

# Flat 4, 14 West Cottages, West End Lane, NW6

# Energy Statement for Planning

Job No: 4187 Issued: December 2021 Issue: 1

other than for the purpose for which it was produced.



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# Document Control

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# 1.0 Executive Summary

- 1.1 T16 Design has been appointed to produce this Energy Statement for the proposed development at Flat 4, 14 West Cottages, NW6.
- 1.2 The report assesses the impact on CO2 emissions of introducing a ASHP which provides heating and cooling for the proposed extension of Flat 4. 14 West Cottages, NW6.
- 1.3 The methodology used to demonstrate the effects of the proposed energy efficiency measures is the 3-stage Energy Hierarchy expounded by the London Plan 2021, Policy Sl2 'Minimising greenhouse gas emissions'.
- 1.4 Emissions reductions are shown for the proposed scheme at each of these stages and the strategy underpinning them is detailed in the relevant sections of the report.
- 1.5 The overall effect of these measures is a reduction in CO<sub>2</sub> emissions of at least 35%.



# 2.0 Project Summary

- 2.1 The site is located at Flat 4, 14 West Cottages, NW6.
- 2.2 Currently the site is occupied by a two bedroom top floor flat.
- 2.3 The proposal involves the refurbishment and extension of the existing flat to provide a one bedroom flat.
- 2.4 The proposal also involves updating the heating and cooling system to provide an ASHP which will provide heating and cooling.



Site Location as Existing



# 3.0 Policy Requirements and Drivers

- 3.1 The relevant planning policy documents for this site, relating to energy are:
  - The London Plan (2021)
- 3.2 The London Plan is the overall strategic plan for London, setting out an integrated economic, environmental, transport and social framework for developments in London over the coming decades.
- 3.3 The primary driver for this report is Policy SI 2 "Minimizing greenhouse emissions".
- 3.4 This policy sets out that residential and non-residential developments are required to reduce emissions by at least 35% over Building Regulations.
- 3.5 In light of these policy requirements and through the developer and design team's commitment to reducing the impact of the development on the environment, this report sets out some of the measures that will be adopted to meet the policy targets.



# 4.0 Overheating Hierarchy

- 4.1 London Plan Policy 5.9 'Overheating and Cooling' states that major development proposals should reduce potential overheating and reliance on air conditioning systems and demonstrate this in accordance with the following cooling hierarchy.
  - minimise internal heat generation through energy efficient design.
  - reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls.
  - manage the heat within the building through exposed internal thermal mass and high ceilings.
  - 4) passive ventilation.
  - 5) mechanical ventilation.
  - 6) active cooling systems (ensuring they are the lowest carbon options).
- 4.2 The building has been designed to be energy efficient and this has been addressed elsewhere in this energy statement and demonstrated in the calculations.
- 4.3 The building contains relatively high ceilings in accordance with stage 3 of the cooling hierarchy.
- 4.4 An initial SAP assessment has shown that there would be a medium risk of overheating.
- 4.5 To avoid being uncomfortable on the hottest days of the year it is proposed that an ASHP will be installed to provide cooling as well as heating.



# 5.0 Energy Strategy and Approach

- 5.1 The London Plan document titled "Energy Assessment Guidance", updated in October 2018, provides the parameters by which Energy Statements should be formulated and the approach to be adopted.
- 5.2 The three stages of the hierarchy are referred to as Be Lean (Use Less Energy), Be Clean (Supply Energy Efficiently) and Be Green (Use Renewable Energy).
- 5.3 Essentially, this means the first step is to improve insulation and air tightness levels and to reduce thermal bridging.
- 5.4 Stage 2 is to supply energy cleanly, meaning consideration of the use of district heating networks, biomass and Combined Heat and Power.
- 5.5 The third stage is the addition, where required and sensible, of renewable technology such as heat pumps, solar panels, wind and hydroelectric.
- 5.6 The first stage of this process is to establish the baseline emissions on which the reductions will be based.
- 5.7 This is done using SAP (Standard Assessment Procedure) for residential developments.



# 6.0 Baseline Emissions

- 6.1 The baseline emissions on which reduction figures are based are calculated using SAP.
- 6.2 SAP calculates a notional building based on the minimum values for Part L1B of the building regulations.
- 6.3 The parameters used are defined by the methodology and represent a target upon which improvements can be measured.
- 6.4 The baseline emission have been taken from the GLA carbon emissions reporting tool.
- 6.5 The baseline emissions are as follows:

Element	Annual Emissions SAP10 (Kg) per Year
Flat 4, 14 West Cottages	1,683



# 7.0 Be Lean Strategy

- 7.1 The next stage, once the baseline has been established, is to make improvements within the "Be Lean" category. This includes improving the U Values and the reduction of thermal bridging.
- 7.2 A gas combi boiler with a 90% efficiency has been assumed at this stage.
- 7.3 Passive ventilation has been assumed at this stage.
- 7.4 Accredited Construction Details have been assumed for the thermal bridging.
- 7.5 The U value improvements for each element, with the relevant Part L notional values are shown below.
- 7.6 The reduction in emissions achieved from these improvements can be seen in Section 9.

Element (Converted Units)	Value Used	Part L1B Backstop	Improvement
Existing wall	0.55 W/m²K	0.55 W/m²K	0%
New Walls	0.28 W/m²K	0.28 W/m²K	0%
Existing Roof	0.18 W m²K	0.18 W/m²K	0%
Proposed Roof	0.18 W m²K	0.18 W/m²K	0%
Windows	1.4 W/m²K	1.6 W/m²k	12.5%
Air Permeability	15	15	0%



# 8.0 Be Clean Strategy

- 8.1 The Be Clean element of the hierarchy refers to supplying energy in a clean manner. This encompasses decentralised energy and heat networks and the consideration of Combined Heat and Power.
- 8.2 The site is not near any existing or proposed decentralized energy or heating network (as shown on the map below).



8.3 Due to the relatively small scale of the proposal, CHP is also not a viable solution. London Plan guidance suggests that CHP is most suitable for developments of at least 500 units.



# 9.0 Be Green Strategy

- 9.1 The Be Green element of the hierarchy requires the consideration of renewable technologies to reduce emissions still further beyond the savings made at the Be Lean and Be Clean stages.
- 9.2 The technologies that are considered here are wind power and solar panels (photovoltaic (PV) or Solar Thermal).
- 9.3 Wind power is not suitable in a location such as this. Wind turbines tend to perform poorly in built-up areas.
- 9.4 Any wind that is received on the site would be too intermittent and turbulent to provide any meaningful reduction in emissions.
- 9.5 Ground Source Heat pumps are also unlikely to be a viable proposition due to the ground disturbance required in their installation.
- 9.6 Air Source Heat Pumps (ASHP) that provides cooling will be used.
- 9.7 It is proposed that the ASHPs will have an efficiency of at least 170% and will provide heating, hot water and cooling to the development.



# 10.0 Summary of Results

- 10.1 The tables below give the percentage improvement in emissions at each stage of the hierarchy and the overall savings made over Part L of the Building Regulations.
- 10.2 The building will be provided with increased U values (as shown above) and ASHPs.
- 10.3 The figures below have been calculated using the GLA carbon emission reporting tool and show the total CO2 emissions expected under SAP 10 Carbon factors.
- 10.4 The SAP worksheets attached have been used for input data into the spreadsheet.

Flat 4, 14 West Cottages, NW6	Carbon Dioxide Emissions for non-domestic buildings (KG CO2 per annum) Regulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	1683
After energy demand reduction	1648
After heat network / CHP	1648
After renewable energy	773

#### Table 1 – SAP10 Emissions Flat 4, 14 West Cottages, NW6

	Regulated domestic carbon dioxide savings					
	(KG CO₂ per annum)	(%)				
Savings from energy demand reduction	35	2%				
Savings from heat network / CHP	0	0%				
Savings from renewable energy	875	53%				
Cumulative on site savings	910	54%				

Table 2 – Carbon savings



# 11.0 Conclusion

- 11.1 This report has been set out to demonstrate how the proposed development at 196 High Street, Hounslow, will meet the policy requirement of achieving 35% reduction in emissions through the Be Lean, Be Clean, Be Green hierarchy.
- 11.2 In doing so, preliminary SAP calculations have been undertaken using the information available and sensible assumptions on construction and M&E parameters.
- 11.3 The baseline figures have been calculated and improvements made to the fabric and plant proposed for the scheme.
- 11.4 The measures proposed are detailed above but summarise as:
  - Air Source Heat Pumps
- 11.5 The results in Section 10 show that a 54% improvement is met using the GLA's carbon emission reporting spreadsheet. This mean that the introduction of the ASHP to provide cooling, heating and hot water will be a benefit to the occupants ensuring that overheating will not be an issue in the hottest parts of the summer.





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# **Regulations Compliance Report**

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50 *Printed on 20 December 2021 at 14:42:33* 

Project Information:								
Assessed By: Samuel Westover (STR0012073) Building Type: Flat								
Dwelling Details:								
NEW EXTENSION 1	TO EXISTING DWE	Total Floor Area: 54	4.3m²					
Site Reference :	4, 14 West Cottage	Plot Reference:	Flat 4 - Backstop					
Address :	, London, NW6 1RJ							
Client Details:								
Name:								
Address :								
This report covers It is not a complete	items included wit report of regulation	hin the SAP calculations ons compliance.	. <b>.</b>					
1a TER and DER								
Fuel for main heating	g system: Mains ga	3						
Fuel factor: 1.00 (ma	ains gas)							
Dwelling Carbon Dioxi	de Emission Rate (		22.36 Kg/m <sup>2</sup>		Fail			
Excess emissions =	$10.95 \text{ kg/m}^2$ (49 %)		55.51 kg/III-		i ali			
1b TFEE and DFE	E							
Target Fabric Energy	y Efficiency (TFEE)		64.1 kWh/m <sup>2</sup>					
Dwelling Fabric Ene	rgy Efficiency (DFE	E)	109.0 kWh/m²					
	$86 ka/m^2 (60.0.9/)$				Fail			
2 Excess energy = 44	1.00 Kg/112 (09.9 %)							
Element		Average	Highest					
External wa	all	0.48 (max, 0.30)	0.55 (max, 0.70)		Fail			
Floor		(no floor)						
Roof		0.18 (max. 0.20)	0.18 (max. 0.35)		ОК			
Openings		1.60 (max. 2.00)	1.60 (max. 3.30)		ОК			
2a Thermal bridgi	ng							
Thermal bri	idging calculated us	ing user-specified y-value	of 0.15					
3 Air permeability								
Air permeabil	ity at 50 pascals		15.00		ОК			
4 Heating efficient	су							
Main Heating system: Boiler systems with radiators or underfloor heating - mains gas Data from manufacturer Combi boiler Efficiency 90.0 % SEDBUK2009 Minimum 88.0 %								
Secondary he	eating system:	None						
5 Cylinder inculati	ion							
Hot water Sta		No cylinder						
	naye.				N/A			

# **Regulations Compliance Report**

6 Cc	ontrols			
	Space heating controls	l electrical services	OK	
	Hot water controls:			
		No cylinder		
	Boiler interlock:	Yes		OK
7 Lo	w energy lights			
	Percentage of fixed lights with lo	w-energy fittings	100.0%	
	Minimum		75.0%	OK
8 Me	echanical ventilation			
	Not applicable			
9 Su	Immertime temperature			
	Overheating risk (Thames valley	):	Medium	OK
Based	d on:			
	Overshading:		Average or unknown	
	Windows facing: North West		9.7m <sup>2</sup>	
	Windows facing: North East		3.4m <sup>2</sup>	
	Windows facing: North East		1.2m <sup>2</sup>	
	Windows facing: South East		4m <sup>2</sup>	
	Ventilation rate:		3.00	
10 K	Cey features			
			N 1	

None

Property Details: Fla	at 4 - Backstop									
Address:		, L	ondon, NW6 1RJ							
Located in:		Er	England							
Region:		Th	Thames valley							
UPRN:										
Date of assessme	ent:	20	December 2021							
Date of certificat	e:	20	December 2021							
Assessment type	:	Ne	ew extension to existing	dwelling						
Transaction type	:	N€	ew dwelling							
Tenure type:		Ur	IKNOWN							
Related party dis	sciosure:		dicativo Valuo Modium							
Mator uso < = 12	1 allieter. 25 litros/por	ni veb/aav								
PCDE Version	5 mies/per	3017 uay. 48	6							
TODI Version.			•							
Property description	:									
Dwelling type:		Fla	at							
Detachment:										
Year Completed:		20	21							
Floor Location:		FI	oor area:							
					Storey height	:				
Floor 0		54	.3 m²		2.8 m					
Living area		25	$25.4 \text{ m}^2$ (fraction 0.468)							
Front of dwelling fa	ices:	No	North West							
Opening types:										
Name:	Source:		Туре:	Glazing:		Argon: Frame:		e:		
NW	Manufacturer		Windows	low-E, En = 0.05, soft coat		Yes				
NE	Manufacturer		Windows	low-E, En = 0.05, soft coat		Yes				
NE Proposed	Manufacturer		Windows	low-E, $En = 0.05$ , soft coat		Yes				
SE Proposed	Manufacturer		Windows	low-E, En = 0.05, soft coat		Yes				
Name:	Gap:		Frame Factor	g-value: U-value		Area:	No. o	f Openinas:		
NW	16mm or	r more	0.7	0.76	1.6	9.7	1			
NE	16mm or	r more	0.7	0.76 1.6		3.4	3.4 1			
NE Proposed	16mm or	r more	0.7	0.76 1.6		1.2 1				
SE Proposed	16mm or	r more	0.7	0.76	1.6	4	1			
Name:	Type-Name	e:	Location:	Orient:		Width: Height:		nt:		
NW			Existing	North West		0	0			
NE			Existing	North East		0	0			
NE Proposed			Proposed	North East		0	0			
SE Proposed			Proposed	South East		0	0			
Overshading:		Av	erage or unknown							
Opaque Elements:			5							
Type: C External Elements	Gross area:	Opening	gs: Net area:	U-value:	Ru value:	Curtair	n wall:	Карра:		
Existing	62.44	13.1	49.34	0.55	0	False		N/A		
Proposed	23.8	5.2	18.6	0.28	0	False		N/A		
Flat	54.3	0	54.3	0.18	0			N/A		
Internal Elements										
Party Elements										

Thermal bridges:

Thermal bridges:	No information on thermal bridging (y=0.15) (y =0.15)					
Ventilation:						
Pressure test: Ventilation: Number of chimneys: Number of open flues: Number of fans: Number of passive stacks: Number of sides sheltered: Pressure test:	No (Assumed) Natural ventilation (extract fans) 0 0 2 0 2 2 15					
Main heating system:						
Main heating system:	Boiler systems with radiators or underfloor heating Gas boilers and oil boilers Fuel: mains gas Info Source: Manufacturer Declaration Manufacturer's data Efficiency: 90.0% (SEDBUK2009) Condensing combi with automatic ignition Fuel Burning Type: Unknown Systems with radiators Central heating pump : 2013 or later Design flow temperature: Unknown Unknown Boiler interlock: Yes Delayed start MCS Installation Certificate					
Main heating Control:						
Main heating Control:	Time and temperature zone control by suitable arrangement of plumbing and electrical services Control code: 2110					
Secondary heating system:						
Secondary heating system:	None					
Water heating:						
Water heating:	From main heating system Water code: 901 Fuel :mains gas No hot water cylinder Solar panel: False					
Others:						
Electricity tariff: In Smoke Control Area: Conservatory: Low energy lights: Terrain type: EPC language: Wind turbine: Photovoltaics: Assess Zero Carbon Home:	Standard Tariff Unknown No conservatory 100% Dense urban English No None None					

	User Details:										
Assessor Name: Software Name:	Samuel Westover Stroma FSAP 201	2	Stroma Number:STRCSoftware Version:Version					012073 n: 1.0.5.50			
		Prope	erty Address:	Flat 4 -	Backsto	р					
Address :	, London, NW6 1RJ										
1. Overall dwelling dimer	ISIONS:		• ( 0)			14.					
Ground floor			4 <b>rea(m²)</b> 54.3	(1a) x	<b>Av. Hei</b>	<b>ght(m)</b> .8	(2a) =	<b>Volume(m³)</b> 152.04	(3a)		
Total floor area TFA = (1a	)+(1b)+(1c)+(1d)+(1e	)+(1n) 🔽	54.3	(4)							
Dwelling volume				(3a)+(3b)-	+(3c)+(3d)	)+(3e)+	.(3n) =	152.04	(5)		
2. Ventilation rate:	-	_									
	main se heating h	econdary eating	other		total			m <sup>3</sup> per hour			
Number of chimneys	0 +	0 +	0	] = [	0	x 4	40 =	0	(6a)		
Number of open flues	0 +	0 +	0	] = [	0	x 2	20 =	0	(6b)		
Number of intermittent fan	is				2	x 1	0 =	20	(7a)		
Number of passive vents					0	x 1	0 =	0	(7b)		
Number of flueless gas fire	es				0	x 4	40 =	0	(7c)		
							Air ch	anges per hou	ur		
Infiltration due to chimney	s flues and fans - (6	a)+(6b)+(7a)+(7	′b)+(7c) =		20		- (5) -	0.12			
If a pressurisation test has be	en carried out or is intende	d, proceed to (	17), otherwise c	continue fro	20 om (9) to (	16)	- (0) -	0.15			
Number of storeys in the	e dwelling (ns)							0	(9)		
Additional infiltration						[(9)-	1]x0.1 =	0	(10)		
Structural infiltration: 0.2	25 for steel or timber f	rame or 0.3	5 for masonr	y constru	uction		[	0	(11)		
if both types of wall are pre	esent, use the value correspondent of the second upper 0, 25	ponding to the g	greater wall area	a (after							
If suspended wooden flo	oor. enter 0.2 (unseal	ed) or 0.1 (s	ealed), else	enter 0			[	0	<b>1</b> (12)		
If no draught lobby, ente	er 0.05, else enter 0		<b>,</b> ,					0	(13)		
Percentage of windows	and doors draught st	ripped						0	(14)		
Window infiltration	-		0.25 - [0.2	x (14) ÷ 10	= [00			0	(15)		
Infiltration rate			(8) + (10) -	+ (11) + (12) + (13) + (15) = 0					(16)		
Air permeability value, o	50, expressed in cub	ic metres pe	r hour per so	quare me	etre of e	nvelope	area	15	(17)		
If based on air permeabilit	y value, then (18) = [(1	7) ÷ 20]+(8), oth	nerwise (18) = (	16)			[	0.88	(18)		
Air permeability value applies	if a pressurisation test has	been done or a	a degree air pei	meability is	s being us	ed	r		-		
Number of sides sheltered Shelter factor	1		(20) = 1 - [	0.075 x (19	9)] =			2	(19)		
Infiltration rate incorporati	na shelter factor		(21) = (18)	(20) =	-/]		l	0.85	$\int_{(21)}^{(20)}$		
Infiltration rate modified for	r monthly wind spood		(21) = (10)	(x (20) -			l	0.75	(21)		
				Son	Oct	Nov	Dec				
	viai   Api   ividy		u Aug	Seh		NUV	Dec				
$(22)_{m-}$ 51 51		38 2	8 37	Δ	43	45	47				
	<sup>1.0</sup>   <sup>1.4</sup>   <sup>4.3</sup>	0.0 0.	5 <u>5.</u> 7	7	ч. <del>у</del>	4.0	7.1				
Wind Factor (22a)m = (22	)m ÷ 4										
(22a)m= 1.27 1.25 1	.23 1.1 1.08	0.95 0.9	95 0.92	1	1.08	1.12	1.18				

Adjust	ed infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
	0.96	0.94	0.92	0.82	0.81	0.71	0.71	0.69	0.75	0.81	0.84	0.88		
Calcul If me	ate etter	ctive air al ventila	change i ation:	rate for t	he appli	cable ca	se					1	0	(232)
lf exh	aust air h	eat pump i	using App	endix N. (2	3b) = (23a	a) x Fmv (e	equation (N	N5)) . othe	rwise (23b	) = (23a)		l	0	(23b)
If bala	anced with	n heat reco	overv: effic	iencv in %	allowing f	or in-use f	actor (from	n Table 4h	) =	(200)		l	0	(230)
a) If	halance	d mech	anical ve	ntilation	with he	at recove		HR) (24a	(2)m - (2)	2h)m + (	23h) v ['	 1 – (23c)	0 ∸ 1001	(230)
(24a)m=					0			0	0			1 - (230)	÷ 100]	(24a)
(,). b) If	halance	d mech:	anical ve		without	heat rec	overv (N	<u> </u>	1 - (22)	2h)m + ('	23h)			. ,
(24b)m=					0				0		0	0		(24b)
c) If	whole h	L OUSE EX	L tract ver	LI	L or positiv	L ve input v	l ventilatio	n from o	L outside	ļ				
0) 11	if (22b)n	n < 0.5 ×	(23b), t	then (240	c) = (23b	b); other	vise (24	c) = (22k	o) m + 0.	.5 × (23b	<b>)</b> )			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If	natural if (22b)n	ventilation = 1 the	on or wh en (24d)	ole hous $m = (22)$	e positiv	ve input ve erwise (2	ventilatio 4d)m = 0	on from I	oft 2b)m² x	0.51	•			
(24d)m=	0.96	0.94	0.92	0.84	0.82	0.75	0.75	0.74	0.78	0.82	0.86	0.89		(24d)
Effe	ctive air	change	rate - er	uter (24a	) or (24t	) or (24	c) or (24	d) in box	(25)					
(25)m=	0.96	0.94	0.92	0.84	0.82	0.75	0.75	0.74	0.78	0.82	0.86	0.89		(25)
										1	1	1		
3. He	at losse	s and he	eat loss p	paramete	ər:				_			1 -1 -1		
ELEN	/IEN I	area	3S (m²)	Openin m	gs I <sup>2</sup>	Net Ar A ,r	ea n²	U-vail W/m2	Je K	A X U (W/I	K)	k-value kJ/m²·ł	) <	A X K kJ/K
Windo	ws Type	e 1				9.7	x1,	/[1/( 1.6 )+	0.04] =	14.59				(27)
Windo	ws Type	92				3.4	x1,	/[1/( 1.6 )+	0.04] =	5.11				(27)
Windo	ws Type	93				1.2	x1,	/[1/( 1.6 )+	0.04] =	1.8				(27)
Windo	ws Type	94				4	x1,	/[1/( 1.6 )+	0.04] =	6.02				(27)
Walls <sup>-</sup>	Type1	62.4	14	13.1		49.34	x	0.55	=	27.14				(29)
Walls	Type2	23.	8	5.2		18.6	x	0.28	=	5.21			<b>┐</b>	(29)
Roof		54.3	3	0		54.3	x	0.18		9.77	T T		<b>┤</b>	(30)
Total a	area of e	lements	, m²			140.5	4	L	'					(31)
* for win ** includ	idows and le the area	roof winde	ows, use e sides of ir	effective wi	ndow U-va Is and part	alue calcul titions	ated using	formula 1	/[(1/U-valı	ıe)+0.04] a	as given in	paragraph	3.2	
Fabric	heat los	s, W/K :	= S (A x	U)				(26)(30)	+ (32) =				69.64	(33)
Heat c	apacity	Cm = S(	(Axk)						((28)	(30) + (32	2) + (32a).	(32e) =	5244.5	(34)
Therm	al mass	parame	ter (TMF	⊃ = Cm ÷	- TFA) ir	n kJ/m²K			Indica	itive Value	: Medium		250	(35)
For desi can be ı	ign assess used inste	sments wh ad of a de	ere the de tailed calc	tails of the ulation.	construct	ion are not	t known pr	ecisely the	e indicative	e values of	TMP in Ta	able 1f		
Therm	al bridge	es : S (L	x Y) cal	culated u	using Ap	pendix ł	<					[	21.08	(36)
if details	s of therma	al bridging	are not kn	10wn (36) =	= 0.05 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			90.72	(37)
Ventila	ation hea	at loss ca	alculated	1 monthly	y				(38)m	= 0.33 × (	25)m x (5)	) 	l	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	47.98	47.09	46.22	42.13	41.36	37.8	37.8	37.14	39.17	41.36	42.91	44.53		(38)
Heat ti	ransfer o	coefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	138.7	137.81	136.94	132.85	132.08	128.52	128.52	127.86	129.89	132.08	133.63	135.25		
										Average =	Sum(39)1	12 /12=	132.85	(39)

Heat lo	oss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	(4)			
(40)m=	2.55	2.54	2.52	2.45	2.43	2.37	2.37	2.35	2.39	2.43	2.46	2.49		
Numbe	er of day	s in mo	nth (Tab	le 1a)				<b>!</b>		Average =	Sum(40)1	.12 /12=	2.45	(40)
- turno	Jan	Feb	Mar	Apr	May	Jun	Jul	Αυσ	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
			-		-		-			-		-		
4. Wa	ater heat	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ied occu A > 13.9 A £ 13.9	upancy, 9, N = 1 9, N = 1	N + 1.76 x	[1 - exp	o(-0.0003	349 x (Tł	FA -13.9	)2)] + 0.(	0013 x ( <sup>-</sup>	TFA -13.	9)	82		(42)
Annua Reduce not more	l averag the annua e that 125	je hot wa al average litres per j	ater usag hot water person pe	ge in litre usage by r day (all w	es per da 5% if the c vater use, l	ay Vd,av Iwelling is hot and co	erage = designed ld)	(25 x N) to achieve	+ 36 a water us	se target o	77. f	.35		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wat	er usage il I	n litres pei I	r day for ea	ach month I	Vd,m = fa 1	ctor from	i able 1c x	(43) T						
(44)m=	85.08	81.99	78.9	75.8	72.71	69.61	69.61	72.71	75.8	78.9	81.99	85.08		
Energy	content of	hot water	used - cal	culated m	onthly = 4.	190 x Vd,ı	m x nm x [	OTm / 3600	) kWh/mor	Total = Su hth (see Ta	m(44) <sub>112</sub> = ables 1b, 10	c, 1d)	928.19	(44)
(45)m=	126.18	110.36	113.88	99.28	95.26	82.2	76.17	87.41	88.46	103.09	112.53	122.2		
lf instan	tanoous w	uator hoati	na at poin	t of use (n	hot water	r storago)	ontor 0 in	hoves (46	) to (61)	Total = Su	m(45) <sub>112</sub> =		1217.01	(45)
						siorage),				45.40	40.00	10.00		(46)
(46)m= Water	18.93 storage	16.55 loss:	17.08	14.89	14.29	12.33	11.43	13.11	13.27	15.46	16.88	18.33		(46)
Storag	e volum	e (litres)	) includir	ng any se	olar or W	WHRS	storage	within sa	ame ves	sel	(	2		(47)
If com	munity h	neating a	and no ta	ink in dw	velling, e	enter 110	) litres in	(47)						
Otherv	vise if no	o stored	hot wate	er (this ir	ncludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in (	47)			
Water	storage	loss:	odorodi	ana fant	or io kno	wp /1/\//	dov)					_		(40)
a) II II Tamma						WII (KVVI	i/uay).					)		(48)
Tempe								(40) (40)	\ \			)		(49)
b) If m	anufact	urer's de	eclared (	cvlinder	ear loss fact	or is not	known:	(46) X (49)	) =		(	)		(50)
Hot wa	ater stor	age loss	factor fi	om Tab	le 2 (kW	h/litre/da	ay)					)		(51)
If com	munity h	neating s	ee secti	on 4.3										
Volum T	e factor	from Ta	ble 2a								(	0		(52)
i empe	erature f	actor fro	m ladie	20								)		(53)
Energy	/ lost fro	m watei	storage	, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =	(	)		(54)
Water	storade		culated :	for each	month			((56)m - (	55) 🗸 (41)	m	(	J		(55)
valer	Sillaye							((50))) – (				•		(50)
(56)m= If cylinde	0 er contains	0 s dedicate	0 d solar sto	0 rage, (57)	0 m = (56)m	0 x [(50) - (	0 [H11)] ÷ (5	0 i0), else (5	0 7)m = (56)	0 m where (	0 H11) is fro	0 m Append	ix H	(96)
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	v circuit	loss (ar	nual) fro	om Table	- - 3							)		(58)
Primar	y circuit	loss cal	culated	for each	month (	59)m =	(58) ÷ 36	65 × (41)	m		`			
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wa	ter heati	ng and a	cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi	loss ca	alculated	for eac	h month	(61)m =	(60)	) ÷ 36	5 × (41)	)m						
(61)m=	43.36	37.74	40.2	37.38	37.05	34	4.33	35.47	37.05	37.38	40.2	40.43	43.36	]	(61)
Total h	eat req	uired for	water h	neating c	alculated	l for	each	month	(62)m =	= 0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	169.54	148.09	154.08	136.66	132.31	11	6.53	111.65	124.46	125.84	143.29	152.96	165.55		(62)
Solar DH	-IW input	calculated	using Ap	pendix G c	r Appendix	: H (r	negativ	e quantity	v) (enter 'C	' if no sola	r contribu	tion to wate	er heating)		
(add a	dditiona	al lines if	FGHR	S and/or	WWHRS	ар	plies,	see Ap	pendix (	G)				-	
(63)m=	0	0	0	0	0		0	0	0	0	0	0	0		(63)
Output	from w	vater hea	ter	_		_	_			_	_	-	_	_	
(64)m=	169.54	148.09	154.08	136.66	132.31	11	6.53	111.65	124.46	125.84	143.29	152.96	165.55		_
									Out	out from w	ater heate	er (annual)₁	12	1680.98	(64)
Heat g	ains fro	om water	heating	g, kWh/m	onth 0.2	5´[	0.85	× (45)m	+ (61)n	n] + 0.8 x	x [(46)m	+ (57)m	+ (59)m	]	
(65)m=	52.79	46.13	47.92	42.36	40.94	35	5.92	34.2	38.33	38.76	44.33	47.52	51.47		(65)
inclu	ide (57)	)m in calo	culation	of (65)m	n only if c	ylin	der is	in the c	dwelling	or hot w	vater is f	rom com	munity h	neating	
5. Int	ernal g	ains (see	Table	5 and 5a	ı):										
Metab	olic gaiı	ns (Table	5), Wa	atts		_								_	
	Jan	Feb	Mar	Apr	May		Jun	Jul	Aug	Sep	Oct	Nov	Dec	]	
(66)m=	109.01	109.01	109.01	109.01	109.01	10	9.01	109.01	109.01	109.01	109.01	109.01	109.01	]	(66)
Lightin	g gains	s (calcula	ted in A	ppendix	L, equat	ion	L9 or	L9a), a	lso see	Table 5				-	
(67)m=	35.3	31.35	25.5	19.3	14.43	12	2.18	13.16	17.11	22.96	29.16	34.03	36.28		(67)
Applia	nces ga	ains (calc	ulated i	n Appen	dix L, eq	uati	on L1	3 or L1	3a), also	see Ta	ble 5		•	-	
(68)m=	236.39	238.84	232.66	219.5	202.89	18	7.28	176.85	174.39	180.57	193.73	210.35	225.96		(68)
Cookir	ng gains	s (calcula	ted in A	Appendix	L, equa	tion	L15 c	or L15a)	, also s	ee Table	5	-		-	
(69)m=	47.72	47.72	47.72	47.72	47.72	47	7.72	47.72	47.72	47.72	47.72	47.72	47.72	]	(69)
Pumps	and fa	ns gains	(Table	5a)										-	
(70)m=	3	3	3	3	3		3	3	3	3	3	3	3	]	(70)
Losses	s e.g. e	vaporatio	n (nega	ative valu	ies) (Tab	le 5					•	-	•	•	
(71)m=	-72.67	-72.67	-72.67	-72.67	-72.67	-7	2.67	-72.67	-72.67	-72.67	-72.67	-72.67	-72.67	]	(71)
Water	heating	, g gains (T	able 5)	•	•	•	!			!	<u>.</u>	•			
(72)m=	70.96	68.64	64.4	58.83	55.02	49	9.88	45.96	51.51	53.83	59.58	66	69.18	]	(72)
Total i	nterna	l gains =		-	•		(66)r	m + (67)m	ı + (68)m ·	+ (69)m +	(70)m + (	71)m + (72)	)m		
(73)m=	429.7	425.89	409.61	384.69	359.4	33	6.39	323.03	330.07	344.42	369.53	397.44	418.47	]	(73)
6. So	lar gain	IS:		•			-			•	•				
Solar g	ains are	calculated	using sol	ar flux fron	Table 6a	and	associa	ated equa	tions to co	onvert to th	ne applica	ble orientat	tion.		
Orienta	ation:	Access F	actor	Area	ı		Flux	(		g_		FF		Gains	
		Table 6d		m²			Tab	le 6a	T	able 6b	T	able 6c		(W)	
Northea	ast <mark>0.9x</mark>	0.77	;	<b>(</b> 3	.4	x	11	1.28	x	0.76	<b>x</b>	0.7	=	14.14	(75)
Northea	ast <mark>0.9x</mark>	0.77	)	( 1	.2	<b>x</b> [	11	1.28	x	0.76	<b>x</b>	0.7	=	4.99	(75)
Northea	ast <mark>0.9x</mark>	0.77	;	3	.4	<b>x</b> [	22	2.97	x	0.76	×	0.7	=	28.79	(75)
Northea	ast <mark>0.9x</mark>	0.77	;	( 1	.2	x	22	2.97	x	0.76	x	0.7	=	10.16	(75)
Northea	ast <mark>0.9x</mark>	0.77	;	( 3	.4	×	41	1.38	x	0.76	x	0.7	=	51.87	(75)

No who a set a s		٦		1		1		1		1		٦
Northeast 0.9x	0.77	×	1.2	X	41.38	X	0.76	X	0.7	=	18.31	_(75)
Northeast 0.9x	0.77	x	3.4	x	67.96	x	0.76	x	0.7	=	85.18	(75)
Northeast 0.9x	0.77	x	1.2	x	67.96	x	0.76	x	0.7	=	30.06	(75)
Northeast 0.9x	0.77	x	3.4	x	91.35	x	0.76	x	0.7	=	114.5	(75)
Northeast 0.9x	0.77	x	1.2	x	91.35	x	0.76	x	0.7	=	40.41	(75)
Northeast 0.9x	0.77	x	3.4	x	97.38	x	0.76	x	0.7	=	122.07	(75)
Northeast 0.9x	0.77	x	1.2	x	97.38	x	0.76	x	0.7	=	43.08	(75)
Northeast 0.9x	0.77	x	3.4	x	91.1	x	0.76	x	0.7	=	114.2	(75)
Northeast 0.9x	0.77	x	1.2	x	91.1	x	0.76	x	0.7	] =	40.3	(75)
Northeast 0.9x	0.77	x	3.4	×	72.63	×	0.76	x	0.7	=	91.04	(75)
Northeast 0.9x	0.77	x	1.2	x	72.63	x	0.76	x	0.7	=	32.13	(75)
Northeast 0.9x	0.77	x	3.4	x	50.42	x	0.76	x	0.7	=	63.2	(75)
Northeast 0.9x	0.77	x	1.2	x	50.42	x	0.76	x	0.7	=	22.31	(75)
Northeast 0.9x	0.77	x	3.4	x	28.07	x	0.76	x	0.7	=	35.18	(75)
Northeast 0.9x	0.77	x	1.2	x	28.07	x	0.76	x	0.7	=	12.42	(75)
Northeast 0.9x	0.77	x	3.4	x	14.2	x	0.76	x	0.7	=	17.8	(75)
Northeast 0.9x	0.77	x	1.2	x	14.2	x	0.76	x	0.7	] =	6.28	(75)
Northeast 0.9x	0.77	x	3.4	x	9.21	x	0.76	x	0.7	=	11.55	(75)
Northeast 0.9x	0.77	x	1.2	x	9.21	x	0.76	x	0.7	] =	4.08	(75)
Southeast 0.9x	0.77	x	4	x	36.79	x	0.76	x	0.7	=	54.26	(77)
Southeast 0.9x	0.77	x	4	x	62.67	x	0.76	x	0.7	=	92.42	(77)
Southeast 0.9x	0.77	x	4	x	85.75	x	0.76	x	0.7	=	126.46	(77)
Southeast 0.9x	0.77	x	4	x	106.25	x	0.76	x	0.7	=	156.69	(77)
Southeast 0.9x	0.77	x	4	x	119.01	x	0.76	x	0.7	=	175.51	(77)
Southeast 0.9x	0.77	x	4	x	118.15	x	0.76	x	0.7	=	174.24	(77)
Southeast 0.9x	0.77	x	4	x	113.91	x	0.76	x	0.7	=	167.98	(77)
Southeast 0.9x	0.77	x	4	x	104.39	x	0.76	x	0.7	=	153.94	(77)
Southeast 0.9x	0.77	x	4	x	92.85	x	0.76	x	0.7	=	136.93	(77)
Southeast 0.9x	0.77	x	4	x	69.27	x	0.76	x	0.7	=	102.15	(77)
Southeast 0.9x	0.77	x	4	x	44.07	x	0.76	x	0.7	=	64.99	(77)
Southeast 0.9x	0.77	x	4	x	31.49	x	0.76	x	0.7	=	46.44	(77)
Northwest 0.9x	0.77	x	9.7	x	11.28	x	0.76	x	0.7	=	40.35	(81)
Northwest 0.9x	0.77	x	9.7	×	22.97	x	0.76	x	0.7	] =	82.13	(81)
Northwest 0.9x	0.77	x	9.7	x	41.38	x	0.76	x	0.7	=	147.98	(81)
Northwest 0.9x	0.77	x	9.7	x	67.96	x	0.76	x	0.7	=	243.02	(81)
Northwest 0.9x	0.77	x	9.7	x	91.35	x	0.76	x	0.7	=	326.67	(81)
Northwest 0.9x	0.77	x	9.7	×	97.38	x	0.76	x	0.7	=	348.26	(81)
Northwest 0.9x	0.77	x	9.7	×	91.1	×	0.76	x	0.7	=	325.79	(81)
Northwest 0.9x	0.77	x	9.7	×	72.63	×	0.76	x	0.7	] =	259.73	(81)
Northwest 0.9x	0.77	x	9.7	×	50.42	×	0.76	x	0.7	=	180.31	(81)
Northwest 0.9x	0.77	x	9.7	×	28.07	x	0.76	x	0.7	=	100.37	(81)

Northw	est 0.9x	0.77	x	9.	7	×	1	14.2	x	0.76	] × [	0.7	=	50.77	(81)
Northw	est 0.9x	0.77	x	9.	7	×Ī	ç	9.21	×	0.76	=	0.7		32.95	(81)
	L	-				L						-			
Solar	nains in	watts c	alculated	l for eac	h month				(83)m = S	um(74)m	(82)m				
(83)m=	113.74	213.51	344.61	514.96	657.09	68	7.65	648.27	536.84	402.75	250.12	139.84	95.01	l	(83)
Total g	jains – i	nternal a	and solar	r (84)m =	i = (73)m	ı + (8	3)m	, watts						1	
(84)m=	543.44	639.4	754.22	899.64	1016.48	102	24.05	971.3	866.91	747.17	619.65	537.27	513.49	I	(84)
				<i>(</i> ) <i>(</i> )							I			l	
7. Me	an inter	nal temp	perature	(heating	season	)									7
Temp	erature	during h	neating p	eriods ir	h the livi	ng a	area f	rom Tab	ole 9, Th	1 (°C)				21	(85)
Utilisa	ation fac	tor for g	ains for l	living are	ea, h1,m	i (se	e Ta	ble 9a)			r			1	
	Jan	Feb	Mar	Apr	May	<u> </u>	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	0.99	0.98	0.96	0.91	0.81	0	.66	0.53	0.59	0.81	0.94	0.98	0.99		(86)
Mean	interna	l temper	rature in	living are	ea T1 (fo	ollov	<i>w</i> ste	ps 3 to 7	in Tabl	e 9c)					
(87)m=	18.55	18.8	19.25	19.89	20.43	20	0.79	20.92	20.89	20.59	19.89	19.14	18.55	1	(87)
Tomp		during k		u Norioda ir	roct of	duu	olling	from To		h2 (⁰C)				1	
(88)m-					19.06		a 1	101117		10.08	19.06	10.04	10.03	1	(88)
(00)11=	10.99	19	19.01	19.05	19.00	<u> </u>	9.1	19.1	19.11	19.00	19.00	19.04	19.03	I	(00)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,ı	m (se	e Table	9a)					1	
(89)m=	0.98	0.97	0.94	0.87	0.73	0	.51	0.32	0.38	0.69	0.91	0.97	0.98	j	(89)
Mean	interna	l temper	rature in	the rest	of dwell	ing	T2 (fo	ollow ste	ps 3 to 7	7 in Tabl	e 9c)				
(90)m=	15.96	16.32	16.98	17.89	18.58	18	3.99	19.08	19.08	18.81	17.92	16.85	15.97	1	(90)
			!							f	LA = Livin	g area ÷ (4	+) =	0.47	(91)
Maan	interne		atura (fa	ماريم ماريم		11:00 0	.\ £I	Δ	. (4 4	A) <b>T</b> O					
			Tature (IC			liing L 40	)) = IL		+(1 - 1L)	A) X 12	10.05	17.02	17 10	1	(02)
(92)m=		17.40	10.04	10.03	19.40		9.03	19.94	19.93	19.04		17.92	17.10	i	(32)
Appiy									40, Whe	are appro		47 77	17.02	1	(03)
(93)m=	17.02	17.33	17.89	10.00	19.3		9.00	19.79	19.78	19.49	18.7	17.77	17.03	1	(33)
8. Sp		lung req	uirement				-1 -1				4 T:	70)	-		
Set I	i to the i	factor fo	ternal ter or gains	mperatui using Ta	re obtair able 9a	nea	at ste	эр 11 ог	Table 9	o, so tha	t II,m=(	76)m and	d re-calo	ulate	
	Jan	Feb	Mar	Apr	May	Γ.	lun	Jul	Aug	Sep	Oct	Nov	Dec	I	
Utilisa	ation fac	tor for a	ains, hm	<u>  , , , , , , , , , , , , , , , , , , ,</u>	may		Juit	oui	, tag	000	000		200	1	
(94)m=	0.97	0.96	0.93	0.86	0.74	0	.56	0.4	0.46	0.72	0.9	0.96	0.98	I	(94)
Usefu	L Il dains.	ı hmGm	I . W = (94	1 4)m x (84	L 4)m	1								1	
(95)m=	529.58	614.04	701.37	773.99	751.16	57	8.05	391.25	402.48	539.01	558.98	516.69	502.25	l	(95)
Month	L hlv aver	i ade exte	ernal tem	i perature	e from T	ı able	 9 8							1	
(96)m=	4.3	4.9	6.5	8.9	11.7	1	4.6	16.6	16.4	14.1	10.6	7.1	4.2	l	(96)
Heat	Loss rate	i e for me	ı an intern	al tempe	erature.	L Lm	. W =	=[(39)m :	x [(93)m	– (96)m	1			l	
(97)m=	1764.11	1713.42	1560.08	1299.07	1003.42	65	, 3.48	410.46	431.73	700.56	1069.27	1425.87	1734.9		(97)
Space	L e heatin	a reauir	I ement fo	r each n	i nonth. k'	ı Wh/	'mont	h = 0.02	4 x [(97)	)m – (95	)ml x (4	1)m		1	
(98)m=	918.49	738.79	638.88	378.06	187.69		0	0	0	0	379.66	654.61	917.09	l	
									Tota	l per vear	l (kWh/veai	) = Sum(9	B)1 59 12 =	4813.26	(98)
Creek	o hootin	~ ~ ~ ~			244004					1 - 7			- ,		
Space	e neatin	y require	ement in	KVVN/M4	year									88.64	(99)
9a. En	ergy red	quiremer	nts – Ind	ividual h	eating s	yste	ems i	ncluding	micro-C	HP)					
Spac	e heatii	ng:													٦.
Fracti	ion of sp	bace hea	at from s	econdar	y/supple	eme	ntary	system						0	(201)

Fracti	ion of sp	ace hea	t from m	nain syst	em(s)			(202) = 1 ·	- (201) =				1	(202)
Fracti	on of to	tal heatii	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of I	main spa	ace heat	ing syste	em 1								90	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g system	n, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	e heatin	g require	ement (c	alculate	d above)	)	r					1	1	
	918.49	738.79	638.88	378.06	187.69	0	0	0	0	379.66	654.61	917.09		
(211)m	$n = \{[(98)]$	)m x (20	4)] } x 1	00 ÷ (20	)6)						707.04		1	(211)
	1020.55	820.87	709.87	420.06	208.54	0	0			421.84	727.34	1018.99	50.40.07	
Casa	a haatin	a fuel (a			un a u th			TOLA		ar) =0um(2	15,1012	<u>-</u>	5348.07	(211)
Space = {[(98	e neatin )m x (2(	g tuel (s )1)]	econdar 00 ÷ (20	У), KVVN/ 181	month									
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
							1	Tota	l I (kWh/yea	ar) =Sum(2	1 215) <sub>15,1012</sub>		0	(215)
Water	heating	J												_
Output	from w	ater hea	ter (calc	ulated a	bove)	i	i	i	i	i	i	i	1	
	169.54	148.09	154.08	136.66	132.31	116.53	111.65	124.46	125.84	143.29	152.96	165.55		۰
Efficier	ncy of w	ater hea		00			0.0	00			00	00	90	(216)
(217)m=	90	90	90	90	90	90	90	90	90	90	90	90		(217)
Fuel to (219)m	or water 1 = (64)	neating, m x 100	кvvn/me ) ÷ (217)	ontn Im										
(219)m=	188.37	164.55	171.2	151.85	147.02	129.48	124.05	138.29	139.82	159.21	169.96	183.95		
								Tota	I = Sum(2	19a) <sub>112</sub> =			1867.75	(219)
Annua	I totals									k	Wh/year	•	kWh/year	-
Space	heating	fuel use	ed, main	system	1								5348.07	
Water	heating	fuel use	d										1867.75	
Electri	city for p	oumps, fa	ans and	electric	keep-ho	t								
centra	al heatir	g pump:	:									30		(230c)
Total e	electricity	/ for the	above, l	kWh/yea	r			sum	of (230a).	(230g) =			30	(231)
Electri	city for li	ghting											249.36	(232)
Total d	lelivered	l enerav	for all u	ses (211	)(221)	+ (231)	+ (232).	(237b)	=				7495.18	 ](338)
102		te - indiv	vidual be		etome:	. (_0.)	(_0_)	(_0: 0)						
104.1	uer coa		nuuai ne	sanny sy	36113.									
						Fu	el /h/veer			Fuel P	rice		Fuel Cost	
-						KV	/n/year				12)		£/year	-
Space	heating	- main s	system 1			(21	1) X			3.4	.8	x 0.01 =	186.11	(240)
Space	heating	- main s	system 2	2		(21:	3) x			0		x 0.01 =	0	(241)
Space	heating	- secon	dary			(21	5) x			13.	19	x 0.01 =	0	(242)
Water	heating	cost (oth	ner fuel)			(219	9)			3.4	-8	x 0.01 =	65	(247)
Pumps	s, fans a	nd elect	ric keep	-hot		(23)	1)			13.	19	x 0.01 =	3.96	(249)
(if off-n	eak tari	ff, list ea	ch of (2	30a) to (	230g) se	eparatel	/ as app	licable a	nd apply	fuel prie	ce accor	ding to	Fable 12a	_
	, for ligh	tina	Ň	, (	0,	(232	2)		,	13.	19	x 0.01 =	32.89	(250)
Lineigy	/ IOI ligh	ung												

Additional standing charges (Table 12)				120	(251)
Appendix Q items: repeat lines (253) and (25	4) as needed				
Total energy cost(245)	(247) + (250)(254) =			407.96	(255)
11a. SAP rating - individual heating systems	3				
Energy cost deflator (Table 12)				0.42	(256)
Energy cost factor (ECF) [(255	) x (256)] ÷ [(4) + 45.0] =			1.73	(257)
SAP rating (Section 12)				75.93	(258)
12a. CO2 emissions – Individual heating sys	stems including micro-CHF	)			
	<b>Energy</b> kWh/year	Emission factor kg CO2/kWh	r	<b>Emissions</b> kg CO2/yea	r
Space heating (main system 1)	(211) x	0.216	-	1155.18	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	-	403.43	(264)
Space and water heating	(261) + (262) + (263) + (	(264) =		1558.62	(265)
Electricity for pumps, fans and electric keep-h	not (231) x	0.519 =	=	15.57	(267)
Electricity for lighting	(232) x	0.519 =	-	129.42	(268)
Total CO2, kg/year		sum of (265)(271) =		1703.6	(272)
CO2 emissions per m <sup>2</sup>		(272) ÷ (4) =		31.37	(273)
EI rating (section 14)				77	(274)
13a. Primary Energy					
	<b>Energy</b> kWh/year	<b>Primary</b> factor		<b>P. Energy</b> kWh/year	
Space heating (main system 1)	(211) x	1.22 =	-	6524.64	(261)
Space heating (secondary)	(215) x	3.07	-	0	(263)
Energy for water heating	(219) x	1.22	-	2278.66	(264)
Space and water heating	(261) + (262) + (263) + (	(264) =		8803.3	(265)
Electricity for pumps, fans and electric keep-l	not (231) x	3.07	=	92.1	(267)
Electricity for lighting	(232) x	0 =	=	765.53	(268)
'Total Primary Energy		sum of (265)(271) =		9660.93	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		177.92	(273)

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 20 December 2021

#### Property Details: Flat 4 - Backstop

Dwelling type: Located in: Region: Cross ventilation po Number of storeys: Front of dwelling fac Overshading: Overhangs: Thermal mass param Night ventilation: Blinds, curtains, shu Ventilation rate durin	ssible: es: neter: tters: ng hot wea	ather (a	ch):	Flat England Thames va Yes 1 North Wes Average o None Indicative False 3 ( Window	alley st r unknown Value Medium ws open half t	ı he time)		
Summer ventilation Transmission heat lo Summer heat loss co	heat loss ( oss coeffic oefficient:	coefficie cient:	ent:	150.52 90.7 241.24				(P1) (P2)
Orientation: North West (NW) North East (NE) North East (NE Propos South East (SE Propos Solar shading:	Ratio: 0 0 sed)0 sed)0		<b>Z_overhangs:</b> 1 1 1 1					
<b>Orientation:</b> North West (NW) North East (NE) North East (NE Propos South East (SE Propos	Z blind 1 1 sed)1 sed)1	s:	<b>Solar access:</b> 0.9 0.9 0.9 0.9 0.9	<b>Ove</b> 1 1 1 1	rhangs:	<b>Z summer:</b> 0.9 0.9 0.9 0.9 0.9		(P8) (P8) (P8) (P8)
Solar gains: Orientation North West (NW) North East (NE) North East (NE Propos South East (SE Propos	0.9 x 0.9 x sed)0.9 x sed)0.9 x	<b>Area</b> 9.7 3.4 1.2 4	<b>Flux</b> 98.85 98.85 98.85 119.92	<b>g_</b> 0.76 0.76 0.76 0.76	FF 0.7 0.7 0.7 0.7	<b>Shading</b> 0.9 0.9 0.9 0.9 0.9 <b>Total</b>	<b>Gains</b> 413.17 144.82 51.11 206.71 815.81	(P3/P4)
Internal gains Internal gains Total summer gains Summer gain/loss rati Mean summer externa Thermal mass temper Threshold temperature Likelihood of high in	o Il temperat ature incre e <b>ternal ter</b>	ure (Th ment	names valley) <b>'e</b>	Ju 33 12 5.0 16 0.1 21 <b>SI</b>	<b>ine</b> 13.39 107.94 01 25 .26 <b>ight</b>	<b>July</b> 320.03 1135.83 4.71 17.9 0.25 22.86 <b>Medium</b>	August 327.07 1018.22 4.22 17.8 0.25 22.27 Medium	(P5) (P6) (P7)

# SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

# **Regulations Compliance Report**

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50 *Printed on 20 December 2021 at 14:42:33* 

Project Information	n:				
Assessed By:	Samuel Westover (	STRO012073)	Building Type:	Flat	
Dwelling Details:					
NEW EXTENSION	TO EXISTING DWE	LLING	Total Floor Area: 54	4.3m²	
Site Reference :	4, 14 West Cottage	s	Plot Reference:	Flat 4 - Be Lean	
Address :	, London, NW6 1R.	I			
Client Details:					
Name: Address :					
This report covers It is not a complet	items included wite report of regulation	hin the SAP calculations.			
1a TER and DER					
Fuel for main heatir	ng system: Mains ga	S			
Fuel factor: 1.00 (m Target Carbon Diox Dwelling Carbon Di Excess emissions =	ains gas) kide Emission Rate ( oxide Emission Rate = 10.3 kg/m² (46.1 %	TER) ₂ (DER) )	22.36 kg/m <sup>2</sup> 32.66 kg/m <sup>2</sup>		Fail
Target Fabric Energy	LE av Efficiency (TEEE)		64.1 k\/\/b/m²		
Dwelling Fabric Energy	ergy Efficiency (DFE	E)	106.1 kWh/m²		
0	<u> </u>	,			Fail
Excess energy = 4	1.96 kg/m² (65.4 %)				
2 Fabric U-values	\$				
Element		Average	Highest		
External w	vall	0.48 (max. 0.30)	0.55 (max. 0.70)		Fail
Floor		(no floor)	0.48 (max, 0.25)		01/
Openings		0.16 (Max. 0.20) 1.40 (max. 2.00)	0.16 (max, 0.35) 1.40 (max, 3.30)		OK
2a Thermal bridg	ina	1.40 (max. 2.00)	1.40 (max. 0.00)		UN
Thermal b	ridging calculated us	ing user-specified v-value of	of 0 15		
3 Air permeability	/	ing user specified y value (	51 0.15		
Air permeab	ility at 50 pascals		15.00		ок
	, i				
4 Heating emclen Main Heating	g system:	Boiler systems with radiate Data from manufacturer Combi boiler Efficiency 90.0 % SEDBU Minimum 88.0 %	ors or underfloor heating - ma	ins gas	ок
Secondary h	eating system:	None			
5 Cylinder insula	tion				
Hot water St	orage:	No cylinder			
	-	-			N/A

# **Regulations Compliance Report**

6 Cc	ontrols			
	Space heating controls	TTZC by plumbing and	l electrical services	OK
	Hot water controls:	No cylinder thermostat		
		No cylinder		
	Boiler interlock:	Yes		OK
7 Lo	w energy lights			
	Percentage of fixed lights with lo	w-energy fittings	100.0%	
	Minimum		75.0%	OK
8 Me	echanical ventilation			
	Not applicable			
9 Su	Immertime temperature			
	Overheating risk (Thames valley	):	Medium	ОК
Based	d on:			
	Overshading:		Average or unknown	
	Windows facing: North West		9.7m <sup>2</sup>	
	Windows facing: North East		3.4m <sup>2</sup>	
	Windows facing: North East		1.2m <sup>2</sup>	
	Windows facing: South East		4m <sup>2</sup>	
	Ventilation rate:		3.00	
10 K	Cey features			
			N 1	

None

Property Details: Fla	nt 4 - Be Lean							
Address: Located in: Region: UPRN:		, Ei Ti	London, NW6 1RJ ngland hames valley					
Date of assessme	ent:	20	December 2021					
Date of certificat	e:	20	December 2021					
Assessment type	:	N	ew extension to existing	dwelling				
Transaction type	:		ew aweiling nknown					
Related party dis	closure <sup>.</sup>	N	o related party					
Thermal Mass Pa	rameter:	Ir	ndicative Value Medium					
Water use <= 12	25 litres/per	son/day:	True					
PCDF Version:	·	48	36					
Droporty description								
	1		- 4					
Dwelling type: Detachment:		FI	at					
Year Completed:		20	021					
Floor Location:		F	loor area:					
		-			Storey height	:		
Floor U		54	4.3 m <sup>2</sup>		2.8 M			
Living area: Front of dwelling fa	ices:	29 N	orth West					
Opening types:								
Name:	Source:		Туре:	Glazing:		Argon:	Fram	e:
NW	Manufacturer		Windows	low-E, En =	0.05, soft coat	Yes		
NE	Manufacturer		Windows	low-E, En =	0.05, soft coat	Yes		
NE Proposed	Manufacturer		Windows	low-E, En =	0.05, soft coat	Yes		
SE Proposed	Manufacturer		windows	IOW-E, EN =	0.05, soft coat	Yes		
Name:	Gap:		Frame Factor	: g-value:	U-value:	Area:	No. o	f Openings:
NW	16mm oi	r more	0.7	0.76	1.4	9.7	1	
NE	16mm oi	r more	0.7	0.76	1.4	3.4	1	
NE Proposed	16mm oi	r more	0.7	0.76	1.4	1.2	1	
SE FIOPOSEU		ITTOLE	0.7	0.70	1.4	4	I	
Name:	Type-Name	e:	Location:	Orient:		Width:	Heigł	nt:
NW			Existing	North West		0	0	
NE			Existing	North East		0	0	
NE Proposed			Proposed	North East		0	0	
SE Proposed			Proposed	South East		0	0	
Overshading:		A	verage or unknown					
Opaque Elements:								
_	_							
l ype: (	Foss area:	Openin	gs: Net area:	U-value:	Ru value:	Curtair	n wall:	Карра:
Existing	62.44	13.1	49.34	0.55	0	False		N/A
Proposed	23.8	5.2	18.6	0.28	0	False		N/A
Flat	54.3	0	54.3	0.18	0			N/A
Internal Elements								
Party Elements								

Thermal bridges:

Thermal bridges:	No information on thermal bridging $(y=0.15)$ $(y=0.15)$
Ventilation:	
Pressure test: Ventilation: Number of chimneys: Number of open flues: Number of fans: Number of passive stacks: Number of sides sheltered: Pressure test:	No (Assumed) Natural ventilation (extract fans) 0 0 2 0 2 2 15
Main heating system:	
Main heating system:	Boiler systems with radiators or underfloor heating Gas boilers and oil boilers Fuel: mains gas Info Source: Manufacturer Declaration Manufacturer's data Efficiency: 90.0% (SEDBUK2009) Condensing combi with automatic ignition Fuel Burning Type: Unknown Systems with radiators Central heating pump : 2013 or later Design flow temperature: Unknown Unknown Boiler interlock: Yes Delayed start MCS Installation Certificate
Main heating Control:	
Main heating Control:	Time and temperature zone control by suitable arrangement of plumbing and electrical services Control code: 2110
Secondary heating system:	
Secondary heating system:	None
Water heating:	
Water heating:	From main heating system Water code: 901 Fuel :mains gas No hot water cylinder Solar panel: False
Others:	
Electricity tariff: In Smoke Control Area: Conservatory: Low energy lights: Terrain type: EPC language: Wind turbine: Photovoltaics: Assess Zero Carbon Home:	Standard Tariff Unknown No conservatory 100% Dense urban English No None None

Assessor Name:Samuel Westover Stroma FSAP 2012Stroma Number: Software Version:STR0012073 Version: 1.0.5.50Property Address: Flat 4 - Be LeanAddress: Flat 4 - Be LeanAv. Height(m)Volume(m <sup>3</sup> )Ground floorGround floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n)Stood (3a)Output: (3a)+(3b)+(3c)+(3d)+(3e)+(3n) =152.04Mumber of chimneysNumber of chimneys0+0Av. Height(m)Volume(m <sup>3</sup> )(3a)+(3b)+(3c)+(3d)+(3e)+(3n) =152.04(3a)+(3b)+(3c)+(3d)+(3e)+(3n) =0Number of chimneys040(a)0(a)0 <tr <td="">Number of chi</tr>
Property Address: Flat 4 - Be LeanAddress :, London, NW6 1RJ1. Overall dwelling dimensions:Area(m²)Av. Height(m)Volume(m³)Ground floor $54.3$ (1a) x $2.8$ (2a) = $152.04$ (3a)Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) $54.3$ (4) $2.8$ (2a) = $152.04$ (5)Dwelling volume $(3a)+(3b)+(3c)+(3d)+(3e)+(3n) =$ $152.04$ (5)2. Ventilation rate:main heating neatingsecondary heating +othertotalm³ per hourNumber of chimneys $0$ + $0$ + $0$ = $0$ × 40 = $0$ (6a)Number of open flues $0$ + $0$ + $0$ = $2$ × 10 = $20$ (7a)Number of passive vents $0$ × 10 = $0$ (7b)
Address :, London, NW6 1RJI. Overall dwelling dimensions:Area(m²)Av. Height(m)Volume(m³)Ground floor $54.3$ (1a) x $2.8$ (2a) = $152.04$ (3a)Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) $54.3$ (4) $(3a)+(3b)+(3c)+(3d)+(3e)+(3n) =$ $152.04$ (5)Dwelling volume $(3a)+(3b)+(3c)+(3d)+(3e)+(3n) =$ $152.04$ (5)Owelling volume $0$ + $0$ = $0$ Number of chimneys $0$ + $0$ = $0$ $x 40 =$ $0$ Number of open flues $0$ + $0$ = $0$ $x 40 =$ $0$ (6a)Number of intermittent fans $0$ + $0$ = $0$ $x 20 =$ $0$ (6b)Number of passive vents $0$ + $0$ = $0$ $x 10 =$ $20$ $(7a)$
1. Overall dwelling dimensions:Area(m²)Av. Height(m)Volume(m³)Ground floor $54.3$ $(1a) \times 2.8$ $(2a) =$ $152.04$ $(3a)$ Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ $54.3$ $(4)$ Dwelling volume(3a)+ $(3b)+(3c)+(3d)+(3e)+(3n) =$ $152.04$ $(5)$ Overliation rate:Number of chimneysN + 0=0x 40 =0Number of chimneys $0$ + $0$ = $0$ $x 40 =$ $0$ $(6a)$ Number of open flues $0$ + $0$ = $0$ $x 40 =$ $0$ $(6a)$ Number of intermittent fans $2$ $x 10 =$ $20$ $(7a)$ Number of passive vents
Area(m²)Av. Height(m)Volume(m³)Ground floor $54.3$ $(1a) \times 2.8$ $(2a) = 152.04$ $(3a)$ Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ $54.3$ $(4)$ $(3a)+(3b)+(3c)+(3d)+(3e)+(3n) = 152.04$ $(5)$ Dwelling volume $(3a)+(3b)+(3c)+(3d)+(3e)+(3n) = 152.04$ $(5)$ $(5)$ 2. Ventilation rate: $(3a)+(3b)+(3c)+(3d)+(3e)+(3n) = 152.04$ $(5)$ Number of chimneys $0$ $+$ $0$ $=$ $0$ $x 40 = 0$ $(6a)$ Number of open flues $0$ $+$ $0$ $=$ $0$ $x 20 = 0$ $(6b)$ Number of intermittent fans $2$ $x 10 =$ $20$ $(7a)$ Number of passive vents $0$ $x 10 =$ $0$ $(7b)$
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+\dots(1n)$ 54.3(4)Dwelling volume(3a)+(3b)+(3c)+(3d)+(3e)+\dots(3n) =152.04(5)2. Ventilation rate:Number of chimneys $0$ $+$ $0$ $=$ $0$ $x 40 =$ $0$ (6a)Number of open flues $0$ $+$ $0$ $=$ $0$ $x 20 =$ $0$ (6b)Number of intermittent fans $2$ $x 10 =$ $20$ $(7a)$ Number of passive vents $0$ $10$ $0$ $10$ $0$ $10$ $0$ $10$ $0$ $10$ $0$ $10$ $0$ $10$ $0$ $10$ $0$ $10$ $0$ $10$ $0$ $10$ $0$ $10$ $0$ $10$ $0$ $10$ $0$ $10$ $0$ $10$ $0$ $10$ $0$ $1$
Dwelling volume $(3a)+(3c)+(3d)+(3e)+(3n) =$ 152.04(5)2. Ventilation rate:main heatingsecondary heatingothertotalm³ per hourNumber of chimneys $0$ $+$ $0$ $=$ $0$ $x 40 =$ $0$ (6a)Number of open flues $0$ $+$ $0$ $=$ $0$ $x 20 =$ $0$ (6b)Number of intermittent fans $2$ $x 10 =$ $20$ (7a)Number of passive vents $0$ $x 10 =$ $0$ (7b)
2. Ventilation rate:Main heatingsecondary heatingother heatingtotal $m^3$ per hourNumber of chimneys0+0=0x 40 =0(6a)Number of open flues0+0+0=0x 20 =0(6b)Number of intermittent fans2x 10 =20(7a)Number of passive vents00(7b)
Main heatingsecondary heatingothertotalm³ per hourNumber of chimneys $0$ $+$ $0$ $=$ $0$ $x 40 =$ $0$ (6a)Number of open flues $0$ $+$ $0$ $=$ $0$ $x 20 =$ $0$ (6b)Number of intermittent fans $2$ $x 10 =$ $20$ (7a)Number of passive vents $0$ $x 10 =$ $0$ (7b)
Number of chimneys $0$ $+$ $0$ $+$ $0$ $=$ $0$ $x 40 =$ $0$ $(6a)$ Number of open flues $0$ $+$ $0$ $+$ $0$ $=$ $0$ $x 20 =$ $0$ $(6b)$ Number of intermittent fans $2$ $x 10 =$ $20$ $(7a)$ Number of passive vents $0$ $x 10 =$ $0$ $(7b)$
Number of open flues0+0=0 $\times 20 =$ 0(6b)Number of intermittent fans2 $\times 10 =$ 20(7a)Number of passive vents0 $\times 10 =$ 0(7b)
Number of intermittent fans $2$ $x 10 =$ $20$ $(7a)$ Number of passive vents $0$ $x 10 =$ $0$ $(7b)$
Number of passive vents $0 \times 10 = 0$ (7b)
Number of flueless gas fires $0 \times 40 = 0$ (7c)
Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) = 20$ If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) $\div$ (5) = 0.13 (8)
Number of storeys in the dwelling (ns) 0 (9)
Additional infiltration $[(9)-1]x0.1 = 0$ (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction       0       (11)         if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35       0       (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)
If no draught lobby, enter 0.05, else enter 0 0 (13)
Percentage of windows and doors draught stripped 0 (14)
Window infiltration $0.25 - [0.2 \times (14) \div 100] =$ 0       (15)
Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) = 0$ (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 15 (17)
If based on air permeability value, then $(18) = [(17) \div 20] + (8)$ , otherwise $(18) = (16)$ 0.88 (18)
Air permeability value applies it a pressurisation test has been done or a degree air permeability is being used
Shelter factor $(20) = 1 - [0.075 \times (19)] = 0.85$ (20)
Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$
Infiltration rate modified for monthly wind speed
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Monthly average wind speed from Table 7
(22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7
Wind Factor (22a)m = (22)m ÷ 4
(22a)m= 1.27 1.25 1.23 1.1 1.08 0.95 0.95 0.92 1 1.08 1.12 1.18

Adjust	ed infiltr	ation rat	e (allowi	ing for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
	0.96	0.94	0.92	0.82	0.81	0.71	0.71	0.69	0.75	0.81	0.84	0.88		
Calcula If ma	ate etter	ctive air al ventila	change	rate for t	he appli	cable ca	se					1	0	(232)
lf exh	aust air h	eat pump (	usina App	endix N. (2	(23a) = (23a	a) × Fmv (e	equation (N	N5)) . othe	rwise (23b	) = (23a)		l	0	(23b)
lf bala	anced with	n heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (from	n Table 4h	) =	, ( ,		l	0	(23c)
a) If	balance	d mech	, anical ve	entilation	with he	at recove	erv (MVI	HR) (24a	a)m = (2)	2h)m + (	23b) <b>x</b> [*	l 1 – (23c)	- 1001	(200)
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	]	(24a)
b) If	balance	d mecha	ı anical ve	ntilation	u without	heat rec	coverv (N	и ЛV) (24b	m = (22)	1 2b)m + ()	1 23b)			
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole h	ouse ex	tract ver	ntilation of	or positiv	ve input v	ventilatic	n from o	outside					
, i	if (22b)n	n < 0.5 ×	(23b), t	then (24d	c) = (23b	); otherv	vise (24	c) = (22k	o) m + 0.	.5 × (23b	))			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If	natural	ventilatio	on or wh	ole hous	se positiv	/e input	ventilatio	on from I	oft					
i	if (22b)n	n = 1, the	en (24d) I	m = (22t	o)m othe I	erwise (2	4d)m = (	0.5 + [(2	2b)m² x I	0.5]	1			
(24d)m=	0.96	0.94	0.92	0.84	0.82	0.75	0.75	0.74	0.78	0.82	0.86	0.89		(24d)
Effe	ctive air	change	rate - er	nter (24a	) or (24b	o) or (240	c) or (24	d) in boy	(25)					(05)
(25)m=	0.96	0.94	0.92	0.84	0.82	0.75	0.75	0.74	0.78	0.82	0.86	0.89		(25)
3. He	at losse	s and he	eat loss	paramete	er:									
ELEN	IENT	Gros area	ss (m²)	Openin m	lgs 1 <sup>2</sup>	Net Ar A ,r	ea n²	U-valı W/m2	ue :K	A X U (W/	K)	k-value kJ/m²⋅ł	) <	A X k kJ/K
Windo	ws Type	e 1				9.7	x1,	/[1/( 1.4 )+	0.04] =	12.86				(27)
Windo	ws Type	2				3.4	x1,	/[1/( 1.4 )+	0.04] =	4.51				(27)
Windo	ws Type	e 3				1.2	x1,	/[1/( 1.4 )+	0.04] =	1.59				(27)
Windo	ws Type	e 4				4	x1,	/[1/( 1.4 )+	0.04] =	5.3				(27)
Walls <sup>-</sup>	Type1	62.4	4	13.1		49.34	x	0.55	=	27.14				(29)
Walls <sup>-</sup>	Type2	23.	8	5.2		18.6	x	0.28		5.21			$\exists$	(29)
Roof		54.3	3	0		54.3	×	0.18		9.77			$\exists$	(30)
Total a	rea of e	lements	, m²			140.5	4				L			(31)
* for win	dows and	roof wind	ows, use e	effective wi	ndow U-va	alue calcul	ated using	formula 1	/[(1/U-valı	ıe)+0.04] a	as given in	paragraph	3.2	
Fabric	heat los	as on doin as W/K :	= S (A x)		is and pari	llions		(26)(30)	) + (32) =			1	66.29	(33)
Heat c	anacity	Cm = S(	-0(// /	0)				()	((28)	(30) + (3)	(32a)	(32e) =	5044 F	(34)
Therm	apacity al mass	narame	ter (TMF	- Cm -	- TFA) ir	n k. l/m²K			Indica	tive Value	· Medium	(020) -	250	(35)
For desi	ian assess	sments wh	ere the de	tails of the	construct	ion are not	t known pr	ecisely the	e indicative	e values of	TMP in Ta	able 1f	230	(00)
can be ι	used inste	ad of a de	tailed calc	ulation.			,	,						
Therm	al bridg	es : S (L	x Y) cal	culated u	using Ap	pendix ł	<						21.08	(36)
if details	of therma	al bridging	are not kr	10wn (36) =	= 0.05 x (3	1)			(22)	(00)		I		
			-     - 4	l					(33) +	(36) =		l	87.46	(37)
ventila					y May	lun	lul.	<u> </u>	(38)m	$= 0.33 \times ($	25)m x (5)			
(38)m-	Jan 47.09	47.00	101ar	Apr	11 26	Jun 37.9	37 9	Aug	30 17	41 26	1NOV	Dec		(38)
	-1.30			72.13	-1.50	57.0	57.0	J 37.14	(22)	(0=)	L 72.31	-4.00		(00)
			11, VV/K	120 50	100.00	125.26	105.00	104.6	(39)m	= (37) + (37)	38)M	121 00		
(33)112	155.45	104.00	155.00	129.09	120.03	120.20	120.20	124.0	120.03	Average =	Sum(39)	/12=	129.59	(39)

Heat lo	oss para	meter (I	HLP), W	/m²K					(40)m	= (39)m ÷	(4)			
(40)m=	2.49	2.48	2.46	2.39	2.37	2.31	2.31	2.29	2.33	2.37	2.4	2.43		
Numbe	er of day	us in mo	nth (Tab	le 1a)						Average =	Sum(40)1	.12 /12=	2.39	(40)
- turno	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
		_	_		-		-			-		-		
4. Wa	ater hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ned occu A > 13.9 A £ 13.9	upancy, 9, N = 1 9, N = 1	N + 1.76 x	[1 - exp	o(-0.0003	349 x (TF	FA -13.9	)2)] + 0.(	0013 x ( <sup>-</sup>	TFA -13.	9)	82		(42)
Annua Reduce not more	l averag the annua e that 125	e hot wa al average litres per j	ater usag hot water person pe	ge in litre usage by <sup>r</sup> day (all w	es per da 5% if the c vater use, l	ay Vd,av Iwelling is hot and co	erage = <sup>designed</sup> ld)	(25 x N) to achieve	+ 36 a water us	se target o	77.	.35		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres pei I	r day for ea T	ach month I	Vd,m = fa	ctor from	Table 1c x	: (43) T	r	r				
(44)m=	85.08	81.99	78.9	75.8	72.71	69.61	69.61	72.71	75.8	78.9	81.99	85.08		<b>-</b>
Energy	content of	hot water	used - cal	culated m	onthly $= 4$ .	190 x Vd,i	m x nm x L	OTm / 3600	) kWh/mor	Total = Su hth (see Ta	m(44) <sub>112</sub> = ables 1b, 10	: c, 1d)	928.19	(44)
(45)m=	126.18	110.36	113.88	99.28	95.26	82.2	76.17	87.41	88.46	103.09	112.53	122.2		
16 1								L	•	Total = Su	m(45) <sub>112</sub> =		1217.01	(45)
lt instan	taneous w	ater heati.	ng at point 1	t of use (no	o hot watei I	r storage), I	enter 0 in I	boxes (46)	) to (61)	i				(12)
(46)m= Water	18.93 storage	16.55	17.08	14.89	14.29	12.33	11.43	13.11	13.27	15.46	16.88	18.33		(46)
Storag	e volum	e (litres)	) includir	ng any s	olar or W	WHRS	storage	within sa	ame ves	sel	(	)		(47)
If com	munity h	eating a	and no ta	ink in dv	velling, e	enter 110	) litres in	ı (47)						
Otherv	vise if no	o stored	hot wate	er (this ir	ncludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in (	47)			
Water	storage	loss:			! I		- /-/)-							(12)
a) if n		urer's d	eciared i	OSS TACT	or is kno	wn (kvvi	n/day):				(	0		(48)
Tempe	erature f	actor fro	m Table					(10) (10)				)		(49)
Energy b) If m	/ IOSt IFC	om water urer's de	r storage eclared (	, KVVN/y cylinder	ear loss fact	or is not	known.	(48) x (49)	) =		(	)		(50)
Hot wa	ater stor	age loss	factor fi	om Tab	le 2 (kW	h/litre/da	ay)					0		(51)
If com	munity h	eating s	see secti	on 4.3										
Volum	e factor	from Ta	ble 2a								(	)		(52)
Tempe	erature f	actor fro	m Table	2b								)		(53)
Energy	y lost fro	m water	r storage	, kWh/y	ear			(47) x (51)	) x (52) x (	53) =	(	C		(54)
Enter	(50) or	(54) IN (8	05) Isulata du					((50)(			(	)		(55)
water	storage	loss cal	culated	for each	month	1	1	((56)m = (	55) × (41)i	m				
(56)m= If cylinde	0 er contain	0 s dedicate	0 d solar sto	0 rage, (57)	0 = (56)m	$0 \times [(50) - ($	0 [H11)] ÷ (5	0 i0), else (5	0 7)m = (56)	0 m where (	0 H11) is fro	0 m Append	ix H	(56)
(57)m=	0	0	0	0	0			0	0	0	0	0		(57)
						L	Ĺ	Ļ	Ĺ	Ĺ				(58)
Primar	y circuit	loss (ar	nual) fro	om Table	∋3 month (	59)m –	(58) <u>-</u> 20	35 🗴 (11)	m			J		(00)
(mo	dified by	factor f	rom Tab	le H5 if t	there is s	solar wa	ter heati	ng and a	u cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
	L	I	I	I	I	I	I	I	I	I				

Combi	loss ca	alculated	for eac	h month	(61)m =	(60)	) ÷ 36	5 × (41)	)m						
(61)m=	43.36	37.74	40.2	37.38	37.05	34	4.33	35.47	37.05	37.38	40.2	40.43	43.36	]	(61)
Total h	eat req	uired for	water h	neating c	alculated	l for	each	month	(62)m =	= 0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	169.54	148.09	154.08	136.66	132.31	11	6.53	111.65	124.46	125.84	143.29	152.96	165.55		(62)
Solar DH	-IW input	calculated	using Ap	pendix G c	r Appendix	: H (r	negativ	e quantity	v) (enter 'C	' if no sola	r contribu	tion to wate	er heating)		
(add a	dditiona	al lines if	FGHR	S and/or	WWHRS	ар	plies,	see Ap	pendix (	G)				-	
(63)m=	0	0	0	0	0		0	0	0	0	0	0	0		(63)
Output	from w	vater hea	ter	_		_	_			_	_	-	_	_	
(64)m=	169.54	148.09	154.08	136.66	132.31	11	6.53	111.65	124.46	125.84	143.29	152.96	165.55		_
									Out	out from w	ater heate	er (annual)₁	12	1680.98	(64)
Heat g	ains fro	om water	heating	g, kWh/m	onth 0.2	5´[	0.85 :	× (45)m	+ (61)n	n] + 0.8 x	x [(46)m	+ (57)m	+ (59)m	]	
(65)m=	52.79	46.13	47.92	42.36	40.94	35	5.92	34.2	38.33	38.76	44.33	47.52	51.47		(65)
inclu	ide (57)	)m in calo	culation	of (65)m	n only if c	ylin	der is	in the c	dwelling	or hot w	vater is f	rom com	munity h	neating	
5. Int	ernal g	ains (see	Table	5 and 5a	ı):										
Metab	olic gaiı	ns (Table	5), Wa	atts		_								_	
	Jan	Feb	Mar	Apr	May		Jun	Jul	Aug	Sep	Oct	Nov	Dec	]	
(66)m=	109.01	109.01	109.01	109.01	109.01	10	9.01	109.01	109.01	109.01	109.01	109.01	109.01	]	(66)
Lightin	g gains	s (calcula	ted in A	ppendix	L, equat	ion	L9 or	L9a), a	lso see	Table 5				-	
(67)m=	35.3	31.35	25.5	19.3	14.43	12	2.18	13.16	17.11	22.96	29.16	34.03	36.28		(67)
Applia	nces ga	ains (calc	ulated i	n Appen	dix L, eq	uati	on L1	3 or L1	3a), also	see Ta	ble 5		•	-	
(68)m=	236.39	238.84	232.66	219.5	202.89	18	7.28	176.85	174.39	180.57	193.73	210.35	225.96		(68)
Cookir	ng gains	s (calcula	ted in A	Appendix	L, equa	tion	L15 c	or L15a)	, also s	ee Table	5	-		-	
(69)m=	47.72	47.72	47.72	47.72	47.72	47	7.72	47.72	47.72	47.72	47.72	47.72	47.72	]	(69)
Pumps	and fa	ns gains	(Table	5a)										-	
(70)m=	3	3	3	3	3		3	3	3	3	3	3	3	]	(70)
Losses	s e.g. e	vaporatio	n (nega	ative valu	ies) (Tab	le 5					•	-	•	•	
(71)m=	-72.67	-72.67	-72.67	-72.67	-72.67	-7	2.67	-72.67	-72.67	-72.67	-72.67	-72.67	-72.67	]	(71)
Water	heating	, g gains (T	able 5)	•	•	•	!			!	<u>.</u>	•			
(72)m=	70.96	68.64	64.4	58.83	55.02	49	9.88	45.96	51.51	53.83	59.58	66	69.18	]	(72)
Total i	nterna	l gains =		-	•		(66)r	m + (67)m	ı + (68)m ·	+ (69)m +	(70)m + (	71)m + (72)	)m		
(73)m=	429.7	425.89	409.61	384.69	359.4	33	6.39	323.03	330.07	344.42	369.53	397.44	418.47	]	(73)
6. So	lar gain	IS:		•			-			•	•				
Solar g	ains are	calculated	using sol	ar flux fron	Table 6a	and	associa	ated equa	tions to co	onvert to th	ne applica	ble orientat	tion.		
Orienta	ation:	Access F	actor	Area	ı		Flux	(		g_		FF		Gains	
		Table 6d		m²			Tab	le 6a	T	able 6b	T	able 6c		(W)	
Northea	ast <mark>0.9x</mark>	0.77	;	<b>(</b> 3	.4	x	11	1.28	x	0.76	<b>x</b>	0.7	=	14.14	(75)
Northea	ast <mark>0.9x</mark>	0.77	)	( 1	.2	<b>x</b> [	11	1.28	x	0.76	<b>x</b>	0.7	=	4.99	(75)
Northea	ast <mark>0.9x</mark>	0.77	;	3	.4	<b>x</b> [	22	2.97	x	0.76	×	0.7	=	28.79	(75)
Northea	ast <mark>0.9x</mark>	0.77	;	( 1	.2	x	22	2.97	x	0.76	x	0.7	=	10.16	(75)
Northea	ast <mark>0.9x</mark>	0.77	;	( 3	.4	×	41	1.38	x	0.76	x	0.7	=	51.87	(75)

No who a set a s		٦		1		1		1		1		٦
Northeast 0.9x	0.77	×	1.2	X	41.38	X	0.76	X	0.7	=	18.31	_(75)
Northeast 0.9x	0.77	x	3.4	x	67.96	x	0.76	x	0.7	=	85.18	(75)
Northeast 0.9x	0.77	x	1.2	x	67.96	x	0.76	x	0.7	=	30.06	(75)
Northeast 0.9x	0.77	x	3.4	x	91.35	x	0.76	x	0.7	=	114.5	(75)
Northeast 0.9x	0.77	x	1.2	x	91.35	x	0.76	x	0.7	=	40.41	(75)
Northeast 0.9x	0.77	x	3.4	x	97.38	x	0.76	x	0.7	=	122.07	(75)
Northeast 0.9x	0.77	x	1.2	x	97.38	x	0.76	x	0.7	=	43.08	(75)
Northeast 0.9x	0.77	x	3.4	x	91.1	x	0.76	x	0.7	=	114.2	(75)
Northeast 0.9x	0.77	x	1.2	x	91.1	x	0.76	x	0.7	] =	40.3	(75)
Northeast 0.9x	0.77	x	3.4	×	72.63	×	0.76	x	0.7	=	91.04	(75)
Northeast 0.9x	0.77	x	1.2	x	72.63	x	0.76	x	0.7	=	32.13	(75)
Northeast 0.9x	0.77	x	3.4	x	50.42	x	0.76	x	0.7	=	63.2	(75)
Northeast 0.9x	0.77	x	1.2	x	50.42	x	0.76	x	0.7	=	22.31	(75)
Northeast 0.9x	0.77	x	3.4	x	28.07	x	0.76	x	0.7	=	35.18	(75)
Northeast 0.9x	0.77	x	1.2	x	28.07	x	0.76	x	0.7	=	12.42	(75)
Northeast 0.9x	0.77	x	3.4	x	14.2	x	0.76	x	0.7	=	17.8	(75)
Northeast 0.9x	0.77	x	1.2	x	14.2	x	0.76	x	0.7	] =	6.28	(75)
Northeast 0.9x	0.77	x	3.4	x	9.21	x	0.76	x	0.7	=	11.55	(75)
Northeast 0.9x	0.77	x	1.2	x	9.21	x	0.76	x	0.7	=	4.08	(75)
Southeast 0.9x	0.77	x	4	x	36.79	x	0.76	x	0.7	=	54.26	(77)
Southeast 0.9x	0.77	x	4	x	62.67	x	0.76	x	0.7	=	92.42	(77)
Southeast 0.9x	0.77	x	4	x	85.75	x	0.76	x	0.7	=	126.46	(77)
Southeast 0.9x	0.77	x	4	x	106.25	x	0.76	x	0.7	=	156.69	(77)
Southeast 0.9x	0.77	x	4	x	119.01	x	0.76	x	0.7	=	175.51	(77)
Southeast 0.9x	0.77	x	4	x	118.15	x	0.76	x	0.7	=	174.24	(77)
Southeast 0.9x	0.77	x	4	x	113.91	x	0.76	x	0.7	=	167.98	(77)
Southeast 0.9x	0.77	x	4	x	104.39	x	0.76	x	0.7	=	153.94	(77)
Southeast 0.9x	0.77	x	4	x	92.85	x	0.76	x	0.7	=	136.93	(77)
Southeast 0.9x	0.77	x	4	x	69.27	x	0.76	x	0.7	=	102.15	(77)
Southeast 0.9x	0.77	x	4	x	44.07	x	0.76	x	0.7	=	64.99	(77)
Southeast 0.9x	0.77	x	4	x	31.49	x	0.76	x	0.7	=	46.44	(77)
Northwest 0.9x	0.77	x	9.7	x	11.28	x	0.76	x	0.7	=	40.35	(81)
Northwest 0.9x	0.77	x	9.7	×	22.97	x	0.76	x	0.7	] =	82.13	(81)
Northwest 0.9x	0.77	x	9.7	x	41.38	x	0.76	x	0.7	=	147.98	(81)
Northwest 0.9x	0.77	x	9.7	x	67.96	x	0.76	x	0.7	=	243.02	(81)
Northwest 0.9x	0.77	x	9.7	x	91.35	x	0.76	x	0.7	=	326.67	(81)
Northwest 0.9x	0.77	x	9.7	×	97.38	x	0.76	x	0.7	=	348.26	(81)
Northwest 0.9x	0.77	x	9.7	×	91.1	×	0.76	x	0.7	=	325.79	(81)
Northwest 0.9x	0.77	x	9.7	×	72.63	×	0.76	x	0.7	] =	259.73	(81)
Northwest 0.9x	0.77	x	9.7	×	50.42	×	0.76	x	0.7	=	180.31	(81)
Northwest 0.9x	0.77	x	9.7	×	28.07	x	0.76	x	0.7	=	100.37	(81)

Northw	est 0.9x	0.77	x	9.	7	x		14.2	x	0.76	] × [	0.7	=	50.77	(81)
Northw	est 0.9x	0.77	×	9.	7	x	ę	9.21	×	0.76	=	0.7	=	32.95	(81)
	L			L											
Solar	nains in	watts ca	alculated	l for eac	n month				(83)m = S	um(74)m .	(82)m				
(83)m=	113.74	213.51	344.61	514.96	657.09	68	37.65	648.27	536.84	402.75	250.12	139.84	95.01		(83)
Total g	ains – i	nternal a	and solar	. (84)m =	= (73)m	+ (8	33)m	, watts		I		1			
(84)m=	543.44	639.4	754.22	899.64	1016.48	10	, 24.05	971.3	866.91	747.17	619.65	537.27	513.49		(84)
				<i>(</i> ) <i>(</i> )		\									
7. Me	an inter	nal temp	berature	(heating	season	)									<b>-</b>
Temp	erature	during h	neating p	eriods ir	n the livi	ng	area f	rom Tab	ole 9, Th	1 (°C)				21	(85)
Utilisa	ation fac	tor for g	ains for	iving are	ea, h1,m	1 (S	ee Ta	ble 9a)			r	1		1	
	Jan	Feb	Mar	Apr	May		Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	0.99	0.98	0.96	0.91	0.8	(	0.65	0.52	0.58	0.8	0.94	0.98	0.99		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fe	ollo	w ste	ps 3 to 7	in Tabl	e 9c)					
(87)m=	18.6	18.85	19.3	19.94	20.46	2	0.81	20.93	20.9	, 20.61	19.93	19.19	18.6		(87)
Tomo		l durina k		oriodo ir	root of			from To							
					10.1	uw I₁					10.1	10.09	10.06	l	(88)
(00)11=	19.02	19.03	19.04	19.09	19.1	'	9.14	19.14	19.14	19.12	19.1	19.00	19.00		(00)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,	m (se	e Table	9a)		i				
(89)m=	0.98	0.97	0.94	0.87	0.72	(	).51	0.32	0.38	0.69	0.91	0.97	0.98		(89)
Mean	interna	l temper	ature in	the rest	of dwell	ing	T2 (fo	ollow ste	ps 3 to	7 in Tabl	e 9c)				
(90)m=	16.05	16.42	17.07	17.97	18.64	1	9.04	19.12	19.12	18.86	18	16.93	16.07		(90)
						-				f	LA = Livin	g area ÷ (4	4) =	0.47	(91)
							\ <b>(</b>	·	<i>( ) ( )</i>	•) <b>T</b> O					
Mean	Interna	I temper	ature (fo	r the wh	ole dwe	lling	g) = fl		+ (1 – fL	A) × 12	40.0	17.00	17.00	I	(00)
(92)m=	17.25	17.56	18.11	18.89	19.49		9.87	19.97	19.95	19.68	18.9	17.99	17.26		(92)
Apply	adjustr	nent to t	he mear		temper	atu	re fro	m Table	4e, whe	ere appro	opriate	17.04	17.14	I	(02)
(93)m=	17.1	17.41	17.96	18.74	19.34	1	9.72	19.82	19.8	19.53	18.75	17.84	17.11		(93)
8. Sp	ace hea	ting requ	uirement									>		• •	
Set T	i to the i	mean int	ternal ter	nperatui using Ta	e obtair	ned	at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(	76)m an	d re-calc	culate	
ine ui	lan	Eeb	Mar		May	Г	lun	lul	Δυσ	Sen	Oct	Nov	Dec		
l Itilie:	tion fac	tor for a	ains hm		iviay		Jun	Jui	Aug	Seb			Dec		
(94)m-	0.97		0.93	. 0.86	0.73		) 56	0.4	0.46	0.72	0.9	0.96	0.98	l	(94)
			$\frac{1}{1000}$	1)m x (8)	1)m			0.4	0.40	0.72	0.0	0.00	0.00		()
(95)m-	529.69	614 11	701 14	772 49	747 09	5	71 7	385 78	397 38	535 92	558 49	516 75	502 37	l	(95)
Mont				porature	from T		0.8	000.70	007.00	000.02	000.40	010.70	002.01		()
(96)m=	4.3			8.9	11 7		14.6	16.6	16.4	14 1	10.6	71	42		(96)
Heat	loss rate	for mo	an intern	al temp	raturo	L Im	······································	-[(30)m	v [(03)m	- (96)m	1	/.1	7.2		(00)
(07)m-	1733 03	1683 13	1532.5	ai tempe			, VV =	403.03	423.88	687.81	1050.07	1400.01	1703 /1	l	(97)
(57)III-	hoatin			r ooch n	onth k	10- W/b	/mont	+00.00	420.00	m (05)	$\frac{1000.07}{1000.07}$	1)m	1700.41		(01)
	805 28	718 30		362.07	176.84	1		11 = 0.02	4 X [(97	)11 – (95	365 73	635.04	803 57	l	
(30)11-	090.20	/10.53	010.55	302.07	170.04		0	0		0	303.73	033.94	095.57	4000.00	
									lota	i per year	(kvvn/year	r) = Sum(9)	8)15,912 =	4666.36	(98)
Space	e heatin	g require	ement in	kWh/m <sup>2</sup>	/year									85.94	(99)
9a. En	ergy rec	quiremer	nts – Indi	vidual h	eating s	yst	ems i	ncluding	micro-C	CHP)					
Spac	e heatii	ng:													
Fracti	on of sp	ace hea	at from s	econdar	y/supple	eme	entary	system						0	(201)

Fracti	on of spa	ace hea	t from m	nain syst	em(s)			(202) = 1 ·	- (201) =				1	(202)
Fracti	on of tot	al heatir	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of n	nain spa	ace heat	ing syste	em 1								90	(206)
Efficie	ency of s	econda	ry/suppl	ementar	y heating	g system	ז, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	e heating	require	ement (c	alculate	d above)	)						1	1	
	895.28	718.39	618.53	362.07	176.84	0	0	0	0	365.73	635.94	893.57		
(211)m	= {[(98)	m x (20	4)] } x 1	00 ÷ (20	)6) Luca va								1	(211)
	994.76	798.21	687.26	402.3	196.49	0	0			406.37	706.6	992.86		
0	1	6 . 1 / .		\				TULA			211) <sub>15,1012</sub>	2	5184.85	(211)
	e neating	1)] \ v 1)	econdar 00 ± (20	y), KVVN/ IR)	month									
(215)m=	0	0	00.(20	0	0	0	0	0	0	0	0	0		
	I							Tota	l (kWh/yea	ar) =Sum(2	215) <sub>15,1012</sub>		0	(215)
Water	heating													_
Output	from wa	ter hea	ter (calc	ulated a	bove)								1	
	169.54	148.09	154.08	136.66	132.31	116.53	111.65	124.46	125.84	143.29	152.96	165.55		-
Efficier	ncy of wa	ater hea	ter										90	(216)
(217)m=	90	90	90	90	90	90	90	90	90	90	90	90		(217)
Fuel fo (219)m	r water h = (64)r	neating, n x 100	kWh/mo ) ∸ (217)	onth										
(219)m=	188.37	164.55	171.2	151.85	147.02	129.48	124.05	138.29	139.82	159.21	169.96	183.95		
								Tota	I = Sum(2	19a) <sub>112</sub> =			1867.75	(219)
Annua	I totals									k	Wh/year	•	kWh/year	-
Space	heating	fuel use	ed, main	system	1								5184.85	
Water	heating f	uel use	d										1867.75	]
Electric	city for p	umps, fa	ans and	electric	keep-ho	t								
centra	al heating	g pump:										30		(230c)
Total e	lectricity	for the	above, l	(Wh/yea	r			sum	of (230a).	(230g) =			30	(231)
Electric	city for lig	ghting											249.36	(232)
Total d	elivered	energy	for all u	ses (211	)(221)	+ (231)	+ (232).	(237b)	=				7331.96	(338)
10a. F	- uel cost	ts - indiv	vidual he	eating sy	stems:									
				Ŭ,		E.,	al			Eucl D	rico		Eucl Cost	
						гu kW	h/vear			(Table	12)		£/vear	
Space	heating	- main s	system 1			(21	1) x			` 3.4	.8	x 0.01 =	180.43	(240)
' Space	heating	- main s	svstem 2	2		(213	3) x				<u> </u>	x 0.01 =	0	$\frac{1}{(241)}$
Space	heating	- secon	darv			(21	5) x				19	x 0.01 =	0	$\int (242)$
Water	heating	cost (oth	ner fuel)			(219	) Э)			34	8	x 0.01 =	65	(247)
Pumps	, fans ar	nd elect	ric keen	-hot		` (23 <sup>,</sup>	1)				<u> </u>	x 0.01 =	3.06	](249)
(if off-n	eak tarif	f list pa	ch of (?	30a) to (	230a) ea	anaratel	, as ann	licahle a	nd annly	L <sup>13.</sup>		dina to <sup>1</sup>	L	
Energy	for light	ing	21 01 (21			(232	2)		uppiy	13.	19	x 0.01 =	32.89	(250)

Additional standing charges (Table 12)			120	(251)
Appendix Q items: repeat lines (253) and (25	4) as needed			
Total energy cost (245)	(247) + (250)(254) =		402.28	(255)
11a. SAP rating - individual heating systems	;			
Energy cost deflator (Table 12)			0.42	(256)
Energy cost factor (ECF) [(255	) x (256)] ÷ [(4) + 45.0] =		1.7	(257)
SAP rating (Section 12)			76.26	(258)
12a. CO2 emissions – Individual heating sys	stems including micro-CHI	P		
	<b>Energy</b> kWh/year	<b>Emission factor</b> kg CO2/kWh	<b>Emissions</b> kg CO2/yea	r
Space heating (main system 1)	(211) x	0.216 =	1119.93	(261)
Space heating (secondary)	(215) x	0.519 =	0	(263)
Water heating	(219) x	0.216 =	403.43	(264)
Space and water heating	(261) + (262) + (263) +	(264) =	1523.36	(265)
Electricity for pumps, fans and electric keep-h	not (231) x	0.519 =	15.57	(267)
Electricity for lighting	(232) x	0.519 =	129.42	(268)
Total CO2, kg/year		sum of (265)(271) =	1668.35	(272)
CO2 emissions per m <sup>2</sup>		(272) ÷ (4) =	30.72	(273)
EI rating (section 14)			77	(274)
13a. Primary Energy				
	<b>Energy</b> kWh/year	<b>Primary</b> factor	<b>P. Energy</b> kWh/year	
Space heating (main system 1)	(211) x	1.22 =	6325.52	(261)
Space heating (secondary)	(215) x	3.07 =	0	(263)
Energy for water heating	(219) x	1.22 =	2278.66	(264)
Space and water heating	(261) + (262) + (263) +	(264) =	8604.18	(265)
Electricity for pumps, fans and electric keep-h	not (231) x	3.07 =	92.1	(267)
Electricity for lighting	(232) x	0 =	765.53	(268)
'Total Primary Energy		sum of (265)(271) =	9461.8	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =	174.25	(273)

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 20 December 2021

#### Property Details: Flat 4 - Be Lean

Dwelling type: Located in: Region: Cross ventilation po Number of storeys: Front of dwelling fac Overshading: Overhangs: Thermal mass parar Night ventilation: Blinds, curtains, shu Ventilation rate duri	ssible: ces: neter: utters: ng hot wea	ather (ac	:h):	Flat England Thames va Yes 1 North West Average or None Indicative V False 3 ( Window	lley unknown /alue Medium /s open half t	ו he time)		
Summer ventilation Transmission heat loss c	heat loss oss coefficient:	coefficie cient:	ent:	150.52 87.5 237.98				(P1) (P2)
Orientation: North West (NW) North East (NE) North East (NE Proposition South East (SE Proposition Solar shading:	Ratio: 0 sed)) sed))		<b>Z_overhangs:</b> 1 1 1 1					
Orientation: North West (NW) North East (NE) North East (NE Propos South East (SE Propos	<b>Z blind</b> 1 1 sed)1 sed)1	ls:	<b>Solar access:</b> 0.9 0.9 0.9 0.9 0.9	<b>Over</b> 1 1 1 1	hangs:	<b>Z summer:</b> 0.9 0.9 0.9 0.9 0.9		(P8) (P8) (P8) (P8)
Orientation North West (NW) North East (NE) North East (NE Propos South East (SE Propos	0.9 x 0.9 x sed)0.9 x sed)0.9 x	<b>Area</b> 9.7 3.4 1.2 4	<b>Flux</b> 98.85 98.85 98.85 119.92	<b>g_</b> 0.76 0.76 0.76 0.76	FF 0.7 0.7 0.7 0.7	<b>Shading</b> 0.9 0.9 0.9 0.9 0.9 0.9 <b>Total</b>	<b>Gains</b> 413.17 144.82 51.11 206.71 815.81	(P3/P4)
Internal gains Total summer gains Summer gain/loss rat Mean summer externa Thermal mass temper Threshold temperatur Likelihood of high ir	io al tempera ature incre e <b>nternal ten</b>	ture (Th ement nperatur	ames valley) <b>e</b>	Jui 333 120 5.0 16 0.2 21. <b>Sli</b>	ne 3.39 )7.94 8 5 33 ght	<b>July</b> 320.03 1135.83 4.77 17.9 0.25 22.92 <b>Medium</b>	August 327.07 1018.22 4.28 17.8 0.25 22.33 Medium	(P5) (P6) (P7)

# SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

# **Regulations Compliance Report**

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50 *Printed on 20 December 2021 at 14:42:32* 

Project informatio	n:			
Assessed By:	Samuel Westover (	STRO012073)	Building Type:	Flat
Dwelling Details:				
NEW EXTENSION	TO EXISTING DWE	LLING	Total Floor Area: 54	4.3m <sup>2</sup>
Site Reference :	4, 14 West Cottage	S	Plot Reference:	Flat 4 - Be Green
Address :	, London, NW6 1R.	J		
Client Details:				
Name: Address :				
This report covers	s items included wit	thin the SAP calculations	S.	
It is not a complet	te report of regulation	ons compliance.		
1a TER and DER				
Fuel for main heati	ng system: Electricity	1		
Fuel factor: 1.55 (e	lectricity)		$22.44 km/m^{2}$	
Dwelling Carbon Dio	xide Emission Rate (		32.44 Kg/M <sup>2</sup>	OK
1b TEEE and DE	EE		31.7 T Kg/m	OR
Target Fabric Ener	av Efficiency (TFEE)		64.1 kWh/m²	
Dwelling Fabric En	ergy Efficiency (DFE	E)	106.1 kWh/m²	
5	<b>3</b>	,		Fail
Excess energy $= 4$	1.96 kg/m² (65.4 %)			
2 Fabric U-value	S			
Element		Average	Highest	
External v	vall	0.48 (max. 0.30)	0.55 (max. 0.70)	Fail
Floor		(no floor)		
Roof		0.18 (max. 0.20)	0.18 (max. 0.35)	OK
Openings		1.40 (max. 2.00)	1.40 (max. 3.30)	OK
2a Thermal bridg	jing			
Thermal b	oridging calculated us	ing user-specified y-value	of 0.15	
3 Air permeabilit	У			
Air permeab	oility at 50 pascals		15.00	OK
4 Heating efficient	ncy			
Main Heatin	g system:	Heat pumps with radiator Air source heat pump wit	rs or underfloor heating - electr th flow temperature <= 35°C	ic
Secondary h	neating system:	None		
5 Cylinder insula	ation			
Hot water St	torage:	Measured cylinder loss: ( Permitted by DBSCG: 1.3	0.89 kWh/day 58 kWh/day	ОК
Primary pipe	ework insulated:	Yes	-	ОК
6 Controls				
Space heati	ng controls	TTZC by plumbing and e	electrical services	ОК
Hot water co	ontrols:	Cylinderstat		ОК
		Independent timer for DH	HVV	OK

# **Regulations Compliance Report**

7 Low energy lights		
Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK
8 Mechanical ventilation		
Not applicable		
9 Summertime temperature		
Overheating risk (Thames valley):	Medium	ОК
Based on:		
Overshading:	Average or unknown	
Windows facing: North West	9.7m <sup>2</sup>	
Windows facing: North East	3.4m <sup>2</sup>	
Windows facing: North East	1.2m <sup>2</sup>	
Windows facing: South East	4m²	
Ventilation rate:	3.00	

#### 10 Key features

Fixed cooling system

Property Details: Fla	t 4 - Be Green							
Address: Located in: Region: UPRN:		, E T	London, NW6 1RJ Ingland Thames valley					
Date of assessme	ent:	2	0 December 2021					
Date of certificat	e:	2	20 December 2021					
Assessment type	:	N	lew extension to existing	dwelling				
Transaction type	:	N I	vew dwelling					
Polatod party dis	closuro	L L	lo related narty					
Thermal Mass Pa	rameter	1	ndicative Value Medium					
Water use $<= 12$	25 litres/pers	son/day	r: True					
PCDF Version:	, i	4	86					
Droporty description								
	1		-					
Dwelling type: Detachment:		F	lat					
Year Completed:		2	2021					
Floor Location:		F	loor area:		Storov boight			
Floor 0		5	54.3 m²		2.8 m			
Living area:		2	25.4 m <sup>2</sup> (fraction 0.468)					
Front of dwelling fa	ices:	М	lorth West					
Opening types:								
Name:	Source:		Туре:	Glazing:		Argon:	Fram	e:
NW	Manufacturer		Windows	low-E, En =	0.05, soft coat	Yes		
NE	Manufacturer		Windows	low-E, En =	0.05, soft coat	Yes		
NE Proposed	Manufacturer		Windows	low-E, En =	0.05, soft coat	Yes		
SE Proposed	Manufacturer		Windows	low-e, en =	0.05, soft coat	Yes		
Name:	Gap:		Frame Factor	: g-value:	U-value:	Area:	No. o	f Openings:
NW	16mm or	r more	0.7	0.76	1.4	9.7	1	
NE Dropood	16mm or	r more	0.7	0.76	1.4	3.4	1	
SE Proposed		more	0.7	0.76	1.4	1.2	1	
SE Proposed		more	0.7	0.70	1.4	4	I	
Name:	Type-Name	Э:	Location:	Orient:		Width:	Heigh	nt:
NW			Existing	North West		0	0	
NE			Existing	North East		0	0	
NE Proposed			Proposed	North East		0	0	
SE Proposed			Proposed	SOULIT EASI		0	0	
Overshading:		A	verage or unknown					
Opaque Elements:								
Type: C	Gross area:	Openir	ngs: Net area:	U-value:	Ru value:	Curtair	n wall:	Kappa:
Existing	62.44	13.1	49.34	0.55	0	False		N/A
Proposed	23.8	5.2	18.6	0.28	0	False		N/A
Flat	54.3	0	54.3	0.18	0			N/A
Internal Elements								
Party Elements								

Thermal bridges:

Thermal bridges:	No information on thermal bridging ( $y=0.15$ ) ( $y=0.15$ )
Ventilation:	
Pressure test:	No (Assumed)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	
Number of fans:	2
Number of passive stacks:	0
Number of sides sheltered:	2
Pressure test:	15
Main heating system:	
Main heating system:	Heat pumps with radiators or underfloor heating
	Electric heat pumps
	Info Source: SAP Tables
	SAP Table: 214
	Air source heat pump with flow temperature $\leq 35^{\circ}$ C
	Fan coil units
	Central heating pump : 2013 or later
	Unknown
	Boiler interlock: Yes
	MCS Installation Certificate
Main heating Control:	
Main heating Control:	Time and temperature zone control by suitable arrangement of plumbing and electrical
	services
Secondary heating system:	
Secondary heating system:	Napa
Secondary heating system:	None
Secondary heating system: Space cooling system: Space cooling system:	None Split/multiple systems
Secondary heating system: Space cooling system: Space cooling system:	None Split/multiple systems Energy label class: A
Secondary heating system: Space cooling system: Space cooling system:	None Split/multiple systems Energy label class: A Compressor control: Systems with On/Off control
Secondary heating system: Space cooling system: Space cooling system:	None Split/multiple systems Energy label class: A Compressor control: Systems with On/Off control Cooled area: 54.3 (fraction 1.000)
Secondary heating system: Space cooling system: Space cooling system: Water heating:	None Split/multiple systems Energy label class: A Compressor control: Systems with On/Off control Cooled area: 54.3 (fraction 1.000)
Secondary heating system: Space cooling system: Space cooling system: Water heating: Water heating:	None Split/multiple systems Energy label class: A Compressor control: Systems with On/Off control Cooled area: 54.3 (fraction 1.000) From main heating system Water code, 201
Secondary heating system: Space cooling system: Space cooling system: Water heating: Water heating:	None Split/multiple systems Energy label class: A Compressor control: Systems with On/Off control Cooled area: 54.3 (fraction 1.000) From main heating system Water code: 901 Euel : Electricity
Secondary heating system: Space cooling system: Space cooling system: Water heating: Water heating:	None Split/multiple systems Energy label class: A Compressor control: Systems with On/Off control Cooled area: 54.3 (fraction 1.000) From main heating system Water code: 901 Fuel :Electricity Hot water cylinder
Secondary heating system: Space cooling system: Space cooling system: Water heating: Water heating:	None Split/multiple systems Energy label class: A Compressor control: Systems with On/Off control Cooled area: 54.3 (fraction 1.000) From main heating system Water code: 901 Fuel :Electricity Hot water cylinder Cylinder volume: 110 litres
Secondary heating system: Space cooling system: Space cooling system: Water heating: Water heating:	None Split/multiple systems Energy label class: A Compressor control: Systems with On/Off control Cooled area: 54.3 (fraction 1.000) From main heating system Water code: 901 Fuel :Electricity Hot water cylinder Cylinder volume: 110 litres Cylinder insulation: Measured loss, 0.89kWh/day
Secondary heating system: Space cooling system: Space cooling system: Water heating: Water heating:	None Split/multiple systems Energy label class: A Compressor control: Systems with On/Off control Cooled area: 54.3 (fraction 1.000) From main heating system Water code: 901 Fuel :Electricity Hot water cylinder Cylinder volume: 110 litres Cylinder insulation: Measured loss, 0.89kWh/day Primary pipework insulation: True
Secondary heating system: Space cooling system: Space cooling system: Water heating: Water heating:	None Split/multiple systems Energy label class: A Compressor control: Systems with On/Off control Cooled area: 54.3 (fraction 1.000) From main heating system Water code: 901 Fuel :Electricity Hot water cylinder Cylinder colume: 110 litres Cylinder insulation: Measured loss, 0.89kWh/day Primary pipework insulation: True Cylinderstat: True Cylinder in heated space: True
Secondary heating system: Space cooling system: Space cooling system: Water heating: Water heating:	None Split/multiple systems Energy label class: A Compressor control: Systems with On/Off control Cooled area: 54.3 (fraction 1.000) From main heating system Water code: 901 Fuel :Electricity Hot water cylinder Cylinder volume: 110 litres Cylinder insulation: Measured loss, 0.89kWh/day Primary pipework insulation: True Cylinderstat: True Cylinder in heated space: True Solar panel: False
Secondary heating system: Space cooling system: Space cooling system: Water heating: Water heating: Water heating:	None Split/multiple systems Energy label class: A Compressor control: Systems with On/Off control Cooled area: 54.3 (fraction 1.000) From main heating system Water code: 901 Fuel :Electricity Hot water cylinder Cylinder colume: 110 litres Cylinder insulation: Measured loss, 0.89kWh/day Primary pipework insulation: True Cylinderstat: True Cylinder in heated space: True Solar panel: False
Secondary heating system: Space cooling system: Space cooling system: Water heating: Water heating: Others: Electricity tariff:	None Split/multiple systems Energy label class: A Compressor control: Systems with On/Off control Cooled area: 54.3 (fraction 1.000) From main heating system Water code: 901 Fuel :Electricity Hot water cylinder Cylinder volume: 110 litres Cylinder volume: 110 litres Cylinder insulation: Measured loss, 0.89kWh/day Primary pipework insulation: True Cylinderstat: True Cylinder in heated space: True Solar panel: False
Secondary heating system: Space cooling system: Space cooling system: Water heating: Water heating: Water heating: Mater heating: Electricity tariff: In Smoke Control Area:	None Split/multiple systems Energy label class: A Compressor control: Systems with On/Off control Cooled area: 54.3 (fraction 1.000) From main heating system Water code: 901 Fuel :Electricity Hot water cylinder Cylinder volume: 110 litres Cylinder insulation: Measured loss, 0.89kWh/day Primary pipework insulation: True Cylinderstat: True Cylinder in heated space: True Solar panel: False
Secondary heating system: Space cooling system: Space cooling system: Water heating: Water heating: Water heating: Dthers: Electricity tariff: In Smoke Control Area: Conservatory:	None Split/multiple systems Energy label class: A Compressor control: Systems with On/Off control Cooled area: 54.3 (fraction 1.000) From main heating system Water code: 901 Fuel :Electricity Hot water cylinder Cylinder volume: 110 litres Cylinder insulation: Measured loss, 0.89kWh/day Primary pipework insulation: True Cylinderstat: True Cylinder in heated space: True Solar panel: False Standard Tariff Unknown No conservatory
Secondary heating system: Secondary heating system: Space cooling system: Space cooling system: Water heating: Water heating: Water heating: Uthers: Electricity tariff: In Smoke Control Area: Conservatory: Low energy lights: Torrain typo:	None Split/multiple systems Energy label class: A Compressor control: Systems with On/Off control Cooled area: 54.3 (fraction 1.000) From main heating system Water code: 901 Fuel : Electricity Hot water cylinder Cylinder volume: 110 litres Cylinder insulation: Measured loss, 0.89kWh/day Primary pipework insulation: True Cylinderstat: True Cylinder in heated space: True Solar panel: False Standard Tariff Unknown No conservatory 100% Dense urban
Secondary heating system: Space cooling system: Space cooling system: Water heating: Water heating: Water heating: Uthers: Electricity tariff: In Smoke Control Area: Conservatory: Low energy lights: Terrain type: EPC language:	None Split/multiple systems Energy label class: A Compressor control: Systems with On/Off control Cooled area: 54.3 (fraction 1.000) From main heating system Water code: 901 Fuel :Electricity Hot water cylinder Cylinder volume: 110 litres Cylinder insulation: Measured loss, 0.89kWh/day Primary pipework insulation: True Cylinder in heated space: True Solar panel: False Standard Tariff Unknown No conservatory 100% Dense urban English
Secondary heating system: Secondary heating system: Space cooling system: Space cooling system: Water heating: Water heating: Water heating: Vater heating: Electricity tariff: In Smoke Control Area: Conservatory: Low energy lights: Terrain type: EPC language: Wind turbine:	None Split/multiple systems Energy label class: A Compressor control: Systems with On/Off control Cooled area: 54.3 (fraction 1.000) From main heating system Water code: 901 Fuel :Electricity Hot water cylinder Cylinder volume: 110 litres Cylinder volume: 110 litres Cylinder insulation: Measured loss, 0.89kWh/day Primary pipework insulation: True Cylinderstat: True Cylinder in heated space: True Solar panel: False Standard Tariff Unknown No conservatory 100% Dense urban English No
Secondary heating system: Secondary heating system: Space cooling system: Space cooling system: Water heating: Water heating: Water heating: Water heating: Electricity tariff: In Smoke Control Area: Conservatory: Low energy lights: Terrain type: EPC language: Wind turbine: Photovoltaics:	None Split/multiple systems Energy label class: A Compressor control: Systems with On/Off control Cooled area: 54.3 (fraction 1.000) From main heating system Water code: 901 Fuel :Electricity Hot water cylinder Cylinder volume: 110 litres Cylinder volume: 110 litres Cylinder insulation: True Cylinder in heated space: True Solar panel: False Standard Tariff Unknown No conservatory 100% Dense urban English No None

Assess Zero Carbon Home: No

		User	Details:								
Assessor Name: Software Name:	Samuel Westover Stroma FSAP 201	2	Stroma Number:STRO012073Software Version:Version: 1.0.5.50								
		Property	Address:	Flat 4 -	Be Gree	en					
Address :	, London, NW6 1RJ										
1. Overall dwelling dimer	ISIONS:		( 2)			14.					
Ground floor		Ar	54.3	(1a) x	<b>Av. Hei</b>	<b>ght(m)</b> .8	(2a) =	<b>Volume(m³)</b> 152.04	(3a)		
Total floor area TFA = (1a	)+(1b)+(1c)+(1d)+(1e	)+(1n)	54.3	(4)							
Dwelling volume				(3a)+(3b)·	+(3c)+(3d)	)+(3e)+	.(3n) =	152.04	(5)		
2. Ventilation rate:	-										
	main se heating h	econdary eating	other		total			m <sup>3</sup> per hour			
Number of chimneys	0 +	0 +	0	=	0	x 4	40 =	0	(6a)		
Number of open flues	0 +	0 +	0	i = [	0	x 2	20 =	0	(6b)		
Number of intermittent fan	is	J L		, r	2	x 1	0 =	20	(7a)		
Number of passive vents					0	x 1	0 =	0	(7b)		
Number of flueless gas fire	es				0	x 4	40 =	0	(7c)		
							Air ch	anges per ho	ur		
Infiltration due to chimney	s flues and fans - (6	a)+(6b)+(7a)+(7b)-	+(7c) =		20		- (5) -	0.12			
If a pressurisation test has be	en carried out or is intende	d, proceed to (17)	, otherwise c	ontinue fro	20 om (9) to (	16)	- (0) -	0.15			
Number of storeys in the	e dwelling (ns)							0	(9)		
Additional infiltration						[(9)-	1]x0.1 =	0	(10)		
Structural infiltration: 0.2	25 for steel or timber f	rame or 0.35 f	or masonry	y constru	uction		[	0	(11)		
if both types of wall are pre	esent, use the value correspondent of the second upper 0, 25	oonding to the gre	ater wall area	a (after							
If suspended wooden flo	oor. enter 0.2 (unseal	ed) or 0.1 (sea	led). else e	enter 0			[	0	<b>]</b> (12)		
If no draught lobby, ente	er 0.05, else enter 0		,,					0	(13)		
Percentage of windows	and doors draught st	ripped						0	(14)		
Window infiltration	-		0.25 - [0.2	x (14) ÷ 10	= [00			0	(15)		
Infiltration rate			(8) + (10) +	+ (11) + (12	2) + (13) +	- (15) =		0	(16)		
Air permeability value, o	50, expressed in cub	ic metres per h	our per sc	quare me	etre of e	nvelope	area	15	(17)		
If based on air permeabilit	y value, then (18) = [(1	7) ÷ 20]+(8), other	wise (18) = (1	16)			[	0.88	(18)		
Air permeability value applies	if a pressurisation test has	been done or a d	egree air per	meability is	s being us	ed	r		-		
Number of sides sheltered Shelter factor	1		(20) = 1 - [(	0.075 x (19	9)] =			2	(19)		
Infiltration rate incorporati	na shelter factor		(21) = (18)	x (20) =	-/]		l	0.85	(20)		
Infiltration rate modified for	r monthly wind spood		(21) = (10)	x (20) -			l	0.75	(21)		
			Δυα	Son	Oct	Nov	Dec				
	viai   Api   ividy		Aug	Seh		NUV	Dec				
$(22)_{m-}$ 51 51		38 30	37	4	43	45	47				
	<sup>1.0</sup> 7.7 4.3	5.0 5.0	3.1	7	4.0	4.0	7.7				
Wind Factor (22a)m = (22	)m ÷ 4										
(22a)m= 1.27 1.25 1	.23 1.1 1.08	0.95 0.95	0.92	1	1.08	1.12	1.18				

Adjust	ed infiltr	ation rat	e (allowi	ing for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m				_	
	0.96	0.94	0.92	0.82	0.81	0.71	0.71	0.69	0.75	0.81	0.84	0.88		
Calcula If ma	ate etter	ctive air al ventila	change	rate for t	he appli	cable ca	se					1	0	(232)
lf exh	aust air h	eat pump (	usina App	endix N. (2	(23a) = (23a	a) × Fmv (e	equation (N	N5)) . othe	rwise (23b	) = (23a)		l	0	(23b)
lf bala	anced with	n heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (from	n Table 4h	) =	, ( ,		l	0	(23c)
a) If	balance	d mech	, anical ve	entilation	with he	at recove	erv (MVI	HR) (24a	a)m = (2)	2h)m + (	23b) <b>x</b> [*	l 1 – (23c)	0 ∸ 1001	(200)
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If	balance	d mecha	ı anical ve	entilation	u without	heat rec	coverv (N	и ЛV) (24b	m = (22)	1 2b)m + ()	1 23b)		I	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole h	ouse ex	tract ver	ntilation of	or positiv	ve input v	ventilatic	n from o	outside					
, i	if (22b)n	n < 0.5 ×	(23b), t	then (24d	c) = (23b	); otherv	vise (24	c) = (22k	o) m + 0.	.5 × (23b	))			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If	natural	ventilatio	on or wh	ole hous	se positiv	/e input	ventilatio	on from I	oft					
i	if (22b)n	n = 1, th	en (24d)	m = (22b	o)m othe	erwise (2	4d)m = (	0.5 + [(2	2b)m² x	0.5]			l	
(24d)m=	0.96	0.94	0.92	0.84	0.82	0.75	0.75	0.74	0.78	0.82	0.86	0.89	l	(240)
Effe	ctive air	change	rate - er	nter (24a	) or (24b	o) or (240	c) or (24	d) in boy	(25)				l	(05)
(25)m=	0.96	0.94	0.92	0.84	0.82	0.75	0.75	0.74	0.78	0.82	0.86	0.89	l	(25)
3. He	at losse	s and he	eat loss	paramete	er:									
ELEN	IENT	Gros area	ss (m²)	Openin m	lgs 1 <sup>2</sup>	Net Ar A ,r	ea n²	U-valı W/m2	ue :K	A X U (W/	K)	k-value kJ/m²⋅ł	) <	A X k kJ/K
Windo	ws Type	e 1				9.7	x1,	/[1/( 1.4 )+	0.04] =	12.86				(27)
Windo	ws Type	2				3.4	x1,	/[1/( 1.4 )+	0.04] =	4.51				(27)
Windo	ws Type	e 3				1.2	x1,	/[1/( 1.4 )+	0.04] =	1.59				(27)
Windo	ws Type	e 4				4	x1,	/[1/( 1.4 )+	0.04] =	5.3				(27)
Walls <sup>-</sup>	Type1	62.4	4	13.1		49.34	x	0.55	=	27.14				(29)
Walls <sup>-</sup>	Type2	23.	8	5.2		18.6	x	0.28		5.21				(29)
Roof		54.3	3	0		54.3	×	0.18		9.77			$\exists$	(30)
Total a	rea of e	lements	, m²			140.5	4				L			(31)
* for win	dows and	roof wind	ows, use e	effective wi	ndow U-va	alue calcul	ated using	formula 1	/[(1/U-valı	ıe)+0.04] a	as given in	paragraph	1 3.2	
Eabric	he the area	as on both $N/K$	sides of ir	nternal wal TIN	is and pari	titions		(26) (30)	(32) =			I	00.00	(22)
Heat c	anacity	55, W/N - Cm - Sl	- 5 (~ ^ 'A v k )	0)				(20)(00)	((28)	$(30) \pm (3)$	2) + (32a)	(320) -	66.38 5044.5	(33)
Thorm	apacity al mass		(TAR) Itor (TMI	- Cm -	TEA) ir	k l/m²k				(30) + (3/	· Medium	(326) –	5244.5	(34)
For desi	an massess	sments wh	ere the de	etails of the	construct	ion are not	t known pr	eciselv the	e indicative	e values of	TMP in Ta	able 1f	250	(33)
can be ι	used inste	ad of a de	tailed calc	ulation.	00110110101		naro na pr							
Therm	al bridg	es : S (L	x Y) cal	culated u	using Ap	pendix ł	<						21.08	(36)
if details	of therma	al bridging	are not kr	10wn (36) =	= 0.05 x (3	1)			(00)	(0.0)				
	abric ne	at loss		1					(33) +	(36) =		l	87.46	(37)
ventila	ition nea				y 	l	ll	A	(38)m	$= 0.33 \times ($	25)m x (5)		l	
(38)m-	Jan 47.09	17.00		Apr	11 26	Jun 37.0	JUI	Aug	30.17		12.01			(38)
	-1.30			72.13	-1.50	57.0	57.0	J 37.14	(22)	(0=)	L 72.31	-4.00	l	(00)
			11, VV/K	120 50	100.00	125.26	105.00	104.6	(39)m	= (37) + (37)	38)M	121 00	l	
(33)112	155.45	104.00	155.00	129.09	120.03	120.20	120.20	124.0	120.03	Average =	Sum(39)	/12=	129.59	(39)

Heat le	oss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	(4)			
(40)m=	2.49	2.48	2.46	2.39	2.37	2.31	2.31	2.29	2.33	2.37	2.4	2.43		
Numb	er of day	, /s in mo	nth (Tab	le 1a)					,	Average =	Sum(40)1.	12 /12=	2.39	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Αυσ	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
		-	-		-		-	-		-		_	I	
4. Wa	ater hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ned occu A > 13. A £ 13.	upancy, 9, N = 1 9, N = 1	N + 1.76 x	: [1 - exp	o(-0.0003	349 x (TF	FA -13.9	)2)] + 0.(	0013 x ( <sup>-</sup>	TFA -13.	1. 9)	82		(42)
Annua Reduce not mor	I average the annua that 125	je hot wa al average litres per j	ater usag hot water person pe	ge in litre usage by r day (all w	es per da 5% if the c vater use, i	ay Vd,av Iwelling is hot and co	erage = designed : ld)	(25 x N) to achieve	+ 36 a water us	se target o	77 f	.35		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wat	er usage i	n litres pei	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	85.08	81.99	78.9	75.8	72.71	69.61	69.61	72.71	75.8	78.9	81.99	85.08		
Energy	content of	hot water	used - cal	culated m	onthly = 4.	190 x Vd,r	m x nm x E	) ) ) ) ) ) ) ) ) ) ) ) ) ) ) ) ) ) )	) kWh/mor	Total = Su oth (see Ta	m(44) <sub>112</sub> = ables 1b, 1	= c, 1d)	928.19	(44)
(45)m=	126.18	110.36	113.88	99.28	95.26	82.2	76.17	87.41	88.46	103.09	112.53	122.2		
lf instan	taneous v	/ater heati	ng at point	t of use (no	o hot wate	r storage),	enter 0 in	boxes (46,	) to (61)	Total = Su	m(45) <sub>112</sub> =	-	1217.01	(45)
(46)m=	18.93	16.55	17.08	14.89	14.29	12.33	11.43	13.11	13.27	15.46	16.88	18.33		(46)
Water	storage	loss:		1	1	1					·		, I	
Storag	je volum	e (litres)	includir	ng any s	olar or V	WHRS	storage	within sa	ame ves	sel		110	l	(47)
If com	munity h wise if n	eating a	ind no ta	ank in dw ar (this in	velling, e ocludes i	nter 110	) litres in	(47) mbi boil	ers) ente	er 'O' in (	47)			
Water	storage	loss:	not wat			notantai								
a) If n	nanufact	urer's d	eclared I	oss fact	or is kno	wn (kWł	n/day):				0.	89		(48)
Tempe	erature f	actor fro	m Table	2b							0.	54		(49)
Energ	y lost fro	m water	storage	e, kWh/y	ear			(48) x (49)	) =		0.	48		(50)
b) If n	hanufact	urer's d	eclared (	cylinder	loss fact	or is not	known:						l	
HOI Wa	ater stor munity k	age ioss neating s	ee secti	om 1ab	ie z (kvv	n/iitre/da	iy)					0	l	(51)
Volum	e factor	from Ta	ble 2a	011 1.0								0		(52)
Tempe	erature f	actor fro	m Table	2b								0		(53)
Energ	y lost fro	m watei	storage	, kWh/y	ear			(47) x (51)	) x (52) x (	53) =		0		(54)
Enter	(50) or	(54) in ( <del>5</del>	55)								0.	48		(55)
Water	storage	loss cal	culated	for each	month			((56)m = (	55) × (41)ı	m				
(56)m=	14.9	13.46	14.9	14.42	14.9	14.42	14.9	14.9	14.42	14.9	14.42	14.9		(56)
If cylind	er contain	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (	H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Append	ix H	
(57)m=	14.9	13.46	14.9	14.42	14.9	14.42	14.9	14.9	14.42	14.9	14.42	14.9		(57)
Prima	ry circuit	loss (ar	nnual) fro	om Table	e 3							0		(58)
Prima	ry circuit	loss cal	culated	for each	month (	59)m = (	(58) ÷ 36	65 × (41)	m					
(mo	dified by	factor f	rom Tab I	le H5 if t I	there is s	solar wat	ter heati	ng and a	t cylinde	r thermo	stat)		I	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

Combi	loss ca	alculated	for each	n month	(61)m =	(60	) ÷ 36	65 × (41)	)m							
(61)m=	0	0	0	0	0		0	0	0		0	0	0	0	]	(61)
Total h	eat req	uired for	water h	eating ca	alculated	l fo	r eacl	n month	(62)	m =	0.85 × (	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	164.34	144.82	152.04	136.21	133.42	11	19.13	114.34	125	.57	125.39	141.25	149.46	160.36	]	(62)
Solar Dł	-IW input	calculated	using App	pendix G o	r Appendix	: H (	negativ	ve quantity	/) (ent	er '0	' if no sola	r contribu	tion to wate	er heating)	-	
(add a	dditiona	al lines if	FGHRS	and/or \	WWHRS	a p	plies	, see Ap	pend	lix C	G)				_	
(63)m=	0	0	0	0	0		0	0	0		0	0	0	0		(63)
Output	from w	ater hea	ter													
(64)m=	164.34	144.82	152.04	136.21	133.42	11	19.13	114.34	125	.57	125.39	141.25	149.46	160.36	]	
										Outp	out from w	ater heate	er (annual)	112	1666.32	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´	[0.85	× (45)m	ı + (6	1)m	n] + 0.8 x	((46)m	ı + (57)m	+ (59)m	]	
(65)m=	72.48	64.27	68.39	62.55	62.2	5	6.88	55.86	59.	59	58.96	64.8	66.96	71.16	]	(65)
inclu	ide (57)	m in calo	culation	of (65)m	only if c	ylir	nder is	s in the o	dwell	ing	or hot w	ater is f	rom com	munity h	- neating	
5. Int	ernal g	ains (see	e Table :	5 and 5a	):											
Metab	olic daii	ns (Table	e 5). Wa	tts												
	Jan	Feb	Mar	Apr	May	, I	Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
(66)m=	109.01	109.01	109.01	109.01	109.01	10	09.01	109.01	109	.01	109.01	109.01	109.01	109.01		(66)
Lightin	g gains	(calcula	ted in A	ppendix	L, equat	ion	L9 oi	r L9a), a	lso s	ee <sup>-</sup>	Table 5		•	I		
(67)m=	35.3	31.35	25.5	19.3	14.43	1	2.18	13.16	17.	11	22.96	29.16	34.03	36.28	]	(67)
Applia	nces da	ins (calc	ulated i	n Appeno	dix L, eq	uat	ion L'	13 or L1	<u>.</u> 3a), a	alsc	see Ta	ble 5	- <u>I</u>		1	
(68)m=	236.39	238.84	232.66	219.5	202.89	18	37.28	176.85	174	.39	180.57	193.73	210.35	225.96	]	(68)
Cookir	na aains	s (calcula	ted in A	ppendix	L. equat	tion	L15	or L15a	), als	0 S6	e Table	5			1	
(69)m=	47.72	47.72	47.72	47.72	47.72	4	7.72	47.72	47.	72	47.72	47.72	47.72	47.72	]	(69)
Pumps	and fa	ns gains	(Table	1 5a)	I							I		I	1	
(70)m=	3	3	3	3	3		3	3	3		3	3	3	3	]	(70)
Losses		vaporatio	n (nega	utive valu	i es) (Tab	l le !	5)						<u> </u>		1	
(71)m=	-72.67	-72.67	-72.67	-72.67	-72.67	-7	2.67	-72.67	-72.	67	-72.67	-72.67	-72.67	-72.67	1	(71)
Water	heating	L aains (T	I Table 5)			I	-			-					1	
(72)m=	97.42	95.64	91.93	86.88	83.61		79	75.08	80	1	81.88	87.1	93	95.64	1	(72)
Total i	ntorna						(66)	m + (67)m	) + (68	3)m -	- (69)m + (	(70)m + (	71)m + (72)	)m	J	· · ·
(73)m=	456 16	452.88	437 14	412 74	387 98	36	(00) 35.51	352 14	358	66	372 48	397.05	424 43	444 94	1	(73)
6.50	lar gain	S.		112.11	001.00		.0.01	002.11	000	.00	072.10	001.00	121110	111.01		( - /
Solar o	ains are	calculated	using sola	ar flux from	Table 6a	and	associ	ated equa	tions t	to co	onvert to th	e applica	ble orienta	tion.		
Orienta	ation:	Access F	actor	Area			Flu	X			g_		FF		Gains	
		Table 6d		m²			Tab	ole 6a		Т	able 6b	Т	able 6c		(W)	
Northea	ast <mark>0.9x</mark>	0.77	x	3.	4	x	1	1.28	x		0.76	x	0.7	=	14.14	(75)
Northea	ast <mark>0.9x</mark>	0.77	×	1.	2	×	1	1.28	x	·	0.76	Ξ × Γ	0.7	=	4.99	(75)
Northea	ast <mark>0.9x</mark>	0.77	×	3.	4	x	2	2.97	x		0.76	Ξ × Γ	0.7	=	28.79	(75)
Northea	ast <mark>0.9x</mark>	0.77	×	1.	2	x [	2	2.97	x		0.76	Ξ × Γ	0.7	=	10.16	(75)
Northea	ast <mark>0.9x</mark>	0.77	×	3.	4	×	4	1.38	x	·	0.76	=	0.7	=	51.87	(75)

No who a set a s		٦		1		1				1		٦
Northeast 0.9x	0.77	×	1.2	X	41.38	X	0.76	х	0.7	=	18.31	(75)
Northeast 0.9x	0.77	x	3.4	x	67.96	x	0.76	x	0.7	=	85.18	(75)
Northeast 0.9x	0.77	x	1.2	x	67.96	x	0.76	x	0.7	=	30.06	(75)
Northeast 0.9x	0.77	x	3.4	x	91.35	x	0.76	x	0.7	=	114.5	(75)
Northeast 0.9x	0.77	x	1.2	x	91.35	x	0.76	x	0.7	=	40.41	(75)
Northeast 0.9x	0.77	x	3.4	x	97.38	x	0.76	x	0.7	=	122.07	(75)
Northeast 0.9x	0.77	x	1.2	x	97.38	x	0.76	x	0.7	=	43.08	(75)
Northeast 0.9x	0.77	x	3.4	x	91.1	x	0.76	x	0.7	=	114.2	(75)
Northeast 0.9x	0.77	x	1.2	x	91.1	x	0.76	x	0.7	] =	40.3	(75)
Northeast 0.9x	0.77	x	3.4	×	72.63	×	0.76	x	0.7	=	91.04	(75)
Northeast 0.9x	0.77	x	1.2	x	72.63	x	0.76	x	0.7	=	32.13	(75)
Northeast 0.9x	0.77	x	3.4	x	50.42	x	0.76	x	0.7	=	63.2	(75)
Northeast 0.9x	0.77	x	1.2	x	50.42	x	0.76	x	0.7	=	22.31	(75)
Northeast 0.9x	0.77	x	3.4	x	28.07	x	0.76	x	0.7	=	35.18	(75)
Northeast 0.9x	0.77	x	1.2	x	28.07	x	0.76	x	0.7	=	12.42	(75)
Northeast 0.9x	0.77	x	3.4	x	14.2	x	0.76	x	0.7	=	17.8	(75)
Northeast 0.9x	0.77	x	1.2	x	14.2	x	0.76	x	0.7	] =	6.28	(75)
Northeast 0.9x	0.77	x	3.4	x	9.21	x	0.76	x	0.7	=	11.55	(75)
Northeast 0.9x	0.77	x	1.2	x	9.21	x	0.76	x	0.7	=	4.08	(75)
Southeast 0.9x	0.77	x	4	x	36.79	x	0.76	x	0.7	=	54.26	(77)
Southeast 0.9x	0.77	x	4	x	62.67	x	0.76	x	0.7	=	92.42	(77)
Southeast 0.9x	0.77	x	4	x	85.75	x	0.76	x	0.7	=	126.46	(77)
Southeast 0.9x	0.77	x	4	x	106.25	x	0.76	x	0.7	=	156.69	(77)
Southeast 0.9x	0.77	x	4	x	119.01	x	0.76	x	0.7	=	175.51	(77)
Southeast 0.9x	0.77	x	4	x	118.15	x	0.76	x	0.7	=	174.24	(77)
Southeast 0.9x	0.77	x	4	x	113.91	x	0.76	x	0.7	=	167.98	(77)
Southeast 0.9x	0.77	x	4	x	104.39	x	0.76	x	0.7	=	153.94	(77)
Southeast 0.9x	0.77	x	4	x	92.85	x	0.76	x	0.7	=	136.93	(77)
Southeast 0.9x	0.77	x	4	x	69.27	x	0.76	x	0.7	=	102.15	(77)
Southeast 0.9x	0.77	x	4	x	44.07	x	0.76	x	0.7	=	64.99	(77)
Southeast 0.9x	0.77	x	4	x	31.49	x	0.76	x	0.7	=	46.44	(77)
Northwest 0.9x	0.77	x	9.7	x	11.28	x	0.76	x	0.7	=	40.35	(81)
Northwest 0.9x	0.77	x	9.7	×	22.97	x	0.76	x	0.7	] =	82.13	(81)
Northwest 0.9x	0.77	x	9.7	x	41.38	x	0.76	x	0.7	=	147.98	(81)
Northwest 0.9x	0.77	x	9.7	x	67.96	x	0.76	x	0.7	=	243.02	(81)
Northwest 0.9x	0.77	x	9.7	x	91.35	x	0.76	x	0.7	=	326.67	(81)
Northwest 0.9x	0.77	x	9.7	×	97.38	x	0.76	x	0.7	=	348.26	(81)
Northwest 0.9x	0.77	x	9.7	×	91.1	×	0.76	x	0.7	=	325.79	(81)
Northwest 0.9x	0.77	x	9.7	×	72.63	×	0.76	x	0.7	] =	259.73	(81)
Northwest 0.9x	0.77	x	9.7	×	50.42	×	0.76	x	0.7	=	180.31	(81)
Northwest 0.9x	0.77	x	9.7	×	28.07	x	0.76	x	0.7	=	100.37	(81)

Northwe	est <mark>0.9x</mark>	0.77	x	9.	7	× [	1	4.2	x	0.76	_ × [	0.7	=	50.77	(81)
Northwe	est <mark>0.9x</mark>	0.77	x	9.	7	× [	ç	9.21	x	0.76	_ × [	0.7	=	32.95	(81)
	L														
Solar c	ains in	watts. ca	alculated	for eac	n month	1			(83)m = S	um(74)m .	(82)m				
(83)m=	113.74	213.51	344.61	514.96	657.09	68	37.65	648.27	536.84	402.75	250.12	139.84	95.01		(83)
Total g	ains – i	nternal a	and solar	. (84)m =	= (73)m	+ (8	33)m ,	watts				1		1	
(84)m=	569.91	666.39	781.75	927.7	1045.07	10	53.16	1000.41	895.49	775.23	647.17	564.27	539.95		(84)
7. Me	an inter	nal temp	perature	(heating	seasor	n)						•			
Temp	erature	during h	neating p	eriods ir	n the livi	ng a	area f	rom Tab	ole 9, Th	1 (°C)				21	(85)
Utilisa	ation fac	tor for a	ains for	living are	ea. h1.m	ı (se	e Ta	ble 9a)							
	Jan	Feb	Mar	Apr	Mav	È,	Jun	Jul	Aua	Sep	Oct	Nov	Dec		
(86)m=	0.99	0.98	0.96	0.9	0.8		).64	0.51	0.57	0.79	0.94	0.98	0.99		(86)
Moon	intorno							oc 2 to 7	in Tobl					ł	
(87)m-	18.64			10 07	20.48			20.94	20.01	20.63	10.06	10.22	18.64	1	(87)
(07)11=	10.04	10.09	19.34	19.97	20.40	2	0.02	20.94	20.91	20.03	19.90	19.22	10.04	i	(07)
Temp	erature	during h	eating p	eriods ir	n rest of	dw	elling	from Ta	ble 9, T	h2 (°C)			r	1	
(88)m=	19.02	19.03	19.04	19.09	19.1	19	9.14	19.14	19.14	19.12	19.1	19.08	19.06		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,	m (se	e Table	9a)						
(89)m=	0.98	0.97	0.94	0.86	0.71		0.5	0.31	, 0.37	0.67	0.9	0.97	0.98		(89)
Mean	interna	l temper	ature in	the rest	of dwell	ina	T2 (fc	ollow ste	os 3 to 7	7 in Tabl	e 9c)			I	
(90)m=	16.1	16.47	17.11	18.01	18.66	19	9.04	19.12	19.12	18.88	18.04	16.98	16.12		(90)
						I				f	LA = Livi	ng area ÷ (4	1 4) =	0.47	(91)
												<b>.</b> .		0.11	
Mean	interna	l temper	ature (fo	or the wh	ole dwe	lling	g) = fL	_A × T1	+ (1 – fL	.A) × T2			i	1	( <b>)</b>
(92)m=	17.29	17.6	18.15	18.92	19.51	19	9.87	19.97	19.96	19.7	18.94	18.03	17.3	İ	(92)
Apply	adjustr	nent to t	he mear I	internal	tempei	atu	re fro	m Table	4e, whe	ere appro	opriate	1	1	1	(22)
(93)m=	17.29	17.6	18.15	18.92	19.51	19	9.87	19.97	19.96	19.7	18.94	18.03	17.3		(93)
8. Spa	ace hea	iting requ	uirement												
Set Ti	i to the i ilisation	mean int	ernal ter	nperatui using Ta	e obtaiı ble 9a	ned	at ste	ep 11 of	Table 9	o, so tha	t Ti,m=	(76)m an	d re-calo	ulate	
ine ui	lan	Feb	Mar	Δnr	Mav	1	lun	hul	Αυσ	Sen	Oct	Nov	Dec		
l Itilisa	tion fac	tor for a	ains hm		iviay	<u> </u>		Jui	Aug	Seb	001		Dec	ł	
(94)m=	0.97	0.96	0.93	. 0.86	0.73		0.56	0.4	0.46	0.71	0.9	0.96	0.98		(94)
l Isefu	Inains	hmGm	W = (9)	1)m x (8/	1)m			0	0.10	0.1.1	0.0	0.00	0.00	i	
(95)m=	554.3	638.37	724.35	793.5	765.76	58	38.97	403.33	414.61	554.04	580.49	541.05	527.18		(95)
Month	nlv aver	ade exte	rnal tem	perature	from T	able	- 8							1	
(96)m=	4.3	4.9	6.5	8.9	11.7		4.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for me	an intern	al tempe	erature	l m		-[(39)m	x [(93)m	(96)m	1			1	
(97)m=	1759 19	1709.02	1557 84	1298.91	1006 57		, <b>vv</b> _	422 15	443.07	708.96	J 1074 04	1425 16	1729	I	(97)
Snace	hoatin		ament fo		onth k	Wh	/mont	h = 0.02	1.10.01	m = (95)	ml x (/	1)m	1120	i	()
(98)m-	896 44	719 48	620 11	363.9	179 16	1		0.02	0	0	367.2	636 56	894 16	I	
(00)11-	000.44	10.40		000.0	110.10	<u> </u>	Ŭ	v	Toto			r) = Sum(0)	8)	1676.00	(98)
0				1.1.1.1.1					TUId	, por year	(yee		⊂j15,912 =	+070.33	
Space	e neatin	g require	ement in	KVVh/m <sup>2</sup>	/year									86.13	(99)
8c. Sp	bace co	oling rec	quiremer	nt											

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat I	loss rate	e Lm (ca	lculated	using 2	5°C inter	nal temp	perature	and ext	ernal ten	nperatur	e from T	able 10)		
(100)m=	0	0	0	0	0	1177.44	926.92	946.96	0	0	0	0		(100)
Utilisa	ation fac	tor for lo	oss hm											
(101)m=	0	0	0	0	0	0.75	0.81	0.76	0	0	0	0		(101)
Usefu	l loss, h	mLm (V	/atts) =	(100)m >	(101)m		_		_		-			
(102)m=	0	0	0	0	0	879.36	753.2	724.41	0	0	0	0		(102)
Gains	(solar (	gains ca	lculated	for appli	cable w	eather re	egion, se	e Table	10)		-			
(103)m=	0	0	0	0	0	1166.26	1106.86	983.13	0	0	0	0		(103)
Space set (1	e <i>coolin</i> 04)m to	g <i>require</i> zero if (	e <i>ment fo</i> (104)m <	r <i>month,</i> < 3 × (98	<i>whole c</i> )m	lwelling,	continue	ous ( kN	/h) = 0.0	24 x [(10	)3)m – (	102)m]:	x (41)m	
(104)m=	0	0	0	0	0	206.57	263.12	192.49	0	0	0	0		
							•	-	Tota	i = Sum(	104)	=	662.17	(104)
Cooled	I fraction	n							f C =	cooled a	area ÷ (4	4) =	1	(105)
Intermi	ttency f	actor (Ta	able 10b	)				·			i			_
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		_
									Tota	l = Sum(	(104)	=	0	(106)
Space	cooling	requirer	ment for	month =	: (104)m	× (105)	× (106)r	n I			i		I	
(107)m=	0	0	0	0	0	51.64	65.78	48.12	0	0	0	0		_
									Tota	l = Sum(	107)	=	165.54	(107)
Space	cooling	requirer	ment in l	«Wh/m²/	year				(107)	) ÷ (4) =			3.05	(108)
9a. Ene	ergy rec	luiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	) micro-C	CHP)					
Space	e heatir	ng:												
Fracti	on of sp	ace hea	at from s	econdar	y/supple	mentary	y system						0	(201)
Fracti	on of sp	ace hea	at from m	nain syst	em(s)			(202) = 1	– (201) =				1	(202)
Fracti	on of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of r	main spa	ace heat	ing syste	em 1								249.9	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heatin	g system	n, %						0	(208)
Coolir	na Svste	em Ener	av Effici	encv Ra	tio								4	(209)
						<u>г.</u>	<b>.</b>						т — т	()
0	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kwh/ye	ear
Space		g require				)				267.2	626 56	904.16		
	090.44	719.40	020.11	303.9	179.10	0	0	0	0	307.2	030.50	094.10		
m(211) ا	ı = {[(98	)m x (20	94)]}x1	00 ÷ (20	)6)	i	i	i	i		i	i	I	(211)
	358.72	287.91	248.14	145.62	71.69	0	0	0	0	146.94	254.73	357.81		_
								Tota	al (kWh/yea	ar) =Sum(2	211) <sub>15,1012</sub>	2=	1871.55	(211)
Space	e heatin	g fuel (s	econdar	y), kWh/	month									
= {[(98)	)m x (20	)1)]}x 1	00 ÷ (20	)8)									l.	
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
								Tota	al (kWh/yea	ar) =Sum(2	2 <b>15)</b> <sub>15,1012</sub>	2=	0	(215)
Water	heating	J												
Output	from w	ater hea	ter (calc	ulated a	bove)	i	1	i	1	i	i		I	
	164.34	144.82	152.04	136.21	133.42	119.13	114.34	125.57	125.39	141.25	149.46	160.36		_
Efficier	ncy of w	ater hea	ter										175.1	(216)

175.1

175.1

175.1

175.1

175.1

175.1

175.1

175.1

175.1

175.1

175.1

(217)m=

175.1

(217)

				En kW	<b>ergy</b> /h/yeai	r		Emiss kg CO	<b>ion fac</b> 2/kWh	tor	<b>Emissions</b> kg CO2/yea	ar
12a. CO2 emissions -	– Individ	ual heati	ing syste	ems inclu	uding m	nicro-CHF	<u>,</u>					
SAP rating (Section 1	2)										75.53	(258)
Energy cost factor (EC	F)		[(255) x	(256)] ÷ [(	(4) + 45.0	)] =					1.75	(257)
Energy cost deflator (T	able 12)	)									0.42	(256)
11a. SAP rating - indi	vidual h	eating sy	/stems									
Appendix Q items: rep Total energy cost	eat lines	(253) aı	nd (254) (245)(	as neec 247) + (25	ded 50)(254	l) =					414.68	(255)
Additional standing cha	arges (T	able 12)									0	(251)
(if off-peak tariff, list ea Energy for lighting	ich of (2	30a) to (	230g) se	eparately (232	/ as apj 2)	plicable a	ind apply	13.	ce accoi 19	x 0.01 =	32.89	(250)
Pumps, fans and elect	ric keep	-hot	\	(231	1)			13.	19	x 0.01 =	3.96	(249)
Space cooling		•		(221	1)			13.	19	x 0.01 =	5.46	(248)
Water heating cost (oth	her fuel)			(219	9)			13.	19	x 0.01 =	125.52	(247)
Space heating - secon	dary			(215	5) x			13.	19	x 0.01 =	0	(242)
Space heating - main s	system 2	2		(213	3) x			0	)	x 0.01 =	0	(241)
Space heating - main s	system 1			(211	1) x			13.	19	x 0.01 =	246.86	(240)
				<b>Fu</b> kW	<b>el</b> /h/yeaı	r		<b>Fuel P</b> (Table	P <b>rice</b> 12)		<b>Fuel Cost</b> £/year	_
10a. Fuel costs - indiv	/idual he	eating sy	stems:									
Total delivered energy	for all u	ses (211	)(221)	+ (231)	+ (232)	)(237b)	=				3143.93	(338)
Electricity for lighting											249.36	(232)
Total electricity for the	above, I	<wh td="" yea<=""><td>r</td><td></td><td></td><td>sum</td><td>of (230a).</td><td>(230g) =</td><td>:</td><td></td><td>30</td><td>(231)</td></wh>	r			sum	of (230a).	(230g) =	:		30	(231)
central heating pump	:									30	]	(230c)
Electricity for pumps, fa	ans and	electric l	keep-ho	t								
Space cooling fuel use	d										41.39	
Water heating fuel use	d										951.64	
Space heating fuel use	ed, main	system	1					ĸ	wii/yea	I	1871.55	
						1012		2 1) <sub>68</sub> —		-	41.39	(221)
(221)m= 0 0	0	0	0	12.91	16.45	12.03	0	0	0	0	44.00	
(221)m = (107)m÷ (209	9)						1		1		7	
Space cooling fuel, k	Wh/mor	nth.				1012		10a) <sub>112</sub> –			951.64	(219)
(219)m= 93.85 82.71	86.83	77.79	76.2	68.04	65.3	71.71	71.61	80.67	85.35	91.58	054.04	
$(219)m = (64)m \times 100$	) ÷ (217)	m							1		7	
	K V V I I / I / I / I	mm										

971.33 (26 0 (26 493.9 (26 1465.23 (26 21.48 (26 15.57 (26)
0 (26) 493.9 (26) 1465.23 (26) 21.48 (26) 15.57 (26)
493.9       (26)         1465.23       (26)         21.48       (26)         15.57       (26)         120.42       (26)
1465.23       (26)         21.48       (26)         15.57       (26)         120.42       (26)
21.48 (26) 15.57 (26)
15.57 (26
120.42 (26)
129.42 (200
1631.7 (27)
30.05 (27:
78 (274
<b>P. Energy</b> kWh/year
5745.65 (26)
0 (263
2921.54 (264
2921.54 (264 8667.19 (265
2921.54 (264 8667.19 (264 127.05 (266
2921.54       (26)         8667.19       (26)         127.05       (26)         92.1       (26)
2921.54       (26)         8667.19       (26)         127.05       (26)         92.1       (26)         765.53       (26)

(272) ÷ (4) =

Primary energy kWh/m²/year

(273)

177.75

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 20 December 2021

#### Property Details: Flat 4 - Be Green

Dwelling type: Located in: Region: Cross ventilation pos Number of storeys: Front of dwelling fact Overshading: Overhangs: Thermal mass param Night ventilation: Blinds, curtains, shur Ventilation rate durin	ssible: es: eter: tters: ig hot wea	other (a	ch):	Flat England Thames va Yes 1 North Wess Average or None Indicative V False 3 ( Windov	lley t ⊂unknown √alue Medium vs open half t	n he time)		
Overheating Details:								
Summer ventilation h Transmission heat lo Summer heat loss co Overhangs:	neat loss o ss coeffic efficient:	coefficie cient:	ent:	150.52 87.5 237.98				(P1) (P2)
Orientation:	Ratio:		Z overhangs:					
North West (NW) North East (NE) North East (NE Propos South East (SE Propos	0 0 ed)0 ed)0		1 1 1 1					
Solar shading:								
Orientation: North West (NW) North East (NE) North East (NE Propos South East (SE Propos	Z blind 1 1 ed)1 ed)1	S:	<b>Solar access:</b> 0.9 0.9 0.9 0.9 0.9	<b>Over</b> 1 1 1 1	hangs:	<b>Z summer:</b> 0.9 0.9 0.9 0.9 0.9		(P8) (P8) (P8) (P8)
Solar gains.								
Orientation North West (NW) North East (NE) North East (NE Propos South East (SE Propos	0.9 x 0.9 x ed)0.9 x ed)0.9 x	<b>Area</b> 9.7 3.4 1.2 4	Flux 98.85 98.85 98.85 119.92	<b>g_</b> 0.76 0.76 0.76 0.76	FF 0.7 0.7 0.7 0.7	Shading           0.9           0.9           0.9           0.9           0.9           0.9           0.9           0.9           0.9           0.9	Gains 413.17 144.82 51.11 206.71 815.81	(P3/P4)
Internal gains:								
Internal gains Total summer gains Summer gain/loss ratio Mean summer externa Thermal mass tempera Threshold temperature <b>Likelihood of high in</b>	o I temperat ature incre e <b>ternal tem</b>	ure (Th ment p <b>eratu</b> i	names valley) T <b>e</b>	Ju 36, 12; 5,2 16 0,2 21, <b>Sli</b>	ne 2.51 37.05 25 45 ght	<b>July</b> 349.14 1164.95 4.9 17.9 0.25 23.05 <b>Medium</b>	August 355.66 1046.81 4.4 17.8 0.25 22.45 Medium	(P5) (P6) (P7)

# SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium