87.94 ains (66)m - 613.42 613.42 atts Σ(74)m 309.62 ernal and sc 923.04	85.70 + (67)m + (6 608.89 	80.88 (8)m + (69)n 585.65 Access f Table 0.7 0.7 734.02 (83)m 1319.67	73.88 m + (70)m - 549.02 actor 6d 7 x 7 x 911.64 1460.66	69.11 + (71)m + (7 511.35 Area m ² 14.21 11.31 1016.87 1528.22	62.65 72)m 477.55 Sola X 4 X 1 1005.99 1483.54	57.73 458.16 ar flux //m ² 6.75 x 9.64 x 971.47 1429.64	64.70 467.42 speci or T 0.9 x (0 0.9 x (0 894.60 1362.03	67.61 488.76 488.76 g ific data able 6b 0.63 x 0.63 x 796.37 1285.13	74.83 525.61 FF specific c or Table 0.80 0.80 589.97 1115.58	82.39 566.06 data 6c = 371.78	85.71 596.72 Gains W 232.04 77.58 264.30 861.02	(72) (73) (73) (78) (80) (80) (83) (84)
Total internal ga 6. Solar gains South West Solar gains in wa Total gains - inte	87.94 ains (66)m - 613.42 613.42 309.62 ernal and sc 923.04	85.70 + (67)m + (6 608.89 (82)m 531.79 olar (73)m + 1140.68	80.88 8)m + (69)n 585.65 Access f Table 0.7 0.7 734.02 (83)m 1319.67	73.88 m + (70)m + 549.02 actor 6d 7 x [7 x [911.64 1460.66	69.11 + (71)m + (7 511.35 Area m ² 14.21 11.31 1016.87 1528.22	62.65 72)m 477.55 Sola X 1005.99 1483.54	57.73 458.16 ar flux //m ² 6.75 x 9.64 x 971.47 1429.64	64.70 467.42 spect or T 0.9 x (0 0.9 x (0 894.60 1362.03	67.61 488.76 488.76 6 6 6 0.63 x 0.63 x 0.63 x 796.37 1285.13	74.83 525.61 FF specific c or Table 0.80 0.80 589.97 1115.58	82.39 566.06 data 6c = [371.78 937.84	85.71 596.72 Gains W 232.04 77.58 264.30 861.02	(72) (73) (78) (80) (83) (84)
Total internal ga 6. Solar gains South West Solar gains in wa Total gains - internal 7. Mean intern	87.94 ains (66)m - 613.42 atts Σ(74)m 309.62 ernal and sc 923.04 mal tempera	85.70 + (67)m + (6 608.89 	80.88 8)m + (69)n 585.65 Access f Table 0.77 0.77 (0.77) 734.02 (83)m 1319.67 ng season)	73.88 m + (70)m + 549.02 actor 6d 7 x 7 x 911.64 1460.66	69.11 + (71)m + (7 511.35 Area m ² 14.21 11.31 1016.87 1528.22	62.65 72)m 477.55 Sol: W 3 x 4 3 x 1 1005.99 1483.54	57.73 458.16 ar flux //m ² 6.75 x 9.64 x 971.47 1429.64	64.70 467.42 speci or T 0.9 x (0.9 x (894.60 1362.03	67.61 488.76 sific data able 6b 0.63 x 0.63 x 796.37 1285.13	74.83 525.61 FF specific c or Table 0.80 0.80 589.97 1115.58	82.39 566.06 Jata 6 c 371.78 937.84	85.71 596.72 Gains W 232.04 77.58 264.30 861.02	(72) (73) (78) (80) (83) (84)
Total internal ga 6. Solar gains South West Solar gains in wa Total gains - international 7. Mean international	87.94 ains (66)m - 613.42 atts Σ(74)m 309.62 ernal and sc 923.04 al tempera uring heatin	85.70 + (67)m + (6 608.89 (82)m 531.79 olar (73)m + 1140.68 ture (heating periods in	80.88 8)m + (69)n 585.65 Access f Table 0.7 0.7 734.02 (83)m 1319.67 ng season) the living a	73.88 m + (70)m + 549.02 actor 6d 7 x [7 x [911.64 1460.66	69.11 + (71)m + (7 511.35 Area m ² 14.21 11.31 1016.87 1528.22 able 9, Th1	62.65 72)m 477.55 Sola X 12 X 12 1005.99 1483.54	57.73 458.16 ar flux //m ² 6.75 x 9.64 x 971.47 1429.64	64.70 467.42 spect or T 0.9 x (0 0.9 x (0 894.60 1362.03	67.61 488.76 488.76 6 6 6 0.63 x 0.63 x 0.63 x 796.37 1285.13	74.83 525.61 FF specific c or Table 0.80 0.80 589.97 1115.58	82.39 566.06 data e 6c = [] = [] 371.78 937.84	85.71 596.72 Gains W 232.04 77.58 264.30 861.02 861.02 21.00	 (72) (73) (78) (80) (83) (84) (85)
Total internal ga 6. Solar gains South West Solar gains in wa Total gains - international 7. Mean internation Temperature du	87.94 ains (66)m - 613.42 atts Σ(74)m 309.62 ernal and sc 923.04 nal tempera uring heatin Jan	85.70 + (67)m + (6 608.89 	80.88 8)m + (69)n 585.65 Access f Table 0.7 0.7 0.7 (33)m 1319.67 ng season) the living a Mar	73.88 m + (70)m + 549.02 actor 6d 7 x 7 x 911.64 1460.66 area from T Apr	69.11 + (71)m + (7 511.35 Area m ² 14.21 11.31 1016.87 1528.22 able 9, Th1 May	62.65 72)m 477.55 Sola W 2 x 4 x 1 1005.99 1483.54 (°C) Jun	57.73 458.16 ar flux //m ² 6.75 x 9.64 x 971.47 1429.64 Jul	64.70 467.42 speci or T 0.9 x (0.9 x (0.9 x (1362.03 Aug	67.61 488.76 fific data able 6b 0.63 x 0.63 x 0.63 x 796.37 1285.13	74.83 525.61 FF specific c or Table 0.80 0.80 0.80 589.97 1115.58	82.39 566.06 data 6c = [371.78 937.84	85.71 596.72 Gains W 232.04 77.58 232.04 77.58 264.30 861.02 861.02 21.00 Dec	 (72) (73) (78) (80) (83) (84) (85)
Total internal ga 6. Solar gains South West Solar gains in wa Total gains - international 7. Mean internation Temperature du Utilisation facto	$\begin{array}{ c }\hline 87.94\\ \hline 87.94\\ \hline \\ \mbox{ins} (66)m - \\ \hline \\ \mbox{613.42}\\ \hline \\mbox{613.42}\\ \hline \\$	85.70 + (67)m + (6 608.89 531.79 blar (73)m + 1140.68 ture (heating periods in Feb for living are	80.88 8)m + (69)n 585.65 Access f Table 0.7 0.7 734.02 (83)m 1319.67 ng season) the living a Mar ea n1,m (se	73.88 m + (70) m - 549.02 actor 6d 7 x 7 x 911.64 911.64 1460.66 area from T Apr e Table 9a)	69.11 + (71)m + (7 511.35 Area m ² 14.21 11.31 1016.87 1528.22 able 9, Th1 May	62.65 72)m 477.55 Sola W 2 x 4 x 1 1005.99 1483.54 (°C) Jun	57.73 458.16 ar flux //m ² 6.75 x 9.64 x 971.47 1429.64 Jul	64.70 467.42 speci or T 0.9 x (0 0.9 x (0 894.60 1362.03	67.61 488.76 488.76 g ific data able 6b 0.63 x 0.63 x 0.63 x 796.37 1285.13	74.83 525.61 FF specific c or Table 0.80 0.80 589.97 1115.58	82.39 566.06 data 6c = [] = [] 371.78 937.84	85.71 596.72 Gains W 232.04 77.58 264.30 861.02 21.00 Dec	 (72) (73) (73) (78) (80) (83) (84) (85)
Total internal ga 6. Solar gains South West Solar gains in wa Total gains - internation 7. Mean internation Temperature du Utilisation facto	87.94 ains (66)m - 613.42 $5(74)m$ 309.62 ernal and sc 923.04 al temperation Jan r for gains f	85.70 + (67)m + (6 608.89 	80.88 8)m + (69)n 585.65 Access f Table 0.7 0.7 0.7 (33)m 1319.67 ng season) the living a Mar ea n1,m (se	73.88 m + (70) m + 549.02 actor 6d 7 x 7 x 911.64 1460.66 area from T Apr e Table 9a)	69.11 + (71)m + (7 511.35 Area m ² 14.21 11.31 1016.87 1528.22 able 9, Th1 May	62.65 72)m 477.55 Sola W 1 x 4 x 1 1005.99 1483.54 (°C) Jun 0 56	57.73 458.16 ar flux //m ² 6.75 x 9.64 x 971.47 1429.64 Jul 0.41	64.70 467.42 speci or T 0.9 x (0 0.9 x (0 0.9 x (0 894.60 1362.03 Aug	67.61 488.76 fific data able 6b 0.63 x 0.63 x 796.37 1285.13 Sep	74.83 525.61 FF specific c or Table 0.80 0.80 589.97 1115.58 1115.58	82.39 566.06 Jata 6 c = [371.78 937.84 Nov	85.71 596.72 Gains W 232.04 77.58 264.30 861.02 21.00 Dec	 (72) (73) (73) (80) (83) (84) (85) (86)
Total internal ga 6. Solar gains South West Solar gains in wa Total gains - internal 7. Mean internal Temperature du Utilisation facto	87.94 ains (66)m - 613.42 atts $\Sigma(74)m$ 309.62 ernal and sc 923.04 al temperauring heatinJanr for gains f 0.99	85.70 + (67)m + (6 608.89 	80.88 8)m + (69)n 585.65 Access f Table 0.77 0.77 734.02 (83)m 1319.67 ng season) the living a Mar ea n1,m (se 0.93 taps 2 to 7	73.88 m + (70) m + 549.02 actor 6d 7 x 7 x 911.64 1460.66 area from T Apr e Table 9a) 0.85 in Table 9c	69.11 + (71)m + (7 511.35 Area m ² 14.21 11.31 1016.87 1528.22 able 9, Th1 May 0.73	62.65 72)m 4777.55 Sola W 2 x 4 3 x 1 1005.99 1483.54 (°C) Jun 0.56	57.73 458.16 ar flux //m ² 6.75 x 9.64 x 971.47 1429.64 Jul 0.41	64.70 467.42 speci or T 0.9 x (0 0.9 x (0 0.9 x (0 1362.03 Aug 0.45	67.61 488.76 488.76 6 ific data able 6 0.63 x 796.37 796.37 1285.13 5 8 9 0.66	74.83 525.61 FF specific c or Table 0.80 0.80 589.97 1115.58 0.89	82.39 566.06 data 6c = [371.78 937.84 Nov 0.97	85.71 596.72 Gains W 232.04 77.58 264.30 264.30 861.02 21.00 Dec 0.99	(72) (73) (73) (80) (83) (83) (84) (85) (86)
Total internal ga 6. Solar gains South West Solar gains in wa Total gains - internation 7. Mean interna Temperature du Utilisation factoo Mean internal to	87.94 ains (66)m 613.42 atts $\Sigma(74)$ m 309.62 ernal and sc 923.04 al temperation Jan r for gains f 0.99 emp of livin	85.70 + (67)m + (6 608.89 	80.88 8)m + (69)n 585.65 Access f Table 0.7 0.7 734.02 (83)m 1319.67 ng season) the living a Mar ea n1,m (se 0.93 teps 3 to 7	73.88 m + (70) m + 549.02 actor 6d 7 x 7 x 911.64 1460.66 area from T Apr e Table 9a) 0.85 in Table 9c	69.11 + (71)m + (7 511.35 Area m ² 14.21 11.31 1016.87 1528.22 able 9, Th1 May 0.73)	62.65 72)m 4777.55 Sola W 2 X 4 X 12 1005.99 1483.54 (°C) Jun 0.56	57.73 458.16 ar flux //m ² 6.75 x 9.64 x 971.47 1429.64 Jul 0.41	64.70 467.42 specior T 0.9 x (0 0.9 x (0 894.60 1362.03 Aug 0.45	67.61 488.76 488.76 6 6 6 7 6 3 8 0.63 x 2.63 x 7 9 6.37 1285.13 1285.13 1285.13	74.83 525.61 FF specific c or Table 0.80 0.80 589.97 1115.58 0ct 0.89	82.39 566.06 data 6c = [371.78 937.84 937.84 Nov 0.97	85.71 596.72 Gains W 232.04 77.58 264.30 861.02 21.00 Dec 0.99	 (72) (73) (73) (80) (83) (84) (85) (85) (86) (86)
Total internal ga 6. Solar gains South West Solar gains in wa Total gains - internal 7. Mean internal Utilisation facto Mean internal to	87.94 ains (66)m - 613.42 $5(74)m$ 309.62 ernal and sc 923.04 al tempera uring heatin Jan r for gains f 0.99 emp of livin 19.63	85.70 + (67)m + (6 608.89 608.89 531.79 531.79 531.79 olar (73)m + 1140.68 ture (heating g periods in Feb for living are 0.97 g area T1 (s 19.90	80.88 8)m + (69)n 585.65 Access f Table 0.7 0.7 0.7 (83)m 1319.67 (83)m 1319.67 the living a Mar ea n1,m (se 0.93 teps 3 to 7 20.24	73.88 m + (70) m + 549.02 actor 6d 7 x 7 x 911.64 1460.66 area from T Apr e Table 9a) 0.85 in Table 9c 20.59	69.11 + (71)m + (7 511.35 Area m ² 14.21 11.31 1016.87 1528.22 able 9, Th1 May 0.73) 20.84	62.65 72)m 4777.55 Sola W 1477.55 1005.99 1483.54 (°C) Jun 0.56 20.96	57.73 458.16 ar flux //m ² 6.75 x 9.64 x 971.47 1429.64 Jul 0.41 20.99	64.70 467.42 specior T 0.9 x (0 0.9 x (0 0.9 x (0 1362.03 1362.03 Aug 0.45 20.99	67.61 488.76 488.76 6 6 7 6 3 8 7 8 7 9 6.3 x 7 9 6.3 x 7 9 6.3 7 1285.13 1285.13 1285.13	74.83 525.61 525.61 6 FF specific c or Table 0.80 0.80 589.97 1115.58 1115.58 0.89 0.89 0.89 20.58	82.39 566.06 Jata 6c = [371.78 937.84 937.84 0.97 Nov	85.71 596.72 Gains W 232.04 77.58 264.30 861.02 21.00 21.00 Dec 0.99 0.99	 (72) (73) (73) (80) (83) (83) (84) (85) (86) (86) (87)
Total internal ga 6. Solar gains South West Solar gains in wa Total gains - internal 7. Mean internal Utilisation facto Mean internal to Temperature du	87.94 ains (66)m 613.42 atts $\Sigma(74)m$ 309.62 ernal and sc 923.04 al temperauring heatinJanr for gains f 0.99 emp of livin 19.63 uring heatin	85.70 + (67)m + (6 608.89 - (62)m 531.79 - (73)m + 1140.68 - (140.68 - (140.68) - (140.6	80.88 8)m + (69)n 585.65 Access f Table 0.7 0.7 734.02 (83)m 1319.67 ng season) the living a Mar an 1,m (se 0.93 teps 3 to 7 20.24 the rest of	73.88 m + (70) m + 549.02 actor 6d 7 x 7 x 911.64 1460.66 area from T Apr e Table 9a) 0.85 in Table 9c 20.59 dwelling fr	69.11 + (71)m + (7 511.35 Area m ² 14.21 11.31 1016.87 1528.22 Table 9, Th1 May 0.73) 20.84 rom Table 9	62.65 72)m 4777.55 Sola W 20.99 1483.54 (°C) Jun 0.56 20.96 9, Th2(°C)	57.73 458.16 ar flux //m ² 6.75 x 9.64 x 971.47 1429.64 Jul 0.41 20.99	64.70 467.42 speci or T 0.9 x (0 0.9 x (0 0.9 x (0 0.9 x (0 0.9 x (0 0.9 x (0 0.45 0.45 0.45	67.61 488.76 488.76 6 6 6 7 6 3 8 7 9 6 3 x 7 9 6.3 x 7 9 6.3 7 1285.13 1285.13 1285.13	74.83 525.61 FF specific c or Table 0.80 0.80 589.97 1115.58 0.89 0.89 0.89	82.39 566.06 data 6c = [] = [371.78 937.84 937.84 0.97 0.97 20.03	85.71 596.72 Gains W 232.04 77.58 264.30 861.02 21.00 Dec 0.99 19.58	 (72) (73) (73) (80) (83) (83) (84) (85) (86) (87)
Total internal ga 6. Solar gains South West Solar gains in wa Total gains - internal 7. Mean internal Utilisation facto Mean internal to Temperature du	87.94 ains (66)m 613.42 atts $\Sigma(74)m$ 309.62 ernal and sc 923.04 nal tempera uring heatin Jan r for gains f 0.99 emp of livin 19.63 uring heatin 19.67	85.70 + (67)m + (6 608.89 - 608.89 - 608.69 - 608.69 - 608.69 - 608.69 - 608.69 - 609.79 - 609.79 - 709.79 - 709.79 - 709.79 - 709.79 - 709.79 - 709.79 - 709.79 - 709.70 - 709.79 - 709.70 - 70	80.88 8)m + (69)n 585.65 Access f Table 0.7 0.7 0.7 (33)m 1319.67 (83)m 1319.67 ng season) the living a Mar ea n1,m (se 0.93 teps 3 to 7 20.24 the rest of 19.67	73.88 m + (70) m + 549.02 actor 6d 7 x 7 x 911.64 1460.66 area from T Apr e Table 9a) 0.85 in Table 9c 20.59 dwelling fr 19.69	69.11 + (71)m + (7 511.35 Area m ² 14.21 11.31 1016.87 1528.22 able 9, Th1 May 0.73) 20.84 rom Table 9 19.69	62.65 72)m 477.55 Sola W 1477.55 (*C) Jun (*C) Jun 0.56 20.96 9, Th2(*C) 19.70	57.73 458.16 ar flux //m ² 6.75 x 9.64 x 971.47 1429.64 Jul 0.41 20.99 19.70	64.70 467.42 speci or T 0.9 x () 0.9 x () 894.60 1362.03 Aug 0.45 20.99 19.70	67.61 488.76 488.76 6 6 6 7 6 3 x 7 9 6 3 x 7 9 6 3 x 7 9 6 3 7 4 2 8 5 ep 0.66 2 0.91 19.70	74.83 525.61 FF specific c or Table 0.80 0.80 589.97 1115.58 1115.58	82.39 566.06 Jata 6 c 371.78 937.84 937.84 0.97 0.97 20.03 19.68	85.71 596.72 596.72 232.04 77.58 232.04 77.58 264.30 861.02 21.00 Dec 0.99 0.99 19.58	(72) (73) (73) (80) (83) (83) (84) (85) (85) (85) (85) (85)

	0.98	0.96	0.91	0.81	0.65	0.46	0.29	0.33	0.56	0.85	0.96	0.99	(89)
Mean internal t	emperature	in the rest	of dwelling	T2 (follow	steps 3 to	7 in Table 9	∋c)						
	18.47	18.74	19.06	19.40	19.60	19.69	19.70	19.70	19.66	19.40	18.88	18.43	(90)
Living area frac	tion								Li	ving area ÷	(4) =	0.52	(91)
Mean internal t	emperature	for the wh	ole dwellin	g fLA x T1 +	(1 - fLA) x	Т2							
	19.07	19.34	19.67	20.02	20.24	20.35	20.37	20.37	20.31	20.01	19.48	19.03	(92)
Apply adjustme	nt to the me	ean internal	temperatu	ire from Ta	ble 4e whe	ere appropr	iate						_
	19.07	19.34	19.67	20.02	20.24	20.35	20.37	20.37	20.31	20.01	19.48	19.03	(93)
8. Space heati	ng requirem	ient											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	or for gains,	ηm		•	-			Ū					
	0.98	0.95	0.91	0.82	0.69	0.51	0.36	0.39	0.61	0.86	0.96	0.98	(94)
Useful gains, ηr	nGm, W (94	l)m x (84)m											
	903.06	1088.42	1199.84	1200.86	1049.05	754.29	507.91	531.51	789.01	957.50	899.47	846.34	(95)
Monthly average	e external to	emperature	e from Tabl	e U1								•	_
	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate f	or mean inte	ernal tempe	rature, Lm	, W [(39)m	x [(93)m -	(96)m]							
	2072.70	2020.75	1838.37	1532.44	1174.36	781.57	512.71	538.61	848.33	1293.95	1710.17	2058.79	(97)
Space heating r	equirement,	, kWh/mon	th 0.024 x	[(97)m - (9	5)m] x (41)	m							
	870.21	626.53	475.07	238.74	93.23	0.00	0.00	0.00	0.00	250.32	583.70	902.06]
									∑(9	8)15, 10	12 =	4039.86	(98)
Space heating r	equirement	kWh/m²/ye	ear							(98)	÷ (4)	43.98	(99)
9a Energy rec	uiroments -	individual	heating sys	toms inclu	ding micro	СНР							
Snace heating	unemento	marriadar	incuting sys										
Fraction of space	e heat from	secondary	/sunnlemei	ntary system	m (table 11)						0.00	(201)
Fraction of space	e heat from	main syste	m(s)	italy system		-,				1 - (20)1) =	1.00	(202)
Fraction of space	e heat from	main syste	m 2							- (0.00	(202)
Fraction of tota	l space heat	from main	system 1						(20	02) x [1- (20	3)] =	1.00	(204)
Fraction of tota	' I space heat	from main	, system 2						· ·	(202) x (20)3) =	0.00	(205)
Efficiency of ma	in system 1	(%)									,	89.70	(206)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating f	uel (main sy	stem 1), kW	/h/month										
	970.13	698.47	529.62	266.15	103.94	0.00	0.00	0.00	0.00	279.06	650.73	1005.65]
									∑(21	1)15, 10	12 = 4	4503.75	(211)
Water heating													
Efficiency of wa	ter heater												
	87.55	87.18	86.52	85.18	82.96	79.60	79.60	79.60	79.60	85.18	86.98	87.65	(217)
Water heating	uel, kWh/m	onth											
	239.22	211.77	223.66	201.50	200.32	183.87	176.16	196.38	198.55	211.27	219.17	233.25	
										∑(219a)1	12 = 2	2495.12	(219)
Annual totals													_
Space heating f	uel - main sy	/stem 1										4503.75	
Water heating f	uel											2495.12	
Electricity for p	umps, fans a	and electric	keep-hot (Table 4f)						٦			
central heat	ing pump or	water pum	p within w	arm air hea	iting unit				30.00				(230c)
boiler flue fa	in								45.00				(230e)

Total electricity for the above, kWh/year

Electricity for lighting (Appendix L)

Total delivered energy for all uses

(211)(221) + (231) + (232)(237b) =	
	-

75.00(231)381.73(232)7455.60(238)

81.86

82

В

(258)

10a. Fuel costs - individual heating systems including micro-CHP)					
	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	4503.75] x	3.48	x 0.01 =	156.73	(240)
Water heating	2495.12) x	3.48	x 0.01 =	86.83	(247)
Pumps and fans	75.00) x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	381.73) x	13.19] x 0.01 =	50.35	(250)
Additional standing charges					120.00	(251)
Total energy cost			(240)(242)	+ (245)(254) =	423.80	(255)
11a. SAP rating - individual heating systems including micro-CHI	Р					
Energy cost deflator (Table 12)					0.42	(256)
Energy cost factor (ECF)					1.30	(257)

SAP value

SAP rating (section 13)

SAP band

12a. CO₂ emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	4503.75	x	0.216	= [972.81	(261)
Water heating	2495.12	x	0.216	= [538.95	(264)
Space and water heating			(261) + (262) +	(263) + (264) = [1511.75	(265)
Pumps and fans	75.00	x	0.519	= [38.93	(267)
Electricity for lighting	381.73	x	0.519	= [198.12	(268)
Total CO ₂ , kg/year				(265)(271) = [1748.80	(272)
Dwelling CO ₂ emission rate				(272) ÷ (4) = [19.04	(273)
El value				[82.88]
El rating (section 14)					83	(274)
El band				[В]

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

	Energy kWh/year		Primary factor	Primary Energy kWh/year	,	
Space heating - main system 1	4503.75	x	1.22	=	5494.57	(261)
Water heating	2495.12	x	1.22	=	3044.04	(264)
Space and water heating			(261) + (262) +	(263) + (264) =	8538.61	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	381.73	x	3.07	=	1171.92	(268)
Primary energy kWh/year					9940.79	(272)
Dwelling primary energy rate kWh/m2/year					108.22	(273)

Appendix B – Water Calculation





<mark>bre</mark>global

Job no: J2629 Date: 11/08/2021 Assessor name: Ioannis Protonotarios Registration no:

Development name: 13

: 13 Netherhall Gardens - Phase 2

BRE Global 2010. BRE Certification is a registered trademark owned by BRE Global and may not be used without BRE Global's written permission.

Permission is given for this tool to be copied without infringement of copyright for use only on projects where a Code for Sustainable Homes assessment is carried out. Whilst every care is taken in preparing the Wat 1 assessment tool, BREG cannot accept responsibility for any inaccuracies or for consequential loss incurred as a result of such inaccuracies arising through the use of the Wat 1 tool.

PRINTING: before printing please make sure that in "Page Setup" you have selected the page to be as "Landscape" and that the Scale has been set up to 70% (maximum)

WATER EFFICIENCY CALCULATOR FOR NEW DWELLINGS - (BASIC CALCULATOR)																							
	House Type:	House Type: Type 1		Type 1		Type 2		Type 3		Type 4		Type 5		Тур	pe 6	Type 7		Type 8		Type 9		Тур	e 10
	Description:	All Reside	ntial Units				-																
Installation Type	Unit of measure	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day		
Is a dual or single flush WC specified? Dual		ual	Select option: Select option:		option:	Select option:		Select	Select option:		Select option:		Select option:		Click to Select		Click to Select		Select				
wo	Full flush volume	6	8.76		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		
WC	Part flush volume	3	8.88		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		
Taps (excluding kitchen and external taps)	Flow rate (litres / minute)	2	4.74		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		
Are both a Bath &	Shower Present?	Bath &	Shower	Select	option:	Select	option:	Select	option:	Select	option:	Select	option:	Select	option:	Select	option:	Select option:		on: Select option			
Bath	Capacity to overflow	150	16.50		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		
Shower	Flow rate (litres / minute)	9	39.33		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		
Kitchen sink taps	Flow rate (litres / minute)	10	14.76		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		
Has a washing maching	ne been specified?	Y	es	Select option:		Select option:		Select option:		Select option:		Select option:		Select option:		Select option:		Select option:		Select option:			
Washing Machine	Litres / kg	8.17	17.16		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		
Has a dishwash	er been specified?	Y	es	Select option: Select option		option:	Select option:																
Dishwasher	Litres / place setting	1.25	4.50		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		
Has a waste	disposal unit been specified?	No	0.00	Select option:	0.00	Select option:	0.00	Select option:	0.00	Select option:	0.00	Select option:	0.00	Select option:	0.00	Select option:	0.00	Select option:	0.00	Select option:	0.00		
Water Softener	Litres / person / day		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		
	Calcu	lated Use	114.6		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		
	Normalisat	tion factor	0.91		0.91		0.91		0.91		0.91		0.91		0.91		0.91		0.91		0.91		
Code for	Total Consur	nption	104.3		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		
Sustainable Homes	Mandatory	level	Level 3/4		-		-		-		-		-		-		-		-		-		
Building	External u	use	5.0		5.0		5.0		5.0		5.0		5.0		5.0		5.0		5.0		5.0		
Regulations 17.K	Total Consu	mption	109.3		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		
17.K Compliance		ance?	Yes		-		-		-		-		-		-		-		-		-		