#### **Regulations Compliance Report**

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.9 Printed on 28 October 2020 at 14:54:00

Project Information:

Assessed By: Zahid Ashraf (STRO001082) **Building Type:** Flat

Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 50.54m<sup>2</sup> Plot Reference: Site Reference : Hermitage Lane Plot 37

Address:

Client Details:

Name: Address:

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas (c)

Fuel factor: 1.00 (mains gas (c))

20.17 kg/m<sup>2</sup> Target Carbon Dioxide Emission Rate (TER)

Dwelling Carbon Dioxide Emission Rate (DER) 13.18 kg/m<sup>2</sup> OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 50.6 kWh/m<sup>2</sup>

Dwelling Fabric Energy Efficiency (DFEE) 40.8 kWh/m<sup>2</sup>

OK 2 Fabric U-values

**Element Average** 

**Highest** External wall 0.14 (max. 0.30) 0.15 (max. 0.70) OK

Floor (no floor)

Roof 0.10 (max. 0.20) OK 0.10 (max. 0.35) **Openings** 1.40 (max. 2.00) 1.40 (max. 3.30) OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals 3.00 (design value)

OK Maximum 10.0

4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls Charging system linked to use of community heating,

programmer and at least two room thermostats

Hot water controls: No cylinder thermostat

No cylinder

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		
Continuous supply and extract system		
Specific fan power:	0.91	
Maximum	1.5	OK
MVHR efficiency:	93%	
Minimum	70%	ок
9 Summertime temperature		
Overheating risk (Thames valley):	Medium	ок
Based on:		
Overshading:	Average or unknown	
Windows facing: North East	8.65m <sup>2</sup>	
Ventilation rate:	4.00	
10 Key features		
Air permeablility	3.0 m³/m²h	
Roofs U-value	0.1 W/m <sup>2</sup> K	
Community heating, heat from boilers – mains gas		
Photovoltaic array		

		Llser	Details:						
Assessor Name:	Zahid Ashraf	0301	Stroma	a Nium	bori		STD∪	001082	
Software Name:	Stroma FSAP 2012	2	Softwa		on: 1.0.5.9				
		Propert	y Address:	Plot 37					
Address :									
Overall dwelling dime	ensions:	•	( 2)		A I I .	tall ((as)		) / - l /	
Ground floor		AI	rea(m²)	(1a) x		<b>ight(m)</b> 2.5	(2a) =	Volume(m³	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)			(4)			]```	120.00	
Dwelling volume	a, ((a) ((a) (a) (a)		30.34		)+(3c)+(3c	d)+(3e)+	.(3n) =	126.26	7(5)
				(54) (55)	, , (00) , (00	.,, (33)	.(0)	126.36	(5)
2. Ventilation rate:		condary	other		total			m³ per hou	r
Number of chimneys	heating he	eating +	0	1 = [	0	x 4	40 =	0	(6a)
Number of open flues	0 +	0 +	0	]	0	x	20 =	0	(6b)
Number of intermittent fa				J	0	x	10 =	0	(7a)
Number of passive vents				F	0	x	10 =	0	(7b)
Number of flueless gas fi				L	0		40 =	<u> </u>	(7c)
Number of flueless gas in	1103							0	(70)
							Air ch	anges per ho	our
Infiltration due to chimne	ys, flues and fans = (6a)	)+(6b)+(7a)+(7b)	)+(7c) =	Γ	0		÷ (5) =	0	(8)
	peen carried out or is intended	l, proceed to (17	), otherwise o	ontinue fr	om (9) to	(16)	'		_ 
Number of storeys in the Additional infiltration	ne aweiling (ns)					[(9)]	-1]x0.1 =	0	(9)
	.25 for steel or timber fr	ame or 0.35	for masonr	v constr	uction	[(0)	1]XO.1 =	0	(11)
	resent, use the value corresp	onding to the gre	eater wall are	a (after					` ′
deducting areas of openia	ngs); if equal user 0.35 floor, enter 0.2 (unseale	d) or 0.1 (se:	aled) else	enter ()				0	(12)
If no draught lobby, en	,	a) or 0.1 (300	aica), cisc	CITICI O				0	(13)
• •	s and doors draught stri	pped						0	(14)
Window infiltration	_		0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate			(8) + (10)	+ (11) + (1	12) + (13)	+ (15) =		0	(16)
•	q50, expressed in cubic	•	•	•	etre of e	envelope	area	3	(17)
If based on air permeabil	-							0.15	(18)
Air permeability value applie  Number of sides sheltere	es if a pressurisation test has i	been done or a d	degree air pei	meability	is being u	sed		2	(19)
Shelter factor	,u		(20) = 1 -	0.075 x (1	19)] =			0.78	(20)
Infiltration rate incorporate	ting shelter factor		(21) = (18)	x (20) =				0.12	(21)
Infiltration rate modified f	or monthly wind speed								
Jan Feb	Mar Apr May	Jun Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	eed from Table 7								
(22)m= 5.1 5	4.9 4.4 4.3	3.8 3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (2.	2)m ÷ 4								
	1.23 1.1 1.08	0.95 0.95	0.92	1	1.08	1.12	1.18		
			•		•	•	•	•	

Adjusted infiltra	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14		
Calculate effect		_	rate for t	he appli	cable ca	se	-		-	-		0.5	(23a)
If exhaust air he			endix N. (2	3b) = (23a	a) × Fmv (e	equation (N	N5)) . othe	rwise (23b	) = (23a)			0.5	(23b)
If balanced with		0		, ,	,	. `	,, .	,	, (200)			0.5	(23c)
a) If balance		-	-	_					2h)m + (	23h) 🗴 [	1 – (23c)	79.05 - 1001	(230)
(24a)m= 0.25	0.25	0.25	0.23	0.23	0.22	0.22	0.21	0.22	0.23	0.24	0.24	]	(24a)
b) If balance	d mecha	anical ve	entilation	without	heat rec	coverv (N	л ЛV) (24b	)m = (22	2b)m + (	1 23b)		J	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(24b)
c) If whole he if (22b)m				•	-				.5 × (23b	) )		1	
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natural vif (22b)m									0.5]				
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effective air	change	rate - er	nter (24a	) or (24b	o) or (24	c) or (24	d) in box	x (25)				_	
(25)m= 0.25	0.25	0.25	0.23	0.23	0.22	0.22	0.21	0.22	0.23	0.24	0.24		(25)
3. Heat losses	s and he	eat loss p	paramete	er:									
ELEMENT	Gros area	_	Openin m		Net Ar A ,r		U-valı W/m2		A X U (W/I	K)	k-value kJ/m²-l		X k //K
Doors					2	X	1.4	= [	2.8				(26)
Windows					8.651	x1,	/[1/( 1.4 )+	0.04] =	11.47				(27)
Walls Type1	24.5	55	8.65		15.9	Х	0.15	= [	2.39				(29)
Walls Type2	20.9	96	2		18.96	<b>X</b>	0.14	= [	2.68				(29)
Roof	11.3	39	0		11.39	) x	0.1	= [	1.14				(30)
Total area of e	lements	, m²			56.9								(31)
* for windows and ** include the area						ated using	ı formula 1	/[(1/U-valu	ıe)+0.04] a	as given in	paragraph	1 3.2	
Fabric heat los	s, W/K :	= S (A x	U)				(26)(30)	) + (32) =				20.48	(33)
Heat capacity	Cm = S(	(Axk)						((28)	(30) + (32	2) + (32a).	(32e) =	590.6	(34)
Thermal mass	parame	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Low		100	(35)
For design assess can be used instea				construct	ion are not	t known pr	ecisely the	e indicative	e values of	TMP in Ta	able 1f		
Thermal bridge				using Ap	pendix k	<						10.3	(36)
if details of therma	,	,		• .	•								`
Total fabric hea	at loss							(33) +	(36) =			30.78	(37)
Ventilation hea	t loss ca	alculated	monthly	/					= 0.33 × (	25)m x (5)	)	1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m= 10.55	10.43	10.31	9.7	9.58	8.97	8.97	8.85	9.22	9.58	9.82	10.06		(38)
Heat transfer of		_				1		(39)m	= (37) + (3	38)m		1	
(39)m= 41.33	41.21	41.09	40.48	40.36	39.75	39.75	39.63	40	40.36	40.6	40.85		7,55
								•	Average =	Sum(39) <sub>1</sub>	12 /12=	40.45	(39)

Heat Id	oss para	meter (H	HLP), W/	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m=	0.82	0.82	0.81	0.8	0.8	0.79	0.79	0.78	0.79	0.8	0.8	0.81		
							•	•	•	Average =	Sum(40) <sub>1</sub> .	12 /12=	0.8	(40)
Numbe	er of day		, i		N 4 -			Α.		0.1				
(44)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct 31	Nov	Dec		(41)
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ater heat	ing ener	gy requi	rement:								kWh/ye	ear:	
if TF	ned occu FA > 13.9 FA £ 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x ( <sup>-</sup>	TFA -13.		71		(42)
Reduce	I averag the annua e that 125	al average	hot water	usage by	5% if the a	lwelling is	designed t			se target o		.65		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage ir				,			_	[ F					
(44)m=	86.52	83.37	80.23	77.08	73.93	70.79	70.79	73.93	77.08	80.23	83.37	86.52		
											m(44) <sub>112</sub> =	L	943.85	(44)
Energy (	content of	hot water	used - cal	culated mo	onthly $= 4$ .	190 x Vd,r	n x nm x C	Tm / 3600	) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m=	128.31	112.22	115.8	100.96	96.87	83.59	77.46	88.89	89.95	104.82	114.42	124.26		<b>—</b>
If instan	taneous w	ater heatii	na at point	of use (no	hot water	· storage).	enter 0 in	boxes (46		Total = Su	m(45) <sub>112</sub> =	<u> </u>	1237.53	(45)
(46)m=		16.83	17.37	15.14	14.53	12.54	11.62	13.33	13.49	15.72	17.16	18.64		(46)
` '	storage		17.07	10.14	14.00	12.04	11.02	10.00	10.40	10.72	17.10	10.04		(10)
Storag	je volum	e (litres)	includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If com	munity h	eating a	nd no ta	nk in dw	elling, e	nter 110	litres in	(47)						
	vise if no		hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (	(47)			
	storage nanufacti		aclared l	nee facti	nr is kna	wn (k\//k	u/dav/).							(48)
•	erature fa				) 13 KHO	vvii (icvvi	ı, day).					0		(49)
•	y lost fro				ear			(48) x (49)	) =			10		(50)
0.	nanufact		•			or is not		(10) X (10)	, –		'	10		(30)
	ater stora	-			e 2 (kW	h/litre/da	ıy)				0.	02		(51)
	munity h	-		on 4.3										(==)
	e factor i erature fa			2h							-	.6		(52) (53)
•	y lost fro				oor			(47) v (51)	) x (52) x (	53) –				
	(50) or (		_	, KVVII/ y (	zai			(47) X (01)	) X (02) X (	00) =		03		(54) (55)
	storage	, ,	,	or each	month			((56)m = (	(55) × (41)	m				` '
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
(00)												m Appendi	хH	( - <del>-</del> )
If cylinde	er contains	a da locato												
-		28.92		30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
(57)m=	32.01	28.92	32.01	30.98		30.98	32.01	32.01	30.98	32.01		32.01		, ,
(57)m= Primar	32.01 ry circuit	28.92 loss (an	32.01 nual) fro	30.98 om Table	3		<u> </u>		Į	32.01		32.01		(57) (58)
(57)m= Primar Primar	32.01	28.92 loss (an	32.01 inual) fro culated f	30.98 om Table for each	3 month (	59)m = (	(58) ÷ 36	65 × (41)	ım					, ,

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$											
(61)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	(61)										
Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m + (62)m + (63)m + (64)m + (64)m + (65)m + (65)m$	. ,										
(62)m= 183.58   162.14   171.07   154.45   152.15   137.08   132.74   144.16   143.44   160.1   167.92   179.53	(62)										
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)	(02)										
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)											
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0	(63)										
Output from water heater											
(64)m= 183.58 162.14 171.07 154.45 152.15 137.08 132.74 144.16 143.44 160.1 167.92 179.53											
Output from water heater (annual) <sub>112</sub> 1888.37	(64)										
Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]											
(65)m= 86.88 77.25 82.72 76.36 76.43 70.59 69.98 73.78 72.7 79.08 80.84 85.54	(65)										
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating											
5. Internal gains (see Table 5 and 5a):											
Metabolic gains (Table 5), Watts											
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec											
(66)m= 85.31 85.31 85.31 85.31 85.31 85.31 85.31 85.31 85.31 85.31 85.31 85.31 85.31	(66)										
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5											
(67)m= 13.65 12.12 9.86 7.47 5.58 4.71 5.09 6.62 8.88 11.28 13.16 14.03	(67)										
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5											
(68)m= 148.65 150.19 146.3 138.03 127.58 117.77 111.21 109.66 113.55 121.83 132.27 142.09	(68)										
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5											
(69)m= 31.53 31.53 31.53 31.53 31.53 31.53 31.53 31.53 31.53 31.53 31.53 31.53	(69)										
Pumps and fans gains (Table 5a)											
(70)m= 0 0 0 0 0 0 0 0 0 0 0 0 0	(70)										
Losses e.g. evaporation (negative values) (Table 5)											
(71)m= -68.25 -68.25 -68.25 -68.25 -68.25 -68.25 -68.25 -68.25 -68.25 -68.25 -68.25 -68.25	(71)										
Water heating gains (Table 5)											
(72)m= 116.78 114.96 111.19 106.06 102.73 98.04 94.05 99.16 100.98 106.28 112.28 114.97	(72)										
Total internal gains = $(66)m + (67)m + (68)m + (70)m + (71)m + (72)m$	, ,										
(73)m= 327.67 325.87 315.95 300.15 284.49 269.11 258.94 264.03 272 287.98 306.31 319.68	(73)										
6. Solar gains:	, ,										
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.											
Orientation: Access Factor Area Flux g_ FF Gains											
Table 6d m² Table 6a Table 6b Table 6c (W)											
Northeast 0.9x 0.77 x 8.65 x 11.28 x 0.63 x 0.7 = 29.83	(75)										
Northeast 0.9x 0.77 x 8.65 x 22.97 x 0.63 x 0.7 = 60.72	(75)										
Northeast 0.9x 0.77 x 8.65 x 41.38 x 0.63 x 0.7 = 109.4	(75)										
Northeast 0.9x 0.77 x 8.65 x 67.96 x 0.63 x 0.7 = 179.67	(75)										

Northeast <sub>0.9x</sub>	0.77	X	8.6	S5	x	97.38	x[		0.63	x	0.7	=	257.47	(75)
Northeast <sub>0.9x</sub>	0.77	x	8.6	S5	x	91.1	_ x [		0.63	x	0.7	=	240.86	(75)
Northeast <sub>0.9x</sub>	0.77	х	8.6	35	х	72.63	<b>x</b>		0.63	х	0.7	=	192.02	(75)
Northeast <sub>0.9x</sub>	0.77	х	8.6	35	х	50.42	<b>x</b> [		0.63	х	0.7	=	133.31	(75)
Northeast <sub>0.9x</sub>	0.77	x	8.6	35	x	28.07	x		0.63	x	0.7		74.21	(75)
Northeast <sub>0.9x</sub>	0.77	x	8.6	35	x	14.2	x		0.63	x	0.7		37.53	(75)
Northeast 0.9x	0.77	х	8.6	35	х	9.21	x		0.63	x	0.7	=	24.36	(75)
•							•							
Solar gains in	watts, ca	alculated	I for eac	h month			(83)m	= St	um(74)m .	(82)m				
(83)m= 29.83	60.72	109.4	179.67	241.51	257.47	240.86	192.	.02	133.31	74.21	37.53	24.36		(83)
Total gains –	internal a	and solar	(84)m =	= (73)m	+ (83)m	ı , watts							•	
(84)m= 357.5	386.59	425.35	479.81	525.99	526.58	499.8	456.	.05	405.31	362.19	343.84	344.04		(84)
7. Mean inte	rnal temp	erature	(heating	season	)									
Temperature	e during h	neating p	eriods ir	n the livi	ng area	from Ta	ble 9,	Th	1 (°C)				21	(85)
Utilisation fa	ctor for g	ains for I	iving are	ea, h1,m	(see T	able 9a)								
Jan	Feb	Mar	Apr	May	Jun	Jul	Αι	ug	Sep	Oct	Nov	Dec		
(86)m= 0.94	0.92	0.88	0.78	0.63	0.46	0.34	0.3	9	0.61	0.82	0.91	0.95		(86)
Mean interna	al temper	ature in	living ar	ea T1 (fo	ollow st	eps 3 to	7 in T	able	e 9c)		•		•	
(87)m= 19.59	19.77	20.11	20.53	20.82	20.95	20.99	20.9		20.88	20.51	20	19.55		(87)
Temperature	during h	noating n	oriode ir	rest of	dwallin	a from T	abla C		n2 (°C)		ļ	<u>I</u>		
(88)m= 20.24	20.24	20.24	20.25	20.25	20.27	20.27	20.2		20.26	20.25	20.25	20.25		(88)
` '	ļ	<u> </u>		<u> </u>	<u> </u>				20.20		1 -0.20	20.20		, ,
Utilisation factors (89)m= 0.93	ctor for g					1	T	<u> T</u>	0.56	0.0	T 00	0.94	Ī	(89)
` '	Į	0.86	0.75	0.59	0.41	0.29	0.3			0.8	0.9	0.94		(00)
Mean interna	<del>-</del>			ı		<u> </u>	<del>i                                      </del>				<u> </u>	I	1	(00)
(90)m= 18.34	18.6	19.08	19.67	20.05	20.22	20.26	20.2	25	20.14	19.66	18.93	18.29		(90)
									ı	LA = LIVII	ng area ÷ (	4) =	0.43	(91)
Mean_interna	al temper	ature (fo	r the wh	ole dwe	lling) =	fLA × T1	+ (1	– fL	A) × T2				•	
(92)m= 18.88	19.11	19.52	20.04	20.38	20.54	20.57	20.5	!	20.46	20.02	19.39	18.84		(92)
Apply adjust	1					1	1			i -	<u> </u>	ı	1	(00)
(93)m= 18.88	19.11	19.52	20.04	20.38	20.54	20.57	20.5	57	20.46	20.02	19.39	18.84		(93)
8. Space hea								01			(70)		1 4	
Set Ti to the the utilisation					ned at s	tep 11 of	rabi	e 9r	o, so tha	t 11,m=(	76)m an	d re-caid	culate	
Jan	Feb	Mar	Apr	May	Jun	Jul	ΤΑι	ug	Sep	Oct	Nov	Dec		
Utilisation fa	·			· · ·	!		1	<u> </u>		l .	1	ļ.		
(94)m= 0.92	0.89	0.85	0.74	0.6	0.43	0.31	0.3	5	0.57	0.79	0.89	0.92		(94)
Useful gains	, hmGm	, W = (9 <sup>2</sup>	4)m x (8	4)m	•	•					•	•		
(95)m= 327.84	345.89	359.62	356.85	313.62	226.88	155.59	161	.6	231.29	285.01	304.77	317.92		(95)
Monthly ave	rage exte	rnal tem	perature	from T	able 8								•	
(96)m= 4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.		14.1	10.6	7.1	4.2		(96)
Heat loss rat							T	· ·		Ī	Ι	ı	1	<b></b>
(97)m= 602.39		535.09	450.95	350.32	235.98		165.		254.3	380.37	499.1	597.91		(97)
Space heatir	Ť					1	<del></del>	Ť		<del>- `</del>	<del> </del>	000.04	[	
(98)m= 204.27	160.97	130.55	67.75	27.31	0	0	0		0	70.95	139.91	208.31		

	_		
та	otal per year (kWh/year) = Sum(98) <sub>15,912</sub> =	1010.02	(98)
Space heating requirement in kWh/m²/year		19.98	(99)
9b. Energy requirements – Community heating scheme			
This part is used for space heating, space cooling or water heating pre- Fraction of space heat from secondary/supplementary heating (Table		0	(301)
Fraction of space heat from community system 1 – (301) =	· [	1	(302)
The community scheme may obtain heat from several sources. The procedure allows f	ם or CHP and up to four other heat sources; th	ne latter	_
includes boilers, heat pumps, geothermal and waste heat from power stations. See App Fraction of heat from Community boilers	oendix C. [	1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community h		1	(305)
Distribution loss factor (Table 12c) for community heating system	[	1.05	(306)
Space heating	L	kWh/yea	
Annual space heating requirement		1010.02	7
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1060.52	(307a)
Efficiency of secondary/supplementary heating system in % (from Tak	ole 4a or Appendix E)	0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating Annual water heating requirement	Γ	1888.37	$\neg$
If DHW from community scheme:	L	1000.07	_
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1982.79	(310a)
Electricity used for heat distribution 0.	01 × [(307a)(307e) + (310a)(310e)] =	30.43	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outsice	de [	175.36	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	175.36	(331)
Energy for lighting (calculated in Appendix L)		241.09	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-510.48	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)	•	0	(334)
12b. CO2 Emissions – Community heating scheme			
	nergy Emission factor I Wh/year kg CO2/kWh I	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)  Efficiency of heat source 1 (%)  If there is CHP using two fu	els repeat (363) to (366) for the second fuel	94	(367a)
CO2 associated with heat source 1 [(307b)+(310b)]	x 100 ÷ (367b) x 0.22 =	699.31	(367)
Electrical energy for heat distribution [(313) x	0.52	15.79	(372)

Total CO2 associated with community systems	(363)(366) + (368)(372)	=	715.11	(373)
CO2 associated with space heating (secondary)	(309) x	=	0	(374)
CO2 associated with water from immersion heater	or instantaneous heater (312) x 0.2	=	0	(375)
Total CO2 associated with space and water heating	$g \qquad (373) + (374) + (375) =$		715.11	(376)
CO2 associated with electricity for pumps and fans	within dwelling (331)) x 0.6	52 =	91.01	(378)
CO2 associated with electricity for lighting	(332))) x 0.s	52 =	125.12	(379)
Energy saving/generation technologies (333) to (33 Item 1	34) as applicable 0.52	x 0.01 =	-264.94	(380)
Total CO2, kg/year sum of (376)	)(382) =		666.31	(383)
Dwelling CO2 Emission Rate (383) ÷ (4) =			13.18	(384)
El rating (section 14)			90.66	(385)

#### **SAP 2012 Overheating Assessment**

Calculated by Stroma FSAP 2012 program, produced and printed on 28 October 2020

Property Details: Plot 37

Dwelling type:FlatLocated in:EnglandRegion:Thames valley

Cross ventilation possible: No Number of storeys: 1

Front of dwelling faces: South West

Overshading: Average or unknown

None

Thermal mass parameter: Indicative Value Low

Night ventilation: False

Blinds, curtains, shutters:

Ventilation rate during hot weather (ach): 4 (Windows fully open)

Overheating Details

Summer ventilation heat loss coefficient: 166.8 (P1)

Transmission heat loss coefficient: 30.8

Summer heat loss coefficient: 197.58 (P2)

Overhangs:

Overhangs:

Orientation: Ratio: Z\_overhangs:

North East (NE) 0 1

Solar shading:

Orientation:Z blinds:Solar access:Overhangs:Z summer:North East (NE)10.910.9

Solar gains:

Orientation FF Area Flux Shading Gains  $g_{-}$ 98.85 0.9 305.45 North East (NE) 0.9 x8.65 0.63 0.7 **Total** 305.45 (P3/P4)

Internal gains:

June July **August** 360.45 Internal gains 366.65 353.83 610.35 696.41 659.28 (P5) Total summer gains Summer gain/loss ratio 3.52 3.34 3.09 (P6) Mean summer external temperature (Thames valley) 16 17.9 17.8 Thermal mass temperature increment 1.3 1.3 1.3 (P7) Threshold temperature 20.82 22.54 22.19 Likelihood of high internal temperature Slight Medium Medium

Assessment of likelihood of high internal temperature: Medium

Stroma Number:   Stroma FSAP 2012   Stroma Number:   STRO001082
Software Name: Stroma FSAP 2012   Software Version: Version: 1.0.5.9
Address:  1. Overall dwelling dimensions.  Area(m²)
Address:  1. Overall dwelling dimensions:  Area(m²)
Area(m²)
Ground floor  Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n)
Dwelling volume
2. Ventilation rate:    Main   Heating   Heati
Number of chimneys
Number of chimneys
Number of chimneys
Number of intermittent fans  2
Number of passive vents  0
Number of flueless gas fires  Air changes per hour  Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20
Number of flueless gas fires  Air changes per hour  Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) =$ If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)  Number of storeys in the dwelling (ns)  Additional infiltration  Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction  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  If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0  Percentage of windows and doors draught stripped  Window infiltration  0.25 - $[0.2 \times (14) \div 100] =$ 0.165  Infiltration rate  (8) + (10) + (11) + (12) + (13) + (15) =  0.167  Air changes per hour $\div (5) = 0.16$ (8)  (9)  (9)  (10)  (11)  (10)  (11)  (11)  (12)  (13)  (14)  (14)  (15) =  0.165  (16)
Air changes per hour  Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20
Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) =$ If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)  Number of storeys in the dwelling (ns)  Additional infiltration  Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction  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  If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0  If no draught lobby, enter 0.05, else enter 0  Percentage of windows and doors draught stripped  Window infiltration  0.25 - [0.2 x (14) ÷ 100] =  0 (15)  Infiltration rate  (8) + (10) + (11) + (12) + (13) + (15) =  0 (16)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)  Number of storeys in the dwelling (ns)  Additional infiltration  Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction  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  If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0  If no draught lobby, enter 0.05, else enter 0  Percentage of windows and doors draught stripped  Window infiltration  0.25 - [0.2 x (14) ÷ 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
Number of storeys in the dwelling (ns)  Additional infiltration  Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction  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  If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0  If no draught lobby, enter 0.05, else enter 0  Percentage of windows and doors draught stripped  Window infiltration  0.25 - [0.2 × (14) ÷ 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
Additional infiltration  Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction  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  If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0  If no draught lobby, enter 0.05, else enter 0  Percentage of windows and doors draught stripped  Window infiltration  0.25 - [0.2 × (14) ÷ 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
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction  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  If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0  If no draught lobby, enter 0.05, else enter 0  Percentage of windows and doors draught stripped  Window infiltration  0 (12)  0 (13)  0 (14)  Window infiltration  0.25 - [0.2 x (14) ÷ 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  3 (17)
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  If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0  If no draught lobby, enter 0.05, else enter 0  Percentage of windows and doors draught stripped  Window infiltration $0.25 - [0.2 \times (14) \div 100] =$ Infiltration rate $0.25 - [0.2 \times (14) \div 100] =$ $0.25 - [0.2 \times (14) \div 100] =$ Infiltration rate $0.25 - [0.2 \times (14) \div 100] =$ $0.25 - [0.2 \times (14) \div 100] =$ Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area $0.25 - [0.2 \times (14) \div 100] =$ $0.25 - [0.2 \times ($
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0  If no draught lobby, enter 0.05, else enter 0  Percentage of windows and doors draught stripped  Window infiltration $0.25 - [0.2 \times (14) \div 100] = 0.25 - [0.2 \times (14) \div 100] =$
If no draught lobby, enter 0.05, else enter 0  Percentage of windows and doors draught stripped  Window infiltration $0.25 - [0.2 \times (14) \div 100] = 0$ Infiltration rate $0 (14)$ $0 (15)$ $0 (15)$ $0 (15)$ Infiltration rate $0 (15)$ Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area $0 (17)$
Percentage of windows and doors draught stripped  Window infiltration $0.25 - [0.2 \times (14) \div 100] =$ Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) =$ Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area  3 (17)
Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) = 0 $ Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area $3 $ $(17)$
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area  (17)
(40) (40) (40)
If based on air permeability value, then $(10) = [(17) \div 20] \div (0)$ , otherwise $(10) = (10)$ 0.31
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used
Number of sides sheltered  3 (19)
Shelter factor $(20) = 1 - [0.075 \times (19)] = 0.78$ (20)
Infiltration rate incorporating shelter factor $(21) = (18) \times (20) = 0.24$ (21)
Infiltration rate modified for monthly wind speed
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Monthly average wind speed from Table 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

Adjusted infiltr	ation rat	e (allowi	ing for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
0.3	0.3	0.29	0.26	0.26	0.23	0.23	0.22	0.24	0.26	0.27	0.28	]	
C <i>alcul<mark>ate effed</mark></i> If mechanica		•	rate for t	he appli	cable ca	se			-	-			(23
If exhaust air h			endix N. (2	3b) = (23a	a) × Fmv (e	equation (N	N5)) . othe	wise (23b	) = (23a)			0	(23
If balanced with									, (===,			0	(23
a) If balance		•	•	J		,		•	2h\m + (	23h) <b>√</b> [¹	1 – (23c)		(20
24a)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(24
b) If balance	d mech:	anical ve	I entilation	without	heat red	overv (N	//\/) (24h	lm = (22)	2h)m + (:	23h)		J	•
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(24
c) If whole h	ouse ex n < 0.5 ×				•				5 × (23b	) )	ı	J	
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(24
d) If natural	ventilatio	on or wh	ole hous	e positiv	re input	ventilatio	on from I	oft				J	
if (22b)n	n = 1, the	en (24d)	m = (22l	o)m othe	erwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]			_	
24d)m= 0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.52	0.53	0.53	0.54	0.54		(24
Effective air	change	rate - er	nter (24a	) or (24b	o) or (24	c) or (24	d) in box	(25)				_	
25)m= 0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.52	0.53	0.53	0.54	0.54		(25
3. Heat losse	s and he	eat loss i	paramet	er:									
LEMENT	Gros area	SS	Openin m	gs	Net Ar A ,r		U-valı W/m2		A X U (W/I	K)	k-value kJ/m²-	-	A X k kJ/K
Doors					2	Х	1.4	=	2.8				(26
Vindows					8.651	x1,	/[1/( 1.4 )+	0.04] =	11.47				(27
Valls Type1	24.5	55	8.65		15.9	x	0.15		2.39	<b>=</b> [		$\neg$	(29
Valls Type2	20.9	96	2		18.96	×	0.14	<b>=</b>	2.68	F i			(29
Roof	11.3	==	0		11.39	x	0.1	<b>=</b>	1.14	≓ i			(30
otal area of e					56.9								(3
for windows and * include the area	roof wind	ows, use e			alue calcul	ated using	g formula 1	/[(1/U-valu	ie)+0.04] a	as given in	paragrapl	h 3.2	(-
abric heat los	ss, W/K :	= S (A x	U)				(26)(30)	+ (32) =				20.48	(3:
leat capacity	Cm = S(	(A x k )						((28)	.(30) + (32	2) + (32a).	(32e) =	590.6	(3-
hermal mass	parame	ter (TMF	= Cm +	TFA) ir	n kJ/m²K			Indica	tive Value	: Low		100	(3
or design assess an be used inste				construct	ion are no	known pr	recisely the	indicative	values of	TMP in Ta	able 1f		
hermal bridge	∍s : S (L	x Y) cal	culated (	using Ap	pendix l	<						10.3	(3
details of therma otal fabric he		are not kn	own (36) =	= 0.05 x (3	11)			(33) +	(36) =			30.78	(3
entilation hea	at loss ca	alculated	d monthly	y				(38)m	= 0.33 × (	(25)m x (5)	)		
	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	]	
Jan		——			21.92	21.92	21.87	22.04	22.23	22.36	22.49	1	(3
	22.71	22.64	22.29	22.23	21.92						1		(-
38)m= 22.78	<u> </u>	L	22.29	22.23	21.92		1			 38)m		J	(-
	<u> </u>	L	53.07	53.01	52.7	52.7	52.65		= (37) + (37)	38)m 53.14	53.27	]	(-

Heat loss para	meter (H	HLP). W/	m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 1.06	1.06	1.06	1.05	1.05	1.04	1.04	1.04	1.05	1.05	1.05	1.05		
` /								<u> </u>	L Average =	Sum(40) <sub>1</sub> .	12 /12=	1.05	(40)
Number of day	s in mo	nth (Tabl	le 1a)							, ,			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water heat	ing one	rav requi	romont:								kWh/ye	or:	
4. Water fleat	ing ene	igy requi	rement.								KVVII/ y C	<i>τ</i> αι.	
Assumed occur if TFA > 13.9 if TFA £ 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)	)2)] + 0.0	0013 x ( <sup>-</sup>	TFA -13		71		(42)
Annual averag Reduce the annua not more that 125	ıl average	hot water	usage by	5% if the a	lwelling is	designed t			se target o		.65		(43)
			- ,			<i></i>				T			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in					Clor Ironii i	able ICX	, ,						
(44)m= 86.52	83.37	80.23	77.08	73.93	70.79	70.79	73.93	77.08	80.23	83.37	86.52		_
Energy content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	m x nm x D	OTm / 3600			m(44) <sub>112</sub> = ables 1b, 1		943.85	(44)
(45)m= 128.31	112.22	115.8	100.96	96.87	83.59	77.46	88.89	89.95	104.82	114.42	124.26		
									Total = Su	m(45) <sub>112</sub> =	=	1237.53	(45)
If instantaneous w	ater heati	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46,	) to (61)					
(46)m= 0	0	0	0	0	0	0	0	0	0	0	0		(46)
Water storage													
Storage volum	, ,					_		ame ves	sel		0		(47)
If community h	•			•			` '	a wa\ a wa tu	a = (O) in /	(4 <b>-7</b> )			
Otherwise if no Water storage		not wate	er (tnis in	iciuaes i	nstantar	ieous co	ווסם ומוזונ	ers) ente	er o in (	(47)			
a) If manufact		eclared lo	oss facto	or is kno	wn (kWł	n/day).					0		(48)
Temperature fa				) 10 KHO	**** (1.000)	"day).							(49)
Energy lost fro				oor			(48) x (49)	\ _			0		, ,
b) If manufact		_	-		or is not		(40) X (49)	, =			0		(50)
Hot water stora			-								0		(51)
If community h	eating s	ee section	on 4.3										
Volume factor	from Ta	ble 2a									0		(52)
Temperature fa	actor fro	m Table	2b								0		(53)
Energy lost fro	m water	storage	, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =		0		(54)
Enter (50) or (	54) in (5	55)									0		(55)
Water storage	loss cal	culated f	or each	month			((56)m = (	55) × (41)	m				
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contains	dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (	H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Append	ix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit	loss (ar	nual) fro	m Table	3							0		(58)
Primary circuit	•	•			59)m = (	(58) ÷ 36	65 × (41)	m					
(modified by	factor f	rom Tabl	le H5 if t	here is s	olar wat	er heatir	ng and a	cylinde	r thermo	stat)			
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi loss calculate	d for each	month (	(61)m =	(60) ÷ 3	65 × (41	)m							
(61)m= 0 0	0	0	0 0	0	00 % (41)	)   0		0	0	T 0	0	]	(61)
Total heat required for	or water h	eating ca	alculated	l for eac	h month	<u> </u>	!			ļ	ļ	J (59)m + (61)m	, ,
(62)m= 109.06 95.38		85.81	82.34	71.05	65.84	75.5	_	76.45	89.1	97.26	105.62	]	(62)
Solar DHW input calculate	d using App	endix G o	r Appendix	L H (negat	Iive quantity	y) (ent	er '0'	if no sola	r contribu	I ition to wate	er heating)	J	
(add additional lines											0,		
(63)m= 0 0	0	0	0	0	0	0		0	0	0	0	]	(63)
Output from water he	ater						•			•	!	•	
(64)m= 109.06 95.38	98.43	85.81	82.34	71.05	65.84	75.	55	76.45	89.1	97.26	105.62	]	
		Į.	ı	<u> </u>			Outp	ut from wa	ater heat	er (annual)	112	1051.9	(64)
Heat gains from water	er heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	ı + (6	1)m	] + 0.8 x	: [(46)m	n + (57)m	+ (59)m	]	
(65)m= 27.26 23.85	24.61	21.45	20.58	17.76	16.46	18.8	89	19.11	22.28	24.32	26.4	]	(65)
include (57)m in ca	alculation	of (65)m	only if c	ylinder i	s in the	dwell	ing (	or hot w	ater is	from com	munity h	neating	
5. Internal gains (s	ee Table 5	and 5a	):									-	
Metabolic gains (Tab			,										
Jan Feb		Apr	May	Jun	Jul	Αι	ug	Sep	Oct	Nov	Dec		
(66)m= 85.31 85.31	85.31	85.31	85.31	85.31	85.31	85.3	31	85.31	85.31	85.31	85.31	1	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m= 13.65 12.12	9.86	7.47	5.58	4.71	5.09	6.6	52	8.88	11.28	13.16	14.03	]	(67)
Appliances gains (ca	lculated ir	Append	dix L, eq	uation L	.13 or L1	3a), a	also	see Tal	ole 5	•	•	•	
(68)m= 148.65 150.1	146.3	138.03	127.58	117.77	111.21	109.	.66	113.55	121.83	132.27	142.09	]	(68)
Cooking gains (calcu	lated in A	ppendix	L, equat	ion L15	or L15a	), als	o se	e Table	5	•	•	•	
(69)m= 31.53 31.53	31.53	31.53	31.53	31.53	31.53	31.	53	31.53	31.53	31.53	31.53	]	(69)
Pumps and fans gair	ıs (Table క	Ба)	•		•		•			•	•	4	
(70)m= 0 0	0	0	0	0	0	0		0	0	0	0	]	(70)
Losses e.g. evapora	ion (nega	tive valu	es) (Tab	le 5)			•					•	
(71)m= -68.25 -68.25	-68.25	-68.25	-68.25	-68.25	-68.25	-68.	.25	-68.25	-68.25	-68.25	-68.25		(71)
Water heating gains	(Table 5)	•	•	•	•	•				•	•	•	
(72)m= 36.65 35.49	33.07	29.8	27.67	24.67	22.12	25.3	39	26.55	29.94	33.77	35.49	]	(72)
Total internal gains	=	•	•	(66	)m + (67)m	n + (68	3)m +	· (69)m + (	70)m + (	71)m + (72)	)m	•	
(73)m= 247.54 246.3	237.83	223.88	209.42	195.74	187.01	190.	.26	197.57	211.64	227.8	240.2	]	(73)
6. Solar gains:	•				,	,	j			•	•		
Solar gains are calculate	d using sola	r flux from	Table 6a	and assoc	iated equa	ations t	to co	nvert to th	e applica	ble orienta	tion.		
Orientation: Access		Area		Flu			_	g_ - b l - Cb	_	FF		Gains	
Table 6	oa 	m²			ble 6a		1 8	able 6b		Table 6c		(W)	_
Northeast 0.9x 0.7	7 ×	8.6	S5	х	11.28	X		0.63	x	0.7	=	29.83	(75)
Northeast 0.9x 0.7	7 ×	8.6	S5	x	22.97	X		0.63	x [	0.7	=	60.72	(75)
Northeast 0.9x 0.7	7 ×	8.6	S5	x	41.38	X		0.63	x [	0.7	=	109.4	(75)
Northeast 0.9x 0.7	7 ×	8.6	65	x (	67.96	X		0.63	x [	0.7	=	179.67	(75)
Northeast 0.9x 0.7	7 ×	8.6	35	x .	91.35	X		0.63	X	0.7	=	241.51	(75)

Northeast <sub>0.9x</sub>	0.77	Х	8.6	5	x	9	7.38	X		0.63	x	0.7	=	257.47	(75)
Northeast <sub>0.9x</sub>	0.77	x	8.6	5	x	(	91.1	x		0.63	_ x [	0.7		240.86	(75)
Northeast <sub>0.9x</sub>	0.77	x	8.6	5	x	7	2.63	x		0.63	x	0.7		192.02	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	5	x	5	0.42	X		0.63	x	0.7		133.31	(75)
Northeast <sub>0.9x</sub>	0.77	x	8.6	5	x	2	8.07	x		0.63	_ x [	0.7	<del>=</del>	74.21	(75)
Northeast <sub>0.9x</sub>	0.77	Х	8.6	5	x	,	14.2	X		0.63	×	0.7		37.53	(75)
Northeast 0.9x	0.77	X	8.6	5	x	Ç	9.21	x		0.63		0.7	╡ -	24.36	(75)
								,							
Solar gains in	watts, ca	alculated	for eacl	n month				(83)m	n = Si	um(74)m .	(82)m				
(83)m= 29.83	60.72	109.4	179.67	241.51	25	57.47	240.86	192	2.02	133.31	74.21	37.53	24.36		(83)
Total gains – ir	nternal a	nd solar	(84)m =	(73)m	+ (8	33)m	, watts							•	
(84)m= 277.37	307.12	347.23	403.55	450.93	45	53.21	427.87	382	2.28	330.88	285.84	265.33	264.56		(84)
7. Mean inter	nal temp	erature	(heating	season	)										
Temperature						area f	from Tal	ole 9	, Th	1 (°C)				21	(85)
Utilisation fac	_	•			-					, ,					_
Jan	Feb	Mar	Apr	May	È	Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
(86)m= 0.97	0.96	0.94	0.88	0.77	(	).62	0.49	0.5	55	0.77	0.91	0.96	0.98		(86)
Mean interna	l tampar	atura in l	living ar	22 T1 (f	مالد	w sta	ns 3 to 7	7 in T	Table	2 0c)			ļ.		
(87)m= 18.72	18.93	19.36	19.94	20.46	_	0.79	20.92	20.		20.6	19.94	19.23	18.67		(87)
` '					_		<u> </u>					1			` '
Temperature	during h	eating p	eriods ir	20.04	1	elling <sub>0.05</sub>	20.05	20.		12 (°C) 20.05	20.04	20.04	20.04	Ī	(88)
(88)m= 20.03	20.04	20.04	20.04	20.04		0.05	20.05	20.	.05	20.05	20.04	20.04	20.04		(00)
Utilisation fac					1		1	T				_	1	1	>
(89)m= 0.97	0.96	0.93	0.86	0.73	(	).55	0.4	0.4	46	0.72	0.9	0.95	0.97		(89)
Mean interna	temper	ature in	the rest	of dwell	ing	T2 (f	ollow ste	eps 3	3 to 7	7 in Tabl	e 9c)			-	
(90)m= 17.94	18.15	18.57	19.14	19.62	1	9.92	20.01	19.	.99	19.76	19.15	18.45	17.89		(90)
										f	LA = Livi	ng area ÷ (4	4) =	0.43	(91)
Mean interna	l temper	ature (fo	r the wh	ole dwe	lling	g) = fl	LA × T1	+ (1	– fL	A) × T2					
(92)m= 18.28	18.49	18.91	19.49	19.99	2	0.29	20.4	20.	.38	20.12	19.49	18.79	18.23		(92)
Apply adjustn	nent to th	ne mean	internal	temper	atu	re fro	m Table	4e,	whe	re appro	priate				
(93)m= 18.28	18.49	18.91	19.49	19.99	2	0.29	20.4	20.	.38	20.12	19.49	18.79	18.23		(93)
8. Space hea	ting requ	uirement													
Set Ti to the r					ned	at ste	ep 11 of	Tab	le 9b	o, so tha	t Ti,m=	(76)m an	d re-cald	culate	
the utilisation						Luc	11	Ι ,		Con	0-4	Nov	Daa		
Jan Utilisation fac	Feb	Mar	Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
(94)m= 0.96	0.94	0.91	0.84	0.72	(	).57	0.44	0.	5	0.72	0.88	0.94	0.96		(94)
Useful gains,					L`		••••	<u> </u>		02	0.00	1 0.0 .	0.00		, ,
(95)m= 265.67	289.84	316.64	339.58	326.78	2	59.2	186.71	189	.65	238.33	252.56	250.2	254.61		(95)
Monthly avera			perature									<u> </u>	ļ		
(96)m= 4.3	4.9	6.5	8.9	11.7	_	14.6	16.6	16	5.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate	for mea	an intern	al tempe	erature,	Lm	, W =	=[(39)m	x [(9	3)m-	– (96)m	]	1		1	
(97)m= 748.62	726.89	662.93	561.85	439.17	30	00.11	200.48	209	.52	318.13	471.19	621.05	747.39		(97)
Space heatin	g require	ement fo	r each m	nonth, k	Wh.	/mont	th = 0.02	24 x	[(97)	m – (95	)m] x (4	11)m		•	
(98)m= 359.31	293.7	257.64	160.03	83.62		0	0		)	0	162.66	267.01	366.63		

								Tota	l per year	(kWh/yeaı	) = Sum(9	08)15,912 =	1950.6	(98)
Space	e heating	g require	ement in	kWh/m²	/year								38.59	(99)
8c. Sp	pace co	oling req	uiremen	it										
Calcu	lated for	r June, J	luly and	August.	See Tal	ole 10b	_				_			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat I	loss rate	Lm (ca	lculated	using 2	5°C inter	nal temp	oerature	and exte	ernal ten	nperatur	e from T	able 10)		
(100)m=	0	0	0	0	0	495.43	390.02	400.13	0	0	0	0		(100)
Utilisa	ation fac	tor for lo	ss hm											
(101)m=	0	0	0	0	0	0.8	0.85	0.82	0	0	0	0		(101)
Usefu	l loss, h	mLm (V	/atts) = (	100)m x	(101)m		-							
(102)m=	0	0	0	0	0	395.32	332.42	327.18	0	0	0	0		(102)
Gains	(solar ç	gains cal	culated	for appli	cable we	eather re	egion, se	e Table	10)					
(103)m=	0	0	0	0	0	594.22	563.42	511.11	0	0	0	0		(103)
						lwelling,	continu	ous ( kW	h = 0.0	24 x [(10	03)m – (	102)m ] :	x (41)m	
set (1	04)m to	zero if (	104)m <	3 × (98	)m		•	•			•	•	•	
(104)m=	0	0	0	0	0	143.21	171.87	136.84	0	0	0	0		
										= Sum(	,	=	451.91	(104)
	I fraction								f C =	cooled	area ÷ (4	4) =	1	(105)
ı		actor (Ta	able 10b	)			ı	ı			ı	_	ı	
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		_
_									Total	l = Sum(	(104)	=	0	(106)
· .						× (105)		1			Т	_	ı	
(107)m=	0	0	0	0	0	35.8	42.97	34.21	0	0	0	0		_
									Total	= Sum(	107)	=	112.98	(107)
Space	cooling	requirer	nent in k	:Wh/m²/y	/ear				(107)	÷ (4) =			2.24	(108)
8f. Fab	ric Ener	gy Effici	ency (ca	alculated	only un	der spec	cial cond	litions, se	ee sectio	on 11)				
Fabrio	Energy	/ Efficier	псу						(99)	+ (108) =	=		40.83	(109)

#### **SAP Input**

Property Details: Plot 37

Address:

Located in: England Region: Thames valley

UPRN:

Date of assessment: 08 July 2020
Date of certificate: 28 October 2020

Assessment type: New dwelling design stage

Transaction type:

Tenure type:

Related party disclosure:

Thermal Mass Parameter:

New dwelling
Unknown

No related party
Indicative Value Low

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

PCDF Version: 466

Property description:

Troporty accompliant

Flat

Dwelling type: Detachment:

2020

Year Completed: Floor Location:

Floor area:

Storey height:

Floor 0  $50.545 \text{ m}^2$  2.5 m

Living area: 21.831 m<sup>2</sup> (fraction 0.432)

Front of dwelling faces: South West

Opening types:

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

SW Manufacturer Solid

NE Manufacturer Windows double-glazed Yes

Name: Gap: Frame Factor: g-value: U-value: Area: No. of Openings: 1.4 SW mm 0 0 2 ΝE 16mm or more 0.7 0.63 1.4 8.651

Name: Type-Name: Location: Orient: Width: Height: SW South West 0 0

NE External Wall North East 0 0

Overshading: Average or unknown

Opaque Elements:

Type: Gross area: Openings: Net area: U-value: Ru value: Curtain wall: Kappa: **External Elements** External Wall 24.553 8.65 15.9 0.15 0 False N/A Corridor Wall 20.964 2 18.96 0.15 0.4 False N/A Flat Roof 11.386 0 11.39 0.1 0 N/A

Internal Elements
Party Elements

Thermal bridges

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1811

LengthPsi-value4.7950.289E2Other lintels (including other steel lintels)13.20.047E4Jamb22.9250.062E7Party floor between dwellings (in blocks of flats)

#### **SAP Input**

8.7	0.053	E18	Party wall between dwellings
2.9	0.12	E25	Staggered party wall between dwellings
8.467	0.56	E15	Flat roof with parapet
7.229	0.12	E24	Eaves (insulation at ceiling level - inverted)
21.67	0	P3	Intermediate floor between dwellings (in blocks of flats)
1.912	0.24	P4	Roof (insulation at ceiling level)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery

Number of wet rooms: Kitchen + 1

Ductwork: Insulation, rigid

Approved Installation Scheme: True

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

Main heating system:

Main heating system: Community heating schemes

Heat source: Community boilers

heat from boilers – mains gas, heat fraction 1, efficiency 94 Piping>=1991, pre-insulated, low temp, variable flow

Central heating pump: 2013 or later Design flow temperature: Unknown

Boiler interlock: Yes

Main heating Control:

Main heating Control: Charging system linked to use of community heating, programmer and at least two room

thermostats

Control code: 2312

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

Low energy lights: 100%

Terrain type: Low rise urban / suburban

EPC language: English Wind turbine: No

Photovoltaics: Photovoltaic 1

Installed Peak power: 0.62 Tilt of collector: 30°

Overshading: None or very little Collector Orientation: South West

Assess Zero Carbon Home: No

		User_l	Details:						
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 2012		Strom Softwa					0001082 on: 1.0.5.9	
		Property	Address	: Plot 37					
Address :									
1. Overall dwelling dime	ensions:								
Ground floor		_	ea(m²)	l(10) v		ight(m)	_	Volume(m <sup>3</sup>	_
	\			(1a) x		2.5	(2a) =	126.36	(3a)
	a)+(1b)+(1c)+(1d)+(1e)+(1	n)	50.54	(4)					_
Dwelling volume				(3a)+(3b	)+(3c)+(3c	d)+(3e)+	(3n) =	126.36	(5)
2. Ventilation rate:									
	main seconda heating heating		other		total			m³ per hou	r
Number of chimneys	0 + 0	+	0	=	0	Х	40 =	0	(6a)
Number of open flues	0 + 0	+	0	=	0	×	20 =	0	(6b)
Number of intermittent fa	ins				2	×	10 =	20	(7a)
Number of passive vents	<b>;</b>			F	0	×	10 =	0	(7b)
Number of flueless gas fi	ires			F	0	x	40 =	0	(7c)
J. 11. 11. 11. 11. 11. 11. 11. 11. 11. 1				L					(* -7
							Air ch	nanges per ho	our
Infiltration due to chimne	ys, flues and fans = $(6a)+(6b)+$	(7a)+(7b)+	·(7c) =	Γ	20		÷ (5) =	0.16	(8)
	peen carried out or is intended, proce	ed to (17),	otherwise of	continue fi	rom (9) to	(16)			_
Number of storeys in the Additional infiltration	he dwelling (ns)					T/0	N 41-0 4	0	(9)
	.25 for steel or timber frame of	or 0 35 fc	or mason	rv coneti	ruction	9)]	9)-1]x0.1 =	0	(10)
	resent, use the value corresponding			•	detion			0	(11)
deducting areas of openii									_
·	floor, enter 0.2 (unsealed) or t	J.1 (seal	ed), else	enter 0				0	(12)
If no draught lobby, en	s and doors draught stripped							0	(13)
Window infiltration	s and doors draught stripped		0.25 - [0.2	2 x (14) ÷ 1	100] =			0	(15)
Infiltration rate			(8) + (10)	+ (11) + (	12) + (13) -	+ (15) =		0	(16)
Air permeability value,	q50, expressed in cubic metr	es per h	our per s	quare m	etre of e	envelop	e area	5	(17)
If based on air permeabil	lity value, then $(18) = [(17) \div 20]$ +	(8), otherv	vise (18) =	(16)				0.41	(18)
	es if a pressurisation test has been de	one or a de	egree air pe	rmeability	is being u	sed			<b>-</b>
Number of sides sheltere Shelter factor	ed .		(20) = 1 -	[0.075 x ( <sup>-</sup>	19)1 =			0.78	(19) (20)
Infiltration rate incorporate	ting shelter factor		(21) = (18	`	/,1			0.78	(21)
Infiltration rate modified f	•		( ) (	, , ,				0.32	(21)
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec	]	
Monthly average wind sp	1 ' 1 ' 1	1	<u>,                                     </u>			ı		J	
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7	]	
W. J. F. (1921) (2	0)	1	1	•	•	•	1	ı	
Wind Factor (22a)m = (2.32)m $= 4.37$	<del></del>	1 005	0.00		4.00	1 40	1 10	1	
(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	J	

Adjusted infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
0.4	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37		
Calculate effecture of the Calculate of		•	rate for t	he appli	cable ca	se	-	-	-	-	-	· -	
If exhaust air h			andiv N (2	3h) - (23s	a) v Emy (e	aguation (1	VS)) othe	rwisa (23h	) <i>- (</i> 23a)			0	(23
If balanced with		0		, ,	,	. ,	,, .	,	) = (234)			0	(23
		-	-	_					26\m . /	22h) [	1 (22a)	0 . 1001	(23
a) If balance	o mecha	anicai ve	niliation 0	with ne	at recove		1R) (248	$\frac{1}{0} = \frac{2}{2}$	2b)m + (	23b) × [	0	÷ 100] [	(24
						<u> </u>	<u> </u>		<u> </u>				(27
b) If balance		ı —				<del>-                                    </del>	<del>ÉÉÉ</del>	<del>``</del>	<del>`</del>	<del></del>		1	(24
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
c) If whole h				•	•				E (22h	.\			
	0.5 x	0	0	0 = (231)	o); otherv	0	0 = (221)	0	0 × (231	0	0	1	(24
.,						<u> </u>	<u> </u>		U				(24
d) If natural if (22b)n					rwise (2				0.5]				
24d)m= 0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57		(24
Effective air	change	rate - er	nter (24a	) or (24k	o) or (24	c) or (24	d) in box	(25)					
(25)m= 0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57		(25
3. Heat losse	s and he	at loss i	naramete	or.									
ELEMENT	Gros		Openin		Net Ar	ea	U-valı	IE.	AXU		k-value	2	ΑΧk
	area	-	m	-	A ,r		W/m2		(W/	K)	kJ/m²·l		kJ/K
Doors					2	х	1	=	2				(26
Vindows					8.651	x1.	/[1/( 1.4 )+	0.04] =	11.47				(27
Walls Type1	24.5	55	8.65		15.9	x	0.18	╗╸┆	2.86	<b>=</b>		$\neg \vdash$	(29
Nalls Type2	20.9		2	=	18.96	=	0.18	<u> </u>	3.41	<b>=</b>		7 H	(29
Roof	11.3		0	=	11.39	=	0.13	<del>-</del>	1.48	룩 ;		= =	(30
Total area of e	L					_	0.13	[	1.40				
for windows and			offoctivo wi	ndow I I ve	56.9		ı formula 1	/F/1/LL volu	(0) 1 0 041 4	ne aivon in	naraarank	. 2 2	(31
* include the area						ateu using	i ioiiiiula i	/[( 1/ <b>O-</b> valu	0.04j c	is given in	paragrapi	1 3.2	
abric heat los	s, W/K	= S (A x	U)				(26)(30)	) + (32) =				21.23	(33
Heat capacity	Cm = S(	(Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	590.6	(34
Thermal mass	parame	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35
For design assess	sments wh	ere the de	tails of the	construct	ion are not	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		`
can be used inste	ad of a de	tailed calc	ulation.										
Thermal bridge	es : S (L	x Y) cal	culated ı	using Ap	pendix ł	<						9.91	(36
f details of therma		are not kn	own (36) =	= 0.05 x (3	1)			(0.0)	(2.5)				
Total fabric he									(36) =			31.13	(37
entilation hea		i	·			_			·	(25)m x (5)	1	Ī	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
38)m= 24.24	24.11	23.98	23.38	23.26	22.73	22.73	22.64	22.94	23.26	23.49	23.73		(38
Heat transfer of	coefficier	nt, W/K						(39)m	= (37) + (	38)m		-	
39)m= 55.37	55.24	55.11	54.51	54.39	53.87	53.87	53.77	54.07	54.39	54.62	54.86		
39)m= 55.37			0 1.0 1	000	00.0.					002	0 1.00		

Heat loss para	ameter (I	HLP), W	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 1.1	1.09	1.09	1.08	1.08	1.07	1.07	1.06	1.07	1.08	1.08	1.09		
							l .		Average =	Sum(40) <sub>1</sub>	12 /12=	1.08	(40)
Number of day	<u> </u>	nth (Tab	le 1a)	1	1	1							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water hea	ting ene	rgy requi	rement:								kWh/ye	ear:	
Assumed occu if TFA > 13.	9, N = 1		[1 - exp	o(-0.0003	349 x (Ti	FA -13.9	)2)] + 0.0	0013 x ( <sup>-</sup>	TFA -13		71		(42)
if TFA £ 13.	•						(O.E. N.I)	00					
Annual averag									se target o		.72		(43)
not more that 125	•		0 ,		•	•			J				
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage i	in litres pe	r day for ea		Vd,m = fa	ctor from	Table 1c x							
(44)m= 82.19	79.2	76.22	73.23	70.24	67.25	67.25	70.24	73.23	76.22	79.2	82.19		
	!			!		!	ļ.		Total = Su	ım(44) <sub>112</sub> =	=	896.65	(44)
Energy content of	f hot water	used - cal	culated m	onthly $= 4$ .	190 x Vd,ı	m x nm x E	OTm / 3600	0 kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 121.89	106.61	110.01	95.91	92.03	79.41	73.59	84.44	85.45	99.58	108.7	118.04		
			. ,						Total = Su	ım(45) <sub>112</sub> =	=	1175.66	(45)
If instantaneous v	vater heati	ng at point	of use (no	not water	storage),	enter 0 ın	boxes (46)	i) to (61)		i			
(46)m= 0	0	0	0	0	0	0	0	0	0	0	0		(46)
Water storage Storage volum		) includir	na anv si	olar or M	/WHRS	etorana	within sa	ame ves	امء		150		(47)
If community h	` '					_		arric ves	301		150		(41)
Otherwise if no	•			•			` '	ers) ente	er '0' in <i>(</i>	(47)			
Water storage			. (						o. o (	( )			
a) If manufact	turer's d	eclared I	oss fact	or is kno	wn (kWł	n/day):					0		(48)
Temperature f	actor fro	m Table	2b								0		(49)
Energy lost fro	m watei	r storage	, kWh/y	ear			(48) x (49)	) =			0		(50)
b) If manufact			-										
Hot water stor	•			le 2 (kW	h/litre/da	ay)					0		(51)
If community he Volume factor	_		on 4.3								_		(50)
Temperature f			2h								0		(52) (53)
Energy lost fro				oar			(47) v (51)	) x (52) x (	53) -				` '
Enter (50) or		_	, KVVII/y	cai			(47) X (31)	) X (32) X (	00) =	-	0		(54) (55)
Water storage	` , ` `	,	or each	month			((56)m = (	(55) × (41)	m		<u> </u>		(00)
	1	1								1 0			(56)
(56)m= 0 If cylinder contain	0 s dedicate	od solar sto	0 rage (57)	0 = (56)m	0 x [(50) = (	0 H11)] <i>- (</i> 5	0) else (5)	7)m = (56)	0 m where (	0 (H11) is fro	0 m Appendi	<b>у</b> Н	(30)
	1				1					1		A11	(57)
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit	t loss (ar	nnual) fro	m Table	e 3							0		(58)
Primary circuit				,	•	. ,	, ,						
(modified by	1	1			i		<del></del>	<u> </u>	1	<del>-                                    </del>			,
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi loss ca	lculated	for each	month (	′61)m =	(60) ± 3	865 <b>v</b> (41	)m							
(61)m= 0	0	0	0	0	0	0	)   0		0	0	0	0	]	(61)
	uired for	water h	eating ca	alculated	l for ead	ch month	(62)ı	—— m =	0.85 × (	(45)m +	(46)m +	(57)m +	נ · (59)m + (61)m	
(62)m= 103.61	90.62	93.51	81.52	78.22	67.5	62.55	71.	_	72.63	84.65	92.4	100.34	1 ′ ′ ′	(62)
Solar DHW input	calculated	using App	endix G oı	· Appendix	H (nega	tive quantity	y) (ent	er '0'	if no sola	r contribu	tion to wate	er heating)	)	
(add additiona	al lines if	FGHRS	and/or \	WWHRS	applie	s, see Ap	pend	lix C	3)					
(63)m= 0	0	0	0	0	0	0	0		0	0	0	0	]	(63)
Output from w	ater hea	ter												
(64)m= 103.61	90.62	93.51	81.52	78.22	67.5	62.55	71.	77	72.63	84.65	92.4	100.34		_
								Outp	out from wa	ater heate	er (annual)	112	999.31	(64)
Heat gains fro	m water	heating,	kWh/m	onth 0.2	5 ′ [0.8	5 × (45)m	ı + (6	1)m	] + 0.8 x	( [(46)m	+ (57)m	+ (59)m	<u>]</u> ]	
(65)m= 25.9	22.65	23.38	20.38	19.56	16.87	15.64	17.9	94	18.16	21.16	23.1	25.08		(65)
include (57)	m in cald	culation (	of (65)m	only if c	ylinder	is in the	dwell	ing	or hot w	ater is f	rom com	munity h	neating	
5. Internal g	ains (see	Table 5	and 5a	):										
Metabolic gair	ns (Table	5), Wat	ts	_			_			_			_	
Jan	Feb	Mar	Apr	May	Jun	Jul	Αι	ug	Sep	Oct	Nov	Dec	]	
(66)m= 85.31	85.31	85.31	85.31	85.31	85.31	85.31	85.3	31	85.31	85.31	85.31	85.31	]	(66)
Lighting gains	(calcula	ted in Ap	pendix	L, equat	ion L9 d	or L9a), a	lso s	ee ¯	Table 5				_	
(67)m= 13.65	12.12	9.86	7.47	5.58	4.71	5.09	6.6	2	8.88	11.28	13.16	14.03	]	(67)
Appliances ga	ins (calc	ulated ir	Append	dix L, eq	uation l	_13 or L1	3a), a	also	see Tal	ble 5				
(68)m= 148.65	150.19	146.3	138.03	127.58	117.77	111.21	109	.66	113.55	121.83	132.27	142.09	]	(68)
Cooking gains	(calcula	ted in A	ppendix	L, equat	ion L15	or L15a	), als	o se	e Table	5			_	
(69)m= 31.53	31.53	31.53	31.53	31.53	31.53	31.53	31.	53	31.53	31.53	31.53	31.53	]	(69)
Pumps and fa	ns gains	(Table 5	ōa)										_	
(70)m= 0	0	0	0	0	0	0	0		0	0	0	0	]	(70)
Losses e.g. ev	vaporatio	n (nega	tive valu	es) (Tab	le 5)								_	
(71)m= -68.25	-68.25	-68.25	-68.25	-68.25	-68.25	-68.25	-68.	.25	-68.25	-68.25	-68.25	-68.25	]	(71)
Water heating	gains (T	able 5)											_	
(72)m= 34.81	33.71	31.42	28.31	26.28	23.44	21.02	24.	12	25.22	28.44	32.08	33.72	]	(72)
Total internal	gains =				(66	6)m + (67)m	า + (68	3)m +	- (69)m + (	(70)m + (7	71)m + (72)	)m	_	
(73)m= 245.71	244.62	236.18	222.39	208.04	194.51	185.91	188	.99	196.24	210.14	226.11	238.43		(73)
6. Solar gain														
Solar gains are		•					ations 1	to co		e applica		tion.		
Orientation:	Access F Table 6d		Area m²			ux able 6a		Т	g_ able 6b	Т	FF able 6c		Gains (W)	
_							1 1					_	. ,	٦
Northeast 0.9x	0.77	X	8.6		X	11.28	X 1		0.63	×	0.7	_ =	29.83	(75)
Northeast 0.9x	0.77	X	8.6			22.97	X		0.63	X	0.7	=	60.72	(75)
Northeast 0.9x	0.77	X	8.6		<b>—</b>	41.38	X 1		0.63		0.7	=	109.4	(75)
Northeast 0.9x	0.77	X	8.6		-	67.96	X 1		0.63	×	0.7	=	179.67	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	35	X	91.35	X		0.63	X	0.7	=	241.51	(75)

Northeast <sub>0.9x</sub>	0.77	X	8.6	65	X	97.38	X		0.63	X	0.7	=	257.47	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	65	x	91.1	X		0.63	x	0.7	=	240.86	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	55	x	72.63	X		0.63	x	0.7	=	192.02	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	65	x	50.42	X		0.63	x	0.7	=	133.31	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	55	x	28.07	X		0.63	X	0.7	=	74.21	(75)
Northeast <sub>0.9x</sub>	0.77	x	8.6	55	x	14.2	X		0.63	_ x	0.7	=	37.53	(75)
Northeast 0.9x	0.77	X	8.6	55	x	9.21	X		0.63	_ x [	0.7	=	24.36	(75)
•														_
Solar gains in	watts, ca	alculated	for eac	h month			(83)m	n = S	um(74)m .	(82)m				
(83)m= 29.83	60.72	109.4	179.67	241.51	257.47	240.86	192	.02	133.31	74.21	37.53	24.36		(83)
Total gains – i	internal a	nd solar	(84)m =	= (73)m	+ (83)m	, watts							•	
(84)m= 275.54	305.34	345.58	402.06	449.55	451.98	426.77	381	.01	329.55	284.34	263.64	262.79		(84)
7. Mean inter	rnal temp	erature	(heating	season	)									
Temperature	during h	eating p	eriods ir	the livi	ng area	from Ta	ble 9	, Th	1 (°C)				21	(85)
Utilisation fac	ctor for ga	ains for l	living are	ea, h1,m	(see T	able 9a)								_
Jan	Feb	Mar	Apr	May	Jun	Jul	Α	ug	Sep	Oct	Nov	Dec		
(86)m= 1	1	0.99	0.97	0.89	0.71	0.54	0.6	63	0.89	0.99	1	1		(86)
Mean interna	al temper	ature in	living are	ea T1 (fo	ollow st	eps 3 to	7 in T	able	e 9c)					
(87)m= 19.78	19.9	20.14	20.49	20.8	20.96	20.99	20.		20.85	20.46	20.07	19.76		(87)
Temperature	during h	eating p	eriods ir	rest of	dwellin	g from Ta	able 9	—— 9 TI	h2 (°C)	•	•	•	•	
(88)m= 20	20.01	20.01	20.02	20.02	20.03	20.03	20.		20.03	20.02	20.02	20.01		(88)
Litilization for	otor for a	oine for	root of d	wolling	h2 m /o	oo Toblo	. 00)				Į.	!		
Utilisation fac	1	0.99	0.96	0.84	0.62	0.43	9a) 0.5	51	0.83	0.98	1	1		(89)
	<u> </u>		<u> </u>		<u> </u>					<u> </u>		<u> </u>		(==)
Mean interna	T -		I			1	<del>i                                     </del>				10.10	10.00		(90)
(90)m= 18.89	19.01	19.25	19.6	19.88	20.01	20.03	20.	03	19.94	19.58	19.18 ng area ÷ (	18.88	0.40	(90)
										L/ ( - L/V)	ig area . (	, -	0.43	(31)
Mean interna	<del></del>	<u> </u>				1	— <u> </u>			i			ı	
(92)m= 19.27	19.4	19.64	19.99	20.28	20.42	20.44	20.		20.33	19.96	19.56	19.26		(92)
Apply adjustr			1		1	1	T i			·	10.50	40.00	1	(02)
(93)m= 19.27	19.4	19.64	19.99	20.28	20.42	20.44	20.	44	20.33	19.96	19.56	19.26		(93)
8. Space hea				ra abtair	and at a	ton 11 of	Tobl	ام ۸	th	t Time	76\m on	d ro oolo	vuloto	
Set Ti to the the utilisation			•		ieu ai s	teb i i oi	Tabl	ie ar	), SO IIIa	ıt 11,111=(	(16)III ali	u re-caic	uiale	
Jan	Feb	Mar	Apr	May	Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
Utilisation fac	ctor for g	ains, hm	):				'			Į.			l	
(94)m= 1	1	0.99	0.96	0.86	0.66	0.48	0.5	56	0.85	0.98	1	1		(94)
Useful gains,	, hmGm ,	W = (94	4)m x (8	4)m		_					_	-	•	
(95)m= 274.96	304.13	341.81	385.2	385.06	298.33	204.76	212	.42	280.48	278.48	262.57	262.36		(95)
Monthly aver	<del></del>		<del>.                                      </del>		i e		_			i			ı	
(96)m= 4.3	4.9	6.5	8.9	11.7	14.6	16.6	16		14.1	10.6	7.1	4.2		(96)
Heat loss rate	_					<del></del>	<del></del>	_	·	ī —	000.00	000 ::		(07)
(97)m= 829.19	800.8	724.06	604.34	466.59	313.37		217		336.91	509.2	680.86	826.11		(97)
Space heatin (98)m= 412.35	ng require	284.4	r each n 157.78	60.66	/Vh/mor	$\frac{1 + 0.02}{1}$	24 x [	Ť	)m – (95 0	)m] x (4 171.66	1)m 301.17	419.43		
(98)m= 412.35	JJJ./6	∠04.4	137.78	00.00	L "	1 "		,	U	171.00	301.17	419.43		

								Tota	l per year	(kWh/year	r) = Sum(9	08)15,912 =	2141.21	(98)
Space	e heating	g require	ement in	kWh/m²	?/year								42.36	(99)
8c. Sp	ace co	oling req	uiremer	nt										
Calcu	lated for	r June, J	luly and	August.	See Tal	ole 10b							i	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
г	oss rate	Lm (ca	lculated	using 2	5°C inter		r		ernal ten	nperatur	e from T	able 10)	ı	
(100)m=	0	0	0	0	0	506.33	398.6	408.63	0	0	0	0		(100)
		tor for lo									1	1	I	
(101)m=	0	0	0	0	0	0.9	0.95	0.92	0	0	0	0		(101)
r				<del>'</del>	(101)m						Ι		1	
(102)m=	0	0	0	0	0	456.08	377.81	375.75	0	0	0	0		(102)
г	<del>` i</del>					r		e Table			1		1	
(103)m=	0	0	0	0	0	592.99	562.31	509.84	0	0	0	0		(103)
•				r month, : 3 × (98		lwelling,	continu	ous ( kW	h') = 0.02	24 x [(10	03)m – (	102)m]:	x (41)m	
(104)m=	04)11110	0	0	0 7 (30	0	98.57	137.27	99.76	0	0	0	0		
(101)						00.01	101.21	000		= Sum(		=	335.61	(104)
Cooled	fraction	1								cooled	,		1	(105)
Intermi	ttency fa	actor (Ta	able 10b	)							(	′	•	<b></b> )` ′
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		
									Total	= Sum(	(104)	=	0	(106)
Space	cooling	requirer	nent for	month =	(104)m	× (105)	× (106)r	n						
(107)m=	0	0	0	0	0	24.64	34.32	24.94	0	0	0	0		
									Total	= Sum(	107)	=	83.9	(107)
Space	cooling	requirer	nent in k	:Wh/m²/y	/ear				(107)	÷ (4) =			1.66	(108)
8f. Fab	ric Ener	gy Effici	ency (ca	alculated	only un	der spec	cial cond	litions, se	ee sectio	on 11)				
Fabric	Energy	/ Efficier	псу						(99) -	+ (108) =	=		44.02	(109)
Targe	t Fabric	Energ	y Efficie	ency (TF	EE)								50.63	(109)

		l lser I	Details:						
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 2012		Strom Softwa	are Ve	rsion:			0001082 on: 1.0.5.9	
Address :	F	roperty	Address	: Plot 37	,				
Overall dwelling dime	ensions:								
		Are	a(m²)		Av. He	ight(m)		Volume(m <sup>3</sup>	<sup>3</sup> )
Ground floor		:	50.54	(1a) x	2	2.5	(2a) =	126.36	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1	n) [	50.54	(4)					
Dwelling volume				(3a)+(3b	)+(3c)+(3c	d)+(3e)+	.(3n) =	126.36	(5)
2. Ventilation rate:									
	main seconda heating heating	ry	other		total			m³ per hou	ır
Number of chimneys	0 + 0	] + [	0	= [	0	X 4	40 =	0	(6a)
Number of open flues	0 + 0	<b>+</b> [	0	_ = [	0	x 2	20 =	0	(6b)
Number of intermittent fa	ins				0	x ′	10 =	0	(7a)
Number of passive vents	3			Ē	0	x ′	10 =	0	(7b)
Number of flueless gas f	ires				0	X 4	40 =	0	(7c)
				L					
				_			Air ch	nanges per ho	our
	ys, flues and fans = $(6a)+(6b)+(6b)+(6a)+(6b)+(6a)+(6b)+(6a)+(6b)+(6a)+(6b)+(6b)+(6a)+(6b)+(6a)+(6b)+(6b)+(6b)+(6b)+(6b)+(6b)+(6b)+(6b$				0		÷ (5) =	0	(8)
Number of storeys in t	peen carried out or is intended, procee he dwelling (ns)	ed to (17),	otherwise (	continue ti	rom (9) to	(16)		0	(9)
Additional infiltration	ine arreining (ine)					[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or timber frame o	r 0.35 fo	r masoni	ry consti	ruction			0	(11)
if both types of wall are p deducting areas of openi	resent, use the value corresponding to	o the grea	ter wall are	ea (after			'		
,	floor, enter 0.2 (unsealed) or 0	.1 (seal	ed), else	enter 0				0	(12)
If no draught lobby, en	,	•	,,					0	(13)
Percentage of window	s and doors draught stripped							0	(14)
Window infiltration			0.25 - [0.2	2 x (14) ÷ 1	100] =			0	(15)
Infiltration rate			(8) + (10)					0	(16)
,	q50, expressed in cubic metre	-	•	•	etre of e	envelope	area	3	(17)
•	lity value, then $(18) = [(17) \div 20] + (6)$ es if a pressurisation test has been do.				is haina u	sad		0.15	(18)
Number of sides sheltere		ie or a de	gree an pe	тпеаышу	is being u	seu		3	(19)
Shelter factor			(20) = 1 -	[0.075 x (	19)] =			0.78	(20)
Infiltration rate incorpora	ting shelter factor		(21) = (18	s) x (20) =				0.12	(21)
Infiltration rate modified f	or monthly wind speed								
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	peed from Table 7								
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (2	2)m ÷ 4								
(22a)m= 1.27 1.25	1.23 1.1 1.08 0.95	0.95	0.92	1	1.08	1.12	1.18	]	
-		•	•	•	•	•	•	•	

Adjusted infiltra	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14	]	
Calculate effect If mechanica		_	rate for t	he appli	cable ca	se		•	•	•		, 	(00-)
If exhaust air he			andiv N (2	3h) - (23s	a) × Fmv (e	aguation (1	VS)) othe	rwisa (23h	) - (23a)			0.5	(23a)
If balanced with		0		, ,	,	. ,	,, .	,	) = (23a)			0.5	(23b)
a) If balance		•	-	_					2h\m + (	23P) ^ [-	1 _ (23c)	79.05	(23c)
(24a)m= 0.25	0.25	0.25	0.23	0.23	0.22	0.22	0.21	0.22	0.23	0.24	0.24	]	(24a)
b) If balance		L				l	l		l	L		J	, ,
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(24b)
c) If whole ho if (22b)m				•					5 × (23h	) 	1	ı	
(24c)m = 0	0	0	0	0	0	0	0	0	0	0	0	]	(24c)
d) If natural v	/entilatio	on or wh	ole hous	e positiv		ventilatio	on from I	oft	<u> </u>	<u> </u>	ļ	J	
if (22b)m									0.5]			_	
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effective air	change	rate - er	iter (24a	) or (24b	o) or (24	c) or (24	d) in box	x (25)				_	
(25)m= 0.25	0.25	0.25	0.23	0.23	0.22	0.22	0.21	0.22	0.23	0.24	0.24		(25)
3. Heat losses	s and he	eat loss p	paramete	er:									
ELEMENT	Gros area		Openin m		Net Ar A ,r		U-valı W/m2		A X U (W/I	K)	k-value kJ/m²-		X k J/K
Doors					2	х	1.4	=	2.8				(26)
Windows					8.651	x1.	/[1/( 1.4 )+	0.04] =	11.47				(27)
Walls Type1	24.5	55	8.65		15.9	x	0.15	=	2.39	$\equiv$ [			(29)
Walls Type2	20.9	96	2		18.96	3 x	0.14	=	2.68				(29)
Roof	11.3	39	0		11.39	) x	0.1	=	1.14				(30)
Total area of el	ements	, m²			56.9								(31)
* for windows and ** include the area						ated using	ı formula 1	/[(1/U-valu	ıe)+0.04] a	as given in	paragraph	1 3.2	
Fabric heat los	s, W/K :	= S (A x	U)				(26)(30)	) + (32) =				20.48	(33)
Heat capacity (	Cm = S(	(Axk)						((28).	(30) + (32	2) + (32a).	(32e) =	590.6	(34)
Thermal mass	parame	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Low		100	(35)
For design assess				construct	ion are not	t known pr	ecisely the	e indicative	values of	TMP in T	able 1f		
can be used insteat Thermal bridge				ısina Ar	nendix k	<						10.3	(36)
if details of therma	`	,		٠.	•	`						10.3	(50)
Total fabric hea			, ,	,	,			(33) +	(36) =			30.78	(37)
Ventilation hea	t loss ca	alculated	monthly	/				(38)m	= 0.33 × (	(25)m x (5)	)		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	]	
(38)m= 10.55	10.43	10.31	9.7	9.58	8.97	8.97	8.85	9.22	9.58	9.82	10.06		(38)
Heat transfer c	oefficier	nt, W/K	_					(39)m	= (37) + (3	38)m		_	
(39)m= 41.33	41.21	41.09	40.48	40.36	39.75	39.75	39.63	40	40.36	40.6	40.85		
									Average =	Sum(39) <sub>1</sub>	12 /12=	40.45	(39)

Heat Id	oss para	meter (H	HLP), W/	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m=	0.82	0.82	0.81	0.8	0.8	0.79	0.79	0.78	0.79	0.8	0.8	0.81		
							•	•	•	Average =	Sum(40) <sub>1</sub> .	12 /12=	0.8	(40)
Numbe	er of day		, i		N 4 -			Α.		0.1				
(44)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct 31	Nov	Dec		(41)
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ater heat	ing ener	gy requi	rement:								kWh/ye	ear:	
if TF	ned occu FA > 13.9 FA £ 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x ( <sup>-</sup>	TFA -13.		71		(42)
Reduce	I averag the annua e that 125	al average	hot water	usage by	5% if the a	lwelling is	designed t			se target o		.65		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage ir				,			_	[ F					
(44)m=	86.52	83.37	80.23	77.08	73.93	70.79	70.79	73.93	77.08	80.23	83.37	86.52		
											m(44) <sub>112</sub> =	L	943.85	(44)
Energy (	content of	hot water	used - cal	culated mo	onthly $= 4$ .	190 x Vd,r	n x nm x C	Tm / 3600	) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m=	128.31	112.22	115.8	100.96	96.87	83.59	77.46	88.89	89.95	104.82	114.42	124.26		<b>—</b>
If instan	taneous w	ater heatii	na at point	of use (no	hot water	· storage).	enter 0 in	boxes (46		Total = Su	m(45) <sub>112</sub> =	<u> </u>	1237.53	(45)
(46)m=		16.83	17.37	15.14	14.53	12.54	11.62	13.33	13.49	15.72	17.16	18.64		(46)
` '	storage		17.07	10.14	14.00	12.04	11.02	10.00	10.40	10.72	17.10	10.04		(10)
Storag	je volum	e (litres)	includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If com	munity h	eating a	nd no ta	nk in dw	elling, e	nter 110	litres in	(47)						
	vise if no		hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (	(47)			
	storage nanufacti		aclared l	nee facti	nr is kna	wn (k\//k	u/dav/).							(48)
•	erature fa				) 13 KHO	vvii (icvvi	ı, day).					0		(49)
•	y lost fro				ear			(48) x (49)	) =			10		(50)
0.	nanufact		•			or is not		(10) X (10)	, –		'	10		(30)
	ater stora	-			e 2 (kW	h/litre/da	ıy)				0.	02		(51)
	munity h	-		on 4.3										(==)
	e factor i erature fa			2h							-	.6		(52) (53)
•	y lost fro				oor			(47) v (51)	) x (52) x (	53) –				
	(50) or (		_	, KVVII/ y (	zai			(47) X (01)	) X (02) X (	00) =		03		(54) (55)
	storage	, ,	,	or each	month			((56)m = (	(55) × (41)	m				` '
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
(00)												m Appendi	хH	( - <del>-</del> )
If cylinde	er contains	a da locato												
-		28.92		30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
(57)m=	32.01	28.92	32.01	30.98		30.98	32.01	32.01	30.98	32.01		32.01		, ,
(57)m= Primar	32.01 ry circuit	28.92 loss (an	32.01 nual) fro	30.98 om Table	3		<u> </u>		Į	32.01		32.01		(57) (58)
(57)m= Primar Primar	32.01	28.92 loss (an	32.01 inual) fro culated f	30.98 om Table for each	3 month (	59)m = (	(58) ÷ 36	65 × (41)	ım					, ,

Combi loss o	ealculated	for each	month (	(61)m –	(60) <i>- '</i>	R65 <b>v</b> (41	)m							
(61)m= 0	0	0	0	01)111 =	00) - (	0 0	) T o		0	0	0	0	1	(61)
				alculated	for ea	ch month						<u> </u>	J · (59)m + (61)m	` ,
(62)m= 183.5	<u> </u>	171.07	154.45	152.15	137.08		144	_	143.44	160.1	167.92	179.53	1	(62)
Solar DHW inpu		<u> </u>	<u> </u>	<u> </u>	H (nega		<u> </u>					er heating	<u></u>	` ,
(add addition												-: ····································		
(63)m= 0	0	0	0	0	0	0	0		0	0	0	0	7	(63)
Output from	water hea	ter	ı			_							_	
(64)m= 183.5		171.07	154.45	152.15	137.08	132.74	144.	.16	143.44	160.1	167.92	179.53	1	
		ı	ı	ı		-1		Outp	out from wa	ater heate	er (annual)	112	1888.37	(64)
Heat gains fr	om water	heating,	kWh/m	onth 0.2	5 ′ [0.8	5 × (45)m	ı + (6	1)m	n] + 0.8 x	د [(46)m	+ (57)m	+ (59)m	 n ]	_
(65)m= 86.88	77.25	82.72	76.36	76.43	70.59	69.98	73.	78	72.7	79.08	80.84	85.54	1	(65)
include (57	7)m in cal	culation	of (65)m	only if c	ylinder	is in the	dwell	ing	or hot w	ater is f	rom com	munity h	neating	
5. Internal	gains (see	Table 5	and 5a	):										
Metabolic ga	ins (Table	5), Wat	ts										_	
Jan	Feb	Mar	Apr	May	Jun	Jul	Αι	ug	Sep	Oct	Nov	Dec	]	
(66)m= 102.3	7 102.37	102.37	102.37	102.37	102.37	102.37	102	.37	102.37	102.37	102.37	102.37	]	(66)
Lighting gain	s (calcula	ted in Ap	pendix	L, equat	ion L9	or L9a), a	lso s	ee -	Table 5					
(67)m= 34.13	30.31	24.65	18.66	13.95	11.78	12.73	16.	54	22.2	28.19	32.9	35.08	]	(67)
Appliances g	ains (calc	ulated ir	Append	dix L, eq	uation	_13 or L1	3a), a	also	see Ta	ble 5			_	
(68)m= 221.8	6 224.17	218.37	206.01	190.42	175.77	165.98	163	.68	169.48	181.83	197.42	212.08	]	(68)
Cooking gair	ns (calcula	ited in A	ppendix	L, equat	ion L1	or L15a	), als	o se	e Table	5				
(69)m= 46.94	46.94	46.94	46.94	46.94	46.94	46.94	46.9	94	46.94	46.94	46.94	46.94		(69)
Pumps and f	ans gains	(Table 5	5a)											
(70)m= 0	0	0	0	0	0	0	0		0	0	0	0	]	(70)
Losses e.g.	evaporatio	n (nega	tive valu	es) (Tab	le 5)									
(71)m= -68.25	5 -68.25	-68.25	-68.25	-68.25	-68.25	-68.25	-68.	.25	-68.25	-68.25	-68.25	-68.25	]	(71)
Water heatin	g gains (T	able 5)											_	
(72)m= 116.7	8 114.96	111.19	106.06	102.73	98.04	94.05	99.	16	100.98	106.28	112.28	114.97	]	(72)
Total interna	al gains =				(6	6)m + (67)n	า + (68	8)m +	- (69)m + (	(70)m + (7	71)m + (72)	)m	_	
(73)m= 453.8	4 450.51	435.27	411.8	388.17	366.65	353.83	360	.45	373.72	397.37	423.67	443.19		(73)
6. Solar gai														
Solar gains are		•					ations 1	to co		e applical		tion.		
Orientation:	Access F Table 6d		Area m²			ux able 6a		Т	g_ able 6b	т	FF able 6c		Gains (W)	
North coat a c					_		1 1					_	. ,	1,
Northeast 0.9		X			X	11.28	X		0.63	×	0.7	=	29.83	(75)
Northeast 0.9		×			x	22.97	] X ]		0.63	_	0.7	=	60.72	](75) ] <sub>(75)</sub>
Northeast 0.9		X	8.6		x	41.38	X 1		0.63	×	0.7	=	109.4	[(75)
Northeast 0.9		X	8.6		x	67.96	X ]		0.63	×	0.7	=	179.67	](75) ] <sub>(75)</sub>
Northeast 0.9	0.77	X	8.6	65	X	91.35	X		0.63	X	0.7	=	241.51	(75)

Northeast <sub>0.9x</sub>	0.77	X	8.6	55	x	97	7.38	x		0.63	x	0.7	=	257.47	(75)
Northeast <sub>0.9x</sub>	0.77	х	8.6	55	x $\lceil$	9	1.1	x		0.63	x	0.7	=	240.86	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	65	x $\lceil$	72	2.63	x		0.63	x	0.7	=	192.02	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	65	x $\lceil$	50	0.42	x		0.63	×	0.7	<del>-</del>	133.31	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	55	x $\lceil$	28	8.07	x		0.63	x	0.7		74.21	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	55	x [	1	4.2	x		0.63	×	0.7	= =	37.53	(75)
Northeast 0.9x	0.77	X	8.6	55	x	9	.21	x		0.63		0.7	= =	24.36	(75)
_					_			•							
Solar gains in	watts, ca	alculated	for eac	h month				(83)m	n = S	um(74)m .	(82)m				
(83)m= 29.83	60.72	109.4	179.67	241.51	257	7.47	240.86	192	2.02	133.31	74.21	37.53	24.36		(83)
Total gains – i	nternal a	nd solar	(84)m =	= (73)m ·	+ (83	3)m ,	watts								
(84)m= 483.67	511.23	544.67	591.47	629.68	624	1.12	594.69	552	2.46	507.03	471.58	461.21	467.55		(84)
7. Mean inter	nal temp	erature	(heating	season	)										
Temperature			•			rea f	rom Tal	ole 9	, Th	1 (°C)				21	(85)
Utilisation fac	_	٠.			_					` ,					_
Jan	Feb	Mar	Apr	May	<u> </u>	un	Jul	A	ug	Sep	Oct	Nov	Dec		
(86)m= 0.88	0.85	0.8	0.69	0.55	0.	.4	0.29	0.3	32	0.51	0.72	0.84	0.89		(86)
Mean interna	l temper	ature in	livina ar	22 T1 (f	سا	, star	ns 3 to 7	Tin T	Table	a 9c)					
(87)m= 19.94	20.09	20.36	20.67	20.88		.97	20.99	20.		20.93	20.68	20.29	19.91		(87)
` '												1			, ,
Temperature	20.24	20.24	eriods ir		_	iling .27	20.27	20.		<u> </u>	20.25	20.25	20.25		(88)
(88)m= 20.24	20.24	20.24	20.25	20.25	20	.21	20.27	20.	.21	20.26	20.25	20.25	20.25		(00)
Utilisation fac			1		1	<del>`</del>		T .			ı	_		I	
(89)m= 0.87	0.84	0.78	0.66	0.51	0.:	35	0.24	0.2	27	0.46	0.69	0.82	0.88		(89)
Mean interna	l temper	ature in	the rest	of dwell	ng T	72 (fc	ollow ste	eps 3	to 7	7 in Tabl	e 9c)			•	
(90)m= 18.84	19.05	19.42	19.86	20.12	20	.24	20.26	20.	.26	20.19	19.88	19.34	18.8		(90)
										f	LA = Livi	ng area ÷ (	4) =	0.43	(91)
Mean interna	l temper	ature (fo	r the wh	ole dwe	lling)	) = fL	A × T1	+ (1	– fL	.A) × T2					
(92)m= 19.32	19.5	19.83	20.21	20.45	20	.55	20.58	20.	.57	20.51	20.22	19.75	19.28		(92)
Apply adjustn	nent to th	ne mean	interna	temper	ature	e fror	m Table	4e,	whe	re appro	opriate				
(93)m= 19.32	19.5	19.83	20.21	20.45	20	.55	20.58	20.	.57	20.51	20.22	19.75	19.28		(93)
8. Space hea	ting requ	uirement													
Set Ti to the			•		ned a	at ste	p 11 of	Tabl	le 9b	o, so tha	t Ti,m=	(76)m an	d re-calc	culate	
the utilisation					Γ.		l. d			Con	0.4	Nov	Dag		
Jan Utilisation fac	Feb	Mar	Apr	May	l J	un	Jul	<u> </u>	ug	Sep	Oct	Nov	Dec		
(94)m= 0.85	0.82	0.77	0.66	0.52	0.:	37	0.26	0.	3	0.48	0.69	0.81	0.86		(94)
Useful gains,			<u> </u>			<u> </u>	0.20			0.10	0.00	0.01	0.00		(- /
(95)m= 411.43	421.28	418.45	391.61	328.27	23	0.9	156.68	163	3.39	242.65	325.03	372.24	402.04		(95)
Monthly avera		rnal tem			L able	8					<u> </u>	_			
(96)m= 4.3	4.9	6.5	8.9	11.7		1.6	16.6	16	5.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate	e for mea	an intern	al tempe	erature,	Lm ,	W =	:[(39)m	x [(9:	3)m	– (96)m	]	1		ı	
(97)m= 620.61	601.73	547.55	457.87	353.02	236	6.67	158.05	165	5.41	256.35	388.44	513.46	616.1		(97)
Space heatin	g require	ement fo	r each n	nonth, k	Wh/r	mont	h = 0.02	24 x	[(97	)m – (95	)m] x (4	l1)m			
(98)m= 155.63	121.27	96.05	47.71	18.42		0	0		)	0	47.18	101.68	159.26		

	Total per year (kWh/year) = Sum(98) <sub>15,912</sub> =	747.19	(98)
Space heating requirement in kWh/m²/year		14.78	(99)
9b. Energy requirements – Community heating scheme			
This part is used for space heating, space cooling or water heating praction of space heat from secondary/supplementary heating (Table		0	(301)
Fraction of space heat from community system 1 – (301) =	Ī	1	(302)
The community scheme may obtain heat from several sources. The procedure allows	•	e latter	
includes boilers, heat pumps, geothermal and waste heat from power stations. See A Fraction of heat from Community boilers	ppenaix C.	1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community	heating system	1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		kWh/year	
Annual space heating requirement	L	747.19	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	784.55	(307a
Efficiency of secondary/supplementary heating system in % (from Ta	able 4a or Appendix E)	0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating Annual water heating requirement	Г	1888.37	٦
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1982.79	 (310a
Electricity used for heat distribution	0.01 × [(307a)(307e) + (310a)(310e)] =	27.67	(313)
Cooling System Energy Efficiency Ratio	Ī	0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outs	side	175.36	(330a)
warm air heating system fans	Ī	0	(330b
pump for solar water heating	Ī	0	(330g
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	175.36	(331)
Energy for lighting (calculated in Appendix L)	Ī	241.09	(332)
Electricity generated by PVs (Appendix M) (negative quantity)	Ī	-510.48	(333)
Electricity generated by wind turbine (Appendix M) (negative quantit	у)	0	(334)
10b. Fuel costs – Community heating scheme			
<b>Fuel</b> kWh/year	Fuel Price (Table 12)	Fuel Cost £/year	
Space heating from CHP (307a) x	4.24 x 0.01 =	33.26	(340a
Water heating from CHP (310a) x	4.24 × 0.01 =	84.07	 (342a)

		Fu	ıel Price		
Pumps and fans	(331)		13.19 × 0.01 =	23.13	349)
Energy for lighting	(332)		13.19 × 0.01 =	31.8	350)
Additional standing charges (Table 12)				120 (3	351)
Energy saving/generation technologies					
Total energy cost	= (340a)(342e) + (345)	.(354) =		292.26	355)
11b. SAP rating - Community heating	scheme				
Energy cost deflator (Table 12)				0.42	356)
Energy cost factor (ECF)	[(355) x (356)] ÷ [(4) + 45.0	] =		1.28	357)
SAP rating (section12)				82.08	358)
12b. CO2 Emissions - Community hea	ting scheme				
		Energy kWh/year	Emission factor kg CO2/kWh	r Emissions kg CO2/year	
CO2 from other sources of space and v Efficiency of heat source 1 (%)		ng two fuels repeat (363) t	to (366) for the second fu	nel 94 (3	367a)
CO2 associated with heat source 1	[(307b)	+(310b)] x 100 ÷ (367b) x	0.22	= 635.9 (3	367)
Electrical energy for heat distribution		[(313) x	0.52	= 14.36 (3	372)
Total CO2 associated with community s	systems	(363)(366) + (368)(3	572)	= 650.26 (3	373)
CO2 associated with space heating (se	econdary)	(309) x	0	= 0 (3	374)
CO2 associated with water from immer	sion heater or instantan	eous heater (312) x	0.22	= 0 (3	375)
Total CO2 associated with space and v	vater heating	(373) + (374) + (375) =		650.26	376)
CO2 associated with electricity for pum	ps and fans within dwel	lling (331)) x	0.52	= 91.01 (3	378)
CO2 associated with electricity for light	ing	(332))) x	0.52	= 125.12 (3	379)
Energy saving/generation technologies Item 1	(333) to (334) as applic	cable	0.52 × 0.01 =	-264.94 (3	380)
Total CO2, kg/year	sum of (376)(382) =			601.46	383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			11.9 (3	384)
El rating (section 14)				91.56	385)
13b. Primary Energy – Community hea	ting scheme				
		Energy kWh/year	Primary factor	P.Energy kWh/year	
Energy from other sources of space an Efficiency of heat source 1 (%)		IP) ng two fuels repeat (363) t	to (366) for the second fu	nel 94 (3	367a)
Energy associated with heat source 1	[(307b)	+(310b)] x 100 ÷ (367b) x	1.22	= 3591.65 (3	367)
Electrical energy for heat distribution		[(313) x		= 84.96 (3	372)
Total Energy associated with communication	ty systems	(363)(366) + (368)(3	<del></del>	= 3676.61 (3	373)
if it is negative set (373) to zero (unle	ess specified otherwise,	see C7 in Appendix	C)	3676.61 (3	373)
Energy associated with space heating	(secondary)	(309) x	0	= 0 (3	374)

Energy associated with water from immersion heater or insta	ntaneous heater(312) x	1.22	=	0	(375)
Total Energy associated with space and water heating	(373) + (374) + (375) =			3676.61	(376)
Energy associated with space cooling	(315) x	3.07	=	0	(377)
Energy associated with electricity for pumps and fans within	dwelling (331)) x	3.07	=	538.35	(378)
Energy associated with electricity for lighting	(332))) x	3.07	=	740.13	(379)
Energy saving/generation technologies Item 1		3.07 × 0.0	1 =	-1567.16	(380)
Total Primary Energy, kWh/year sum of (37	6)(382) =			3387.93	(383)

Stroma Name:   Zahid Ashraf   Stroma FSAP 2012   Software Version:   Version: 1.0.5.9			امعال	r Details:						
Software Name:   Stroma FSAP 2012   Software Version:   Version: 1.0.5.9	Accessor Name	Zahid Ashraf	030		o Nium	bori		STD∪	001092	
## Acade   Common   C			2							
Area(m²)			Proper	ty Address	Plot 37					
Area(m/*)										
Structural infiltration 0.25 for steel or timber frame or 0.35 for masony construction if both types of valid are present, use the value corresponding to the greater wall area (alter deducting areas of openings); if equal user 0.35 if suspended wooden floor; enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 infiltration and premeability value, q50, expressed in cubic metres per hour per south flattation rate incorporating shelter factor [20] = 1,5   4,9   4,4   4,3   3,8   3,8   3,7   4   4,3   4,5   4,7   4,5   4,7   4,4   4,5   3,8   3,8   3,7   4   4,3   4,5   4,7   4,5   4,7   4,5   4,7   4,5   4,7	Overall dwelling dime	ensions:		(m-2)		A 11 .	tall ((as)		Walana dag	· \
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n)	Ground floor		A		(1a) x			(2a) =	·	<u>-</u>
Dwelling volume		a)+(1b)+(1c)+(1d)+(1e)-	+ (1n) ☐					]` ''	120.00	((3.37)
2. Ventilation rate:    main   heating   heating   heating   heating		۵٫۰(۱۵٫۰(۱۵٫۰(۱۵٫۰		30.34		)+(3c)+(3c	d)+(3e)+	.(3n) =	126.26	<b>—</b> (5)
Number of chimneys					(54) (55)	, , (00) , (00	.,, (33)	.(0)	126.36	(5)
Number of chimneys	2. Ventilation rate:			other		total			m³ per hou	ır
Number of open flues  0 + 0 + 0 = 0 x20 = 0 (6b)  Number of intermittent fans  2 x10 = 20 (7a)  Number of passive vents  0 x40 = 0 (7c)  Number of flueless gas fires  Air changes per hour  Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20 + (5) = 0.16 (8)  If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)  Number of storeys in the dwelling (ns)  Additional infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction  if both types of wall are present, use the value corresponding to the greater well area (after deducting areas of openings); if equal ware 0.35  If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0  Percentage of windows and doors draught stripped  Window infiltration  0 25 - [0.2 × (14) + 100] = 0 (15)  Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (15)  Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)  If based on air permeability value, then (18) = ((17) + 20)+(8), otherwise (18) = (16)  Air permeability value, applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  [3 19)  Shelter factor  [20] = 1 + (0.075 × (19)] = 0.78  [3 0.78  [40]  Infiltration rate modified for monthly wind speed  [41]  [42]  [42]  [42]  [43]  [44]  [43]  [44]  [43]  [44]  [43]  [44]  [43]  [44]  [43]  [44]  [43]  [44]  [43]  [44]  [43]  [44]  [43]  [44]  [43]  [44]  [43]  [44]  [43]  [44]  [43]  [44]  [43]  [44]  [43]  [44]  [43]  [44]  [43]  [44]  [43]  [44]  [44]  [45]  [46]  [47]  [47]  [47]  [48]	Number of chimnevs		<del></del>	0	7 <b>-</b> F	0	x 4	40 =	0	(6a)
Number of intermittent fans   2	•				Ј <u>Г</u>		x	20 =		=
Number of passive vents	·				J    -		x	10 =		= ' '
Number of flueless gas fires					L					=
Air changes per hour  Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20	·				Ļ					=
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7c) = 20	Number of flueless gas in	1163			L				U	(70)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)   Number of storeys in the dwelling (ns)								Air ch	anges per ho	our
Number of storeys in the dwelling (ns)   Additional infiltration   (g)-1)x0.1 =   0 (10) (10)	Infiltration due to chimne	ys, flues and fans = (6a)	)+(6b)+(7a)+(7b	)+(7c) =	Γ	20		÷ (5) =	0.16	(8)
Additional infiltration			l, proceed to (17	7), otherwise o	ontinue fr	rom (9) to	(16)	•		
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction  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  If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0  If no draught lobby, enter 0.05, else enter 0  Percentage of windows and doors draught stripped  Window infiltration  0.25 - [0.2 × (14) ÷ 100] =  Infiltration rate  (8) + (10) + (11) + (12) + (13) + (15) =  Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area  If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)  Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  Shelter factor  (20) = 1 - [0.075 × (19)] =  0.32  (21)  Infiltration rate modified for monthly wind speed  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  Monthly average wind speed from Table 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		ne aweiling (ns)					[(9)]	-1]v0 1 =		<b>—</b>
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  If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0  If no draught lobby, enter 0.05, else enter 0  Percentage of windows and doors draught stripped  Window infiltration  0.25 - [0.2 x (14) ÷ 100] =  Infiltration rate  (8) + (10) + (11) + (12) + (13) + (15) =  Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area  If based on air permeability value, then (18) = [(17) + 20]+(8), otherwise (18) = (16)  Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  Shelter factor  (20) = 1 - [0.075 x (19)] =  0.78  (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		.25 for steel or timber fr	ame or 0.35	for mason	v constr	uction	[(0)	1]x0.1 =		= ' '
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			onding to the gr	eater wall are	a (after					`
If no draught lobby, enter 0.05, else enter 0	•	• / .	d) or 0.1 (se	aled) else	enter ()			i	0	7(12)
Percentage of windows and doors draught stripped  Window infiltration  0.25 - [0.2 × (14) ÷ 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  If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)  Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  Shelter factor  (20) = 1 - [0.075 × (19)] = 0.78 (20)  Infiltration rate incorporating shelter factor  (21) = (18) × (20) = 0.32 (21)  Infiltration rate modified for monthly wind speed  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  Monthly average wind speed from Table 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	•	,	a) 01 0.1 (30)	aica), cisc	Critci o					=
Window infiltration $0.25 - [0.2 \times (14) \div 100] = 0.015$ Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) = 0.016$ Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area $5.017$ If based on air permeability value, then $(18) = [(17) \div 20] + (8)$ , otherwise $(18) = (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered $(20) = 1 - [0.075 \times (19)] = 0.78$ Shelter factor $(20) = 1 - [0.075 \times (19)] = 0.78$ Infiltration rate incorporating shelter factor $(21) = (18) \times (20) = 0.32$ 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 $(22a)m = (22)m \div 4$	• •		pped					-		= ' '
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area    17	Window infiltration	-		0.25 - [0.2	x (14) ÷ 1	00] =			0	=
If based on air permeability value, then $(18) = [(17) \div 20] + (8)$ , otherwise $(18) = (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  Shelter factor $(20) = 1 - [0.075 \times (19)] =$ $(20) = 1 - [0.075 \times (19)] =$ Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$ $(21) = (18) \times (20) =$ 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 $(22a)m = (22)m \div 4$	Infiltration rate			(8) + (10)	+ (11) + (1	12) + (13)	+ (15) =		0	(16)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  Shelter factor $(20) = 1 - [0.075 \times (19)] = 0.78  (20)$ Infiltration rate incorporating shelter factor $(21) = (18) \times (20) = 0.32  (21)$ Infiltration rate modified for monthly wind speed  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  Monthly average wind speed from Table 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 $(22a)m = (22)m \div 4$	•	•	•	•	•	etre of e	envelope	area	5	(17)
Number of sides sheltered		•							0.41	(18)
Shelter factor $ (20) = 1 - [0.075 \times (19)] = 0.78                                   $			been done or a	degree air pe	meability	is being u	sed		2	(10)
Infiltration rate incorporating shelter factor $ (21) = (18) \times (20) =                                   $		,u		(20) = 1 -	0.075 x (1	19)] =				<b>→</b>
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         3.7         4         4.3         4.5         4.7           Wind Factor (22a)m = (22)m ÷ 4	Infiltration rate incorporate	ting shelter factor		(21) = (18	x (20) =				0.32	=
Monthly average wind speed from Table 7 (22)m= 5.1 5 4.9 4.4 4.3 3.8 3.7 4 4.3 4.5 4.7  Wind Factor (22a)m = (22)m ÷ 4	Infiltration rate modified f	or monthly wind speed								_
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Jan Feb	Mar Apr May	Jun Jul	Aug	Sep	Oct	Nov	Dec		
Wind Factor (22a)m = (22)m ÷ 4	Monthly average wind sp	peed from Table 7								
	(22)m= 5.1 5	4.9 4.4 4.3	3.8 3.8	3.7	4	4.3	4.5	4.7		
	Wind Factor (22a)m = (2	2)m ÷ 4								
		1.23 1.1 1.08	0.95 0.95	0.92	1	1.08	1.12	1.18		

Adjusted infiltra	ation rate	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m						
0.4	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37	]		
Calculate effect		•	rate for t	he appli	cable ca	se	•	•			•	<u> </u>		7(00-)
If exhaust air he			andiv N (2	3h) - (23a	a) × Emy (e	aguation (1	VS)) othe	rwica (23h	) = (232)			С		(23a)
If balanced with									) = (23a)			С		(23b)
		-	-	_					2h\ (	00h) [/	1 (00.0)	. 4001	·	(23c)
a) If balance	o mecha o	anicai ve	niliation 0	with nea	at recove		7R) (248	$\frac{1}{10} = \frac{2}{10}$	2b)m + (	23b) <b>x</b> [	0	) ÷ 100] ]		(24a)
( 17					<u> </u>	<u> </u>						J		(244)
b) If balance (24b)m= 0	a mecha 0	anicai ve	niliation 0	without 0	neat rec	overy (r	0	$\int_{0}^{\infty} \int_{0}^{\infty} dx = (22)$	20)m + (. 0	230)	0	1		(24b)
		<u> </u>	<u> </u>		<u> </u>							J		(240)
c) If whole he if (22b)m				•	•				5 v (23h	<b>)</b>				
(24c)m = 0	0.5 7	0	0	0	0	0	0	0	0	0	0	1		(24c)
d) If natural						<u> </u>						J		, ,
if (22b)m									0.5]					
(24d)m= 0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	]		(24d)
Effective air	change	rate - er	nter (24a	or (24b	o) or (24	c) or (24	d) in box	x (25)			•	•		
(25)m= 0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	1		(25)
2 Heatlesse	مطلمون	ot loss i	t	~ # ·								1		
3. Heat losses	Gros	•			Net Ar	00	U-valı	110	AXU		k-value	^	АХ	( k
ELEMENT	area	-	Openin m		A,r		W/m2		(W/I	K)	kJ/m <sup>2</sup> ·		kJ/l	
Doors					2	х	1		2	,				(26)
Windows					8.651	x1	/[1/( 1.4 )+	0.04] =	11.47	=				(27)
Walls Type1	24.5	55	8.65		15.9	x	0.18		2.86	=		п г		(29)
Walls Type2	20.9	=	2		18.96	=	0.18	<u> </u>	3.41	<b>=</b>				(29)
Roof	11.3	_	0	=	11.39	=	0.13		1.48	룩 ¦		╡╞		(30)
Total area of e						_	0.13		1.40					<b>-</b>
* for windows and		•	offective wi	ndow I I-vs	56.9		r formula 1	/[/1/    <sub>-</sub> val	ا 0.4 مراها	se aivon in	naragrani	h 2 2		(31)
** include the area						atou using	i Torritala 1	/[( 1/ O - Vaic	ic)+0.0+j c	is giveri iii	paragrapi	7 0.2		
Fabric heat los	s, W/K =	= S (A x	U)				(26)(30)	) + (32) =				21.	23	(33)
Heat capacity (	Cm = S(	(Axk)						((28)	(30) + (32	2) + (32a).	(32e) =	590	 ).6	(34)
Thermal mass	parame	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		25	<del></del>	(35)
For design assess	ments wh	ere the de	tails of the	construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f			_
can be used instead						,								_
Thermal bridge	•	,		• .	•	<						9.9	<del>}</del> 1	(36)
if details of therma  Total fabric hea		are not kn	own (36) =	= <i>0.05 x (</i> 3	1)			(33) ±	(36) =			24	12	(37)
Ventilation hea		alculated	l monthly	,					$= 0.33 \times ($	25)m v (5)	١	31.	13	_(3/)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1		
(38)m= 24.24	24.11	23.98	23.38	23.26	22.73	22.73	22.64	22.94	23.26	23.49	23.73	1		(38)
` '		<u> </u>						<u> </u>		<u> </u>	1 -0.70	J		()
Heat transfer c			E 4 E 4	E4.00	E0.07	E0.07	E0 77	r	= (37) + (37)		F4.00	1		
(39)m= 55.37	55.24	55.11	54.51	54.39	53.87	53.87	53.77	54.07	54.39	54.62	54.86	E 4	<u></u>	(39)
								,	Average =	Surii(39)1	12 / 12=	54.	JΙ	( <sub>29</sub> )

Heat loss para	meter (l	HLP). W/	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 1.1	1.09	1.09	1.08	1.08	1.07	1.07	1.06	1.07	1.08	1.08	1.09		
` /				<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	L Average =	L Sum(40)₁.	12 /12=	1.08	(40)
Number of day	s in mo	nth (Tab	le 1a)						J	, ,	L		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
-													
4. Water heat	ing ene	rgy requi	rement:								kWh/ye	ear:	
Assumed occu	inanov.	NI											(40)
if TFA > 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x ( <sup>-</sup>	TFA -13		71		(42)
Annual averag											.72		(43)
Reduce the annua							to achieve	a water us	se target o	of <sup>1</sup>			
not more that 125	nires per	person per T	uay (ali w	1	ioi and co								
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in	n litres pe	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m= 82.19	79.2	76.22	73.23	70.24	67.25	67.25	70.24	73.23	76.22	79.2	82.19		_
Energy content of	hot water	used - cal	culated m	onthly = 4.	190 x Vd,r	m x nm x D	OTm / 3600			m(44) <sub>112</sub> = ables 1b, 1	L	896.65	(44)
(45)m= 121.89	106.61	110.01	95.91	92.03	79.41	73.59	84.44	85.45	99.58	108.7	118.04		
			<u> </u>		ı			-	Total = Su	m(45) <sub>112</sub> =	=	1175.66	(45)
If instantaneous w	ater heati	ing at point	of use (no	o hot water	storage),	enter 0 in	boxes (46	) to (61)					
(46)m= 18.28	15.99	16.5	14.39	13.8	11.91	11.04	12.67	12.82	14.94	16.31	17.71		(46)
Water storage	loss:			!	<u> </u>	!	!				<u> </u>		
Storage volum	e (litres)	) includin	ig any s	olar or W	/WHRS	storage	within sa	ame ves	sel		150		(47)
If community h	eating a	and no ta	nk in dw	velling, e	nter 110	litres in	(47)						
Otherwise if no		hot wate	er (this in	rcludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (	(47)			
Water storage					(1.) A (1	/ I \							
a) If manufact				or is kno	wn (kVVI	n/day):				1.	39		(48)
Temperature fa	actor fro	m Table	2b							0.	54		(49)
Energy lost fro		_	-				(48) x (49)	) =		0.	75		(50)
b) If manufact			-										(54)
Hot water stora If community h	-			ie z (KVV	ii/iitie/ua	iy)					0		(51)
Volume factor	•		511 4.5								0		(52)
Temperature fa			2b								0		(53)
Energy lost fro				-ar			(47) x (51)	) x (52) x (	53) =		0		(54)
Enter (50) or (		_	, 100011/90	Jui			(11)11(01)	,	<b>55</b> /		75		(55)
Water storage		,	or each	month			((56)m = (	(55) × (41)	m	<u> </u>			(/
		1			00.50		·	1	ī		00.00		(FC)
(56)m= 23.33 If cylinder contains	21.07 dedicate	23.33	22.58 rage, (57)	23.33 m = (56)m	22.58 x [(50) – (	23.33 H11)l ÷ (5	23.33 0), else (5	22.58 7)m = (56)	23.33 m where (	22.58 H11) is fro	23.33 m Appendi	хH	(56)
(57)m= 23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33		(57)
Daine a maraine suit	l /		T-1-1-			ļ	ļ	!	!				(58)
Primary circuit Primary circuit	•	•			50\m = 1	(EQ) + 26	S5 ~ (44)	ım			0		(50)
(modified by					•	. ,	, ,		r thermo	stat)			
(59)m= 23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
(00)111- 23.20	21.01	20.20	١٤.٦١	20.20	١٤.٠٦	20.20	20.20		20.20	۲۲.۷۱	20.20		(00)

Combi loss of	aclaulatad	for oach	month /	(61)m -	(60) · 2(	SE (41	١m						
(61)m= 0	0	0	0	0	00) + 3	0 7 (41)	0	T 0	0	0	0	1	(61)
(3)	!						<u> </u>	ļ		ļ	<u> </u>	J · (59)m + (61)m	(- /
(62)m= 168.4	<del></del>	156.6	141	138.62	124.5	120.18	131.04		146.18	153.79	164.64	1 (39)III + (01)IIII ]	(62)
Solar DHW inpu										ļ		]	(- /
(add addition										o to mate	o:ag)		
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(63)
Output from	water hea	ter				ļ.	Į.	•		•			
(64)m= 168.4		156.6	141	138.62	124.5	120.18	131.04	130.54	146.18	153.79	164.64	1	
	Į.	<u> </u>					Ou	put from w	ater heate	r (annual) <sub>1</sub>	112	1724.27	(64)
Heat gains f	rom water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)	n] + 0.8 x	k [(46)m	+ (57)m	+ (59)m	n ]	_
(65)m= 77.8	1	73.85	67.96	67.87	62.48	61.74	65.35	64.49	70.39	72.22	76.53	]	(65)
include (5	7)m in cal	culation o	of (65)m	only if c	ylinder i	s in the	dwelling	or hot w	ater is fı	rom com	munity h	neating	
5. Internal	gains (see	e Table 5	and 5a	):								_	
Metabolic ga													
Jar		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	]	
(66)m= 85.3°	1 85.31	85.31	85.31	85.31	85.31	85.31	85.31	85.31	85.31	85.31	85.31	1	(66)
Lighting gair	ns (calcula	ted in Ap	pendix	L, equati	on L9 o	r L9a), a	lso see	Table 5				•	
(67)m= 13.65	5 12.12	9.86	7.47	5.58	4.71	5.09	6.62	8.88	11.28	13.16	14.03	]	(67)
Appliances (	gains (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), als	o see Ta	ble 5	•	•	•	
(68)m= 148.6	5 150.19	146.3	138.03	127.58	117.77	111.21	109.66	113.55	121.83	132.27	142.09	]	(68)
Cooking gair	ns (calcula	ted in Ap	pendix	L, equat	ion L15	or L15a	, also s	ee Table	5	•	•	•	
(69)m= 31.53	31.53	31.53	31.53	31.53	31.53	31.53	31.53	31.53	31.53	31.53	31.53		(69)
Pumps and	fans gains	(Table 5	ia)					•		•	•	•	
(70)m= 3	3	3	3	3	3	3	3	3	3	3	3	]	(70)
Losses e.g.	evaporatio	n (negat	ive valu	es) (Tab	le 5)		•	•		•		-	
(71)m= -68.2	5 -68.25	-68.25	-68.25	-68.25	-68.25	-68.25	-68.25	-68.25	-68.25	-68.25	-68.25		(71)
Water heating	ng gains (T	Table 5)		-		-	-		-	-	-	_	
(72)m= 104.5	8 102.85	99.27	94.39	91.23	86.77	82.99	87.84	89.56	94.61	100.3	102.86	]	(72)
Total intern	al gains =				(66)	)m + (67)m	n + (68)m	+ (69)m +	(70)m + (7	'1)m + (72)	)m	_	
(73)m= 318.4	7 316.76	307.02	291.48	275.99	260.84	250.88	255.71	263.59	279.3	297.33	310.57	]	(73)
6. Solar gai	ins:												
Solar gains ar	e calculated	using solar	flux from	Table 6a		•	itions to c	onvert to th	ne applicat		tion.		
Orientation:	Access F Table 6d		Area m²		Flu	ıx ble 6a		g_ Table 6b	т	FF		Gains	
						Die da	. –	able ob	_ '	able 6c		(W)	7
Northeast 0.9		X	8.6	35	x 1	1.28	X	0.63	x	0.7	=	29.83	(75)
Northeast 0.9	0	X	8.6	35	X 2	22.97	X	0.63	x	0.7	=	60.72	(75)
Northeast 0.9	0	X	8.6	S5	X	11.38	x	0.63	x	0.7	=	109.4	(75)
Northeast 0.9		X	8.6	35	x 6	67.96	x	0.63	x	0.7	=	179.67	(75)
Northeast 0.9	× 0.77	X	8.6	65	x 9	91.35	X	0.63	X	0.7	=	241.51	(75)

Northeast <sub>0.9x</sub>	0.77	X	8.6	55	x	9	7.38	x		0.63	x [	0.7	=	257.47	(75)
Northeast <sub>0.9x</sub>	0.77	Х	8.6	55	x	Ç	91.1	x		0.63	x	0.7	=	240.86	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	55	x	7	2.63	x		0.63	x	0.7	=	192.02	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	55	x	5	0.42	x		0.63	_ x [	0.7		133.31	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	55	x	2	28.07	x		0.63	_ x [	0.7	=	74.21	(75)
Northeast <sub>0.9x</sub>	0.77	Х	8.6	55	x	,	14.2	x		0.63	×	0.7	_	37.53	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	55	x [	(	9.21	x		0.63		0.7	_ =	24.36	(75)
<b>L</b>					٠			•							
Solar gains in	watts, ca	alculated	for eacl	n month				(83)m	n = S	um(74)m .	(82)m				
(83)m= 29.83	60.72	109.4	179.67	241.51	25	57.47	240.86	192	2.02	133.31	74.21	37.53	24.36		(83)
Total gains – i	nternal a	nd solar	(84)m =	(73)m	+ (8	33)m	, watts								
(84)m= 348.3	377.48	416.42	471.15	517.49	51	18.31	491.74	447	'.73	396.89	353.51	334.86	334.93		(84)
7. Mean inter	nal temp	erature	(heating	season	)										
Temperature						area f	from Tal	ole 9	, Th	1 (°C)				21	(85)
Utilisation fac	•	•			-				•	( /					
Jan	Feb	Mar	Apr	May	È	Jun	Jul	Α	ug	Sep	Oct	Nov	Dec		
(86)m= 1	0.99	0.98	0.95	0.83	0	).64	0.48	0.5	Ŭ	0.81	0.97	0.99	1		(86)
Mean interna	l tompor	oturo in	livina or	no T1 /f/	حمالا	w cto	no 2 to 7	7 in T		2 00)		1			
(87)m= 19.92	20.03	20.27	20.6	20.86		0.97	21	20.		20.91	20.58	20.2	19.89		(87)
` ′	ļ				<u> </u>		<u> </u>				20.00	1 20.2	10.00		(- )
Temperature	T				_			T		· ,	00.00	T 00 00	00.04	[	(00)
(88)m= 20	20.01	20.01	20.02	20.02	20	0.03	20.03	20.	.03	20.03	20.02	20.02	20.01		(88)
Utilisation fac	ctor for g	ains for I	rest of d	welling,	h2,	m (se	e Table	9a)			<u> </u>		ı	ı	
(89)m= 0.99	0.99	0.98	0.93	0.78	0	).55	0.37	0.4	43	0.74	0.95	0.99	1		(89)
Mean interna	ıl temper	ature in	the rest	of dwell	ng	T2 (f	ollow ste	eps 3	to 7	7 in Tabl	e 9c)				
(90)m= 18.57	18.74	19.08	19.55	19.89	20	0.01	20.03	20.	.03	19.95	19.54	18.99	18.54		(90)
										f	LA = Livi	ng area ÷ (4	4) =	0.43	(91)
Mean interna	ıl temper	ature (fo	r the wh	ole dwe	lling	g) = fl	LA × T1	+ (1	– fL	.A) × T2					
(92)m= 19.15	19.3	19.59	20	20.31	_	0.43	20.45	20.		20.36	19.99	19.51	19.13		(92)
Apply adjustr	nent to the	ne mean	internal	temper	atu	re fro	m Table	4e,	whe	re appro	priate		Į.	l	
(93)m= 19.15	19.3	19.59	20	20.31	20	0.43	20.45	20.	.44	20.36	19.99	19.51	19.13		(93)
8. Space hea	ıting requ	uirement													
Set Ti to the					ed	at ste	ep 11 of	Tabl	le 9b	o, so tha	t Ti,m=	(76)m an	d re-calc	culate	
the utilisation					_							1	_	1	
Jan	Feb	Mar	Apr	May	_ '	Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
Utilisation fac	0.99	0.98	0.93	0.8		).59	0.42	0.4	10	0.77	0.95	0.99	0.99		(94)
Useful gains,						7.58	0.42	0.2	+0	0.77	0.93	0.99	0.99		(04)
(95)m= 346.03	1	406.25	436.18	412.07	30	05.03	205.95	215	04	305.01	336.33	330.73	333.14		(95)
Monthly aver											000.00	1 0000	000		, ,
(96)m= 4.3	4.9	6.5	8.9	11.7		4.6	16.6	16	5.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate	e for mea		al tempe		L		=[(39)m	L		 – (96)m	1	1	I	I	•
(97)m= 822.28	795.47	721.67	605.16	468.08	_	3.88	207.13	217		338.7	510.53	677.8	818.92		(97)
Space heating	g require	ement fo	r each m	nonth, k	Wh	/mont	th = 0.02	24 x	[(97	m – (95	)m] x (4	l1)m		1	
(98)m= 354.33	283.6	234.67	121.67	41.67		0	0			0	129.61	249.89	361.42		
	•							•				•		•	

Space heating requirement in kWh/m²/year   Sum(98)s: =   1776.86   (98   35.15
Space heating:   Fraction of space heat from secondary/supplementary system   (202) = 1 - (201) =   (207) =   (203
Space heating   Fraction of space heat from secondary/supplementary system   C202] = 1 - (201) =   1   (20)   (202) = 1 - (201) =   1   (20)   (202) = 1 - (201) =   1   (20)   (202) = 1 - (203)   (202) =
Fraction of space heat from secondary/supplementary system
Fraction of space heat from main system(s)  Fraction of total heating from main system 1  Efficiency of main space heating system 1  Efficiency of secondary/supplementary heating system, %  Dan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Wh/year Space heating requirement (calculated above)  354.33 283.6 234.67 121.67 41.67 0 0 0 0 129.61 249.89 361.42  [211)m = {[(98)m x (204)] } x 100 ÷ (206)  Total (kWh/year) = Sum(211),s,, = 1900.38 (21)  Space heating fuel (secondary), kWh/month  = {[(98)m x (201)] } x 100 ÷ (208)  [215)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Fraction of total heating from main system 1 (204) = (202) × [1 - (203)] = 1 (20  Efficiency of main space heating system 1 (204) = (202) × [1 - (203)] = 1 (20  Efficiency of secondary/supplementary heating system, % 0 (20  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec kWh/year  Space heating requirement (calculated above)  354.33 283.6 234.67 121.67 41.67 0 0 0 0 0 129.61 249.89 361.42  (211)m = {[(98)m x (204)] } x 100 ÷ (206)  Total (kWh/year) = Sum(211) <sub>1.x.notr</sub> = 1900.38 (21  Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)  (215)m = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  Total (kWh/year) = Sum(215) <sub>1.x.notr</sub> = 0 (21  Water heating  Output from water heater (calculated above)  168.49 148.69 156.6 141 138.62 124.5 120.18 131.04 130.54 146.18 153.79 164.64  Efficiency of water heater (217)m 86.75 86.51 85.89 84.42 82.04 79.8 79.8 79.8 79.8 79.8 84.49 86.1 86.86  Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m
Efficiency of main space heating system 1  Efficiency of secondary/supplementary heating system, %  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec KWh/year Space heating requirement (calculated above)  354.33 283.6 234.67 121.67 41.67 0 0 0 0 129.61 249.89 361.42  (211)m = {[(98)m x (204)]} x 100 ÷ (206)  Total (kWh/year) = Sum(211),s, = 1900.38 (21)  Space heating fuel (secondary), kWh/month  = {[(98)m x (201)]} x 100 ÷ (208)  (215)m = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Efficiency of secondary/supplementary heating system, %    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec
Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec
Space heating requirement (calculated above)  354.33
354.33   283.6   234.67   121.67   41.67   0   0   0   0   129.61   249.89   361.42
378.96 303.32 250.98 130.13 44.57 0 0 0 0 138.62 267.26 386.54  Total (kWh/year) =Sum(211) <sub>151012</sub> 1900.38 (21  Space heating fuel (secondary), kWh/month  = {[(98)m x (201)]} x 100 ÷ (208)  (215)m= 0 0 0 0 0 0 0 0 0 0 0 0 0  Total (kWh/year) =Sum(215) <sub>151012</sub> 0 (21  Water heating  Output from water heater (calculated above)  168.49 148.69 156.6 141 138.62 124.5 120.18 131.04 130.54 146.18 153.79 164.64  Efficiency of water heater  (217)m= 86.75 86.51 85.89 84.42 82.04 79.8 79.8 79.8 79.8 84.49 86.1 86.86  Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m
Total (kWh/year) =Sum(211) <sub>16,1012</sub> = 1900.38 (21  Space heating fuel (secondary), kWh/month  = {[(98)m x (201)]} x 100 ÷ (208)  (215)m= 0 0 0 0 0 0 0 0 0 0 0 0  Total (kWh/year) =Sum(215) <sub>16,1012</sub> = 0 (21  Water heating  Output from water heater (calculated above)  168.49 148.69 156.6 141 138.62 124.5 120.18 131.04 130.54 146.18 153.79 164.64  Efficiency of water heater  (217)m= 86.75 86.51 85.89 84.42 82.04 79.8 79.8 79.8 79.8 84.49 86.1 86.86  Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
= {[(98)m x (201)]} x 100 ÷ (208)  (215)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
(215)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Total (kWh/year) =Sum(215) <sub>15,1012</sub> = 0 (21  Water heating  Output from water heater (calculated above)  168.49 148.69 156.6 141 138.62 124.5 120.18 131.04 130.54 146.18 153.79 164.64  Efficiency of water heater  (217)m= 86.75 86.51 85.89 84.42 82.04 79.8 79.8 79.8 79.8 84.49 86.1 86.86  Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m
Water heating Output from water heater (calculated above)  168.49 148.69 156.6 141 138.62 124.5 120.18 131.04 130.54 146.18 153.79 164.64  Efficiency of water heater (217)m= 86.75 86.51 85.89 84.42 82.04 79.8 79.8 79.8 79.8 84.49 86.1 86.86  Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m
Output from water heater (calculated above)  168.49
Efficiency of water heater  (217)m= 86.75 86.51 85.89 84.42 82.04 79.8 79.8 79.8 79.8 84.49 86.1 86.86  Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m
(217)m= 86.75 86.51 85.89 84.42 82.04 79.8 79.8 79.8 79.8 84.49 86.1 86.86 (217)m= (64)m x 100 ÷ (217)m
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m
$(219)$ m = $(64)$ m x $100 \div (217)$ m
(219)m- 194 22 171 88 182 33 167 01 168 96 156 02 150 6 164 21 163 59 173 178 62 189 56
Total = $Sum(219a)_{112}$ = 2059.99 (21)
Annual totals kWh/year kWh/year Space heating fuel used, main system 1 1900.38
Electricity for pumps, fans and electric keep-hot
central heating pump: 23
boiler with a fan-assisted flue 45 (23
Total electricity for the above, kWh/year sum of (230a)(230g) = 75 (23
Electricity for lighting 241.09 (23
12a. CO2 emissions – Individual heating systems including micro-CHP
Energy Emission factor Emissions kWh/year kg CO2/kWh kg CO2/year
Space heating (main system 1) (211) $\times$ 0.216 = 410.48 (26)

Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216	444.96 (264)
Space and water heating	(261) + (262) + (263) + (264) =		855.44 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	38.93 (267)
Electricity for lighting	(232) x	0.519	125.12 (268)
Total CO2, kg/year	sum	of (265)(271) =	1019.49 (272)

TER = 20.17 (273)